IT TAKES A CO-OP.™

Crop Management Guide











CHS:
INVESTED IN YOUR SUCCESS.

At CHS, we bring together the strength of crop protection and crop nutrients to help you get the most from every acre. Our long-standing relationships with leading formulators and manufacturers mean you can count on CHS retail locations to deliver high-performing products that bring real value to your operation. Backed by a nationwide agronomy network, your local CHS team provides the products, expertise, and support you need to make confident decisions all season long.

For decades, CHS has invested in infrastructure to build a flexible, balanced supply chain for crop nutrients. Key assets include a Texas deep-water port for importing fertilizer and 13 river terminals with offloading capabilities, plus a vast network of owned or leased fertilizer terminals and strategic joint ventures with member cooperatives. To help ensure nitrogen supply during volatile markets and adverse weather, CHS has invested in CF Nitrogen, which produces multiple products and provides CHS access to those products through flexible source points.



CHS brings together the strength of crop nutrients, crop protection, and other specialized crop inputs to help you grow healthy, profitable crops. With access to products from all the major manufacturers plus innovative adjuvants, seed treatments, and plant health enhancers, CHS retail locations are equipped to meet your operation's needs.

Backed by decades of experience and a nationwide agronomy network, CHS provides more than just products. Our team supports you with expert insight, sound recommendations, and dependable supply all with a commitment to safety, stewardship, and your success in every field.

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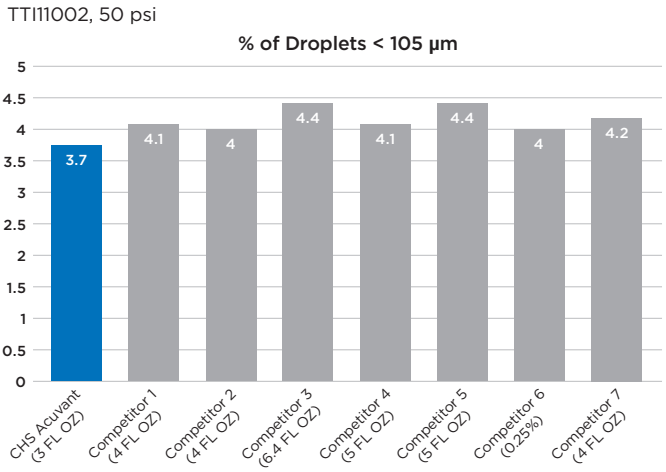
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CASE
1240
EARLY RISER

ACUVANT®

Deposition Aid/Drift Control Agent

CHS Acuvant® is an NPE-free oil emulsion deposition and drift management agent specifically designed to suppress off-target drift of spray applications. CHS Acuvant contains a highly refined soybean oil that improves the performance and handling characteristics versus traditional oil emulsion formulations. CHS Acuvant improves the uniformity and density of spray droplets. CHS Acuvant maximizes deposition by increasing droplet size and maintaining a more uniform spray pattern. CHS Acuvant can be used with air assist and conventional spray nozzles. CHS Acuvant will improve the performance of herbicides, fungicides and insecticides by increasing canopy penetration and deposition, improving humectancy and maintaining uniform droplet size.



Principal Functioning Agents

Modified vegetable oil, refined soybean oil, polyoxyethylene sorbitan fatty acid ester 96.2%

Constituents ineffective as a spray adjuvant 3.8%

TOTAL 100%

All ingredients are exempt from tolerance requirements under 40 CFR 180.

Application Directions

Add CHS Acuvant to the spray tank after all other tank mix partners have been added to the tank. Avoid mixing with other undiluted products in an induction cone or any other container.

- **Herbicides:**
  Ground: 3-4 oz/A
  Aerial: 2-3 oz/A
- **Fungicides and Insecticides:**
  2-3 oz/A

Package Size

2x2.5 gal case

Soy-Enhanced

Always read and follow label directions.

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AGGRESTROL®

High Surfactant Oil Concentrate

CHS Aggrestrol® is a highly concentrated blend of emulsifiers and methylated seed oil. The product is designed for use with a broad range of herbicides where a high surfactant oil concentrate adjuvant is recommended or allowed. High surfactant oil concentrates allow lower use rates than standard oil adjuvants. CHS Aggrestrol increases contact activity and penetration of the spray, while also providing uniform coverage on leaf surfaces.

CHS Aggrestrol contains a highly refined soybean oil that improves the performance and handling characteristics versus traditional high surfactant methylated seed oil formulations.

- High quality concentration of emulsifiers and methylated seed oil.
- Flexible across a broad range of herbicides.
- High quality concentration allows for lower use rates.

Principal Functioning Agents

Soybean oil methyl ester, fatty acids of tall oil, nonylphenol ethoxylate 99.0%

Constituents ineffective as spray adjuvants 1.0%

Application Directions

Ground, Aerial, Low volume, CDA:

Recommended Rate of Crop Oil Concentrate or Methylated Seed Oil	CHS Aggrestrol Use Rate
1% v/v (1 gal/100 gal of water)	0.5-1% v/v (2-4 qt/100 gal of water)
0.5% v/v (2 qt/100 gal of water)	0.25-0.5% v/v (1-2 qt/100 gal of water)
2 pt/A	1-2 pt/A
1.5 pt/A	0.75-1.5 pt/A
1 pt/A	0.5-1 pt/A

Package Size

2x2.5 gal, 275 gal

Soy-Enhanced

Always read and follow label directions.

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CHS Axon®

Nonionic Surfactant-based Basic Blend Adjuvant

CHS Axon® contains three key components that help to improve pesticide efficacy.

1. CHS Axon contains a nonionic surfactant that enhances spray coverage, retention and absorption.
2. CHS Axon contains ammonium ions that help to prevent salt antagonism of certain herbicides while also increasing uptake and translocation of the pesticide solution.
3. CHS Axon contains a pH buffer that raises the pH (or prevents it from being lowered).
   - Raising the pH enhances the solubility of many pesticides (especially sulfonylurea and imidazilinone).
   - Improves the mixability and allows herbicides to be more active and more readily taken in by the plant.



Principal Functioning Agents
Blend of nonionic surfactants, ammonium salts and buffering agents 100%

Application Directions
Typical use rate is 1 gal/100 gal of spray

- Use rate can range from 2-4 qt/100 gal depending on herbicide
- See pesticide labels for more specific rates

Package Size
2x2.5 gal case, 275 gal, Repack

Always read and follow label directions.

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DEPPEX®

Nonionic Surfactant | Water Conditioning Agent | Deposition Aid | Drift Control Agent

CHS Deppex® is the industry's most advanced adjuvant system combining nonionic surfactants, water conditioning agents, deposition and drift management aids and defoamer.

- Improves the performance of glyphosate and many other herbicides that require or recommend surfactant.
- Improves water conditioning, deposition, and drift management along with reducing foam.
- Ensures on-target applications to reduce liability, customer complaints, and crop loss.

CHS Deppex is a unique, all-in-one adjuvant possessing cutting-edge features and an unparalleled use rate, that provides unmatched convenience and simplicity for its users.

CHS Deppex can be used with a wide range of pesticide spray mixtures when accompanying labels recommend surfactants, water conditioners and deposition aids and drift control agents.

CHS Deppex does not contain ammonium sulfate or acidify the spray solution and is compatible with a wide array of herbicides including those that contain glyphosate, dicamba, 2,4-D and many others. Humidome trials with CHS Deppex have demonstrated minimal or no impact on pesticide volatility and wind tunnel trials with CHS Deppex have demonstrated reduced fine droplet formation from most pesticide spray solutions.

- All-in-One adjuvant.
- Unparalleled low use rate.
- Ensures on target application, mitigating risk for your ease of mind.

Principal Functioning Agents
Water conditioners, surfactants, defoamer, drift management agents, and inert ingredients 100%

Application Directions
Typical use rate is 2 qt/100 gal of water

Package Size
2x2.5 gal case, 275 gal

Always read and follow label directions.

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EMULATE®

Modified Vegetable Oil Concentrate

- CHS Emulate® is a blend of methylated soybean oil and surfactant emulsifier specifically designed for use with post emergence herbicides.
- CHS Emulate is a low foam methylated seed oil that provides excellent leaf penetration which will provide greater herbicide activity than traditional oil adjuvants.
- CHS Emulate should be applied at rates recommended on the herbicide label.



Application Directions
Typical use rates will be 1.5-2 pt/A or 1% v/v

Package Size
2x2.5 gal case, 110 gal, Repack, Bulk

Always read and follow label directions.

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CHS ENDURIUM™

NPE-free nonionic surfactant | Drift reduction agent
Canopy penetrating agent | Deposition aid

CHS Endurium™ is a unique nonionic surfactant (NIS) that can be used to replace crop oil concentrate (COC) adjuvants for most herbicides. By enhancing weed control with herbicides that respond to a COC but having the crop safety of a NIS, CHS Endurium fits into many crop production systems for maximizing weed control while reducing crop injury. CHS Endurium can be used to improve the performance of herbicides, fungicides, insecticides, plant growth regulators and crop nutrients by increasing penetration, drift control and deposition.

CHS Endurium is a convenient multi-purpose NIS that has the efficacy of many single-function adjuvants and drift control products. Use 1 qt/100 gallons for most applications of herbicides, fungicides and insecticides.

CHS Endurium is compatible with and will increase the activity of most crop protection and crop nutrient products.

CHS Endurium is NPE-free.

- NIS with unique properties that can replace COC adjuvants.
- Reduces driftable fines.
- Increases deposition and canopy penetration.

Principal Functioning Agents

- Modified fatty acids, Oleic acid, Polyol ethoxylate ester 74%
- Constituents ineffective as a spray adjuvant 26%
- TOTAL 100%

All ingredients are exempt from tolerance under 40 CFR 180.

Application Directions

- **Ground Application**
  – 1 qt/100 gal
- **Aerial**
  – 2-6 oz/A

Package Size

2x2.5 gal, 250 gal

Always read and follow label directions.

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FIXATE®

Water Conditioner | Nonionic Surfactant | Humectant

- CHS Fixate® provides both water conditioning activity as well as pesticide enhancement.
- CHS Fixate contains an ingredient that when added to the spray water reacts with bicarbonate ions in the water to form both nitrogen and sulfate.
  - The nitrogen combines with glyphosate (and other pesticides) to improve the uptake and translocation of glyphosate.
  - The sulfate combines with impurities in the spray solution (calcium, iron, magnesium, sodium and other salts) to prevent them from combining with the pesticide and antagonizing the pesticide.
- CHS Fixate lowers the pH of the spray solution which allows specific pesticides (especially glyphosate) to be more active and less likely to interact with salts in the spray solution.
- CHS Fixate contains a penetrating nonionic surfactant that not only helps improve coverage on the plant but also improves deposition throughout the spray canopy.



Application Directions
Typical use rate is 2 qt/100 gal of spray solution

- 1-2 qt/100 gal for fully loaded glyphosate herbicides
- 2-4 qt/100 gal for partially or unloaded glyphosate herbicides
- 1-2 qt/100 gal for most other herbicides

Package Size
2x2.5 gal case, 275 gal, Repack, Bulk

Always read and follow label directions.

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HYPERTONIC®

Nonionic Surfactant

- CHS Hypertonic® is a high active ingredient nonionic spray adjuvant designed to enhance the effectiveness of herbicides which recommend the addition of a nonionic surfactant. CHS Hypertonic is designed for maximum performance in multiple environmental conditions.
- CHS Hypertonic should be applied at rates recommended on the herbicide label.



Application Directions
Typical use rates will be 0.25-0.5% v/v

Package Size
2x2.5 gal case, 4x1 gal case, 30 gal, 110 gal

Always read and follow label directions.

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LEVEL BEST® PRO

Nonionic Surfactant | Water Conditioner

CHS Level Best® Pro meets the surfactant level requirements of most active ingredient labels in the industry that require or recommend the use of a nonionic surfactant (NIS).

CHS Level Best Pro is a superior deposition aid and significantly improves uniform coverage, adhesion and penetration of the active ingredient through waxy or weather-hardened cuticles. CHS Level Best Pro is formulated with an AMS-FREE water conditioner which helps to prevent the loss of active ingredient efficacy that can occur when the mixing water is mineral saturated or of unknown quality.

It is recommended for use with a broad range of crops and non-crops when tank mixing active ingredients like glyphosate, 2,4-D, dicamba and glufosinate.

A defoamer is included for easier mixing.

- High Efficacy Adjuvant (1st of its kind) that contains a High Load Tallow Amine Surfactant with humectant and dispersant properties. Tallow Amine is well known to increase the "biological activity of glyphosate."
- Formulated for increased performance over that of a standard adjuvant program.
- Significantly improves uptake, translocation, and efficacy of your herbicide.
- Convenient and easy-to-use low use rate.
- Approved as a tank mix partner with XtendiMax®, FeXapan®, Engenia™ and Enlist One®.

Principal Functioning Agents

N-methyl-alkyl glucamide, polyethylene glycol sorbitan monolaurate, polyethylene glycol undecyl ether 77.95%

Constituents ineffective as a spray adjuvant 22.05%

TOTAL 100%

Application Directions

- **Herbicides**
  0.5-6 pt/100 gal

Recommended for use with a broad range of crops and non-crops when tank mixing active ingredients like glyphosate, glufosinate, 2,4-D and dicamba.

Package Size

2x2.5 gal case, 275 gal



Waterhemp: 43 oz Liberty, 3 lbs. AMS, 12 oz Outlook, 1 qt/100 gal CHS Level Best Pro, **2 DAT**



Lambsquarters: Roundup @ 32 oz./A, CHS Fixate @ 2 qt/100 gal, CHS Level Best Pro @ 1 qt/100, **10 DAT**

Always read and follow label directions.

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XtendiMax® is a registered trademark of Monsanto.
Engenia™ is a trademark of BASF.

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PENETREC®

High-load Crop Oil Concentrate

- CHS Penetrec® is a superior blend of highly refined soybean oil and nonionic surfactants designed for use with a broad range of pesticides.
- CHS Penetrec increases contact activity and penetration of the spray, while also providing uniform coverage on leaf surfaces at half the use rate of a standard crop oil.



Application Directions
Typical use rates will be 0.5% v/v (2 qt/100 gal of water) or 0.25% v/v (1 qt/100 gal of water)

Package Size
2x2.5 gal case, 265 gal
Weight 8.1 lbs/gallon.

Storage
Optimal storage temperature between 40° F and 90° F.

Ground, Aerial, Low volume, CDA:

Recommended Rate of Crop Oil Concentrate	CHS Penetrec Use Rate
1% v/v (1 gal per 100 gal of water)	0.5% v/v (2 qt per 100 gal of water)
0.5% v/v (2 qt per 100 gal of water)	0.25% v/v (1 qt per 100 gal of water)
2 pt per acre	1 pt per acre

Soy-Enhanced

Always read and follow label directions.

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TRAPLINE® · PRO 2

Ammonium Sulfate-free Water Conditioner | Nonionic Surfactant
Drift Reduction Agent | Deposition Aid | Anti-foam

CHS Trapline™ Pro 2 contains nonionic surfactants, water conditioning agents, deposition and drift management aids and defoamer. The unique combination of functioning agents improves the performance of glyphosate, dicamba, 2,4-D and many other herbicides that require or recommend surfactant, water conditioning, deposition and drift management as well as reducing foam in the spray tank.

CHS Trapline Pro 2 has been approved for use with XtendiMax® herbicide and is listed on the xtendimaxapplicationrequirements.com website as a Drift Reducing Adjuvant (DRA). When using CHS Trapline Pro 2 with XtendiMax herbicide and XtendiMax tank mixes, no other adjuvant is required. The deposition properties of CHS Trapline Pro 2 further minimize fine spray droplets. The deposition properties also help to improve leaf coverage and pesticide performance by increasing retention and adhesion of the droplet, maximizing on-target application and performance.

CHS Trapline Pro 2 does not contain ammonium sulfate or acidify the spray solution but uses a proprietary water conditioning system that is compatible with a wide array of herbicides including those that contain glyphosate, dicamba, 2,4-D and many others. Humidome trials with CHS Trapline Pro 2 have demonstrated minimal or no impact on increased dicamba volatility. Wind tunnel trials with CHS Trapline Pro 2 have demonstrated reduced fine droplet formation from most pesticide spray solutions.

- Complete adjuvant system

Principal Functioning Agents
2-hydroxypropane-1,2,3 carboxylate, complex trihydric alcohols, oligomeric sugar alcohol condensat. 34.75%

Constituents ineffective as spray adjuvants 65.25%

TOTAL 100%

Application Directions

- **With XtendiMax**
  Consult xtendimaxapplication requirements.com website for approved tank mix partners.
  - Xtendimax herbicide at labeled use rate
  - Approved pesticide tank mix partner at labeled use rate
  - CHS Trapline Pro 2 at 5 pt/100 gal of water
- **With Engenia™**
  - Engenia herbicide at labeled use rate
  - Approved pesticide tank mix partner at labeled use rate
  - CHS Trapline Pro 2 recommended at 5 pt/100 gal of water
- CHS Trapline Pro 2 application rate range is 2-8 pt/100 gal of water
- **With Glyphosate**
  - Glyphosate herbicide at labeled use rate
  - Conventional tank mix partner at labeled use rate
  - CHS Trapline Pro 2 at 4 pt/100 gal of water

Consult pesticide labels for product use rates, instructions and proper mixing order.

Package Size
2x2.5 gal case, 275 gal, Repack, Bulk

Always read and follow label directions.

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TRAPLOK®

Volatility Reduction Agent | Drift Reduction Agent | Water Conditioner | Surfactant

CHS Traplok® contains nonionic surfactants, water conditioning agents, deposition and drift management aids and defoamer. The unique combination of functioning agents improves the performance of glyphosate, dicamba and many other herbicides that require or recommend surfactant, water conditioning, deposition and drift management as well as reducing foam in the spray tank.

CHS Traplok does not contain ammonium sulfate or acidify the spray solution but uses a proprietary water conditioning system that is compatible with a wide array of herbicides including those that contain glyphosate, dicamba, and many others. Humidome trials with CHS Traplok have demonstrated minimal or no impact on increased dicamba volatility. Wind tunnel trials with CHS Traplok have demonstrated reduced fine droplet formation from most pesticide spray solutions.

- Easy to use, all-in-one adjuvant.
- High-quaility drift control without dimishing spray pattern.
- Meets requirements for DRA and VRA in dicamba applications.

Principal Functioning Agents

- Acetic Acid, Potassium Hydroxide, 2-Hydroxy-1,2,3-propane tricarboxylic acid 57.5%
- Constituents ineffective as a spray adjuvant 42.5%
- TOTAL. 100%

Application Directions

- **Use rate as a Surfactant, Water Conditioning Agent, Drift and Volatility Reducing Agent with Dicamba Tank Mixes:** The typical use rate for CHS Traplok is 1% v/v (19.2 oz/A when total spray volume is 15 gallons per acre). Actual use rate may vary based on pesticide label directions and/or tank mix rate instructions on the relevant website for the tank mixed dicamba pesticide.
- **Use rate as a Surfactant, Water Conditioning Agent and Drift Reducing Agent in Non-Dicamba applications:** Use CHS Traplok at 1% v/v or according to pesticide label and/or tank mix website instructions.

Package Size

2x2.5 gal, 265 gal tote, Bulk

Always read and follow label directions.

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WHEELHOUSE® 2

Water Conditioning | Wetting Agent Combination Adjuvant

- A convenient premix delivering both nonionic surfactant and ammonium sulfate.
- Nonionic surfactant improves coverage and deposition throughout the plant canopy improving activity of the pesticide (typically a glyphosate herbicide).
- Ammonium sulfate provides ammonium that combines with glyphosate and other pesticides to improve uptake and translocation. Ammonium sulfate also provides sulfate that combines with salts in the spray solution (calcium, magnesium, iron, sodium, etc.) which prevents them from antagonizing glyphosate and other pesticides.



Application Directions
Typical use rate is 2.5 gal/100 gal of spray solution

- Delivers the equivalent of 2 qt/100 gal of nonionic surfactant + 8.5 lb/100 gal of ammonium sulfate
- Rates can vary between 1.25-5 gal/100 gal of spray solution

Package Size
2x2.5 gal case, 275 gal, Bulk

Always read and follow label directions.

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WHEELHOUSE® · PRO

Buffering Agent | Humectant | Nonionic Surfactant | Water Conditioning Agent | Activator

CHS Wheelhouse® Pro will help to alleviate antagonism from hard water impurities such as iron, calcium, magnesium and other impurities in the spray solution.

CHS Wheelhouse Pro will:
- Maintain certain pesticides, such as glyphosate, in their most active form
- Increase pesticide absorption into plants with a combination of:
  - Improved droplet coverage and canopy penetration
  - Slowed droplet drying

CHS Wheelhouse Pro contains tallow amine, the industry's most effective surfactant to improve the biological activity of glyphosate and other herbicides. This surfactant is proven across millions of acres to increase herbicide uptake and maximize effectiveness of your application.

CHS Wheelhouse Pro can be used with a wide range of pesticide spray mixtures when accompanying labels recommend water conditioners and spreader-wetter adjuvants.

CHS Wheelhouse Pro does not contain ammonium sulfate or acidify the spray solution and is compatible with a wide array of herbicides including those that contain glyphosate, dicamba, 2,4-D and many others. CHS Wheelhouse Pro has demonstrated minimal or no impact on pesticide volatility and wind tunnel trials have demonstrated that CHS Wheelhouse Pro does not increase fine droplet formation from most pesticide spray solutions.

NOT FOR AQUATIC USE.

- Unsurpassed water conditioner.
- Industry-leading surfactant proven across millions of acres.
- Convenient and easy-to-use application rate.

Principal Functioning Agents

Sodium tricarballylate, alkyl polyglucoside, tallow amine ethoxylate, urea 37.7%

Other Ingredients 62.3%

TOTAL 100%

Application Directions
- Typical use rate is 2 qt/100 gal of water
- Use rate may range from 1-4 qt/100 gal of water, depending on herbicide active ingredients with which it is applied

Package Size

2x2.5 gal case, 265 gal, Bulk

Always read and follow label directions.

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Our line of products delivers the most important input you can apply on a farm: knowledge. Offered by CHS agronomy, every product is supplied with a healthy dose of insight for making sound applications, year after year.

CHS Agronomy Adjuvants

ADIUM®

Nonionic Surfactant, Polyacrylamide Deposition, Drift Control, AMS

Adium® is designed for use with herbicides, such as glyphosate, that recommend nonionic surfactant, ammonium sulfate and benefit from drift, deposition, and foam reduction.

Functions

—Multi-functional all-in-one product

—Economical adjuvant

—Shines in applications of glyphosate

CITRI·AMP™

Penetrant, Wetting Agent, Spreader

Citri-Amp™ improves the performance of pesticides and foliar nutrients.

Functions

—Provides wetting and spreading

—Increases plant tissue absorption

—Improves translocation

CROP OIL

Paraffinic-based Oil, 17% Nonionic Surfactant

Our Crop Oil combines highly refined paraffin petroleum with a nonionic surfactant emulsifier to aid penetration of many herbicides.

Functions

—Enhances overall spreading and coverage

—Increases leaf penetration

—Improves pesticide retention on leaf surfaces

ENCLOAX®

Penetrant, Water Conditioning Agent, Humectant

Encloax® is a convenient premix of a proprietary NPE-free surfactant, humectant and ammonium sulfate based water condition agent that improves the ability of the spray droplet to enter the plant and maximize pesticide performance.

Functions

—NPE free surfactant

—Improved glufosinate performance

—Improved glyphosate performance

FORGE

Acidifier, Penetrant, Surfactant

Forge is designed to reduce pH and increase retention and penetration of the spray solution for herbicides, fungicides, and Insecticides.

Functions

—Use to lower the pH of spray solution to prevent alkaline hydrolysis

—Excellent sticking and spreading properties for broad use

H·45™

Injectable Soil Surfactant

H-45™ improves infiltration and percolation of water into the root zone.

Functions

—Lowers surface tension of water and enables precipitation/irrigation to penetrate through water-resistant surfaces

MEDIATE™

Water Conditioning Agent, Humectant, Drift Control

Mediate™ is a multifunctional drift and deposition management and water conditioning agent.

Functions

—Minimizes fine droplets by creating larger uniform droplets

—Reduces spray loss through evaporation

—Increases spray droplet retention

CHS Agronomy Adjuvants

Mediate™ Plus

Deposition, Water Conditioner, Defoamer

Mediate™ Plus contains a high molecular weight drift and deposition agent, ammonium sulfate, and defoamer. Mediate Plus significantly limits the formation of driftable fines.

Functions

—Increased polymer load increases deposition

—2.5 gal/100 gal provides 8.5 lb/100 gal ammonium sulfate

—Reduction in foam formation with herbicides such as glyphosate

Modulate™

Deposition Aid, Drift Reduction Agent

Modulate™ contains a high molecular weight drift and deposition agent. Modulate significantly limits the formation of driftable fines.

Functions

—Increased polymer load increases deposition

—Convenient low use rate

Parachute® II

Penetrant, Drift Reduction Agent, Deposition Aid, NPE-Free

Parachute® II is an NPE-free deposition and drift management agent specifically designed to suppress off-target drift of spray applications.

Functions

—Dual mode of action: drift and deposition aid; minimizing off-target movement

—Oil emulsion technology combined with a resin creates a state-of-the-art DRA

—NPE-free for late corn post-applications

Soiltrate™

Deposition Aid

Soiltrate™ improves deposition and penetration of active ingredients or nutrients onto the target surface.

Functions

—Superior surfactant system

—Improves the efficacy and adsorption of soil-applied herbicides

—Can be used with herbicides, fungicides, and insecticides

Tapran®

High Surfactant Oil Concentrate, Water Conditioning Agent, Deposition Aid

Tapran® is a multi-functional, high-efficacy adjuvant that helps activate herbicides for better performance against tough-to-control weeds, including later season weeds.

Functions

—High quality concentration of emulsifiers and methylated seed oil

—Flexible across a broad range of herbicides.

—Made with highly refined soybean oil for enhanced performance, stability, and mixing

Veracity®

Nonionic Surfactant, Deposition Aid, Defoamer, Water Conditioner

Veracity® combines four active agents to improve drift management and overall herbicide efficacy.

Functions

—Increases glyphosate solubility and systemic activity

—Minimizes drift

—Buffers spray solution pH below neutral

—Reduces hard water antagonism

White Water™ 90

93% Nonionic Surfactant, Humectant

White Water™ 90 provides superior wetting ability to carry and spread actives throughout the intended target.

Functions

—Increases contact time at the target surface which improves penetration

—Slows drying time allowing more leaf surface penetration

White Water™ NIS

Nonionic Surfactant

White Water™ NIS is a concentrated nonionic spreader activator.

Functions

—Increases activity and effectiveness of active ingredients

—Lowers leaf surface tension increasing droplet spreading

—Uniform droplet distribution

AVENTINE®

Starter Fertilizer Enrichment

CHS Aventine® will assure the crop achieves its full yield potential.



- CHS Aventine contains a blend of key nutrients which helps supplement a starter fertilizer program minimizing these key nutrients from being yield limiting factors.
- CHS Aventine is most beneficial when a condition exists that is hampering the availability or uptake of a particular nutrient.
  - Low organic matter/sandy soils
  - Cool/cold soil conditions
  - Stressed soils (saturated or droughty)
  - High pH
  - Excessive phosphorus
  - Excessive rainfall event in spring
- CHS Aventine is formulated with the highest quality ingredients available.
- 2 qt/A of CHS Aventine delivers 1 qt/A of a fully chelated 9% zinc.
- CHS Aventine is compatible with most polyphosphate and orthophosphate fertilizers and is compatible with other fertilizer additives such as CHS Unlocked®, Levesol®, and Levesol® Zn.
- Analysis: 4-0-5-3S-4.5Zn-1Mn-0.5B
- Typical use rate with starter fertilizer program is 2 qt/A.

Package Size
2x2.5 gal case, 250 gal, Bulk

Always read and follow label directions.

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AVENTINE® COMPLETE

Nutrient Shuttle Effect

- CHS Aventine® Complete contains a broad range of nutrients that are necessary to enhance plant growth, increase early season root development and correct nutrient deficiencies in order to maximize yield potential.
- CHS Aventine Complete has a unique chelation agent that prevents micronutrients like iron, copper, zinc and manganese from binding up in soil.
- CHS Aventine Complete is a low salt, premier formulation making it extremely safe on seed thus eliminating risk of injury or yield loss.
- CHS Aventine Complete may be used as a soil or foliar application to any food or fiber crop where the addition of one or more of the nutrients contained in CHS Aventine Complete would be beneficial.
- CHS Aventine Complete is a superior blend of macronutrients and micronutrients that is ready to apply to crops.
- Analysis: Grade 6-12-2+.05Cu+.30Fe+.05Mn+1Zn
- Typical use rate with starter fertilizer program is 1-5 gal/A.
- Typical use rate for foliar application is 1-3 gal/A.

Package Size
2x2.5 gal case, 275 gal, Repack

Always read and follow label directions.

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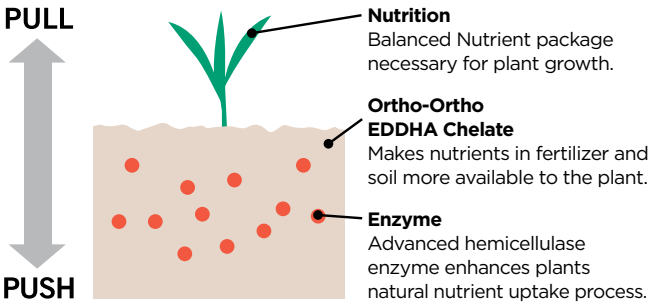
CHS LUMEN®

Nutrient Shuttle Effect

CHS Lumen® is the most advanced starter fertilizer that contains key plant nutrients, patent pending Ortho-Ortho EDDHA chelate, and an advanced enzyme that enhances the plants natural nutrient uptake process. CHS Lumen is formulated for use with cropping systems that have shown benefits with the addition of a nitrogen or phosphorus starter fertilizer application or have exhibited deficiencies in zinc or iron. When used with sound agronomic practices, CHS Lumen has been shown to enhance plant growth, increase root development and correct nutrient deficiencies to maximize yield potential.

Push Pull Nutrition

This combination creates a Push <-> Pull nutrition package by providing nutrition to the plant, making the nutrients more available, and enhancing the plants ability to take up nutrients.



Principal Functioning Agents

Total Nitrogen (N). 5.00%
3.00% Ammoniacal Nitrogen
2.00% Urea Nitrogen

Available Phosphate (P2O5). 15.00%

Soluble Potash (K2O) 3.00%

Iron (Fe) 0.10%
0.10% Chelated Iron (Fe)

Zinc (Zn) 0.80%
0.80% Chelated Zinc (Zn)

Derived from urea, anhydrous ammonia, monoammonium phosphate, Diammonium phosphate, monopotassium phosphate, dipotassium phosphate, Iron EDDHA, and zinc EDTA.

Enzyme
Hemicellulase. . . . . 2,000 uU/mL

Based on activity on Locust Bean as a substrate.

Application Directions

- **Soil**
  Apply 1-5 gal/A as a starter fertilizer or as a soil applied broadcast application in a balanced fertility program. Water may be added to increase application rate. *Corn and Sugarbeet:* The most common use rate is 3 gal/A. Apply 2-3 gal/A as an in-furrow pop-up fertilizer or 3-5 gal in a 2x2" band at planting alone or in combination with other liquid fertilizers as prescribed by state recommendations. Apply 3-5 gal as a broadcast application. *Potato:* Apply 3-5 gal/A as a starter or broadcast fertilizer program often tankmixed with other phosphate fertilizers.
- **Postemergence**
  Apply 1-3 gal/A to an actively growing crop to prevent the occurrence of a nutrient deficiency or as remediation to an existing nutrient deficiency. Postemergence applications should be made in a minimum of 10 gal/A of water.

Package Size

2x2.5 gal case, Bulk, Tote

Always read and follow label directions.

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CHS Rapid Up™

10–52–10

CHS Rapid Up™ 10-52-10 is a fast-acting formula that promotes early root growth as well as shoots and leaves in young plants. An excellent product for transplanted crops whether applied through soil or foliar application. Later applications improve bloom set and flowering.

1. Foliar fertilization is intended as a supplement to a regular fertilizer program and will not by itself, provide all the nutrients normally required by agriculture crops.
2. Nitrogen breakdown is 8.00% ammoniacal, 0.90%, nitrate, and 1.10% urea nitrogen, with chelated micronutrients.

Nutrient Content (%) Guaranteed Analysis

Product	N	P*	K**	B	Cu	Fe	Mn	Mo	S	Zn
CHS Rapid Up 10-52-10	10	52	10	0.02	0.05	0.10	0.05	0.0005	-	0.05

*P_2O_5
**K_2O

Application Directions:

1. **General Foliar Application**
   Apply 2-10 lb/A in a minimum 20 gal of water
2. **Aircraft Application**
   Apply a maximum of 4 lb of product in 2 gal of water per A

Package Size
25 lb bags

Always read and follow label directions.

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CHS Rapid Up™

20-20-20

CHS Rapid Up™ 20-20-20 is a balanced, high-analysis formula which is the 'workhorse' in most growing operations. The 1:1:1 ratio offers a continual supply of nutrients for use on a wide variety of crops. Used for both soil and foliar applications, 20-20-20 is the most common multipurpose product on the market.

1. Lawn and turf use - A slightly acidic formula that dissolves quickly and mixes well with other turf protection products. Excellent for use on greens, tees, and fairways, but also can be used on flowers and shrubs at the same time.
2. Nitrogen breakdown is 3.90% ammoniacal, 5.80%, nitrate nitrogen, and 10.3% urea nitrogen with chelated micronutrients.

Nutrient Content (%) Guaranteed Analysis

Product	N	P*	K**	B	Cu	Fe	Mn	Mo	S	Zn
CHS Rapid Up 20-20-20	20	20	20	0.02	0.05	0.10	0.05	0.0005	-	0.05

*P_2O_5
**K_2O

Application Directions

1. **General Foliar Application**
   Apply 2-10 lb/A in a minimum 20 gal of water
2. **Aircraft Application**
   Apply a maximum of 4 lb of product in 2 gal of water per A

Package Size
25 lb bags

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CHS Rapid Up™

Bean Mix

CHS Rapid Up™ Bean Mix is a premium foliar mix that is used to provide several vital micronutrients to soybeans and other crops. The balanced formula contains boron, iron, manganese and sulfur in levels that improve yield and repairs damage from herbicide sprays.

1. Foliar fertilization is intended as a supplement to a regular fertilizer program and will not by itself, provide all the nutrients normally required by agriculture crops.
2. Nitrogen breakdown is 3.00% ammoniacal and 2.00% urea nitrogen.

Nutrient Content (%) Guaranteed Analysis

Product	N	P*	K**	B	Cu	Fe	Mn	Mo	S	Zn
CHS Rapid Up Bean Mix	5	-	-	1.5	-	3.00	12	-	10	-

*P_2O_5
**K_2O

Application Directions

1. General Application
Typical application rate is 2-5 lb of Bean Mix per acre applied as a foliar spray during the early vegetative stage (V-3 to V-6) of the plant. Additional applications may be made if signs of manganese deficiency are evident. Soil test or tissue tests should be used as a base reference.

2. Mixing Sequence
Mixing sequence must be Bean Mix first, ammonium sulfate or other compatibility agent and lastly any other product. (Each product must be allowed to mix completely before the addition of the next).

Package Size

25 lb bags

Always read and follow label directions.

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CHS Rapid Up™

Corn Mix

CHS Rapid Up™ Corn Mix is a balanced formulation containing zinc and boron for foliar application on corn. It also contains manganese to improve photosynthesis after herbicide applications.

1. Foliar fertilization is intended as a supplement to a regular fertilizer program and will not by itself, provide all the nutrients normally required by agriculture crops.
2. Nitrogen breakdown is 2.30% ammoniacal and 2.70% urea nitrogen.

Nutrient Content (%) Guaranteed Analysis

Product	N	P*	K**	B	Cu	Fe	Mn	Mo	S	Zn
CHS Rapid Up Corn Mix	5	-	-	2	-		6	-	10	10

*P_2O_5
**K_2O

Application Directions

1. General Application
Typical application rate is 2-5 lb of Corn Mix per acre applied as a foliar spray during the early vegetative stage (V-3 to V-6) of the plant. Additional applications may be made if signs of zinc deficiency are evident. Soil test or tissue tests should be used as a base reference.

2. Mixing Sequence
Mixing sequence must be Corn Mix first, Ammonium Sulfate or other compatibility agent and lastly any other product. (Each product must be allowed to mix completely before the addition of the next).

Package Size

25 lb bags

Always read and follow label directions.

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N·EDGE®

Nitrogen Stabilizer

ACTIVE INGREDIENTS

- N-(n-butyl) thiophosphoric triamide (NBPT)
  CAS No. 94317-64-3..... 26.7%
- Inert Ingredients.....73.3%

Dimethyl sulfoxide [DMSO] CAS No. 67-68-5, Benzaldehyde CAS No. 100-52-7, 1,2,3-propanetriol CAS No. 56-81-5

APPLICATION DIRECTIONS

- Urea: 3 qt/ton
- UAN: 1.5-2.5 qt/ton

CROPS

Soybeans, Dry Beans, Sugarbeets, Wheat, Barley, Sorghum, Corn, Sunflowers, Potatoes

PACKAGE SIZE | 2x2.5 gal | 250 gal

FEATURES AND BENEFITS

- **Reduce loss of nitrogen to the atmosphere.**
- **Superior formulation and stewardship.**
- **Improve nutrient management.**

N-Edge® reduces nitrogen loss, providing a valuable window of time for rain, irrigation or incorporation to move fertilizer to the root zone before volatilization occurs.

N-Edge reduces nitrogen loss in two ways:
- Inhibits activity of the enzyme (urease) that breaks down urea
- Slows the conversion of urea to ammonia gas

This advanced nitrogen stabilizer contains a penetrating agent that ensures its proven active ingredient, NBPT, spreads throughout the treated fertilizer granule for maximum effectiveness.

N-Edge also provides superior handling because it dries faster, covers better, produces less dust and enables treated fertilizer to flow better. And the product's bright green color makes it easy to see where treated fertilizer has been applied, helping to ensure nutrients are in the right place.

N-Edge nitrogen stabilizer increases the efficiency of urea or urea-containing fertilizers for all crops, turf and forestry by reducing nitrogen loss to the environment and increasing nutrient availability for plant growth.



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N-EDGE® 2

Fertilizer additive for Urea, UAN, and Manure fertilizer sources that reduces volatilization by inhibiting the activity of the urease enzyme.

ACTIVE INGREDIENTS

- N-(n-butyl) thiophosphoric triamide (NBPT)
  CAS No. 94317-64-3 ..... 40.4%
- Inert Ingredients 59.6%

Dimethyl sulfoxide [DMSO] CAS No. 67-68-5, Benzaldehyde CAS No. 100-52-7, 1,2,3-propanetriol CAS No. 56-81-5

APPLICATION DIRECTIONS

- Urea: 2 qt/ton
- UAN: 1 qt/ton

CROPS

Soybeans, Dry Beans, Sugarbeets, Wheat, Barley, Sorghum, Corn, Sunflowers, Potatoes

PACKAGE SIZE | 2x2.5 gal | 250 gal

FEATURES AND BENEFITS

- **Reduce loss of nitrogen to the atmosphere.**
- **Superior formulation and stewardship.**
- **Improve nutrient management.**

N-Edge® 2 reduces nitrogen loss, providing a three-week window for rain, irrigation or incorporation to move fertilizer to the root zone before volatilization occurs. N-Edge 2 contains a higher concentration of the active ingredient, NBPT, enabling lower use rates.

N-Edge 2 reduces nitrogen loss in two ways:

- Inhibits activity of the enzyme (urease) that breaks down urea
- Slows the conversion of urea to ammonia gas

This advanced nitrogen stabilizer contains a penetrating agent that ensures its proven active ingredient, NBPT, spreads throughout the treated fertilizer granule for maximum effectiveness. And the product's color makes it easy to see where treated fertilizer has been applied, helping to ensure nutrients are in the right place.

N-Edge 2 also provides superior handling because it dries faster, covers better, produces less dust and enables treated fertilizer to flow better.



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N·EDGE® PRO

NBPT & DCD nitrogen stabilizer.

ACTIVE INGREDIENTS

- NBPT.....17%
- DCD.....23%

APPLICATION DIRECTIONS

- Broadcast, Air machine, fertigation, injection/knifed-in
- 2-3 qt/ton use rate for Urea
- 1.5-3 pt/ton use rate for UAN

CROPS

Soybeans, Dry Beans, Sugarbeets, Wheat, Barley, Sorghum

Corn, Sunflowers, Rice, Potatoes, Cotton

FEATURES AND BENEFITS

- **Protects above ground nitrogen from ammonia volatilization.**
- **Protects below ground nitrogen from denitrification and leaching.**
- **Dual formulation and proven solvent offer enhanced mixing and handling.**

N-Edge® Pro is an NBPT and DCD combination nitrogen stabilizer that provides protection against volatility leaching and denitrification in both below and above ground applications. N-Edge Pro helps keep nitrogen available in the root zone longer, providing a greater opportunity for healthy crops to reach their maximum yield potential. The technology reduces nitrogen loss by inhibiting urease enzyme from breaking down urea and slowing the conversion of urea to ammonia gas. N-Edge Pro also acts as a nitrification inhibitor. By inhibiting nitrification (slowing the conversion of ammonium to nitrate), N-Edge Pro reduces losses from leaching or denitrification. N-Edge Pro also provides superior handling because it dries faster, covers better, and produces less dust which all provides better flowability. Applications help fine-tune fertility programs, protect against ground water contamination, reduce greenhouse gasses, and grow more for every pound of fertilizer.



PACKAGE SIZE | 2x2.5 gal | 250 gal

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N·EDGE® SOIL 2

High-load DCD nitrogen stabilizer.

ACTIVE INGREDIENTS

- DCD 30%

APPLICATION DIRECTIONS

- Broadcast, Air machine, fertigation, injection/knifed-in
- 3 qt/ton rate for Urea
- 2 qt/ton rate for UAN
- 5-7 qt/ton rate for Anhydrous Ammonia

CROPS

Soybeans, Dry Beans, Sugarbeets, Wheat, Barley, Sorghum, Corn, Sunflowers, Potatoes

FEATURES AND BENEFITS

- **Protects below ground nitrogen applications from denitrification and leaching.**
- **Higher DCD percentage extends protection window.**
- **Enhanced solvent and low use-rate offer enhanced mixing and handling.**

N-Edge® Soil 2 is a high-load DCD (dicyandiamide) nitrogen stabilizer that provides protection against leaching and denitrification with below ground applications. N-Edge Soil 2 helps keep nitrogen available longer in the root zone, providing greater opportunity for healthy crops that will reach their maximum yield potential. New formulation offers enhanced protection with a higher percentage of DCD for a longer window of protection compared to other below ground applied products on the market. Applications help fine-tune fertility programs, protect against ground water contamination, reduce greenhouse gasses, and grow more for every pound of fertilizer.

PACKAGE SIZE | 2x2.5 gal | 250 gal



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XLR·RATE®

2-17-17 Liquid Starter Fertilizer

GUARANTEED ANALYSIS

- Total Nitrogen (N) 2.0%
  2.0% Urea Nitrogen
- Available Phosphate (P_2O_5) 17.0%
- Soluble Potash (K_2O) 17.0%
- Molybdenum (Mo) 0.001%
  0.001% Water Soluble Molybdenum (Mo)

Derived from: Phosphoric Acid, Potassium Hydroxide, Sodium Molybdate and Urea.

APPLICATION DIRECTIONS

- **SOIL APPLICATION**
  XLR-rate® 2-17-17 can be applied to crops by banding in or near the seed row, surface dribble, strip-till, bed placement, irrigation or by other methods. Follow label instructions or use in accordance with recommendations of a qualified individual or institution, such as, but not limited to, a certified crop advisor, agronomist, university crop extension publication, or apply according to recommendations of an approved nutrient management plan.
- **FOLIAR APPLICATION**
  Vegetable and Field Crops, Deciduous Fruit and Nut Trees, Grapes, Olives and Citrus: Apply 1 to 3 gallons per acre in a minimum of 5 gallons of water per acre. Repeat applications may be beneficial. Use of a surfactant may enhance leaf coverage and increase nutrient absorption. Do not apply when the crop is excessively stressed for moisture or during periods of high temperatures. Use the lowest possible volume for thorough coverage with a small droplet size. Optimum foliar application conditions for most crops generally occur during early morning or late evening hours.

FEATURES AND BENEFITS

- **Provides phosphorus and potassium in a safe, versatile, true solution fertilizer.**
- **Has one of the lowest salt indexes available – can be used on a wide variety of crops to improve yield and quality.**

Provide critical nutrition in the early growth stages.

In either early or late planting seasons, the right starter fertilizer is a key contributor to reaching your yield and productivity goals. XLR-rate® liquid starter fertilizers are low-salt, high-ortho formulations that can be safely used in close proximity to the seed, roots and foliage for better fertilizer efficiency.

- Can often be applied with cover sprays to reduce trips over the field.
- Can be banded into the soil or applied through most types of irrigation systems.
- Can be used with either ground or aerial equipment for effective foliar applications.

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XLR·RATE®

7-23-5 Liquid Starter Fertilizer

GUARANTEED ANALYSIS

- Total Nitrogen (N) 7.0%
  - 5.3% Ammoniacal Nitrogen
  - 1.7% Urea Nitrogen
- Available Phosphate (P_2O_5) 23.0%
- Soluble Potash (K_2O) 5.0%
- Molybdenum (Mo) 0.001%
  - 0.001% Water Soluble Molybdenum (Mo)

Derived from: Anhydrous Ammonia, Phosphoric Acid, Potassium Hydroxide and Urea, Sodium Molybdate.

APPLICATION DIRECTIONS

- **SOIL APPLICATION**
  XLR-rate® 7-23-5 can be applied to crops by banding in or near the seed row, surface dribble, strip-till, bed placement, irrigation or by other methods. Follow label instructions or use in accordance with recommendations of a qualified individual or institution, such as, but not limited to, a certified crop advisor, agronomist, university crop extension publication, or apply according to recommendations of an approved nutrient management plan.
- **FOLIAR APPLICATION**
  Vegetable and Field Crops, Deciduous Fruit and Nut Trees, Grapes, Olives and Citrus: Apply 1 to 3 gallons per acre in a minimum of 5 gallons of water per acre. Repeat applications may be beneficial. Use of a surfactant may enhance leaf coverage and increase nutrient absorption. Do not apply when the crop is excessively stressed for moisture or during periods of high temperatures. Use the lowest possible volume for thorough coverage with a small droplet size. Optimum foliar application conditions for most crops generally occur during early morning or late evening hours.

FEATURES AND BENEFITS

- **Low-salt plant food providing balanced N-P-K nutrition high in orthophosphates.**
- **100% plant-available nutrition, near neutral pH, chloride-free, low salt and designed for maximum plant safety and growth.**

Provide critical nutrition in the early growth stages.

In either early or late planting seasons, the right starter fertilizer is a key contributor to reaching your yield and productivity goals. XLR-rate® liquid starter fertilizers are low-salt, high-ortho formulations that can be safely used in close proximity to the seed, roots and foliage for better fertilizer efficiency.

- Keeps expensive application equipment looking like new – will not cause rust or corrosion.
- Has the highest nutrient usability available – when applied in-furrow or placed 2x2 at planting time, it delivers greater fertilizer efficiency with lower rates.
- Delivers the performance of a high orthophosphate fertilizer at an economical price.

• PLANT NUTRITION •

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XLR·RATE®

10-4-3 Liquid Foliar Fertilizer

GUARANTEED ANALYSIS

- Total Nitrogen (N) 10.0%
  10.0% Urea Nitrogen
- Available Phosphate (P_2O_5) 4.0%
- Soluble Potash (K_2O) 3.0%
- Boron (B) 0.10%
  0.10% Water Soluble Boron (B)
- Copper (Cu) 0.10%
  0.10% Chelated Copper (Cu)
- Iron (Fe) 0.25%
  0.25% Chelated Iron (Fe)
- Manganese (Mn) 0.20%
  0.20% Chelated Manganese (Mn)
- Molybdenum (Mo) 0.001%
  0.001% Water Soluble Molybdenum (Mo)
- Zinc (Zn) 0.10%
  0.10% Chelated Zinc (Zn)

Derived from: Phosphoric Acid, Potassium Hydroxide and Urea, Zinc EDTA, Manganese EDTA, Copper EDTA, Iron EDTA, Boric Acid, Sodium Molybdate.

APPLICATION DIRECTIONS

- **SOIL APPLICATION**
  Apply 2-4 quarts per acre. XLR-rate 10-4-3 may be blended with phosphate-based starter fertilizers including those that contain 100% orthophosphate.
- **FOLIAR APPLICATION**
  - Ground Equipment: Apply 2-4 quarts XLR-rate® 10-4-3 in 10-20 gallons of water per acre. Repeat applications may be beneficial.
  - Aerial: Apply 1-2 quarts with 5 gallons water per acre.

FEATURES AND BENEFITS

- **Balanced blend of N-P-K formulated especially for effective foliar application.**
- **Promotes plant recovery after environmental stress caused by weather or other factors.**
- **Aids in plant growth and helps hasten maturity.**

Deliver immediate, targeted nutrition when it's most needed.

XLR-rate® liquid foliar fertilizer quickly strengthens your crop during pre-productive growth stages to help overcome poor soil nutrient availability, disease, and other adverse growing conditions. And because young, new growth is more receptive to foliar fertilizer, you're taking a major step toward maximizing yields. If you missed the starter fertilizer application window, it's not too late to get your plants off to an early, healthy start.

- 100% plant-available nutrition, near neutral pH, chloride-free, low salt and designed for maximum plant safety and growth.
- Provides good return on investment and complements your existing fertility program.
- Compatible with the 4Rs fertilizer best management practices for environmental stewardship.
- Helps improve profitability in traditional, minimal till or no-till farming.

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CHS®

CHS Agronomy Plant Nutrition

Allocate™ BCMZ

High-load liquid boron, copper, manganese and zinc blend

Allocate™ BCMZ is high load suspension fertilizer for impregnation on most types of dry fertilizer.

Functions

—An easy to use micronutrient suspension fertilizer for impregnating zinc, manganese, boron and copper

—Can be used on Urea, AMS, DAP, MAP, Potash, and MES-10 allowing for even distribution of four critical micronutrients across the whole blend

—Compatible with co-applications of Trivar, Levesol DFC ZN and the N-Edge product family

Allocate™ ZN

High-load liquid zinc

Allocate™ Zn is high load suspension fertilizer for impregnation on most types of dry fertilizer.

Functions

—Concentrated zinc formulation with excellent handling characteristics even in cold weather

—Can be used on Urea, AMS, DAP, MAP, Potash, and MES-10, allowing for use with whole blends

—Compatible with co-applications of Trivar, Levesol DFC ZN and N-Edge product family

Blue Tsunami®

Nitrogen 8%, Zinc 10%

Blue Tsunami® combines nitrogen with chelated zinc to increase nutrient availability and improve uptake.

Functions

—Maintains zinc (Zn) solubility to prevent fixation in soil

—Improves early plant development

Bollbuilder®

Calcium 1.33%, Boron 1.33%, Manganese 0.66%, Zinc 2%

Bollbuilder® provides essential micronutrients to promote yield through increased flowering, fiber strength, and improved nitrogen metabolism.

Functions

—Specially designed for use in cotton to encourage production and retention of larger bolls with increased fiber strength

—Allows growers in-season access to critical timing of plant nutrient needs

—Easily incorporated into a fertility management program

EB Mix®

Nitrogen 6%, Sulfur 3%, Boron 0.25%, Iron 1%, Manganese 3%, Zinc 2%

EB Mix® blends chelated micronutrients with essential macronutrients to help nourish modern hybrids.

Functions

—Package of key nutrients that can increase yield and be applied when plant needs are critical

—Can be used to improve early season growth, provide in-season growth enhancement and correct nutrient deficiencies

Equation™

Phosphorus 10%, Potassium 10%, Boron 1%, Iron 0.5%, Manganese 0.5%, Zinc 0.5%, Copper 0.1%

Equation™ contains a blend of nutrients that improves overall plant health without antagonizing glyphosate or other pesticide performance.

Functions

—Increases nutrient uptake

—Minimizes glyphosate antagonism

—Improves translocation of tank mix partners within the plant

CHS Agronomy Plant Nutrition

FOUR·SCORE™

Nitrogen 3%, Potassium 1%, Copper 0.5%, Iron 0.5%, Manganese 1%, Zinc 2.25%

Four-Score™ combines nitrogen, potassium and a blend of chelated micronutrients for in-furrow or foliar applications.

Functions

—Increases early season root development when used in-furrow

—Prevents mid-season nutrient deficiencies when used as a foliar application

—Fully EDTA chelated to maintain micronutrient availability and minimize herbicide and fertilizer compatibility issues within the tank mix

H·PRO 20

Acid Soluble Humate 20%, Potash 3.5%

H-Pro 20 contains a concentrated source of humic acid derived from leonardite and potash. Humic acids increase complexing capacity and provide more carbon content for soil microbes.

Functions

—Excellent mixing properties with many starter fertilizers

—Highly concentrated form of humic acid

N·ERTIA™ 26

Nitrogen 26%

N-Ertia™ 26 contains 17.4% urea nitrogen and 8.65 slow-release nitrogen. Merging readily available nitrogen with slow release sources increases nitrogen use efficiency.

Functions

—Low salt, crop safe formulation for foliar applications

—Designed for foliar applications

N·ERTIA™ B

Nitrogen 25%, Boron 0.5%

N-Ertia™ B combines readily available nitrogen, slow-release nitrogen and boron to improve nitrogen use efficiencies and target boron deficiencies.

Functions

—Low salt, crop safe formulation for foliar applications

—Designed for foliar applications

POTASSIUM 19

Potassium 19%, Sulfur 6%

Potassium 19 is a readily available source of potassium and sulfur made with potassium acetate and potassium thiosulfate

Functions

—Great tank mix partner and foliar source or potassium

—Excellent herbicide compatibility

TACHLINE®

Sulfur 3.6%, Boron 0.1%, Manganese 3.0%, Zinc 4.0%

Tachline® may be used as a foliar-applied application where the addition of one or more of the essential nutrients contained would be beneficial.

Functions

—Blend of four essential key nutrients for multiple crops

—Foliar application compatible with multiple pesticides

—Nutrient analysis designed to maximize crop impact

TACHLINE®·PRO

Sulfur 3.6%, Boron 0.1%, Manganese 3.0%, Zinc 4.0%

Tachline® Pro may be used as a foliar applied application to any food or fiber crop where the addition of one or more of the essential nutrients contained in Tachline Pro would be beneficial.

Functions

—Blend of 4 key essential nutrients for multiple crops (S, B, Mn, Zn)

—Improved formulation for increased compatibility with the latest technologies

—Nutrient analysis designed to maximize crop impact at 1-2 qt/A

INOCULANTS

For Soybeans

Dual Action Soybean/Growth Promoter
Same maximum yield performance in an enhanced formulation.

Description

CHS Inoculants for Soybeans has been reformulated to provide a high concentration of specially-selected *Bradyrhizobium elkanii* for nitrogen fixation. The new formulation contains more than double the concentration of *Bradyrhizobium* (1 x 10^{10} CFUs per ml) with the same high concentration of *Delftia acidovorans* (2 x 10^{7} CFUs per ml) and also boasts an extended on-seed life of 90 days. The formulation enhancement is the second product improvement under Lallemand Plant Care ownership. Look for new products and product innovations in the near future.

How it Works

The relationship between *Bradyrhizobium elkanii* and the soybean plant results in nodules forming on the roots, where nitrogen fixation occurs, ensuring that nitrogen is available to the plant when the plant needs it. CHS Inoculants for Soybeans is utilizing unique *Bradyrhizobium elkanii* strains to bring soybean growers an innovative product with higher rhizobia survival and competitiveness – ultimately leading to enhanced nodulation, early vigor and higher soybean yields.

Delftia acidovorans is active in the soil, is attracted to root exudates and will move toward growing roots where it will multiply and colonize the root zone. The bacterium has various beneficial modes of action that positively impact plant root growth; this ultimately promotes higher yields.

Modes of Action – *Delftia acidovorans*

- Increase iron solubilization for plant uptake through increase siderophore production. Siderophores are iron-chelating compounds that are secreted by microorganisms such as *Delftia acidovorans* contained in the CHS Inoculant.
- The organism is a known sulfur oxidizer and makes more sulfur available to the plant.
- The organism stimulates root and root hair development, thus helping the plant access more water and nutrients in limiting environmental conditions.
- The organism is an aggressive root colonizer and may out-compete other soil microbes.

Features

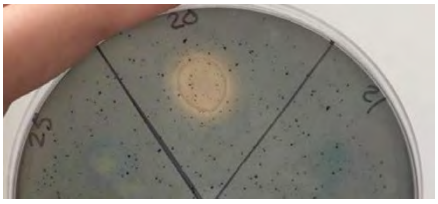
- Two Active Ingredients: *Bradyrhizobium elkanii, Delftia acidovorans*
- Easy-to-use Formulation:
  - one package to open (no mixing)
  - low use rate: 1.5 fl oz/cwt
  - limited tackiness/bridging
- On-Seed Life:
  - 90 days
  - Package shelf live of two seasons

30% average improvement in plant color!

	Greeness Index	Nitrogen Reflectance Index	Green Leaf Index	Triangular Greenness Index
Competitor	1.472	0.191	0.221	3157
CHS Inoculants	1.612	0.234	0.209	6011
% increase to CHS Inoculants	9.5	22.6	-5.7	90.4
Average Increase	29.2			



CHS Inoculants for Soybeans treated plants reliably nodulate earlier than competitor inoculants under controlled laboratory conditions. Shown are roots after 15 days of development with six nodules for the competitor and 23 nodules for CHS Inoculants for Soybeans.



Competitor 1 **CHS Inoculants** **Competitor 2**

Visual representation of iron chelation by *Delftia acidovorans* following CAS agar method.



Competitor **CHS Inoculants**

Vegetative indexes for CHS Inoculants treated soybeans — Buxton, N.D. - 2019

Package Size

4x100 unit case, 1x400 unit case

Powered by Lallemand

LALLEMAND PLANT CARE

Always read and follow label directions.

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CHS UNLOCKED®

Plant Hormone Supplement

CHS Unlocked® contains naturally derived Cytokinin, Auxin, and Gibberellic plant growth regulators in the right balance improving growth and development of many crops.

The active ingredients in CHS Unlocked induce cell division, stimulate cell enlargement, delay senescence, overcome apical dominance and improve nutrient mobilization.

The ingredients that are utilized in the CHS Unlocked formulation provide a molecular configuration that is more innately predisposed to "fit" into plant cellular hormone receptors due to its natural derivation. This feature provides quicker uptake and increased activity. CHS Unlocked has vastly increased bioactivity compared to other plant growth regulator products that are synthetically derived.



Compatibility
CHS Unlocked can be blended with most primary, secondary, or micronutrients as well as crop protection products. Add CHS Unlocked to liquid fertilizer and agitate until thoroughly mixed. In the absence of published information, check compatibility by performing a jar test prior to mixing.

Principal Functioning Agents
Cytokinin (as kinetin, Based on bioassay). 0.010%

6-(4-hydroxy-3-methylbut-trans-2-enylamino)-purine N^6-methylaminopurine, N^6-dimethylaminopurine, N^6-isopentenylaminopurine Auxin (Indole-3-butyric acid) 0.005%

Gibberellin (Gibberellic Acid A_3). 0.004%

Other Ingredients 99.981%

TOTAL 100%

Application Directions
- Apply 0.5-1.0 oz/cwt as a seed treatment on labeled crops such as wheat and soybeans
- Apply 2 oz/A in-furrow on corn (field, sweet, popcorn)
- Apply 4-8 oz/A as a foliar application to labeled crops such as corn, soybeans, sugar beets and wheat

Minimum Storage Temperature
CHS Unlocked will freeze at 32°F. If allowed to freeze, thaw completely prior to use.

Package Size
2x2.5 gal case

Always read and follow label directions.

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CHS UNLOCKED® · PRO

Plant Hormone Supplement

CHS Unlocked® Pro contains naturally derived Cytokinin, Auxin, and Gibberellic plant growth regulators in the right balance improving growth and development of many crops.

The active ingredients in CHS Unlocked Pro induce cell division, stimulate cell enlargement, delay senescence, overcome apical dominance and improve nutrient mobilization.

The ingredients that are utilized in the CHS Unlocked Pro formulation provide a molecular configuration that is more innately predisposed to "fit" into plant cellular hormone receptors due to its natural derivation. This feature provides quicker uptake and increased activity. CHS Unlocked Pro has vastly increased bioactivity compared to other plant growth regulator products that are synthetically derived.

Compatibility
CHS Unlocked Pro can be blended with most primary, secondary, or micronutrients as well as crop protection products. Add CHS Unlocked Pro to liquid fertilizer and agitate until thoroughly mixed. In the absence of published information, check compatibility by performing a jar test prior to mixing.

Active Ingredients

Homobrassinolide	0.0025%
Auxin:	
Indole-3-butyric acid	0.0100%
Gibberellin:	
Gibberellic acid GA_3	0.0090%
Other Ingredients	99.9785%
Total	100.000%

Application Directions
- Apply 1.0-1.5 oz/cwt as a seed treatment on labeled crops corn, soybeans and wheat
- Apply 2 oz/A in-furrow on corn, soybeans
- Apply 4-8 oz/A as a foliar application to labeled crops such as corn, soybeans, sugar beets and wheat

Minimum Storage Temperature
CHS Unlocked Pro will freeze at 32°F. If allowed to freeze, thaw completely prior to use.

Package Size
2x2.5 gal case

Always read and follow label directions.

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Levesol® Family

LEVESOL®

Solution chelated with ortho-ortho EDDHA designed for use in most soil-applied fertilizers.

Functions

—Makes phosphorus, zinc and other key micronutrients more available to the plant

—Enhanced nutrient availability increases early growth, overall plant health, and ultimately yield

—Has three modes of action: it unlocks nutrients in the soil, it allows the nutrients to be more available, and is mobile in the plant for season-long activity

LEVESOL® DFC ZN

Zinc solution chelated with ortho-ortho EDDHA designed to be mixed directly with dry starter fertilizer.

Functions

—Increases the length of time that the zinc is available for optimal plant uptake

—Ortho-ortho chelate allows nutrients in the fertilizer and soil to become more available for plant uptake

—First-of-its-kind chelating agent that can be impregnated to a dry starter fertilizer

LEVESOL® ZN

Zinc solution chelated with ortho-ortho EDDHA, designed for use in most soil-applied fertilizers.

Functions

—Increases length of time zinc is available to the plant

—Allows zinc, phosphorus, and other micronutrients already present in the soil more available for plant uptake

—Enhanced nutrient availability increases speed of emergence, overall plant health, and ultimately yield

MOXON™ B
MOXON™ CU
MOXON™ MN

Foliar ortho-ortho EDDHA chelated Micronutrient.

Moxon™ B is a 7.5% foliar boron equipped with the patented Levesol chelate. Boron is highly responsive in row crops and is a major component in the grain development process for crops. The Levesol chelate works synergistically to increase nutrient availability and translocation into the plant.

Moxon™ Cu contains a low salt, highly efficient source of nitrogen derived from liquid urea. Moxon Cu enhances rapid nitrogen absorption while aiding in the uptake and translocation of other critical nutrients. Moxon Cu also contains copper along with the unique chelating technology used in Levesol. The nutrients in Moxon Cu should reduce the impact of disease and ensure proper flower and grain development.

Moxon™ Mn is a 5% foliar manganese equipped with the patented Levesol chelate. Manganese is one of the most common deficiencies in soybean and pulse crops and can impact the photosynthesis process in the plant. Applications help mitigate this deficiency and can even increase the availability of calcium and phosphorus to the plant.

Functions

—Equipped with the patented Levesol chelate to provide better nutrient availability

—Choose from multiple critical micronutrients essential for plant development and yield outcome

—Convenient use rate and easy handling

Levesol® Family

SOYGREEN®

Most effective and proven IDC product on the market.

Soygreen® improves the availability of iron to field crops.

Functions

—Unparalleled concentration of ortho-ortho EDDHA chelate

—Effectively increases the availability of iron in the soil

SOYGREEN® · PRO

Liquid ortho-ortho EDDHA chelated iron solution.

Soygreen® Pro is designed to improve the availability of iron to field crops.

Functions

—Improves the availability of iron, helping crops overcome IDC

—Low use rate and viscosity, allowing good operational efficiency

SOYGREEN® GRANULAR 2.4

Superior granular ortho-ortho EDDHA chelated iron product.

Soygreen® Granular 2.4 is a peat based granular 2.4% iron (Fe) ortho-ortho EDDHA.

Functions

—Should improve the availability of iron to field crops

—Target crop is soybeans grown in areas with a history of iron deficiency chlorosis

—Other crops may benefit from a Soygreen Granular 2.4 application when uptake of iron is limited

SOYSHOT®

Safe and effective ortho-ortho EDDHA chelated soybean starter fertilizer.

Soyshot® is a starter fertilizer with a low salt index developed for maximum crop safety and performance in soybeans.

Functions

—Increased availability of micronutrients

—Increased availability of phosphorus

—Maximum crop safety

TRIVAR®

A broadcast fertilizer additive for dry phosphate aiding in the availability of phosphorus and other key micronutrients.

Trivar® is the first-of-its-kind chelating agent that can be added directly to a dry phosphate fertilizer and broadcasted on the field.

Functions

—Powered by Levesol, the strongest and most agronomically proven chelate on the market

—Harnesses three unique modes-of-action to make phosphorus and other nutrients more available

—Easy-to-use formulation that takes less time to impregnate than commonly used impregnated products

TRIVAR® · EZ

Chelated granular micronutrient additive

Trivar® EZ is a Levesol enhanced granular micronutrient blend for mixing with dry fertilizer. The patented chelate is infused into the granular boostings micronutrient fertility and availability.

Functions

—Contains the strongest and most agronomically proven chelate on the market

—Chelation prevents phosphorus from locking up micronutrients, creating more nutrition that plants can access

—Easy-to-use granular blend mixes evenly with dry fertilizer

ARMIS™ FI

Fungicide and Insecticide Seed Treatment for Soybeans

Key Performance Benefits

- Protection for the entire plant – Dual mode of action creates a complete zone of defense above and below ground.
- Protects against a wider spectrum – Protects against *Pythium* and *Phytophthora* species plus insects and other diseases.
- User-friendly treatment – Smooth flowability and low use rate ensures a consistent, even application and easy treatment experience.

Compatibility

All slurry mixes should be pre-tested to determine physical compatibility between formulations. When slurry mixing, follow the most restrictive label instructions for any tank mix partner. DO NOT tank mix with any product that bears a label prohibition against slurry mixing. Compatible with most other seed treatment enhancement products and soybean inoculants.

Active Ingredients

Ethaboxam
Ipconazole
Metalaxyl
Clothianidin

Formulation

Flowable Seed Treatment

Chemistry Family

Thizole Carboxamide, Triazole, Phenylamide, Nicotinoids
FRAC no. 22, 3 and 4 IRAC 4A

Signal Word

"Caution"

Restricted Use

No

Colored

Yes

Protection Against

Phytophthora sp.
Pythium sp.
Rhizoctonia sp.
Fusarium
Seed and seedling decay
Seed corn maggot
Bean leaf beetle
Wireworm
Aphids

Storage

Do not store at temperatures below 32°F. If the product is exposed to temperatures below 32°F, thaw at room temperature to 50°F or warmer and shake gently to unify the product.

Application Directions

3.37 fl oz/cwt

Product Weight/Gal

9.51 lb/gal

Package Size

15 gal

Always read and follow label directions.

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CHS Agronomy Seed Care

ABIVIUM™

Graphite flow talc seed lubricant

Abivium™ is a nutritional seed lubricant that improves germination, crop emergence, seedling vigor, and plant tolerance under abiotic stress, leading to higher yields. Equipped with a complete micronutrient package and a combination of Biostimulants and metabolites.

Functions

—Dry powder formulation provides easy on-farm application and adhesion to the seed

—Provides essential nutrients on the seed for improved plant growth, development and vigor

—Biostimulants enhance plant cell activity improving germination and tolerance in harsh conditions

ANOCULARE™

Dual-action biological inoculant for soybeans

Anoculare™ is a dual-action soybean inoculant, boosting nitrogen fixation, root growth, and stress tolerance.

Functions

—Dual-strain nitrogen fixing biological for better nodulation and vegetative growth

—Market-differentiating biological drives vigorous growth, both above and below ground, with improved photosynthetic activity

—Long on-seed life of up to 240 days

ARTECT®

Fungicide seed treatment for cereals.

Artect® is a three-fungicide premix seed treatment for wheat, barley, triticale, and oats.

Functions

—Convenient premix formulated from three proven active ingredients

—Two chemistries for the control of *Rhizoctonia* and *Fusarium*

—Excellent control of *Pythium* with additional metalaxyl than the standard rate provides

ARTECT®·FI

Fungicide and insecticide seed treatment for cereals.

Artect® FI is a ready-to-use fungicide and insecticide seed treatment that offers wheat growers protection against wireworms, *Pythium*, *Fusarium* (scab), and *Rhizoctonia* (root rot).

Functions

—Contact and systemic protection above and below ground

—Unique ethaboxam protection is effective on metalaxyl resistant strains of *Pythium*

—Clothianidin targets troublesome wireworms

AZENTIAL®·ZN

Zinc Micronutrient Seed Treatment.

Azential® Zn is an EDTA chelated zinc seed treatment that is highly efficient and readily available for plant uptake. This zinc seed treatment helps to prevent earlyseason zinc deficiencies by jump-starting plant growth and root establishment.

Functions

—Jump-starts early season plant growth for better root establishment

—Low use rate and low viscosity offer optimal handling features

—Consistent seed coating provides improved planter flowability

CHS Agronomy Crop Enhancement

VELORA™

Biological crop residue digester.

Velora™ is a biological crop residue digester specifically designed to degrade crop stover, increase planting efficiency and release nutrients found in crop residue.

Functions

—Unique combination of six Bacillus species for broad spectrum residue digestion

—Enhanced delivery and microbial activity in-field

—Helps reduce residue clogs and planter issues

CHS Agronomy Utility Products

COMPATIBILITY AGENT

Phosphate Esters Blend 60%

Mixes easily with a range of herbicides, fungicides and insecticides.

DEFOAMER

Dimethylpolysiloxane 10%

Defoamer that can be used to either prevent or knock down foam.

TANK CLEANER ELITE

Tank Cleaner Elite is a high pH tank and equipment cleaner that thoroughly penetrates, solubilizes and removes pesticide residue and hard water deposits from sprayer tank walls, hoses, screens and nozzles.

Adjuvant Chart

Postemergence Herbicide Adjuvant Chart

Herbicide	Common Use Rate/A*	Crops Labeled*	Rainfast (hrs)	High Efficacy Adjuvant	Surfactant / Oil Replacement	High Surfactant Oil Concentrates		HSMOC / Water Conditioning / Deposition	AMS***	NIS + AMS	NIS / AMS Replacement		Basic Blend
				CHS Level Best Pro	CHS Endurium	CHS Penetrec** COC based	CHS Aggrestrol** MSO based	Tapran		Encloax / CHS Wheelhouse 2	CHS Fixate	CHS Deppex	CHS Axon
Accent Q	0.9 oz	Corn	4	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2–4 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Acuron	2.5–3 qt	Corn	1	1 qt/100	1 qt/100	2 qt/100					2 qt/100	2 qt/100	
Acuron Flexi	2–2.25 qt	Corn	1	1 qt/100	1 qt/100	2 qt/100					2 qt/100	2 qt/100	
Acuron GT	3.75 pt	Corn	1	1 qt/100	1 qt/100	2 qt/100					2 qt/100	2 qt/100	
Affinity BroadSpec/ Audit 1:1	0.4–1 oz	Barley, Wheat, Oat, Rye, Triticale	2	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2 lb/A	2.5 gal/ 100			1 gal/100
Affinity TankMix/ Audit 4:1	0.6–0.1 oz	Barley, Wheat, Oat, Rye, Triticale	2	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2 lb/A	2.5 gal/ 100			1 gal/100
Aim EC	0.5–1.6 fl oz	Corn, Cotton, Sorghum, Soybeans, Other (check label)	1	1 qt/100	1 qt/100	2–4 qt/100	2–4 qt/100	2-4 qt/100	+ 2–4 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	2 qt/100
Ally Extra SG	0.3–0.5 oz	Barley, Wheat, Triticale	6	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2 lb/A	2.5 gal/ 100			1 gal/100
Ally XP/Plotter	0.05-0.1 oz	Barley, Wheat, Sorghum, Triticale	4	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2-4 lb/A	2.5 gal/ 100			1 gal/100
Atrazine	See Label	Corn, Sorghum	1			5–10 pt/A	5–10 pt/A	2-4 qt/100					
Amber	0.28–0.47 oz	Barley, Wheat	4	1 qt/100									1 gal/100
Anthem Flex	2.73–4.55 fl oz (wheat); 2.73–3.8 fl oz (cotton)	Wheat, Cotton, Corn, Soybeans, Other (check label)	1	1 qt/100	1 qt/100	0.5–1 pt/A	0.5–1 pt/A	2-4 qt/100	+ 1.5–3 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	
Anthem Maxx	2–6 fl oz (corn); 2–5.7 fl oz (soybean)	Corn, Soybean	1	1 qt/100	1 qt/100	0.5–1 pt/A	0.5–1 pt/A	2-4 qt/100	+ 1.5–3 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	
Armezon	0.5–0.75 fl oz	Corn	1	1 qt/100	1 qt/100	2–3 qt/100	2–3 qt/100	2-4 qt/100	+ 8.5–17 lb/ 100	2.5 gal/ 100	2 qt/100	2 qt/100	
Armezon Pro	14–24 fl oz	Corn	1	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 8.5–17 lb/ 100	2.5 gal/ 100	2 qt/100	2 qt/100	
Assure II/Targa	4–12 fl oz	Canola, Cotton, Soybean, Other (check label)	1	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2–4 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100

Always read and follow the label directions.

* Use rates and adjuvants may vary by crop - rates and adjuvants given for herbicides with multiple crops are for corn, soybeans or wheat.

** CHS Penetrec may be substituted with Crop Oil at 2x rate. CHS Aggrestrol may be substituted with CHS Emulate at 2x rate.

*** In most situations, Encloax, CHS Wheelhouse 2, CHS Fixate or CHS Deppex can be used as AMS replacement.

Postemergence Herbicide Adjuvant Chart

Herbicide	Common Use Rate/A*	Crops Labeled*	Rainfast (hrs)	High Efficacy Adjuvant	Surfactant / Oil Replacement	High Surfactant Oil Concentrates		HSMOC / Water Conditioning / Deposition	AMS***	NIS + AMS	NIS / AMS Replacement		Basic Blend
				CHS Level Best Pro	CHS Endurium	CHS Penetrec** COC based	CHS Aggrestrol** MSO based	Tapran		Encloax / CHS Wheelhouse 2	CHS Fixate	CHS Deppex	CHS Axon
Autumn Super	0.3–0.5 oz	Burndown prior to Corn and Soybean	2			1 gal/100	1 gal/100	2-4 qt/100	+ 1.5–3 lb/A	2.5 gal/ 100			
Axial Star, Axial XL	16.4 fl oz	Wheat (not Durum), Barley	0.5-1	1 qt/100							1 qt/100		2 qt/100
Axial Bold	15 fl oz	Wheat (not Durum), Barley	0.5-1	1 qt/100							1 qt/100		2 qt/100
Clarity/Detonate/ Dicamba/ Dicamba HD	Corn: 0.5–1 pt; Small Grain: 2–4 fl oz; Sorghum: 0.5 pt	Barley, Corn, Oat, Sorghum, Wheat	4	1 qt/100					+ 2.5 lb/A	2.5 gal/ 100	1 qt/100	2 qt/100	
Basagran 5L	1.5–2 pt	Corn, Dry Bean, Pea, Sorghum, Soybean	4	1 qt/100	1 qt/100	2 qt/100			+ 2.5 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Basis Blend	0.825 oz	Corn	4	1 qt/100	1 qt/100	2 qt/100	1 qt/100	2-4 qt/100	+ 2 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Beyond Xtra	4-6 fl oz	Alfalfa, Beans, Traited Crops, Other (check label)	1	1 qt/100	1 qt/100	2–4 qt/100	2–4 qt/100	2-4 qt/100	+ 12–15 lb/ 100	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Brox 2 EC/Maestro 2 EC/Paver	0.75–1.5 pt	Cereals, Flax, Corn, Sorghum, Alfalfa	1	1 qt/100							2 qt/100	2 qt/100	
Brox M, Maestro MA	0.75–1.5 pt	Cereals, Corn, Flax, Sorghum	1	1 qt/100							2 qt/100	2 qt/100	
Cadet	0.4–0.9 fl oz	Corn, Soybean	4	1 qt/100	1 qt/100	0.5–1 pt/A					2 qt/100	2 qt/100	
Calibra	2.4-2.8 qt/A	Corn, Sorghum	1	1 qt/100	1 qt/100	2 qt/100					2 qt/100	2 qt/100	
Callisto/Generic Equivalent	3 fl oz	Corn	1	1 qt/100	1 qt/100	2 qt/100			+ 8.5 lb/100	2.5 gal/ 100	2 qt/100	2 qt/100	
Callisto Xtra	20–24 fl oz	Corn	1	1 qt/100	1 qt/100	2 qt/100			+ 8.5 lb/100	2.5 gal/ 100	2 qt/100	2 qt/100	
Capreno	3 fl oz	Corn	1	1 qt/100	1 qt/100	2 qt/100	1 qt/100	2-4 qt/100	+ 8.5–17 lb/ 100	2.5 gal/ 100	2 qt/100	2 qt/100	
Cimarron Products	See Labels	CRP, Grass Pastures, Rangeland	4	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2–4 lb/A	2.5 gal/ 100			
Classic/Generic Equivalent	0.25–0.75 oz	Soybean, Peanuts	1	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2–4 lb/A	2.5 gal/ 100			
Cobra	4–12.5 fl oz	Cotton, Soybean, Peanuts	0.5	1 qt/100	1 qt/100	0.5–1 pt/A	0.5–1 pt/A	2-4 qt/100	+ 2–4 lb/A	2.5 gal/ 100	1–2 qt/100	2 qt/100	
DiFlexx	6–24 fl oz	Corn	4	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 8.5–17 lb/ 100	2.5 gal/ 100	2 qt/100	2 qt/100	

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Herbicide	Common Use Rate/A*	Crops Labeled*	Rainfast (hrs)	High Efficacy Adjuvant	Surfactant / Oil Replacement	High Surfactant Oil Concentrates		HSMOC / Water Conditioning / Deposition	AMS***	NIS + AMS	NIS / AMS Replacement		Basic Blend
				CHS Level Best Pro	CHS Endurium	CHS Penetrec** COC based	CHS Aggrestrol** MSO based	Tapran		Encloax / CHS Wheelhouse 2	CHS Fixate	CHS Deppex	CHS Axon
DiFlexx Duo	24–40 fl oz	Corn	4	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 8.5–17 lb/ 100	2.5 gal/ 100	2 qt/100	2 qt/100	
Discover NG	12.8–16 oz	Wheat	0.5				2 pt/100	2-4 qt/100					
Distinct	4–6 oz	CRP, Grass Pastures, Non-cropland Areas, Rangeland	4	1 qt/100	1 qt/100				+ 5 lb/100	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Elevore	1 fl oz	Burndown	1			2 qt/100	2 qt/100	2-4 qt/100					
Everest 3.0	2 fl oz	Wheat, Winter Wheat, Durum	1										1 gal/100
Express with TotalSol	Oat: 0.2 oz, Other: 0.5 oz	Barley, Oat, Wheat, Triticale, ExpressSun Sunflower	2	1 qt/100	1 qt/100				+ 2–4 lb/A	2.5 gal/ 100			2 qt/100
Facet L	22–43 fl oz	Rice, Sorghum	6	1 qt/100	1 qt/100	2 pt/A	1–2 pt/A	2-4 qt/100	+8.5 lb/100	2.5 gal/ 100			
Finesse Cereal and Fallow	0.2-0.3 oz	Barley, Wheat	6	1 qt/100									2–4 qt/100
FirstRate	0.3 oz POST rate	Soybean	2	1 qt/100	1 qt/100	5 pt/100	5 pt/100	2-4 qt/100	+ 2 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	
Flexstar/Generic Equivalent	0.75–1 pt	Soybean	1	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 8.5–17 lb/ 100	2.5 gal/ 100	2 qt/100	2 qt/100	
Flexstar GT 3.5	3.5–5.3 pt/A	RR Soybean	1	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 8.5-17 lb/ 100	2.5 gal/ 100	2 qt/100	2 qt/100	
Fusilade DX	6–12 fl oz	Alfalfa, Cotton, Dry Bean, Pea, Lentil, Soybean	1	1 qt/100	1 qt/100	1–2 qt/100					2 qt/100	2 qt/100	
Glyphosate (loaded) Buccaneer Plus and Generic Equivalent	22–32 fl oz common rate Depending on specific product– See label	Check label as RR crops labeled differently by product	0.5-1	1 qt/100					+ 8.5–17 lb/ 100	2.5 gal/ 100	1–3 qt/100	2 qt/100	
GoldSky	1 pt	Wheat, Triticale	4	1 qt/100					+ 1.5 lb/A	2.5 gal/ 100			2–4 qt/100
Gramoxone SL 3.0/ Generic Equivalent	1–4 pt	Burndown, Preharvest, Postharvest	0.5	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100			1–2 qt/100	2 qt/100	
Halex GT	3.6–4 pt	RR Corn	1	1 qt/100					+ 8.5–17 lb/ 100	2.5 gal/ 100	2 qt/100	2 qt/100	

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				CHS Level Best Pro	CHS Endurium	CHS Penetrec** COC based	CHS Aggrestrol** MSO based	Tapran		Encloax / CHS Wheelhouse 2	CHS Fixate	CHS Deppex	CHS Axon
Harmony Extra SG	0.45–0.9 oz	Barley, Oat, Triticale, Wheat	2	1 qt/100		1 qt/100			+ 2–4 lb/100	2.5 gal/ 100			2 qt/100
Huskie	11–15 oz	Barley, Rye, Sorghum, Wheat, Triticale	1	1 qt/100					+ 0.5–1 lb/A	2.5 gal/ 100	1–2 qt/100	2 qt/100	2–4 qt/100
Huskie Complete	13.7 fl oz	Wheat	1										2 qt/100
Impact/Impact Z	0.5–0.75 fl oz/ 8-10.7 fl oz	Corn	1/4	1 qt/100	1 qt/100	2–3 qt/100	2–3 qt/100	2-4 qt/100	+ 8.5–17 lb/100	2.5 gal/ 100	2 qt/100	2 qt/100	
Impact Core	20-40 fl oz	Corn	1	1 qt/100	1 qt/100		1-2 pt/100	2-4 qt/100	+ 8.5–17 lb/100	2.5 gal/ 100	2 qt/100	2 qt/100	
IronGate	8 fl oz	Spring Wheat, Durum, Winter Wheat	1	1 qt/100	1 qt/100				+8.5-17 lb/A	2.5 gal/ 100		2 qt/100	2 qt/100
Laudis	3 fl oz	Corn	1			2 qt/100	2 qt/100	2-4 qt/100	+ 8.5–17 lb/100	2.5 gal/ 100	2 qt/100	2 qt/100	
Lexar EZ/Helmet Maxx	1.5–3.5 qt/A	Corn	1		1 qt/100	2 qt/100							
Liberty 280/Liberty Ultra/Generic Equivalent	22–43 fl oz	LL Canola, LL Corn, LL Cotton, LL Soybean	4	1 qt/100					+ 1.5-3 lb/A	3.5 pt/A	3 qt/100	2 qt/100	
Lumax EZ	2.5–3 qt/A	Corn	1	1 qt/100	1 qt/100	2 qt/100							
Marvel	5–7.25 fl oz	Soybean	1	1 qt/100	1 qt/100	1–2 qt/100	1–2 qt/100	2-4 qt/100	+ 1.5–3 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	
Matrix SG	1.5 oz	Potato	4	1 qt/100	1 qt/100	1 gal/100	1 gal/100	2-4 qt/100	+ 2–4 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	2–4 qt/100
MCPA, 2,4-D	Barley, Corn, Oat, Wheat: 0.5–1 pt; Sorghum: 1 pt	Barley, Corn, Oat, Wheat, Sorghum	1-4	1 qt/100	1 qt/100				+ 2.5 lb/A	2.5 gal/ 100	1 qt/100	2 qt/100	1 gal/100
Milestone	3–7 fl oz	CRP, Grass Pastures, Non-cropland Areas, Rangeland	4	1 qt/100	1 qt/100						2 qt/100	2 qt/100	
Olympus	0.6–0.9 oz	Wheat, Triticale	4	1 qt/100							2 qt/100	2 qt/100	2–4 qt/100
Osprey/Osprey Xtra	4.75 oz	Winter Wheat, Triticale	4	1 qt/100			0.65–0.75 pt/A	2-4 qt/100	+ 1.5–3 lb/A	2.5 gal/ 100			1 gal/100

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				CHS Level Best Pro	CHS Endurium	CHS Penetrec** COC based	CHS Aggrestrol** MSO based	Tapran		Encloax / CHS Wheelhouse 2	CHS Fixate	CHS Deppex	CHS Axon
Panoflex	0.3–0.6 oz	Cereals, Fallow, Preplant and Postharvest Burndown	2	1 qt/100	1 qt/100	1 gal/100	2 qt/100	2-4 qt/100	+ 2 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Peak	0.38–1.0 oz	Cereals, Corn, Sorghum, Proso Millet	4	1 qt/100	1 qt/100	0.5–2 pt/A	0.5–2 pt/A	2-4 qt/100	+ 2 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Permit	Corn/Sorghum/ Rice: 0.67–1.33 oz; Dry Bean: 0.5–0.67 oz	Corn, Sorghum, Dry Bean, Rice, Pumpkins	4	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2–4 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Plateau	2-12 oz	Native Grass and Non-Cropland	1	1 qt/100			1.5–2 pt/A	2-4 qt/100	+ 2–3 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
PowerFlex HL	2 oz	Winter Wheat, Triticale	4	1 qt/100	1 qt/100	2–2.5 qt/100			+ 1.5–3 lb/A	2.5 gal/ 100			2–4 qt/100
Prefix	2–3 pt	Soybean	1	1 qt/100									
Pursuit 2EC	2–4 fl oz	Alfalfa, Pea, Soybean	1	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 12–15 lb/100	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Quelex	0.75 oz	Barley, Spring and Winter Wheat, Triticale	4	1 qt/100	1 qt/100	1-2 qt/100	1-2 qt/100	2-4 qt/100					
Raptor/Vulture	4–5 fl oz	Alfalfa, Dry Bean, Pea, Soybean	1	1 qt/100	1 qt/100	2 gal/100	2 qt/100	2-4 qt/100	+ 12–15 lb/100	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Rave	2–4 oz	Barley, Wheat	4	1 qt/100									
Realm Q	4 oz	Corn	4	1 qt/100	1 qt/100	2 qt/100	1 qt/100	2-4 qt/100	+ 2 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	
Reflex	0.75–1.5 pt	Dry Bean, Soybean	1	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 1–2 lb/100	2.5 gal/ 100			
Reglone	1–2 pt	Desiccation, Preharvest	0.5	1 qt/100							1–2 qt/100		
Resicore REV	2.25–3.0 qt	Corn	1	1 qt/100	1 qt/100	2 qt/100					2 qt/100	2 qt/100	
Resolve Q	1.25 oz	Corn	4	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Resource	4–12 fl oz	Corn, Soybean	1	1 qt/100	1 qt/100	1 pt/A	1 pt/A	2-4 qt/100	+ 2–2.5 lb/A	2.5 gal/ 100	2 qt/100		

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Reviton	1-3 fl oz	Burndown	1			2 qt/100	2 qt/100	2-4 qt/100					
Rimfire Max	3 oz	Wheat (Winter, Spring)	4	1 qt/100			1.3–1.5 pt/A	2-4 qt/100	+ 1.5–3 lb/A	2.5 gal/ 100			1 gal/100
Select Max	12–32 fl oz alone, 6–9 fl oz with glyphosate	Alfalfa, Canola, Cotton, Dry Bean, Potato, Soybean, Sunflower, Sugarbeet, Field Pea, Lentil	1	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2.5–4 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	
Sentrallas	7–14 fl oz	Wheat, Barley, Oat, Triticale	1	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2 lb/A	2.5 gal/ 100			1 gal/100
Sequence	2.5-4 pt	RR Corn, Cotton, Soybean, Sugarbeet	1	1 qt/100					+ 8.5–17 lb/ 100	2.5 gal/ 100	2 qt/100	2 qt/100	
Sharpen	1-3.5 fl oz	Burndown, Harvest Aid	1				2 qt/100	2-4 qt/100					
Staple LX	2.6–3.8 fl oz	Cotton	4	1 qt/100	1 qt/100	1 gal/100			+ 8.5 lb/100	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Starane Flex	13.5 fl oz	Wheat, Barley, Oat	4	1 qt/100	1 qt/100						1 qt/100	2 qt/100	
Starane NXT	14–27.4 fl oz	Wheat, Barley, Oat, Corn, Sorghum	1	1 qt/100	1 qt/100						1 qt/100	2 qt/100	
Starane Ultra	0.3–0.7 pt	Wheat, Barley, Oat, Corn, Sorghum	1	1 qt/100	1 qt/100						1 qt/100	2 qt/100	
Status	2.5–10 oz	Corn	4	1 qt/100	1 qt/100	0.5 pt/A	0.5 pt/A	2-4 qt/100	+ 5-17 lb/ 100	2.5 gal/ 100			
Steadfast Q	1.5 oz	Corn	4	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2.4 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Stinger	Crop Dependent– See label	Canola, Corn, Sugarbeet, Wheat, Barley, Oat	6	1 qt/100	1 qt/100						1–2 qt/100	2 qt/100	
Supremacy	4-5 oz	Barley, Durum, Oat, Triticale, Wheat	2										2–4 qt/100
Synchrony XP	0.375 oz	Soybean	1	1 qt/100					+ 2.4 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	1 gal/100
Talinor	13.7–18.2 fl oz	Barley, Wheat, Winter Wheat	1	1 qt/100	1 qt/100	2 qt/100							

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ThunderMaster	RR Soybean: 2.25 pt; RR Alfalfa: 2.2-4.4 pt	RR Soybeans, RR Alfalfa	1	1 qt/100					+8.5-17 lb/ 100	2.5 gal/ 100	2 qt/100	2 qt/100	
Tolvera	11-14.7 fl oz	Wheat, Barley	1			2 qt/100	2 qt/100	2-4 qt/100					
Torment	0.75–1 pt	Soybean	1	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 8.5–10 lb/ 100	2.5 gal/ 100			
Travallas	7–12 fl oz	Spring and Winter Wheat, Barley	1	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2 lb/A	2.5 gal/ 100			1 gal/100
Ultra Blazer	0.5–1.5 pt	Soybean	4	1 qt/100	1 qt/100	1–2 pt/A	1–2 pt/A	2-4 qt/100	+ 2.5 lb/A	2.5 gal/ 100			1 gal/100
Varisto	16–27 fl oz	Soybean, Dry Beans, Dry Peas	4	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 12–15 lb/ 100	2.5 gal/ 100			
Varro	6.85 fl oz	Wheat, Durum	1	1 qt/100					+ 0.5–1 lb/A	2.5 gal/ 100			2–4 qt/100
Volunteer/ Clethodim 2E/ Shadow 3EC/Gatlin/ Generic Equivalent	6–16 fl oz	Cotton, Soybean, Alfalfa, Dry Beans, Other (check label)	1	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2.5–4 lb/A	2.5 gal/ 100	2 qt/100	2 qt/100	
Widematch/Witness	1–1.33 pt (up to 2.66 pt in CRP)	Barley, CRP, Field Corn, Non-Cropland, Oat, Wheat	6	1 qt/100							1 qt/100	2 qt/100	
WideARmatch	14 fl oz	Wheat, Barley, Triticale	6	1 qt/100							1 qt/100	2 qt/100	
Yukon	4-8 oz	Corn, Sorghum	4	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 2.4 lb/A	2.5 gal/ 100			1 gal/100
Zalo	22-43 oz	LL Canola, LL Cotton, LL Soybean	4	1 qt/100	1 qt/100	2 qt/100	2 qt/100	2-4 qt/100	+ 3 lb/A	2.5 gal/ 100			

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THOR INDEPENDENCE



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Weed Control in Seedling and Established Alfalfa Stands

Herbicide	Rate/A	Stand Establishment Longevity		PHI	Comments[1]
		Seedling (< 12 mo.)	Established (> 12 mo.)		
Aim EC	0.5–2.5 oz	Not Labeled	Labeled	21 days	For control of annual broadleaf weeds in dormant alfalfa and in-between cuttings. Use CHS Hypertonic at 1 qt/100 or CHS Penetrec[2] at 2 qt/100.
Brox 2EC Maestro 2 EC; 4 EC	1–1.5 pt/A	Four trifoliates and larger	Not labeled	Do not cut for feed or graze for 30 days	Applications made when temperatures are expected to exceed 70° F 3 days following, application can result in unacceptable injury.
Butyrac 200	1–3 qt/A	Labeled	Labeled	30 days est. stands and 60 days seedling	Twisted stems and malformed leaves may occur in established stands. Rain or irrigation within 7–10 days of application can cause crop injury.
Chateau SW	4 oz/A	Not Labeled	Late fall to early spring before alfalfa has 6" of new growth	25 days	**Timing to weeds is PRE only.** Do not apply more than 4 oz/A in a single application or more than 8 oz in a single season.
Direx 4L	1.2–2.4 qt/A	Not Labeled	Labeled	N/A	Consult label for specific geographic instructions and rates.
Eptam 7E	2.5–4.5 pt/A	Labeled	Labeled	14 days	PPI right before planting. Use lower rates on coarse textured soils. In established stands irrigate 2.25–3.5 pt/A prior to weed emergence.
Kerb SC	1.25–5 pt/A	Labeled	Labeled	25-45 days west of Mississippi 120 days east of Mississippi	Apply in the fall or winter months. Applications can be made in the fall after alfalfa has reached the trifoliate stage. Apply 1.25–2.5 pt/A for vol. grains, downy brome, and chickweed control. Use 2.5–5 pt/A for quackgrass control.
Prowl H_2O	Rate varies by stand longevity	1.1–2.1 pt/A	1.1–4.2 qt/A	14 DAT	Established Alfalfa: Apply 2–8 pt/A before weed emergence and before alfalfa is 6" tall. Seedling Alfalfa: Apply 1.1–2.1 pt/A prior to weed germination and after alfalfa has two or more trifoliates.
Pursuit /Thunder	3–6 oz/A	2 trifoliates	Apply prior to 3" alfalfa growth for weed coverage	30 days	Use CHS Axon @ 1% v/v to maximize weed control and provide crop safety. CHS Penetrec or CHS Aggrestrol[3] at 2 qt/100 or CHS Endurium at 1 qt/100 may also be used to enhance control.
Raptor/Vulture	4–6 oz/A			No PHI	
Metribuzin/Tricor DF	0.33–1.33 lb/A	Not Labeled	Late fall or early spring to dormant alfalfa	28 days	Do not apply metribuzin after growth begins in the spring or before growth ceases in the fall.
Sinbar WDG	0.5–1.5 lb/A	Regional Restrictions	Late fall or early spring to dormant alfalfa	N/A	Follow regional and state restrictions and recommendations.
Sharpen	1–2 fl oz/A	Not Labeled	Labeled	28 days	Apply to dormant alfalfa. Add CHS Aggrestrol[3] at 2 qt/100 for broadleaf burndown. Refer to label for state and county restrictions.
Velpar DF	0.67–2 lb/A	Not Labeled	Labeled	30 days	Use rate is weed specific and organic matter dependent. Consult label for details on varietal and geographic instructions. Also, Velpar L available.
Velpar AlfaMax	1.5–4.3 lb/A	Not Labeled	Labeled	30 days	Use rate is weed specific and organic matter dependent. Consult label for details on varietal and geographic instructions.
Velpar AlfaMax Gold	2.2–4.3 lb/A	Not Labeled	Labeled	30 days	Use rate is weed specific and organic matter dependent. Consult label for details on varietal and geographic instructions.
Warrant	1.25–2.0 qt/A	Emergence to 4	Up to 7 days after cutting	20 days	Apply from emergence to 4th trifolate in seedling alfalfa. Apply within 7 days of cutting in established stands.
Trifluralin 4EC	1.5–2.0 pt/A	Not Labeled	Labeled	21 days	Apply prior to weed emergence and incorporate with at least 0.5 inch of water. Controls bromegrass and cheat when fall applied.
Select Max	9–32 fl oz/A	Labeled	Labeled	15 days	Add CHS Penetrec or CHS Aggrestrol at 1 pt/A, or 1 qt/100 CHS Endurium + 2 qt/100 CHS Fixate.
Clethodim Products	6–16 fl oz/A	Labeled	Labeled	15 days	Add CHS Penetrec or CHS Aggrestrol at 1 pt/A, or 1 qt/100 CHS Endurium + 2 qt/100 CHS Fixate.
Gramoxone SL 3.0 Helmquat 3SL Paraquat Conc.	0.7–2.7 pt/A	Not Labeled	Labeled	30-60 days	Apply only to dormant alfalfa or between cuttings. Add CHS Hypertonic at 1 qt/100 gal, CHS Fixate or CHS Penetrec at 2 qt/100 gal.
Glyphosate (various)	Formulation Dependent	Labeled **(Roundup Ready Alfalfa Only)**	Labeled **(Roundup Ready Alfalfa Only)**	5 days	Applications may be made before, during, or after planting of Roundup Ready Alfalfa. Apply to seedling alfalfa when at 3 to 4 trifoliate stage to eliminate competition from non-Roundup Ready tolerant plants (up to 10%).
Extreme/Thunder Master	2.2–4.4 pt/A	Labeled **(Roundup Ready Alfalfa Only)**	Labeled **(Roundup Ready Alfalfa Only)**	30 days	Treat when alfalfa has at least 2 expanded trifoliate leaves. Following application, plants may be temporarily stunted. Apply to seedling alfalfa when at 3 to 4 trifoliate stage to eliminate competition from non-Roundup Ready tolerant plants (up to 10%).

[1] This chart is intended as a general guide only. Always read and follow label directions prior to using any product.
[2] CHS Penetrec can be substituted by Crop Oil at 2X rate.
[3] CHS Aggrestrol can be substituted by CHS Emulate at 2X rate.

Aim (carfentrazone)

		Surfactant/Comments	Target Weeds	Timing/Comments
Brand Name:	EPA Reg. #:	Apply only to established alfalfa.	Many broadleaf weeds.	
Aim:	**279-3241**	21 day PHI		
Rate/A:	0.5–2.5 oz			
Spray Volume:	min 10 gpa	• **Use CHS Hypertonic (1 qt/100 gal)**		
Rainfast:	6 hours	or		
S.O.A.:	PPO Inhibitor (Group 14)	• **CHS Penetrec (2 qt/100 gal)**		
P.P.E.:	Coveralls over l.s. shirt and l. pants, c.r. gloves apron, headgear, eyewear, shoes, socks			
R.E.I.:	Till dry			
W. Notification:	Oral			
S. Word:	Caution			

Bromoxynil Products

		Surfactant/Comments	Target Weeds	Timing/Comments
Brand Name:	EPA Reg. #:		Many broadleaf weeds < 2″ in height or < 1″ in diameter including: – wild buckwheat – common sunflower – kochia – Russian thistle – common lambsquarters – pennycress	Apply to seedling alfalfa only possessing at least 2–4 trifoliate leaves in order to avoid unacceptable crop injury.
Maestro 2EC	**71368-29**			
Brox 2EC	**42750-48**			
Maestro 4EC	**71368-78**			
Rate/A:	1–1.5 pt (2EC)			
Spray Volume:	min 5 gpa			
Rainfast:	1 hour			
S.O.A.:	Photosystem II Inhibitor (Group 6)			
P.P.E.:	Coveralls over l.s. shirt and l. pants, c.r. gloves, apron, headgear, eyewear, shoes, socks			
R.E.I.:	12 hours			
W. Notification:	Oral			
S. Word:	Warning			

Butyrac 200 (2,4-DB)

		Surfactant/Comments	Target Weeds	Timing/Comments
Brand Name:	EPA Reg. #:	• **CHS Hypertonic (1 qt/100 gal)**	Many broadleaf weeds 1″–3″ in height including: – common ragweed – common lambsquarters – wild mustard – pennycress – pigweed – yellow rocket	Spray on 2+ trifoliate alfalfa.
Butyrac	**42750-38**			
Rate/A:	2–4 pt	Risk of injury—See label		
Spray Volume:	10–20 gpa			
Rainfast:	4 hours			
S.O.A.:	Growth Regulator (Group 4)			
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks			
R.E.I.:	48 hrs			
W. Notification:	Oral			
S. Word:	Danger			

Clethodim Products

Brand Name:	EPA Reg. #:
Volunteer	**59639-3-55467**
Shadow 3 EC	**66330-414**
Rate/A:	6–8 fl oz
Spray Volume:	5–40 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning

Surfactant/Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (2.5–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (2.5–4 lb/A)**

or

- **CHS Endurium (1 qt/100 gal)**

Target Weeds	6 fl oz	8 fl oz
– barnyardgrass	6″	8″
– crabgrass	2″	6″
– giant foxtail	6″	12″
– green foxtail	6″	8″
– quackgrass	-	4–12″
2nd application may be needed		
– volunteer cereals	6″	8″
– volunteer corn	12″	18″
– wild proso millet	8″	10″
– woolly cupgrass	6″	8″
– yellow foxtail	6″	8″

*Crop Oil (1 gal/100 gal) or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

**CHS Emulate (1 gal/100 gal) can be substituted for CHS Aggrestrol.

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

Timing/ Comments

15 Day PHI

Glyphosate

Brand Name:	EPA Reg. #:	# A.E.	=0.75 AE
Buccaneer Plus	**55467-9**	3.00	32.0
Gly Star Original	**42750-60**	3.00	32.0
Gly Star Plus	**42750-61**	3.00	32.0
Durango DMA	**62719-556**	4.00	24.0
Buccaneer 5 Extra	**55467-15**	4.00	24.0
Gly Star 5 Extra	**42750-59**	4.00	24.0
Gly Star K-Plus	**42750-122**	4.50	21.3
Buccaneer K	**42750-122-55467**	4.50	21.3
Roundup RT 3	**524-544**	4.50	21.3
Roundup PowerMax 3	**524-659**	4.80	19.7
Rate/A:	Variable		
Spray Volume:	5–20 gpa		
Rainfast:	1–6 hours		
M.O.A.:	EPSP Inhibitor		
P.P.E.:	l.s. shirt, l. pants, shoes, socks		
R.E.I.:	12 hours		
W. Notification:	Oral		
S. Word:	Caution		

Surfactant/Comments

- **CHS Level Best Pro (1 qt/100) plus AMS (8.5-17 lb/100)**

or

- **CHS Fixate/CHS Wheelhouse Pro (2-3 qt/100)**

or

- **Encloax (2.5-5 gal/100)**

or

- **CHS Hypertonic (1 qt/100) plus AMS (8.5-17 lb/100)**

Paraquat

Brand Name:	EPA Reg. #:
Parazone 3 SL	**5481-615**
Quik-Quat	**19713-617**
Helmquat 3 SL	**74530-48**
Paraquat Concentrate	**82542-3**
Gramoxone	**100-1652**
Spray Volume:	10–20 gpa
Rainfast:	30 minutes
M.O.A.:	Photosystem 1 inhibitor (22)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, faceshield, c.r. apron, sust mist NIOSH approved respirator, W/N, R, P or HE filter
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Danger Poison
PHI:	3 days when used for late-season desiccation or suppression of regrowth

Adjuvant(s)/Comments

- **CHS Level Best Pro (1 qt/100)**

or

- **CHS Hypertonic (1 qt/100)**

or

- **CHS Fixate (2 qt/100)**

or

- **CHS Penetrec/CHS Aggrestrol (2 qt/100)**

or

- **Encloax (2.5 gal/100)**

Timing/Comments

Paraquat can be applied preplant, pre-emerge, or post-emerge as a directed spray. Paraquat is labeled as a harvest aid for boll opening, desiccation, and suppression of regrowth. See label for specific location recommendations and rates.

Pursuit / Thunder (imazethapyr)

Brand Name:	EPA Reg. #:
Pursuit	**241-310**
Thunder	**42750-146**
Rate/A:	3–4 oz/A
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	ALS Enzyme Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.:	4 (lq), 12 (DG) hours
W. Notification:	Oral
S. Word:	Caution (lq)/Warning(DG)

Surfactant/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (3 qt/100 gal)**

or

- **CHS Aggrestrol** (2 qt/100 gal)**
  plus
  AMS***

Target Weeds	3 fl oz	4 fl oz
– foxtail species	-	3–6″
– wild buckwheat	-	3″
– chickweed	-	3′
– kochia	-	3″
– common mallow	-	3″
– wild mustard	-	3″
– pennycress	3″	3″
– pigweed	3″	3″
– common ragweed	4″	6″
– giant ragweed	-	2″
– shepherd's purse	-	3″
– smartweed	3″	3″
– velvetleaf	-	3″

Timing/Comments

Alfalfa must have at least 2 trifoliates.

*Crop Oil @ (5 qt/100 gal) or CHS Endurium @ (1 qt/100 gal) can be substituted for CHS Penetrec.

**CHS Emulate @ (1 gal/100 gal) can be substituted for CHS Aggrestrol.

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

Raptor / Vulture (imazamox)

Brand Name:	EPA Reg. #:
Raptor	**241-379**
Vulture	**42750-305**
Rate/A:	4–6 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	ALS Enzyme Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Surfactant/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (3 qt/100 gal) plus AMS*** (12–15 lb/100)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (12–15 lb/100)**

Alfalfa must have at least 2 trifoliates.

Target Weeds	4 fl oz	5 fl oz	6 fl oz
– barnyardgrass	-	3″	-
– volunteer corn	4″	5″	8″
– large crabgrass	-	3″	3″
– foxtail species	3″	3″	4″
– bedstraw	-	3″	3″
– wild buckwheat	-	3″	3″
– volunteer canola	3″	3″	3″
– kochia	-	3″	3″
– lambsquarters	-	3″	3″
– common mallow	3″	3″	3″
– morning glory	-	3″	3″
– wild mustard	3″	3″	4″
– pennycress	3″	3″	3″
– pigweed	3″	4″	4″
– shepherd's purse	-	-	3″
– smartweed	3″	3″	3″
– velvetleaf	3″	4″	5″

*Crop Oil at 5 qt/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 gal can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

SelectMax (clethodim)

Brand Name:	EPA Reg. #:
SelectMax	**59639**
Rate/A:	6–12 fl oz
Spray Volume:	5–40 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves p. eyewear, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Surfactant/Comments

- **CHS Penetrec* (1.5 pt/A) plus AMS*** (2.5–4 lb/A)**

or

- **CHS Aggrestrol** (1.5 pt/A) plus AMS*** (2.5–4 lb/A)**

Target Weeds	9 fl oz	12 fl oz
– barnyardgrass	6″	8″
– crabgrass	2″	6″
– giant foxtail	6″	12″
– green foxtail	6″	8″
– quackgrass	-	4–12″
2nd application may be needed		
– volunteer cereals	6″	8″
– volunteer corn	12″	18″
– wild proso millet	8″	10″
– woolly cupgrass	6″	8″
– yellow foxtail	6″	8″

*Crop Oil @ (1 qt/A) or CHS Endurium @ (1 qt/100 gal) can be substituted for CHS Penetrec.
**CHS Emulate @ (1 qt/A) can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

Thunder Master (glyphosate + imazethapyr)

Brand Name:	EPA Reg. #:
Thunder Master	**42750-147**
Rate/A:	2.2–4.4 pt*
Spray Volume:	10–20 gpa
Rainfast:	1 hour
S.O.A.:	ALS Inhibitor EPSP Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Warning

Surfactant/Comments

- **CHS Hypertonic (1 pt/100 gal) plus AMS (8.5–17 lb/100 gal)**

or

- **CHS Fixate/ CHS Wheelhouse Pro (2 qt/100 gal)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec (2 qt/100 gal)**

or

- **CHS Aggrestrol (2 qt/100 gal)**

Timing/ Comments

Roundup Ready Alfalfa Only

Apply POST to seedling or established Roundup Ready alfalfa. See label for specific crop size limitations. Controls many annual and perennial grasses and broadleaf weeds. Temperatures < 50°F and/or weeds > 8″ in height may reduce herbicide efficacy.

*Do not apply more than 3.0 pt/A in N.D. and north of Highway 210 in Minn.

Fungicides increase alfalfa yield and quality and can enhance quality even when weather conditions are favorable for leaf and other diseases. They really prove their value under moderate temperatures and moist conditions which are great growing conditions for alfalfa, but these conditions also favor the development of common leaf spot and many other leaf and stem diseases found on alfalfa. These conditions mainly occur early in the growing season, which is why the greatest benefits for increased yield and quality are observed during the earlier cuttings. Cool wet weather and longer cut schedules favor disease development and greater returns from fungicide applications. Another benefit is faster green-up, which leads to faster regrowth and higher yields. The introduction of low lignin alfalfa varieties with the HarvXtra® trait allow for a longer cut schedule while still maintaining quality. Fungicide applications deliver an even greater value when used in these extended cut systems as lower leaf retention is increased providing higher quality and yield. Applications are typically recommended when the regrowth is 6-8 inches tall and conditions exist for good overall alfalfa growth. Adding deposition aids like CHS Endurium or CHS Acuvant increase canopy penetration, foliage coverage and droplet retention, increasing fungicide efficacy.



Common Leaf Diseases in Alfalfa

Fungicide	Active Ingredients	Frac Code	Rate[1]	PHI	Total Use Rate
Aproach	picoxystrobin	11	6–12 fl oz	14 DAT	36 fl oz
Endura	boscalid	7	6.5 fl oz	14 DAT	19.5 fl oz
Fontelis	penthiopyrad	7	12–24 fl oz	14 DAT	48 fl oz
Headline	pyraclostrobin	11	6–9 fl oz	14 DAT	27 fl oz
Kocide	copper hydroxide	M1	1.5 lb	0	3.5 lb
Priaxor	fluxapryroxad + pyraclostrobin	7 + 11	4–6.9 fl oz	14 DAT	20.7 fl oz
Pristine	boscalid + pyraclostrobin	7 + 11	12–18 fl oz	14 DAT	54 fl oz
Quadris	azoxystrobin	11	6–15.5 fl oz	14 DAT	54 fl oz
Aframe	azoxystrobin	11	6–15.5 fl oz	14 DAT	54 fl oz
Azteroid FC 3.3	azoxystrobin	11	3.9–9.7 fl oz	14 DAT	29.1 fl oz
Veltyma	mefentrifluconazole + pyraclostrobin	3 + 11	7–10 fl oz	14 DAT	30 fl oz

[1] The addition of CHS Endurium at 1 qt/100 gal or CHS Acuvant at 3 fl oz/A can increase canopy penetration, coverage, and droplet retention.

Alfalfa Herbicide Efficacy Chart

			Annual Grasses												Perennial Grasses			Broadleaves																										
Herbicide	Timing: S = Seedling E = Established	Crop Tolerance	Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Goosegrass	Sandbur	Shattercane	Volunteer Corn	Volunteer Wheat	Wild Oat	Wild Proso Millet	Woolly Cupgrass	Johnsongrass (Seedlings)	Johnsongrass (Rhizomes)	Quackgrass	Bindweed, Field	Buffalobur	Canada Thistle	Cocklebur	Kochia	Lambsquarters	Lanceleaf Sage	Marshelder	Morning Glory (Annual)	Nightshade, Black	Pigweed, Redroot	Prickly Sida	Ragweed, Common	Ragweed, Giant	Russian Thistle	Smartweed, Annual	Sunflower	Velvetleaf	Venice Mallow	Waterhemp Species	Wild Mustard	Wild Buckwheat	Wormwood, Biennial	Yellow Nutsedge
Brox 2EC/ Maestro 2EC	S	F	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	F	P	E	G	E	E	E	G	E	G	P	E	F	E	E	G	G	F	F	F	E	F	N
Butyrac 200	S, E	P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	-	-	N	E	P	G	-	-	-	-	P	-	P	-	P	P	-	-	-	-	P	P	-	-
Chateau	E	F	N	P	P	P	P	-	N	N	N	N	N	N	N	N	N	N	N	N	N	G	G	N	P	G	E	E	G	N	N	F	F	P	F	P	G	G	P	G	-
Extreme*/ Thunder Master* (3 pt rate) (RR Alfalfa)	S, E	F	G	E	G	E	E	G	E	E	E	E	E	G	E	E	G	G	E	G	E	G	G	G	G	G	E	E	F	F	G	G	E	E	G	G	P	E	F	P	F
Glyphosate products (RR Alfalfa)	S, E	E	G	E	G	E	E	G	E	E	E	E	E	G	E	E	E	G	E	G	E	G	G	G	G	F	G	E	F	G	G	G	E	E	G	G	P	E	G	F	F
Gramoxone SL 3.0	E	F	G	F	G	G	-	-	F	F	F	G	-	-	P	P	P	-	-	P	F	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	F	-	-
Tricor 75 DF (Post Dormant)	E	F	P	P	N	P	F	N	N	P	P	P	N	N	N	N	N	F	F	N	P	P	G	-	-	P	P	G	P	F	F	F	F	P	F	F	F	G	G	-	P
Pursuit/Thunder	S, E	G	G	F	F	G	P	P	G	P	P	P	F	P	F	P	P	P	F	P	G	G	P	E	E	G	E	E	F	F	F	G	G	E	F	P	P	E	F	P	P
Raptor/Vulture	S, E	F	E	F	F	E	P	P	G	P	P	P	G	P	F	P	F	P	F	P	G	G	F	E	G	G	E	E	F	F	F	G	G	E	F	P	P	E	G	P	P
SelectMax/Clethodim	S, E	E	E	E	E	E	E	G	G	G	G	E	E	E	E	E	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P
Sinbar	E	G	G	G	G	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	E	-	-	-	G	E	-	E	-	-	E	-	-	-	-	E	-	-	-
Velpar L or DF (Post Dormant)**	E	F	G	G	E	G	E	G	G	G	G	F	G	G	G	G	F	N	N	F	G	G	G	N	N	N	F	G	N	G	G	G	G	N	G	G	F	E	G	N	P
Velpar AlfaMax/Gold (PD)	E	F	E	E	G	E	G	E	G	G	G	F	G	G	G	G	F	N	N	F	F	F	G	N	N	N	F	G	F	G	G	G	G	N	G	G	F	E	G	N	P

Weed control table key: E = Excellent G = Good F = Fair P = Poor N = No Control

**Velpar L can provide control of specific problematic annual, winter annual, and perennial weeds not identified in this table. Applications made to established alfalfa at pre-green-up dormancy can control chickweed, field pennycress, shepherd's purse, hoary alyssum, yellow rocket, and common dandelion, although weed infestations the year after seeding may not justify application.

Insecticide	PHI	REI (hrs)	Key Insects Controlled	Rate	Comments
Baythroid XL* (3A)	7 days	12	Alfalfa looper, Cutworms, Green cloverworm, Potato leafhopper	0.8–1.6 fl oz	Max. allowed per cutting is 5.6 fl oz. Max. allowed per season is 22.4 fl oz.
			Alfalfa caterpillar, Alfalfa plant bug, Alfalfa webworm, Alfalfa weevil, 1st and 2nd instar Armyworm, Corn Rootworm beetles, Loopers, Lygus bug	1.6–2.8 fl oz	
			Blotch leafminer, Grasshoppers	2.0–2.8 fl oz	
Besiege* (3A, 28)	1-day forage; 7 days hay	24	Leafhopper sp., Alfalfa Caterpillar, Cutworm Species, Looper Species	5–8 fl oz	Do not apply more than 10 fl oz per cutting.
			Alfalfa Weevil, Armyworm, Fall Armyworm, Pea Aphid, Grasshopper sp.	6–10 fl oz	
			Beet Armyworm, Spider Mites	9–10 fl oz	
Dimethoate 4E/EC/ LV-4 (1B)	10 days	48	Aphids, Grasshopper, Leafhoppers, Lygus bugs, Plant bugs, reduction of Alfalfa weevil larvae	0.5–1.0 pt	Only 1 app. per cutting. Highly toxic to bees.
Fastac EC/SC* (3A)	3 days	12	Alfalfa caterpillar, Alfalfa Looper, Alfalfa Weevil, Cutworm, Green Cloverworm, Potato Leafhopper	2.2–3.8 fl oz	Do not apply more than 11.4 fl oz per season.
			Armyworm, Plant bugs	2.8–3.8 fl oz	
Lannate LV* (1A)	7 days	48	Pea aphid, Lygus Bug, Blotch Leafminer, Alfalfa Aphids, Loopers, Armyworm sp.	1.5–3.0 pt	Do not apply to dormant or semi dormant alfalfa when low daily temp is under 50° F.
			Weevil	3 pt	
Malathion 5E/EC (1B)	0 days	12	Alfalfa weevil larvae, Aphids, Grasshopper, Lygus bug, Potato leafhopper, Spider mite, Spittle bug	1.5–2.0 pt	If spraying during bloom spray early morning or late evening to avoid bee activity.
			Armyworm	2 pt	
Malathion 8 (1B)	0 days	12	Alfalfa weevil larvae, Aphids, Grasshopper, Lygus bug, Potato leafhopper, Spider mite, Spittle bug, Armyworm	1.0–1.25 pt	Higher rate for Armyworm.
Mustang Maxx EC* (3A)	3 days	12	Alfalfa caterpillar, Alfalfa Looper, Alfalfa weevil, Cutworms, Flea beetles, Green cloverworm, Hornworms, Potato leafhoppers, Webworms, Aphid control is variable	2.24–4.0 fl oz	Do not make applications fewer than 7 days apart. No more than 4 fl oz per app. or 12 fl oz per season.
			Armyworms, Grasshoppers, Plant bugs	2.8–4.0 fl oz	
Perm-UP 3.2 EC, Permethrin 3.2 EC (3A)	0 days 4 fl oz or less, 14 days if more than 4 fl oz	12	Alfalfa caterpillar, Armyworms, Blue alfalfa aphid, Cutworms, Green cloverworm, Green peach aphid, Loopers, Pea aphid, Spotted alfalfa aphid, Webworms	2–8 fl oz	Do not apply more than 8 fl oz per cutting.
			Alfalfa weevil, Plant bugs, Potato leafhopper	4–8 fl oz	
Prevathon (28)	0 days	4	Alfalfa caterpillar, Alfalfa looper, Beet armyworm	14–20 fl oz	One application per cutting.
			Grasshoppers	8–20 fl oz	

MOA/IRAC Abbreviations in Parentheses: 3A=Pyrethroid, 1B=Organophosphate, 1A=Carbamate, 28=Diamides, 22=Oxadiazines, 4D=Butenolides

*Applications of insecticides in hot conditions have been improved by the addition of adjuvants.

The addition of CHS Endurium @ 0.25% v/v or CHS Penetrec @ 0.25% v/v may improve control by increasing coverage in dense canopies and preventing evaporation of small spray droplets in hot conditions.

Insecticide	PHI	REI (hrs)	Key Insects Controlled	Rate	Comments
Sevin XLR Plus Carbaryl 4L (1A)	7 days	12	Alfalfa caterpillar, Bean leaf beetle, Green cloverworm, Leafhoppers, Potato leafhopper, Thrips	1 qt	Do not apply more than once or exceed 1.5 qt per cutting.
			Alfalfa blotch leafminer, Armyworm, Cutworm, Lygus bugs, Stink bugs, Webworms	1.0–1.5 qt	
			Alfalfa weevil larvae	1.5 qt	
SIVANTO prime (4D)	7 days	4	Aphids, Leafhoppers	7-14 oz	Use lower rate if infestation is light.
			Threecornered alfalfa hopper, Whiteflies	14 oz	
			Suppression of Tarnished plant bug and Western plant bug	14 oz	
Steward EC (22)	7 days	12	Cabbage Loopers, Grasshoppers	4.6-11.3 fl oz	Do not apply more than 45 fl oz per year.
			Alfalfa weevil larvae, Egyptian alfalfa weevil larvae, Beet armyworm	6.7-11.3 fl oz	
			Potato leafhopper, Lygus Bugs	9.2-11.3 fl oz	
Province*, LambdaStar 1 CS*, Lambda Cy EC*, Lambda Cyhalothrin 1 EC*, Silencer*, Crusader 1E*, (3A)	1 day forage, 7 days hay	24	Alfalfa caterpillar, Green cloverworm, Cutworms, Leafhoppers, Loopers, Webworm sp.	1.92–3.2 fl oz	Do not apply more than 3.84 fl oz per cutting or 15.36 fl oz per season.
			Alfalfa weevil, Armyworm, Bean leaf beetle, Aphid sp., Grasshoppers, Plant bugs, Spotted alfalfa aphid, Thrips	2.56–3.84 fl oz	
			Beet armyworm, Blotch leafminer	3.84 fl oz	
LambdaStar Plus*, Warrior II w/Zeon*, Province II*, Crusader 2ME* (3A)	1 day forage 7 days hay	24	Alfalfa caterpillar, Cutworm sp., Green cloverworm, Leafhopper, Loopers, Webworm spp	0.96–1.60 fl oz	Do not apply more than 1.92 fl oz per cutting or 7.68 fl oz per season.
			Alfalfa weevil, Armyworm, Aphid sp., Bean leaf beetle, Grasshoppers, Plant bugs, Thrips	1.28–1.92 fl oz	
			Beet armyworm, Blotch leafminer	1.92 fl oz	

MOA/IRAC Abbreviations in Parentheses: 3A=Pyrethroid, 1B=Organophosphate, 1A=Carbamate, 28=Diamides, 22=Oxadiazines, 4D=Butenolides

*Applications of insecticides in hot conditions have been improved by the addition of adjuvants.

The addition of CHS Endurium @ 0.25% v/v or CHS Penetrec @ 0.25% v/v may improve control by increasing coverage in dense canopies and preventing evaporation of small spray droplets in hot conditions.

Foliar-Applied Micronutrients For Alfalfa

Growers demand high yields, tight cutting schedules, and top quality from their alfalfa crop. To match these demands, foliar nutrition has become a key management method to supplement micronutrient fertility. The macronutrients phosphorus and potassium are typically applied through dry fertilizer spreading or additional manure applications during the growing season because high replacement demands make these the most practical application methods. Micronutrients are just as important but needed in much smaller amounts, which means that they can be applied efficiently through foliar applications. Typically, these applications can be tank-mixed with already planned trips across the field for insect or weed control. Foliar applications allow prescriptive micronutrient applications to address nutrient loss and crop stress during the growing season. These essential micronutrients, if applied to the soil, would require greater rates to equal the same effect from a foliar application.

B Boron

Boron is the most widely applied micronutrient in alfalfa production. Alfalfa shows consistent responses to annual boron applications across a wide range of soil types and soil levels. One reason for this response is that boron is less soluble at higher pH's which are required for alfalfa establishment and growth. Boron is also an anion (negatively charged ion) which makes it susceptible to leaching on coarse soils. Boron is important for the translocation of sugar and carbohydrates, cell division, nitrogen metabolism, protein formation, and cell wall formation. Boron deficiency is characterized by yellowing of the youngest leaf and a decrease of stem length, giving a rosette appearance or bunchy growth.

Mn Manganese

Manganese can be one of the more common deficiencies in alfalfa especially under high soil pH. Manganese aids in the synthesis of chlorophyll, nitrate assimilation, and activates fat forming enzymes. Mn is involved in the formation of riboflavin, ascorbic acid, carotene, and is essential for electron transport during photosynthesis. Excess available K, Fe, Cu Zn, or Na can contribute to manganese deficiency. Symptoms appear on younger leaves as interveinal chlorosis. Alfalfa typically doesn't have a sharp color contrast between veins and interveinal areas which may lead to confusion with other nutrient problems. Foliar applications are the most practical way to correct deficiencies as high levels of Mn are tied up in the soil under high pH conditions.

Fe Iron

Iron deficiency in alfalfa is rare in most of the U.S. and typically occurs in alkaline or sodic soils in dry climates. Iron functions in chlorophyll development and function, energy transfer, plant respiration and metabolism, and nitrogen fixation. Deficiencies appear on young leaves as interveinal chlorosis. In severe cases the entire plant can turn yellow-green to bleached white.

Zn Zinc

High levels of phosphorus in the soil can lead to zinc deficiencies due to the formation of zinc phosphate. Availability can also be reduced in high pH soils though this is not universal. Zn is important in the production of auxins, protein synthesis, starch formation, and root development. Deficient plants will be stunted with smaller terminal leaves and shortened internodes giving a rosette type appearance.

Alfalfa Nutrient Removal (dry matter basis/ton)										
	N	P_2O_5	K_2O	Ca	Mg	S	B*	Fe*	Mn*	Zn*
lb/ton	56	12–15	55–70	28	5.25	6.61	High	Med	Med	Low

*Relative response of alfalfa to micronutrient. High pH reduces availability.

Products for Foliar Application in Alfalfa

CHS LUMEN®

CHS Lumen is primarily used as a starter fertilizer but has utility as a foliar fertilizer as it contains macronutrients and Zn along with the ortho-ortho EDDHA chelate and the enzyme hemicellulase. It contains nitrogen (5%), phosphorus (15%), and potassium (3%) in addition to the micronutrient Zn (0.8%). CHS Lumen is unique as it contains the chelate ortho-ortho EDDHA which has the ability to keep micronutrient available under conditions that lead to tie up in the soil and in the plant. By keeping these micronutrients chelated and separate from phosphorus there are more micronutrients and phosphorus available for uptake and plant growth.

Use rate of 0.5–2 gal/A

MOXON™ B

Moxon B contains 7.5% boron plus the ortho, ortho EDDHA chelate. Foliar applied boron can correct one of the most common deficiencies in alfalfa. While the EDDHA helps with the uptake and movement of many essential micronutrients needed to grow a quality alfalfa crop. This formulation is readily mixable with other tank-mix products like insecticides, herbicides, and additives.

Use rate of 1–2 qt/A

BORON 10

Boron 10 contains 10% boron derived from boric acid. When specifically targeting boron deficiencies Boron 10 is a highly concentrated source of boron that is readily mixable with other tank-mix products like insecticides, herbicides, and additives.

Use rate 2–4 qt/A



Preemergence Herbicides 59
Postemergence Herbicides 60

Trifluralin Products

Brand Name:	EPA Reg. #:
Treflan 4D	**68156-4**
Triflurex HFP	**66222-46**
Multiple Brands	
Rate/A:	1–2 pt of EC
	5–10 lb of 10G
Spray Volume:	5–40 gpa
Rainfast:	NA
S.O.A.:	Mitotic Inhibitor (Group 3)
P.P.E.:	l.s. shirt, l. pants, eyewear, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution (Treflan, Triflurex HFP)
	Warning (Trifluralin)
P.H.I.:	60 Days

Labeled Crops

- Canola, rapeseed

Comments

- For best results, incorporate within 24 hours.
- Can be applied through sprinkler irrigation systems as directed on the label.
- Do not plant sorghum or oats for 18 months if less than 20″ of rainfall or irrigation is received.

Target Weeds

– Trifluralin applied according to directions will selectively control annual weeds in canola.

Annual Grasses

– barnyardgrass
– foxtail
– bromegrass
– ryegrass, Italian

Annual Broadleaf

– common lambsquarters
– kochia
– Russian thistle
– pigweed

Sonalan (ethalfluralin)

EPA Reg. #:	**10163-355**
Rate/A:	1.5–2.5 pt EC
	5.5–9.5 lb 10G
Application:	PPI
Timing:	
Spray Volume:	min 5 gpa
Rainfast:	NA
S.O.A.:	Mitotic Inhibitor (Group 3)
P.P.E.:	l.s. shirt, l. pants, eyewear, gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Danger

Labeled Crops

- Canola, rapeseed

Comments

- Adjust rate for soil type.
- Poor wild oat and no wild mustard control.
- Do not apply as broadcast post-emerge application.

Annual Grasses

– barnyardgrass
– foxtail
– crabgrass
– ryegrass, Italian

Annual Broadleaf

– wild buckwheat
– kochia
– Russian thistle
– lambsquarters

Assure II (quizalofop P-ethyl)

EPA Reg. #: **352-541**
Rate/A: 5–12 fl oz
Spray Volume: min 10 gpa
Rainfast: 1 hour
S.O.A.: ACC-ase Inhibitor
P.P.E.: l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.: 12 hours
W. Notification: Oral
S. Word: Danger

Labeled Crops

- Canola, rapeseed

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (2–4 lb/A)**

Target Weeds	4 oz	6 oz	8 oz
– barnyardgrass	-	-	2–6″
– field sandbur	-	-	2–6″
– crabgrass	-	-	2–6″
– giant foxtail	-	-	2–8″
– green foxtail	-	-	2–4″
– volunteer corn	6-24″	24″+	-
– wild proso millet	-	-	2–6″
– yellow foxtail	-	-	2–4″
– wild oat	-	-	2–6″
– woolly cupgrass		2–4″@ 9 oz	
– quackgrass		6–10″@ 10 oz	

Timing/Comments

Apply up to 60 days PHI.

*Crop Oil @ 1 gal/A or CHS Endurium @ 1 qt/100 gal.
**CHS Emulate @ 1 gal/A or CHS Endurium @ 1 qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Beyond (imazamox)

EPA Reg. #: **241-441**
Rate/A: 4 fl oz
Spray Volume: min 10 gpa
Rainfast: 1 hour
S.O.A.: ALS Inhibitor
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.: 4 hours
W. Notification: Oral
S. Word: Caution

Labeled Crops

- Clearfield Canola

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Aggrestrol** (0.75–1 pt/A) plus AMS*** (12–15 lb/100 gal)**

or

- **CHS Penetrec* (0.5 qt/A) plus AMS*** (12–15 lb/100 gal)**

Target Weeds

4″ or less

– black nightshade
– common cocklebur
– foxtail
– giant ragweed
– lambsquarters
– pigweed
– sunflower
– volunteer corn
– venice mallow

Timing/Comments

Do not apply more than 4 fl oz per cropping season.

*Crop Oil @ 1 qt/100 gal or CHS Endurium @ 1 qt/100 gal.
**CHS Emulate @ 1 qt/100 gal or CHS Endurium @ 1 qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Clethodim Products

Brand Name:	EPA Reg. #:
Arrow	**66222-60**
Clethodim 2E	**42750-72**
Shadow 3 EC	**66330-414**
Volunteer	**59639-3-55467**
Rate/Acre:	4–6 fl oz 4–6 fl oz 2.67–5.33 fl oz 4–6 fl oz
Spray Volume:	5–40 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Canola, rapeseed

Adjuvant(s)/Comments

- **CHS Penetrec* (1 pt/A) plus AMS*** (2.5–4 lb/A)**

or

- **CHS Aggrestrol** (1 pt/A) plus AMS*** (2.5–4 lb/A)**

Target Weeds	5.33 oz	6 oz	8 oz
– barnyardgrass	8″	6″	8″
– crabgrass	6″	2″	6″
– giant foxtail	12″	6″	12″
– green foxtail	8″	6″	8″
– quackgrass *2nd application may be needed*	4-12″	-	4-12″
– volunteer cereals	8″	6″	8″
– volunteer corn	18″	12″	18″
– wild proso millet	10″	8″	10″
– woolly cupgrass	8″	6″	8″
– yellow foxtail	8″	6″	8″
– cheat	6″	6″	6″
– downy brome	6″	6″	6″

Timing/Comments

Apply up to 70 day PHI.

*Crop Oil @ 1 qt/A or CHS Endurium @ 1 qt/100 gal.
**CHS Emulate @ 1 qt/A or CHS Endurium @ 1qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Draft (thifensulfuron-methyl + tribenuron-methyl)

EPA Reg. #:	**83100-24-83979**
Rate/A:	0.3 fl oz
Spray Volume:	min 5 gpa
Rainfast:	4 hour
S.O.A:	ALS Enzyme Inhibitors (Group 2)
P.P.E:	l.s. shirt, l. pants, shoes, socks, c.r. gloves
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- SU Tolerant Canola

Adjuvant(s)/Comments

- **CHS Hypertonic (2 qt/100 gal)**

Target Weeds

- wild buckwheat
- curly dock
- field pennycress
- kochia
- prickley lettuce
- Russian thistle
- common lambsquarters
- wild mustard
- shepherd's purse
- redroot pigweed

Timing/Comments

Apply from 2 to 5 leaf stage.

Glufosinate

Brand Name:	EPA Reg. #:
Liberty 280 SL	**264-829**
Autonomy	**7969-448-55467**
Cheetah	**71368-112**
Noventa	**7696-448**
Interline	**70506-310**
Spray Volume:	15–20 gpa
Rainfast:	4 hours
M.O.A.:	Glutamine Synthase Inhibitor
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

- **CHS Level Best Pro plus AMS (1.5-3.0 lb/A)**

or

- **CHS Fixate (3 qt/100)**

or

- **Encloax (3.5 pt/A)**

Target Weeds	32 fl oz
– wild buckwheat	6″
– cocklebur	6″
– kochia	4″
– morning glory	6″
– wild mustard	4″
– nightshade	6″
– pigweed species	3″
– ragweed species	6″
– velvetleaf	6″
– waterhemp	3″
– barnyardgrass	4″
– foxtail species	3″
– wild oat	3″
– volunteer corn	6″
– crabgrass	3″

Glufosinate – High Load

Brand Name:	EPA Reg. #:
Surmise 5	**42750-401**
Spray Volume:	15–20 gpa
Rainfast:	4 hours
M.O.A.:	Glutamine Synthase Inhibitor
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

- **CHS Level Best Pro plus AMS (1.5-3.0 lb/A)**

or

- **CHS Fixate (3 qt/100)**

or

- **Encloax (3.5 pt/A)**

Target Weeds	16.3 fl oz
– wild buckwheat	6″
– cocklebur	6″
– kochia	4″
– morning glory	6″
– wild mustard	4″
– nightshade	6″
– pigweed species	3″
– ragweed species	6″
– velvetleaf	6″
– waterhemp	3″
– barnyardgrass	4″
– foxtail species	3″
– wild oat	3″
– volunteer corn	6″
– crabgrass	3″

Glyphosate

Brand Name:	EPA Reg. #:	# A.E.	=0.75 AE
Buccaneer Plus	**55467-9**	3.00	32.0
Gly Star Original	**42750-60**	3.00	32.0
Gly Star Plus	**42750-61**	3.00	32.0
Durango DMA	**62719-556**	4.00	24.0
Buccaneer 5 Extra	**55467-15**	4.00	24.0
Gly Star 5 Extra	**42750-59**	4.00	24.0
Gly Star K-Plus	**42750-122**	4.50	21.3
Buccaneer K	**42750-122-55467**	4.50	21.3
Roundup RT 3	**524-544**	4.50	21.3
Roundup PowerMax 3	**524-659**	4.80	19.7
Rate/A:	Variable		
Spray Volume:	5–20 gpa		
Rainfast:	1–6 hours		
M.O.A.:	EPSP Inhibitor		
P.P.E.:	l.s. shirt, l. pants, shoes, socks		
R.E.I.:	12 hours		
W. Notification:	Oral		
S. Word:	Caution		

Surfactant/Comments

- **CHS Level Best Pro (1 qt/100) plus AMS (8.5-17 lb/100)**

or

- **CHS Fixate/CHS Wheelhouse Pro (2-3 qt/100)**

or

- **Encloax (2.5-5 gal/100)**

or

- **CHS Hypertonic (1 qt/100) plus AMS (8.5-17 lb/100)**

Poast (sethoxydim)

EPA Reg. #: **7969-58-51036**
Rate/Acre: 1.0–2.5 pt
Spray Volume: min 5 gpa (air)
min 10 gpa (ground)
Rainfast: 1 hour
S.O.A.: ACC-ase Inhibitor
P.P.E.: coveralls, l.s. shirt, l. pants, c.r. gloves, c.r. footwear, head gear, eyewear, shoes, socks, apron
R.E.I.: 12 hours
W. Notification: Oral
S. Word: Warning

Labeled Crops

- Canola, rapeseed

Adjuvant(s)/Comments

- **CHS Aggrestrol** (0.75–1 pt/A)**
  plus
  AMS* (2.5 lb/A)**

or

- **CHS Penetrec* (1 pt/A)**
  plus
  AMS* (2.5 lb/A)**

Use the surfactant required by the broadleaf herbicide.

Target Weeds	0.5 pt	1 pt	1.5 pt
– barnyardgrass		8″	
– crabgrass		6″	
– field sandbur			3″
– foxtails		8″	
– volunteer cereals			4″
– volunteer corn		20″	
– wild proso millet	10″		
– wild oat		4″	
– woolly cupgrass		8″	

Timing/Comments

Apply up to 60 day PHI.

*Crop Oil @ 1 qt/A or CHS Endurium @ 1 qt/100 gal.
**CHS Emulate @ 1 qt/A or CHS Endurium @ 1qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Select Max (clethodim)

EPA Reg. #: **59639-132**
Rate/Acre: 9–12 fl oz
Spray Volume: 5–40 gpa
Rainfast: 1 hour
S.O.A.: ACC-ase Inhibitor
P.P.E.: l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.: 24 hours
W. Notification: Oral
S. Word: Caution

Labeled Crops

- Canola, rapeseed

Adjuvant(s)/Comments

- **CHS Hypertonic* (1 qt/100 gal)**
  plus
  AMS (2.5–4 lb/A)**

Target Weeds	9 oz	12 oz
– barnyardgrass	-6″	8″
– crabgrass	2″	6″
– giant foxtail	6″	12″
– green foxtail	6″	8″
– quackgrass	-	4-12″
2nd application may be needed		
– volunteer cereals	6″	8″
– volunteer corn	12″	18″
– wild proso millet	8″	10″
– woolly cupgrass	6″	8″
– yellow foxtail	6″	8″

Timing/Comments

Apply 70 day PHI.

*CHS Endurium @ 1 qt/100 gal can be substituted for CHS Hypertonic.
**CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Stinger (clopyralid)

EPA Reg. #:	**62719-73**
Rate/Acre:	0.25–0.5 pt
Spray Volume:	min 10 pga
Rainfast:	6 hours
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt and l. pants, eyewear, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Canola, rapeseed

Adjuvant(s)/Comments

- **CHS Hypertonic (2 pt/100 gal)**

or

- **CHS Fixate/CHS Wheelhouse Pro (1–2 qt/100 gal)**

Adjuvants are not usually necessary.

They may increase effectiveness on weeds, but may reduce selectivity to the crop.

Target Weeds

– common/giant ragweed	5 leaf
– Canada thistle	5 leaf
– cocklebur	5 leaf
– sunflower	5 leaf
– wild buckwheat	1-3 leaf
– prickly lettuce	5 leaf

Timing/Comments

Apply in the 2-6 leaf stage of crop growth.

Do not apply within 50 days of harvest.

Targa (quizalofop P-ethyl)

EPA Reg. #:	**33906-9-81880**
Rate/Acre:	5–12 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Danger

Labeled Crops

- Canola, rapeseed

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (2–4 lb/A)**

Target Weeds	4 oz	6 oz	8 oz
– barnyardgrass			2–6″
– field sandbur			2–6″
– crabgrass			2–6″
– giant foxtail			2–8″
– green foxtail			2–4″
– volunteer corn	6–24″	24″+	
– wild proso millet			2–6″
– yellow foxtail			2–4″
– wild oat			2–6″
– wooly cupgrass		2–4″@ 9 oz	
– quackgrass		6–10″@ 10 oz	

*Crop Oil @ 1 gal/A or CHS Endurium @ 1 qt/100 gal.

**CHS Emulate @ 1 gal/A or CHS Endurium @ 1 qt/100 gal.

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply 60 days PHI.



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Fallow Syndrome in Corn 101
Efficacy Chart 102

The application of a preemergence herbicide has long been the foundation of effective weed management strategies in corn mainly due to the broad-spectrum activity of atrazine. Today, a well-timed preemergence application is still the basis of a strong weed management program. A preemergence herbicide followed by a postemergence herbicide will provide the most consistent season-long weed control. A preemergence application is especially effective in fields with moderate to high grass populations as well as giant ragweed, cocklebur, velvetleaf, morning glory, palmer amaranth, and waterhemp populations. Many, but not all, preemergence herbicides provide residual weed control creating a wider window for postemergence herbicide applications. Rotating herbicide modes of action can help to slow the development of herbicide resistant weed species.

Preemergence herbicides with a SINGLE MODE OF ACTION

Pre-Emerge Herbicide[1]	MOA[2]	Rate/A[3]	Timing[4]	Tough-to-Kill Target Weeds[4]	Rotation Restrictions (months)[4]						
					Alfalfa	Barley	Potato	Soybean	Sugarbeet	Sunflower	Wheat
Acetochlor (Many)	15	Consult label	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence. Consult label for geographic restrictions.	Barnyard grass, crabgrass, giant foxtail, yellow foxtail, nightshade, pigweed, yellow nutsedge.	9	12	12	12	12	12	4
Acumen/ Prowl	3	2.4–4.8 pt	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence. Consult label for geographic restrictions.	Barnyard grass, crabgrass, giant foxtail, yellow foxtail, shattercane, palmer amaranth, kochia, lambsquarters, smartweed, velvetleaf, waterhemp.	N/A	4	N/A	N/A	12	N/A	4
Atrazine (Many)	5	Consult label	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence.	Nightshade, common ragweed, jimsonweed, kochia, lambsquarters, pigweed, smartweed.	**Rotation to crops other than corn or sorghum is soil pH, rate, rainfall, and geography dependent.**						
Balance Flexx	27	5.0–6.0 fl oz	Apply PPI, PP, or PRE. Consult label for geographic restrictions.	Nightshade, common ragweed, jimsonweed, kochia, lambsquarters, pigweed, smartweed.	10	6	6	6	18	6	4
Callisto	27	3.0 fl oz	Apply PRE. Consult label for geographic restrictions.	Nightshade, lambsquarters, pigweed, smartweed, velvetleaf.	10	4	10	10	18	10	4
Lorox DF/ Linex	7	1.0–1.5 lb/ 1.0–1.5 pt	Apply PRE. Consult label for geographic restrictions.	Lambsquarters, pigweed, smartweed.	**Rotation interval is depended upon geography.**						
Metolachlor (Many)	15	Consult label	Apply PPI, PP, or PRE. Consult label for geographic restrictions.	Crabgrass, giant foxtail, yellow foxtail, nightshade, pigweed, yellow nutsedge.	4	4.5	N/A	N/A	N/A	N/A	4.5
Outlook	15	14.0–21.0 fl oz	Apply PPI, PP, or PRE.	Barnyard grass, crabgrass, fall panicum, giant foxtail, yellow foxtail, nightshade, pigweed, yellow nutsedge.	6	4	N/A	N/A	N/A	9	4
Pendimethalin (Many)	3	Consult label	Apply PRE. Consult label for geographic restrictions.	Barnyard grass, crabgrass, fall panicum, giant foxtail, yellow foxtail, woolly cupgrass, lambsquarters, pigweed.	N/A	4	N/A	N/A	12	N/A	4
Python	2	0.9–1.33 oz	Apply PPI, PP, or PRE.	Nightshade, lambsquarters, pigweed, smartweed, velvetleaf.	4	4	12	N/A	26ba[5]	18	4
Resolve DF	2	0.5–2.0 oz	Apply PP or PRE. PRE applications must be made prior to emergence.	Barnyard grass, giant foxtail, yellow foxtail, morning glory, common ragweed, jimsonweed, kochia, lambsquarters, pigweed, smartweed.	18	9	N/A	10	18	10	9
Sharpen	14	2.5–3.0 fl oz	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence.	Morning glory, nightshade, cocklebur, common ragweed, jimsonweed, kochia, lambsquarters, palmer amaranth, pigweed, smartweed, velvetleaf, waterhemp.	9	3	9	6	9	9	3
Simazine (Many)	5	Consult label	Apply PP or PRE. PRE applications must be made prior to emergence. Consult label for geographic restrictions.	Barnyard grass, giant foxtail, yellow foxtail, nightshade, common ragweed, jimsonweed, lambsquarters, palmer amaranth, pigweed, smartweed, waterhemp.	**Rotation interval is depended upon geography.**						
Valor EZ	14	2.0–3.0 fl oz	Apply PP.	Nightshade, lambsquarters, palmer amaranth, pigweed, waterhemp.	10	4	10	N/A	10	2	2
Valor SX	14	2.0–3.0 oz	Apply PP.	Nightshade, lambsquarters, palmer amaranth, pigweed, waterhemp.	10	4	10	N/A	10	2	2
Zidua SC	15	3.25–5.0 fl oz	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence.	Barnyard grass, crabgrass, fall panicum, giant foxtail, yellow foxtail, nightshade, lambsquarters, palmer amaranth, pigweed, waterhemp.	10	11	3	N/A	15	3	4

Always read and follow the label directions.

[1] All trademarks and registered trademarks are the property of their respective owners.

[2] MOA = Mode of action designated by the herbicide resistance action committee.

[3] Application rate provided is for medium soil texture. Refer to label for complete rate guidelines.

[4] Refer to label for specific timing guidelines, target weed species, and rotation restrictions. PP = Pre-plant, PPI = Pre-plant incorporated, PRE = Preemergence.

[5] ba: Product label requires the designated rotation period for the crop listed in addition to a successful field bioassay.

Preemergence herbicides with MULTIPLE MODES OF ACTION												
Pre-Emerge Herbicide[1]	MOA[2]	Rate/A[3]	Timing[4]	Tough-to-Kill Target Weeds[4]	Rotation Restrictions (months)[4]						
					Alfalfa	Barley	Potato	Soybean	Sugarbeet	Sunflower	Wheat
Atrazine + Acetochlor (Many)	5 and 15	Consult label	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence. Consult label for geographic restrictions.	Barnyardgrass, crabgrass, giant foxtail, yellow foxtail, yellow nutsedge, nightshade, ragweed, jimsonweed, kochia, lambsquarters, palmer amaranth, pigweed, smartweed, waterhemp.	**Rotation interval is depended upon geography.**						
Atrazine + Metolachlor (Many)	5 and 15	Consult label	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence. Consult label for geographic restrictions.	Barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail, yellow nutsedge, nightshade, cocklebur, ragweed, jimsonweed, kochia, lambsquarters, palmer amaranth, pigweed, smartweed, velvetleaf, waterhemp.	**Rotation interval is depended upon geography.**						
Atrazine + Metolachlor + Mesotrione (Many)	5 and 15 and 27	Consult label	Apply PP or PRE. Consult label for geographic restrictions.	Barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail, yellow nutsedge, nightshade, ragweed, jimsonweed, kochia, lambsquarters, palmer amaranth, pigweed, smartweed, velvetleaf, waterhemp.	**Rotation interval is depended upon geography.**						
Acuron	5 and 15 and 27	2.5-3.0 qt	Apply PP or PRE. Consult label for geographic restrictions.	Barnyardgrass, crabgrass, giant foxtail, yellow foxtail, yellow nutsedge, nightshade, common ragweed, jimsonweed, kochia, lambsquarters, palmer amaranth, pigweed, smartweed, velvetleaf, waterhemp.	18	4	10	10	18	18	4
Acuron Flexi	15 and 27	2.0-2.25 qt	Apply PP or PRE.	Crabgrass, giant foxtail, yellow foxtail, yellow nutsedge, nightshade, lambsquarters, pigweed, smartweed, velvetleaf.	10	4	10	10	18	18	4
Anthem Flex or Maxx	14 and 15	3.0-6.0 fl oz	Apply PP or PRE.	Barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail, nightshade, lambsquarters, palmer amaranth, pigweed, waterhemp.	10	11	N/A	N/A	15	N/A	4
Armezon Pro	15 and 27	16.0-24.0 fl oz	Apply PRE.	Barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail, yellow nutsedge, nightshade, pigweed.	9	4	9	9	9	9	4
Corvus	2 and 27	5.6 fl oz	Apply PPI, PP, or PRE. Consult label for geographic restrictions.	Crabgrass, fall panicum, giant foxtail, yellow foxtail, nightshade, lambsquarters, pigweed, smartweed, velvetleaf, waterhemp.	17	9	17	9	17	17	4
Fierce EZ	14 and 15	6 fl oz	Apply early PP.	Barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail, nightshade, ragweed, lambsquarters, palmer amaranth, pigweed, waterhemp.	10	11	4	N/A	12	4	1
Fierce MTZ/ Kyber	5 and 14 and 15	1.0-1.5 pt	Apply early PP.	Barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail, nightshade, ragweed, kochia, lambsquarters, palmer amaranth, pigweed, smartweed, waterhemp.	10	12	9	N/A	18	12	8
Harness Max	15 and 27	64.0-75.0 fl oz	Apply PP, PPI, or PRE.	Barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail, nightshade, lambsquarters, palmer amaranth, pigweed, smartweed, velvetleaf, waterhemp.	10	12	18	10	18	18	4
Hornet	2 and 4	4.0-5.0 oz	Apply PP, PPI, or PRE.	Nightshade, cocklebur, ragweed, jimsonweed, kochia, lambsquarters, pigweed, smartweed, velvetleaf.	10.5	4	18	10.5	26	18	4
Maverick	4 and 15 and 27	18.0-32.0 fl oz	Apply PP, PPI, or PRE.	Barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail, nightshade, cocklebur, ragweed, lambsquarters, palmer amaranth, pigweed, smartweed, velvetleaf, waterhemp.	18	18	18	10.5	18	10.5	6
Resicore XL	4 and 15 and 27	2.5-2.75 qt	Apply PP, PPI, or PRE.	Barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail, yellow nutsedge, nightshade, cocklebur, ragweed, lambsquarters, palmer amaranth, pigweed, smartweed, velvetleaf, waterhemp.	10.5	10.5	18	10.5	18	10.5	4
Staunch II/ SureStart II/ TripleFlex II	2 and 4 and 15	2.0-3.0 pt	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence.	Barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail, nightshade, cocklebur, common ragweed, jimsonweed, kochia, lambsquarters, pigweed, smartweed, velvetleaf.	12	12	18	12	26ba[5]	18	4
TriVolt	2 and 15 and 27	20 fl.oz	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence.	Barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail, nightshade, common ragweed, jimsonweed, kochia, lambsquarters, palmer amaranth, pigweed, smartweed, velvetleaf, waterhemp.	17	12	17	9	17	17	4
Verdict	14 and 15	13.0-15.0 fl oz	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence. Consult label for geographic restrictions.	Barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail, morning glory, nightshade, cocklebur, ragweed, jimsonweed, kochia, lambsquarters, palmer amaranth, pigweed, smartweed, velvetleaf, waterhemp.	7	4	7	4	7	7	4

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[4] Refer to label for specific timing guidelines, target weed species, and rotation restrictions. PP = Pre-plant, PPI = Pre-plant incorporated, PRE = Preemergence.

[5] ba: Product label requires the designated rotation period for the crop listed in addition to a successful field bioassay.

Some PRE corn herbicides can be used POST to provide residual weed control but often require the use of a tank mix partner for controlling emerged weeds (i.e. glyphosate). Adjuvant and fertilizer options vary by product and tank mix partner.

Product	Max. Corn Height or Stage	Rate/A*	Comments
Acumen / Prowl 3.3 EC	30″ or V8	1.8–4.8 pt	In corn > 24″ use drop nozzles to get product to the soil.
Acuron Flexi	30″	1.25–3.0 qt	Do not apply with organophosphate or carbamate insecticides.
Acuron[1]	12″	2.5–3.0 qt	Do not apply with organophosphate or carbamate insecticides.
Anthem ATZ[1]	V4	1.5–3.0 pt	Requires multiple rain events due to low water solubility.
Anthem Maxx	V4	2.0–6.0 oz	Can be applied from 45 days before planting up to V4.
Armezon Pro	30″ or V8	14–24 oz	Do not apply to sand textured soils with < 3% OM.
Atrazine[1]	12″	1.5–3.0 pt	Follow state and ground water restrictions.
Balance Flexx[1]	V2	3–6 fl oz	Apply up to 21 days prior to planting. Corn seed must be covered > 1.5″.
Basis Blend	V4	0.825–2.5 oz	Do not apply to coarse soils with < 1% OM.
Bicep II Magnum / Cinch ATZ / LITE / Brawl II ATZ[1]	12″	1.6–2.58 qt	Apply as directed spray when corn over 5″.
Bicep Lite II Magnum[1]	12″	0.9–1.9 qt	Apply as directed spray when corn over 5″.
Brawl / Brawl II / Dual II Magnum / Dual Magnum / Cinch	40″	1–2 pt	For best results, direct spray toward base of corn plants if > 5″.
Breakfree ATZ[1] **/ Volley ATZ**[1]	11″	2.2–3.4 qt	Apply prior to weed seedling emergence.
Callisto	30″ or V8	3 oz	Do not apply with organophosphate or carbamate insecticides.
Capreno	V5	3.3–5.6 fl oz	Do not apply to coarse textured soils with < 2% OM.
Corvus[1]	V2	3.3–5.6 fl oz	Apply up to 21 days before planting. Corn seed must be covered > 1.5″. If OM < 2% and pH > 7.5 reduce rate by 0.5 oz/A.
Degree Xtra[1]	11″	1.5–3.7 qt	Apply prior to weed seedling emergence.
Fulltime NXT	11″	2.9–3.7 qt	Apply up to 45 days before planting.
Halex GT	30″ or V8	3.6–4 pt	Do not mix with EC formulations of grass herbicides.
Harness / Volley NXT / Surpass NXT / Breakfree NXT	11″	1.25–2.75 pt	Apply prior to weed seedling emergence.

*Dependent on soil type and tank mix partner.

[1] Restricted Use Product

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Product	Max. Corn Height or Stage	Rate/A*	Comments
Harness Xtra / Volley ATZ Lite NXT / Breakfree NXT Lite / Keystone LA NXT[1]	11"	1.8–2.3 qt	Apply prior to weed seedling emergence.
Harness Xtra 5.6 / Breakfree NXT ATZ / Volley ATZ NXT[1]	11"	1.4–3.0 qt	Apply prior to weed seedling emergence.
Hornet WDG	20" or V6	2–5 oz	Can use drop nozzles up to 36".
Impact Core	11"	20–40 oz	See label for adjuvants, AMS, UAN.
Instigate	V2	5.25–7.0 oz	Do not apply to coarse soils.
Laudis	V-8	3.0 fl oz	Only spray with water as the primary carrier.
Lexar EZ[1]	12"	2.25–3.5 qt	Do not make an additional application of any mesotrione containing products.
Lumax EZ[1]	12"	2.0–3.0 qt	Do not make an additional application of any mesotrione containing products.
Maverick	V6 or 18"	14 oz	Check label for approved states.
Outlook	12"	12–21 fl oz	Follow label guidelines for rates based on %OM.
Perpetuo	V2 to V6	30–40 oz	Follow label for OM and Soil Texture Recs.
Prowl H2O	30" or V8	2.0–4.0 pt	In corn > 24" use drop nozzles to get product to the soil.
Python WDG	20" or V^	0.8–1.14 oz	Do not use liquid fertilizer solutions or suspensions as the total carrier.
Realm Q	20" or V6	4 oz	Contains safener to reduce crop injury.
Resicore XL	11"	1.25–3.0 qt	Do not make more than 2 applications per year or 3 qt/A/year.
Resolve Q	20" or V6	1.25 oz	Do not mix with Basagran or rimsulfuron.
SureStart / SureStart II / TripleFlex II / Staunch / Staunch II	11"	1.5–3.0 pt	No POST activity on grasses at application.
TriVolt	V2	10–20 oz	Do Not Use COC or MSO on emerged corn.
Volley NXT / Breakfree NXT	11"	1.5–3.75 pt	Apply prior to weed seedling emergence.
Volley ATZ Lite[1] / Breakfree ATZ Lite[1]	11"	1.6–3.0 qt	Apply prior to weed seedling emergence.
Warrant	30"	1.5–3.0 qt	In corn > 24" use drop nozzles to get product to the soil.
Zidua SC	V4	1.0–4.0 oz	Rates vary based on soil texture, see label.

*Dependent on soil type and tank mix partner.

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Weed Control Rating: 9 = 90% to 100% control 8 = 80% to 90% control 7 = 70% to 80% control 6 = 60% to 70% control - Less than 60% control, not recommended			**Common Ragweed** (Group 2-R)	**Giant Ragweed** (Group 2-R)	**Kochia**	**Lambsquarters** (Group 5-R)	**Palmer Amaranth** (Group 2+9-R)	**Redroot Pigweed**	**Velvetleaf**	**Waterhemp** (Group 2+9+14-R)	- Herbicides will not control resistant biotypes or provide minimal control in tank-mix/premixes with alternative modes of action - Weed control is dependent on rate, size of weeds, environmental conditions, and number of applications	
Herbicide	**Rate[1]**	**Adjuvant Rec.[2]**									**Max Growth Stage**	**Comments**
Accent Q	0.9 oz/A	**CHS Aggrestrol/CHS Penetrec/ Tapran** @ 2 qt/100 + **AMS** @ 2-4 lb/A	-	-	-	-	-	9	8	-	20" or V6. Use drop nozzles for 20" to 36" (V10) corn	Accent Q (nicosulfuron+Safener) is a translocated herbicide. Ear malformation can occur when applications are made to V7–V10 corn. Rotational restrictions apply. See label.
Acuron Flexi	2.0–2.25 qt/A	**CHS Hypertonic** @ 1 qt/100 or **CHS Penetrec** @ 2 qt/100	9	8	6	9	8	9	9	8	30" or V8	Premix of S-metolachlor, mesotrione, and bicyclopyrone for control of grass and broadleaf weeds. Soils with less than 3% OM—2 qt/A; soils with more than 3% OM—2.25 qt/A. Add AMS if tank mixed with Glyphosate.
Acuron GT	3.75 pt/A	**CHS Hypertonic** @ 1 qt/A + **AMS** @ 8.7-17 lb/100	9	8+	8	9	8	9	9	8	30" or V8	**Apply to Glyphosate Resistant Corn Only.** Premix of S-metolachlor, mesotrione, bicyclopyrone and glyphosate.
Aim	0.5–1.0 oz/A	**CHS Hypertonic** @ 1 qt/A + **AMS** @ 2-4 lb/A	6	-	7	7	-	8	9	-	V8 corn Use drop nozzles for V8–V14 corn	Aim (carfentrazone) can be added to herbicide programs to improve control of velvetleaf. Speckling and necrosis is common. Avoid excessive amounts of herbicide into corn whorls.
Armezon Pro	14–24 oz/A	**CHS Penetrec** @ 2 qt/100 + **AMS** @ 8.5 lb/100	7	7	8	9	8	9	9	8	30" or V8	Premix of topramezone and dimethenamid for control of emerged broadleaf weeds and residual control of grasses and pigweeds. Should not be relied upon to provide complete control of grasses, but can control small (less than 3-inch) grasses.
Atrazine	0.5–2.0 lb/A	**CHS Penetrec** @ 2 qt/100	9	8	9	9	8+	9	8	8+	12" corn	Limited grass control when grass is less than 1" tall All weed control ratings are based on application to small weed (1-2" tall) followed by rain. Can see some burn on leaf margins.
Basagran	1.5–2.0 pt/A	**CHS Penetrec** @ 1 pt/A + **AMS** @ 1-2 lb/A	7	6	7	6	-	-	8	-	Apply up to 45 days prior to harvest	Basagran (bentazon) is a contact herbicide that controls certain annual broadleaf weeds including cocklebur, velvetleaf, and Pennsylvania smartweed.
Bromoxynil	1–2 pt/A	-	9	8	8	9	-	7	8	-	Prior to tassel emergence	Bromxynil is a contact herbicide that controls many annual broadleaf weeds, but is weak on pigweeds and velvetleaf.
Buctril + Atrazine/ Brawl II	1.5–2 pt/A	**CHS Hypertonic** @ 1 qt/100 or **CHS Penetrec** @ 2 qt/100	9	9	9	9	8	9	9	8	12" corn	Addition of atrazine to bromoxynil increases the effectiveness of giant ragweed, pigweeds and velvetleaf. The addition of adjuvants may increase burn on the crop.

1. Specific products may utilize reduced rates and/or adjuvant recommendation adjustments when used in a glyphosate or glufosinate-resistant cropping system. When making tank mix applications with any combination of products, always refer to product labels for specific restrictions and precautions regarding herbicide rates and proper adjuvant selection.
2. - CHS Liquid AMS or combination CHS Liquid AMS sproducts; Adium, Encloax, or Mediate Plus can be used to replace dry AMS at equivalent AMS rates.
   - CHS Deppex, CHS Fixate, or CHS Trapline Pro 2, can be used as AMS and surfactant replacements in most situations. Consult your local Rep for details.
   - CHS Endurium can be used to replace CHS Penetrec or CHS Hypertonic in many situations @ 1 qt/100 gal.
   - CHS Emulate can be used to replace CHS Aggrestrol @ 2x the use rate.
   - Crop Oil can be used to replace CHS Penetrec @ 2x the use rate.
   - CHS Acuvant should be included for drift and deposition at 3 fl oz/A.

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Weed Control Rating: 9 = 90% to 100% control 8 = 80% to 90% control 7 = 70% to 80% control 6 = 60% to 70% control - Less than 60% control, not recommended			**Common Ragweed** (Group 2-R)	**Giant Ragweed** (Group 2-R)	**Kochia**	**Lambsquarters** (Group 5-R)	**Palmer Amaranth** (Group 2+9-R)	**Redroot Pigweed**	**Velvetleaf**	**Waterhemp** (Group 2+9+14-R)	- Herbicides will not control resistant biotypes or provide minimal control in tank-mix/ premixes with alternative modes of action - Weed control is dependent on rate, size of weeds, environmental conditions, and number of applications	
Herbicide	**Rate**[1]	**Adjuvant Rec.**[2]									**Max Growth Stage**	**Comments**
Cadet	0.6–0.9 fl oz/A	**CHS Penetrec** @ 1 pt/A	-	-	8	7	-	7	8	-	V2 to 48" corn	Cadet (fluthiacet-methyl) is a contact herbicide that controls velvetleaf. Expect crop speckling to be about half as much as with Aim.
Callisto Xtra	20–24 oz/A	**CHS Hypertonic** @ 1qt/100 or **CHS Penetrec** @ 2 qt/100	9	9	9	9	9	9	9	9	12" corn	Premix of mesotrione and atrazine for control of emerged broadleaf weeds. 8.5 to 17 lbs/100 gal of AMS is also suggested.
Capreno	3.0 fl oz/A	**CHS Penetrec** @ 2 qt/100 + **AMS** @ 8.5 lb/100 gal	8	8	8+	9	8	9	9	8	12" corn	The addition of 0.5 of atrazine increases speed of control. MSO may be substituted for COC under drought stress.
Diflexx	8.0–16.0 fl oz/A	**CHS Hypertonic** @ 1 qt/100 gal + **AMS** @ 8.5 lb/100 gal	9	9	8	8	8	8	7+	8	36" or V10	Premix of dicamba and safener, to reduce the risk of injury to corn. Add CHS Acuvant @ 3 fl oz/A for drift control and be aware of sensitive crops nearby. Addition of atrazine to Diflexx enhances control of lambsquarter, pigweeds and velvetleaf.
Diflexx DUO	24–40 fl oz/A	**CHS Penetrec/CHS Aggrestrol/ Tapran** @ 2 qt/100 gal + **AMS** @ 8.5 lb/100 gal	9	9	9	9	9	9	9	9	36" or V7 V7-V10 Directed spray	Premix of dicamba, tembotrione and safener to reduce the risk of injury to corn. Add CHS Acuvant @ 3 fl oz/A for drift control and be aware of sensitive crops nearby.
Enlist Duo	3.5–4.75 pt/A	See Notes	9	9	8	9	8	9	9	8	Up to V8 or 30" Use drop nozzles for 30" to 48"	**Apply to corn with the Enlist Trait only.** Refer to Enlisttankmix.com for Adjuvant and tank mix approvals.
Enlist One	1.5–2.0 pt/A	See Notes	9	9	7	9	8	9	8	8	Up to V8 or 30" Use drop nozzles for 30" to 48"	**Apply to corn with the Enlist Trait only.** Refer to Enlisttankmix.com for Adjuvant and tank mix approvals.
Glyphosate	0.5–1.0 ae/A	**CHS Hypertonic** @ 1 qt/100 gal + **AMS** @ 8.5 lb/100 gal	8	8	8	8	-	9	8	-	Up to V8 or 30"	**Apply to Glyphosate Resistant Corn Only.** Glyphosate is a translocated herbicide that controls emerged annual and perennial grass and broadleaf weeds.
Glufosinate	22–43 fl oz/A	**CHS Level Best Pro** @ 1 qt/100 gal + **AMS** @ 1.5-3 lb/A	9	9	8	7	8	8	8	8	Emergence through V6	**Apply to Glufosinate Tolerant Corn Only.** Encloax @ 3.5 pt/A can be substituted with glufosinate.

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2. - CHS Liquid AMS or combination CHS Liquid AMS sproducts; Adium, Encloax, or Mediate Plus can be used to replace dry AMS at equivalent AMS rates.
   - CHS Deppex, CHS Fixate, or CHS Trapline Pro 2, can be used as AMS and surfactant replacements in most situations. Consult your local Rep for details.
   - CHS Endurium can be used to replace CHS Penetrec or CHS Hypertonic in many situations @ 1 qt/100 gal.
   - CHS Emulate can be used to replace CHS Aggrestrol @ 2x the use rate.
   - Crop Oil can be used to replace CHS Penetrec @ 2x the use rate.
   - CHS Acuvant should be included for drift and deposition at 3 fl oz/A.

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Weed Control Rating: 9 = 90% to 100% control 8 = 80% to 90% control 7 = 70% to 80% control 6 = 60% to 70% control - Less than 60% control, not recommended			**Common Ragweed** (Group 2-R)	**Giant Ragweed** (Group 2-R)	**Kochia**	**Lambsquarters** (Group 5-R)	**Palmer Amaranth** (Group 2+9-R)	**Redroot Pigweed**	**Velvetleaf**	**Waterhemp** (Group 2+9+14-R)	- Herbicides will not control resistant biotypes or provide minimal control in tank-mix/premixes with alternative modes of action - Weed control is dependent on rate, size of weeds, environmental conditions, and number of applications	
Herbicide	**Rate**[1]	**Adjuvant Rec.**[2]									**Max Growth Stage**	**Comments**
Halex GT	3.6–4.0 pt/A	**CHS Hypertonic** @ 1 qt/100 gal + **AMS** @ 8.5 lb/100 gal	9	8	8	9	8	9	9	8	Up to V8 or 30"	**Apply to Glyphosate Resistant Corn Only.** Premix of glyphosate, mesotrione, and S-metolachlor for control of grasses and broadleaf weeds.
Hornet	2–5 oz/A	**CHS Hypertonic** @ 1 qt/100 gal + **AMS** @ 2 lb/A	9	9	7	7	-	7	8+	-	Up to V6 or 20"	CHS Endurium @ 1 qt/100 or CHS Aggrestrol/CHS Penetrec @ 2 qt/100 may be substituted for CHS Hypertonic.
Impact / Armezon	0.75–1.0 oz/A	**CHS Aggrestrol or Tapran** @ 2 qt/100 gal + **AMS** @ 1.5-2.5 lb/A	7	7	8	9	8	8	9	8	Apply up to 45 days prior to harvest	Impact/Armezon (topramezone) controls many broadleaf weeds. Should not be relied upon to provide complete control of grasses. The addition of atrazine increases the control of many weeds.
Impact Core	20–40 fl oz/A	**CHS Aggrestrol or Tapran** @ 2 qt/100 gal + **AMS** @ 1.5-2.5 lb/A	7	7	8	9	8	8	9	8	Spike to 11"	Premix of Impact and acetochlor. Addition of low rates of atrazine can increase the control of some broadleaves.
Impact Z	8–10.7 fl oz/A	**CHS Aggrestrol or Tapran** @ 2 qt/100 gal + **AMS** @ 8.5-17 lb/100	9	9	9	9	9	9	9	9	Spike to 11"	Premix of Impact and atrazine.
Laudis	3.0 oz/A	**CHS Aggrestrol or Tapran** @ 2 qt/100 gal + **AMS** @ 8.5 lb/100 gal	8	8	8	9	8	9	9	8	Emergence to V8 corn	Laudis (tembotrione) controls many broadleaf weeds, including biotypes resistant to groups 2, 5, and 9. For best results, tank mix with bromoxynil @ 6 fl oz/A.
Katagon	2.3–3.4 fl oz/A	**CHS Aggrestrol/CHS Penetrec/ Tapran** @ 2 qt/100 gal + **AMS** @ 8.5 lb/100	7	7	7	9	8	9	9	8	V5 or 20" corn Whichever is more restrictive	May use CHS Hypertonic at 1 qt/100 in place of oils. Adding atrazine enhances the control of ragweeds, kochia and pigweeds.
Kyro	30-60 fl oz/A	**CHS Aggrestrol/CHS Penetrec/ Tapran** @ 2 qt/100 gal + **AMS** @ 8.5 lb/100	8-9	8-9	8-9	9	7	9	9	9	Up to 24"	Kyro is a premix of acetachlor, topramezone and clopyralid. May use CHS Hypertonic at 1 qt/100 in place of oils when using atrazine as a tank mix partner.

1. Specific products may utilize reduced rates and/or adjuvant recommendation adjustments when used in a glyphosate or glufosinate-resistant cropping system. When making tank mix applications with any combination of products, always refer to product labels for specific restrictions and precautions regarding herbicide rates and proper adjuvant selection.
2. - CHS Liquid AMS or combination CHS Liquid AMS sproducts; Adium, Encloax, or Mediate Plus can be used to replace dry AMS at equivalent AMS rates.
   - CHS Deppex, CHS Fixate, or CHS Trapline Pro 2, can be used as AMS and surfactant replacements in most situations. Consult your local Rep for details.
   - CHS Endurium can be used to replace CHS Penetrec or CHS Hypertonic in many situations @ 1 qt/100 gal.
   - CHS Emulate can be used to replace CHS Aggrestrol @ 2x the use rate.
   - Crop Oil can be used to replace CHS Penetrec @ 2x the use rate.
   - CHS Acuvant should be included for drift and deposition at 3 fl oz/A.

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Weed Control Rating: 9 = 90% to 100% control 8 = 80% to 90% control 7 = 70% to 80% control 6 = 60% to 70% control - Less than 60% control, not recommended			Common Ragweed (Group 2-R)	Giant Ragweed (Group 2-R)	Kochia	Lambsquarters (Group 5-R)	Palmer Amaranth (Group 2+9-R)	Redroot Pigweed	Velvetleaf	Waterhemp (Group 2+9+14-R)	- Herbicides will not control resistant biotypes or provide minimal control in tank-mix/premixes with alternative modes of action - Weed control is dependent on rate, size of weeds, environmental conditions, and number of applications	
Herbicide	**Rate[1]**	**Adjuvant Rec.[2]**									**Max Growth Stage**	**Comments**
Maverick	14 fl oz/A	**CHS Hypertonic** @ 1 qt/100 gal or **CHS Penetrec** @ 2 qt/100 gal	8	8	8-9	9	9	7	9	8-9	V6 or 18"	Maverick is a premix of mesotrione, clopyraild and pyroxasulfone. Do not apply to popcorn post. To achieve best weed control atrazine should be tank mixed.
Mesotrione	3.0 oz/A	**CHS Penetrec** @ 2 qt/100 gal + **AMS** @ 8.5 lb/100 gal	7	8	8	9	8	8	9	8	30" or V8	Systemic herbicide that controls annual broadleaf weeds. To avoid crop injury, do not apply postemergence with emulsifiable concentrate herbicides or MSOs. Tank mix with other herbicides for improved weed control.
Palace	2.4 qt/A	**CHS Penetrec** @ 2 qt/100 gal	8	8	8	9	8	9	9	8	30" or V8	Premix of S-metolachlor and mesotrione for control of grass and broadleaf weeds. Do not apply postemergence with MSO or in liquid fertilizer to prevent severe crop injury.
Permit	0.7–1.3 oz/A	**CHS Hypertonic** @ 1 qt/100 gal + **AMS** @ 2-4 lb/A	-	-	7	-	-	9	8	-	Up to Layby Stage Drop Nozzle 24-36"	Permit (halosulfuron) is a translocated herbicide that controls yellow nutsedge and annual broadleaf weeds. Labeled for tank mix application with Accent. Major rotational restrictions apply. See label.
Realm Q	4.0 oz/A	**CHS Penetrec** @ 2 qt/100 gal + **AMS** @ 2-4 lb/A	7	8	8	9	8	9	9	8	20" or V6	Premix of rimsulfuron, mesotrione and safener. To avoid severe injury, do not apply after prolonged cold weather or soils, or mix with Basagran.
Resource	4-6 oz/A	**CHS Penetrec** @ 1 pt/A + **AMS** @ 2 lb/A	7	-	-	7	-	7	9	-	V2 to V10	Controls velvet leaf up to 10" tall. Apply in a spray volume of at least 15 gpa.
Revulin Q	3.4–4 oz/A	**CHS Penetrec** @ 2 qt/100 gal + **AMS** @ 2 lb/A	7	8	8	9	8	9	9	8	Prior to V6 and up to 20" corn	Mix of nicosulfuron and mesotrione.
Status	4–5 oz/A	**CHS Aggrestrol/CHS Penetrec** @ 1 pt/A + **AMS** @ 8.5 lb/100	9	9	8	9	9	9	9	9	36" or V10	Premix of dicamba, diflufenzopyr and safener. Add CHS Acuvant @ 3 fl oz/A for drift control and be aware of sensitive crops nearby.
Stinger	0.4–0.6 pt/A	**CHS Hypertonic** @ 1 qt/100 gal	9	9	-	-	-	-	-	-	24" Corn	Stinger (clopyralid) is a translocated herbicide that ragweeds, cocklebur, jimsonweed, and Canada thistle.
Yukon	4–8 oz/A	**CHS Penetrec** @ 2 qt/100 gal + **AMS** @ 2-4 lb/A	9	9	8	8	7	9	9	7	20" Corn	Premix of halosulfuron and dicamba for control of most annual broadleaf weeds. Add CHS Acuvant @ 3 fl oz/A for drift control and be aware of sensitive crops nearby.

1. Specific products may utilize reduced rates and/or adjuvant recommendation adjustments when used in a glyphosate or glufosinate-resistant cropping system. When making tank mix applications with any combination of products, always refer to product labels for specific restrictions and precautions regarding herbicide rates and proper adjuvant selection.
2. - CHS Liquid AMS or combination CHS Liquid AMS sproducts; Adium, Encloax, or Mediate Plus can be used to replace dry AMS at equivalent AMS rates.
   - CHS Deppex, CHS Fixate, or CHS Trapline Pro 2, can be used as AMS and surfactant replacements in most situations. Consult your local Rep for details.
   - CHS Endurium can be used to replace CHS Penetrec or CHS Hypertonic in many situations @ 1 qt/100 gal.
   - CHS Emulate can be used to replace CHS Aggrestrol @ 2x the use rate.
   - Crop Oil can be used to replace CHS Penetrec @ 2x the use rate.
   - CHS Acuvant should be included for drift and deposition at 3 fl oz/A.

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Common Glyphosate Tank Mix Partners in Corn

Herbicide[2]	Rate	Height Restriction[4]	Corn Tolerance	Burcucumber	Canada Thistle	Cocklebur	Jimsonweed	Kochia[1]	Lambsquarters[1]	Morning Glory (An.)	Nightshade, Black	Pigweed, Redroot	Ragweed, C.[1]	Ragweed, Giant[1]	Russian Thistle	Smartweed	Sunflower	Velvetleaf	Waterhemp Sp.[1]	Wild Buckwheat	Wild Mustard
Atrazine[5]	0.5–2.0 qt	12"	E	G	F	E	E	E	E	G/E	E	E	E	G	E	E	G	G	G	G	E
Armezon Pro	14–24 oz	V8 or 30"	E	F/G	G	G	E	G/E	E	F	E	E	F	F	E	E	E	E	G	E	E
Cadet	0.4–0.6 oz	48"	E	P	P	P	G	G	F	F/G	F	G	P	P	P	P	F	E	P	P	P
Callisto	3 fl oz	30"	E	G	P	E	E	G	E	G	E	E	E	E	G	E	E	E	E	F	E
Callisto Xtra	20–24 fl oz	12"	E	G	P	E	E	E	E	G	E	E	E	E	E	G	E	E	G	F	E
Capreno	3 fl oz	V1–V5	E	G	P	G	E	E	G	F	E	E	G	G	E	G	E	E	G	F	E
Clarity/Detonate[3]	4–16 fl oz	36"	G	F	F	E	E	G	G	E	G	G	E	E	F/G	G	E	F/G	G	E	P
DiFlexx	8–16 fl oz	36"	G	F	F	E	E	G	G	E	G	G	G	E	F/G	G	E	F/G	G	E	P
DiFlexx DUO	24–40 fl oz	36"	G	G	F/G	E	E	E	E	E	E	E	E	E	G/E	E	E	E	E	E	E
Hornet WDG	2–5 oz	V6 or 20"	G	-	G/E	E	F	F/G	P/F	-	G/E	P/F	E	E	F/G	F/G	E	G	-	F/G	E
Impact/Armezon	0.5–0.75 fl oz	45 day PHI	E	F/G	G	G	E	G/E	E	F	E	E	F	F	E	P	E	E	G	P	E
ImpactZ	8–10.7 fl oz	12"	E	G	G	E	E	E	E	G	E	E	E	E	E	E	E	E	E	E	E
Laudis	3.0 fl oz	VE–V8	E	P	F	G	E	G	E	F	E	E	G	G	G	E	E	E	G	F	E
Permit/Sandea	2/3–1 1/3 oz	24"	G	P	N	E	G	F	N	F	P	E	G	G	-	F	E	G	-	P	E
Realm Q	4 oz	V7 or 20"	F	F	N	G	E	G	E	F	E	E	G	G	-	E	E	E	G	P	E
Resolve Q	1.25 oz	V7 or 20"	G	E	N	P	P	F	F	F	G	G	P	P	P	F	P	F	-	P	E
Resource	4–6 oz	V–2–V10	E	P	F	F	F	P	F	P	P	F	F	P	P	P	P	E	P	P	P
Status	2.5–10.0 oz	4–36"	G	G	E	E	E	G	E	E	E	E	E	E	E	G/E	E	G	G	E	E
Stinger	0.33–0.67 pt	24"	E	-	E	E	G	-	P	-	G	P	E	E	P/F	G/E	F/G	P	P	F/G	P
Yukon	4–8 oz	36"	G	F	P	E	E	G	G	G	F	E	E	E	F	E	E	E	G	F	E

[1]Weed species may have biotypes resistant to tank mix partners and may not provide additional weed control.

[2]All products are trademarks or registered trademarks of their associated manufacturers.

[3]Reduce rates to 4–8 fl oz when corn is greater than 8" tall.

[4]Height restriction relates to broadcast use of tank mix partner.

[5]Follow state and soil restrictions.

Weed control table key:

E = Excellent G = Good F = Fair P = Poor N = No Control

Ratings are based on experience and data available to the researcher.

Always Read and Follow Label Directions.

Rotation interval in months

Herbicide[3]	Small Grain	Alfalfa	Soybean	Sunflower	Potato	Canola	Flax	Pea	Dry Bean	Sugarbeet	All Other
Atrazine[3]	Refer to Label										
Armezon Pro	4	9	9	9	9	9-18[4]	18	9-18[4]	9-18[4]	9-18[4]	18
Cadet	NCS	NCS	0	NCS	NCS	NCS	NCS	NCS	NCS	NCS	MCS
Callisto	4	10	10	10	10	10	0	10	18	18	18
Callisto Xtra	NCS	NCS	NCS	NCS	NCS	NCS	NCS	18	18	18	18
Capreno[1]	4	18	10	18	18	18	18	18	18	18	18
Clarity/Banvel[2]	22 days	4	4[4]	4	4	4	4	4	4	4	4
DiFlexx	22 days	4	4[4]	4	4	4	4	4	4	4	4
DiFlexx DUO	4	10	8	10	10	10	18	10	18	10	18
Hornet WDG	4	10.5-18[4]	10.5-18[4]	18	18	26	26	18	10.5-18[4]	26	26
Impact/Armezon	3	9	9	9	9	9	9	9	18	18	18
ImpactZ	9	9	9	9	9	9-18[4]	9-18[4]	18	18	18	18
Laudis	4	10	8	10	10	10	18	10	10	10	18
Permit/Sandea	2	9	9	18	9	15	Bio	9	0	36	36
Realm Q	9	10	10	10	10	10	10	18	18	18	18
Resolve Q	9	10	10	10	0	10	10	10	10	10	18
Resource	1	1	1	1	1	1	1	1	1	1	1
Status	1	4	4	4	4	4	4	4	4	4	4
Stinger	0	10.5	18	18	18	0	0	18	18	0	18
Yukon	2	9	9	18	9	15	18	9	9	36	18

[1]Rotation restriction dependent on 30" of cumulative rainfall except soybean and spring seeded alfalfa 15" of rainfall.

[2]For Barley, oats and wheat 15 days per 8 fl oz east of Mississippi River or 22 days per 8 fl oz west of Mississippi River.

[3]Follow state and soil restrictions.

[4]See label for replant restrictions.

[5]Addition of AMS could increase the potential for herbicide volatility.

Always Read and Follow Label Directions.

Adjuvant when tank mixed with glyphosate

Herbicide	Adjuvant Recommendation	AMS[1]
Atrazine	CHS Penetrec (2 qt/100)	None
Armezon Pro	CHS Endurium (1 qt/100) or CHS Hypertonic (1 qt/100) or CHS Penetrec (2 qt/100)	8.5 lb/100
Cadet	CHS Endurium (1 qt/100) or CHS Hypertonic (1 qt/100) or CHS Penetrec (2 qt/100)	None
Callisto	CHS Fixate (1-2 qt/100) alone or Encloax (3-4 qt/100) alone or CHS Hypertonic (1 qt/100) with AMS	8.5–17 lb/100
Callisto Xtra	CHS Fixate (1-2 qt/100) alone or Encloax (3-4 qt/100) alone or CHS Hypertonic (1 qt/100) with AMS	8.5–17 lb/100
Capreno	CHS Penetrec (2 qt/100) or CHS Endurium (1 qt/100) with AMS	8.5–17 lb/100
Clarity/ Banvel	CHS Trapline Pro 2 (2 qt/100) alone or with AMS	2.5 lb/A[5]
DiFlexx	CHS Trapline Pro 2 (2 qt/100) alone or CHS Hypertonic (1 qt/100) or CHS Penetrec or CHS Aggrestrol (2 qt/100) with AMS	8.5–17 lb/ 100 gal[5]
DiFlexx DUO	CHS Penetrec or CHS Aggrestrol at (2 qt/100), CHS Endurium (1 qt/100 gal) with AMS	8.5–17 lb/ 100 gal[5]
Hornet WDG	CHS Endurium or CHS Hypertonic (1 qt/100) or CHS Aggrestrol or CHS Penetrec (2 qt/100) with AMS	2 lb/A
Impact/ Armezon	CHS Penetrec or CHS Aggrestrol at (2 qt/100) or CHS Endurium (1 qt/100) with AMS	8.5–17 lb/100
ImpactZ	CHS Emulate (1 gal/100) with AMS	
Laudis	CHS Aggrestrol or CHS Penetrec (2 qt/100)	8.5 lb/100
Permit/ Sandea	CHS Endurium (1 qt/100) or CHS Hypertonic (1 qt/100) or CHS Penetrec or CHS Aggrestrol at (2 qt/100) with AMS	2.0–4.0 lb/A
Realm Q	CHS Endurium (1 qt/100) or CHS Hypertonic (1 qt/100) or CHS Penetrec at (2 qt/100) with AMS	2.0 lb/A
Resolve Q	CHS Endurium (1 qt/100) or CHS Hypertonic (1 qt/100) or CHS Penetrec at (2 qt/100) with AMS	2.0 lb/A
Resource	CHS Endurium (1 qt/100) or CHS Hypertonic (1 qt/100) or CHS Penetrec or CHS Aggrestrol at (2 qt/100) with AMS	2.0 lb/A
Status	CHS Trapline Pro 2 alone or CHS Endurium (1 qt/100) or CHS Hypertonic (1 qt/100) or CHS Penetrec or CHS Aggrestrol (2 qt/100) with AMS	5.0–17.0 lb/ 100 gal[5]
Stinger	CHS Endurium (1 qt/100) or CHS Hypertonic (1 qt/100) or CHS Penetrec at (2 qt/100) with AMS	
Yukon	CHS Endurium (1 qt/100) or CHS Penetrec or CHS Aggrestrol at (2 qt/100) with AMS	2.0–4.0 lb/A

2, 4-D

EPA Reg. #:	Several
Rate/A:	Ester: 0.5–0.75 pt Amine: 0.5–1.0 pt
Spray Volume:	min 10 gpa
Rainfast:	Ester: 1 hour, Amine: 6–8 hours
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear
R.E.I.:	Ester: 12 hours Amine: 48 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Fixate/ CHS Level Best Pro* (1 qt/100 gal)**

Target Weeds

Many broadleaf weeds.

Corn: Up to 4 leaf collars or 8", whichever comes first.

*CHS Wheelhouse Pro can be used at equivalent rates.

Accent Q (nicosulfuron + safener)

EPA Reg. #:	**352-773**
Rate/A:	0.9 oz
Spray Volume:	min 10 gpa
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (2–4 lb/A)**

or

- **Tapran (2 qt/100 gal)**

Target Weeds

- barnyardgrass
- foxtail
- pigweed
- quackgrass
- wild proso millet
- woolly cup

Timing/Comments

Apply to corn up to 20" or 6 or fewer collars.

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 can be substituted for CHS Aggrestrol.
***CHS Fixate @ 2 qt/100 or Encloax @ 2.5 gal/100 gal can be substituted for AMS.

Acuron (metolachlor+mesotrione+bicyclopyrone+atrazine)

EPA Reg. #:	**100-1466**
Rate/A:	2.5–3.0 qt
Spray Volume:	10–30 gpa
Rainfast:	
S.O.A.:	Very Long Chain Fatty Acid Inhibitor (Group 15) HPPD Inhibitor (Group 27) Photosystem II Inhibitor (Group 5)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal)**

Timing/Comments

Apply up to 12" corn.

Do not apply post to sweet corn or yellow popcorn.

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.

Acuron Flexi (metolachlor+mesotrione+bycylopyrone)

EPA Reg. #:	**100-1568**
Rate/A:	2.0–2.25 qt
Spray Volume:	10–30 gpa
Rainfast:	
S.O.A.:	Very Long Chain Fatty Acid Inhibitor (Group 15) HPPD Inhibitor (Group 27)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal)**

Timing/Comments

Apply up to 30 inches tall or V-8.

Do not apply post to sweet corn or yellow popcorn.

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.

Acuron GT (s-metholachlor+mesotrione+bycyclopyrone+glyphosate)

EPA Reg. #:	**100-1675**
Rate/A:	3.75 pt
Spray Volume:	10-30 gpa
Rainfast:	
S.O.A.:	Very Long Chain Fatty Acid Inhibitor (Group 15) HPPD Inhibitor (Group 27) EPSP Inhibitor (Group 9)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS (8.5 lb/100 gal)**

or

- **CHS Level Best Pro* (1 qt/100 gal) plus AMS (8.5 lb/100 gal)**

or

- **CHS Fixate (2 qt/100 gal)**

Timing/Comments

Apply to corn from emergence up to V8 (8 leaves with collars) or until corn reaches 30", whichever comes first.

Do not apply post to sweet corn or yellow popcorn.

Roundup Ready Corn Only

*CHS Level Best Pro can be added to any adjuvant program at 1 qt/100 gal for maximum efficacy.

Aim EC (carfentrazone–ethyl)

EPA Reg. #:	**279-3241**
Rate/A:	0.5 oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Fixate*/ CHS Level Best Pro (2 qt/100 gal)**
- **NIS or COC may be used**
- Under very dry conditions COC can be used instead of NIS. However, more leaf speckling may occur.
- Many tank mix options available.

Target Weeds

– black nightshade	4"
– kochia	2"
– lambsquarters	3"
– morning glory	3 leaves
– redroot pigweed	4"
– velvetleaf	12"
– waterhemp	2"

Timing/Comments

Apply up to 14-leaf collar corn.

Corn larger than V8, use drop nozzles.

*CHS Endurium can be used at equivalent rates.

Anthem Flex (pyroxasulfone + carfentrazone-ethyll)

EPA Reg. #:	**279-3464**
Rate/A:	2.25–6.5 fl oz
Spray Volume:	Refer to equipment instructions
Rainfast:	1 hour
S.O.A.:	Very Long Chain Fatty Acid Inhibitor (Group 15) PPO Inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Fixate/ CHS Level Best Pro* (2 qt/100 gal)**

or

- **CHS Penetrec** (1/2–1 pt/A)**

or

- **CHS Aggrestrol*** (0.5–1 pt/A)**

or

- **Tapran (2 qt/100 gal)**
- Apply up to V4 corn.
- Do not apply by aerial equipment.

Target Weeds

– lambsquarters	3″
– morning glory	3″
– nightshade species	4″
– pigweed species	4″
– velvetleaf	4″
– waterhemp	4″

*CHS Endurium can be used at equivalent rates.
**Crop Oil @ 1–2 pt/A or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.
***CHS Emulate @ 1–2 pt/A can be substituted for CHS Aggrestrol.

Timing/Comments

Apply through V4 stage.

Anthem Maxx (pyroxasulfone + fluthiacet-methyl)

EPA Reg. #:	**279-3468**
Rate/A:	2–6 fl oz
Spray Volume:	Refer to equipment instructions
Rainfast:	1 hour
S.O.A.:	Very Long Chain Fatty Acid Inhibitor (Group 15) PPO Inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Fixate/ CHS Level Best Pro* (2 qt/100 gal)**

or

- **CHS Penetrec** (1/2–1 pt/A)**

or

- **CHS Aggrestrol*** (2 qt/100 gal)**
- **Tapran (2 qt/100 gal)**
- Apply up to V4 corn.
- Do not apply by aerial equipment.

Target Weeds

- burcucumber
- jimsonweed
- kochia
- lambsquarters
- morning glory
- nightshade species
- pigweed species
- Pennsylvania smartweed
- velvetleaf
- waterhemp

*CHS Endurium can be used at equivalent rates.
**Crop Oil @ 1–2 pt/A or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.
***CHS Emulate @ 1–2 pt/A can be substituted for CHS Aggrestrol.

Timing/Comments

Apply through V4 stage.

Armezon Pro (topramezone+dimethenamid)

EPA Reg. #:	**7969-372**
Rate/A:	14–24 fl oz
Spray Volume:	10 or greater/2–10 Air
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27) Very Long Chain Fatty Acid Inhibitor (Group 15)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS (8.5–17 lb/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS (8.5–17 lb/100 gal)**

or

- **CHS Endurium (1 qt/100 gal) plus AMS (8.5–17 lb/100 gal)**

or

- **Tapran (2 qt/100 gal)**

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 can be substituted for CHS Aggrestrol.

Atrazine 4L or 90DF

Brand Name:	EPA Reg. #:
Atrazine 4L (Mana)	**66222-36**
Atrazine 4L (Tenkoz)	**35915-4-55467**
Atrazine 90 DF (Mana)	**66222-37**
Atrazine 90 DF (Sipcam)	**35915-3-60063**
Drexel Atra 5	**19716-80**
EPA Reg. #:	**11773-1 or 11773-13**
Rate/A:	0.5–2.0 qt or 1.33–2.2 lb
Spray Volume:	min 10 gpa
Rainfast:	4 hours
S.O.A.:	Photosystem II Inhibitor (Group 5)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, c.r. footwear, socks, coveralls
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Penetrec* (1 pt/A)**

or

- **CHS Aggrestrol** (1 pt/A)**

or

- **Tapran (2 qt/100 gal)**
- Follow local specifications relating to the use of atrazine or atrazine products.

Target Weeds

– pigweed	6″
– lambsquarters	6″
– other weeds	1.5″

Timing/Comments

Atrazine and all applications that include atrazine as a tank mix partner may only be applied to corn up to 12″ tall.

*Crop Oil @ 1 qt/A or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.
**CHS Emulate @ 1 qt/A can be substituted for CHS Aggrestrol.

Balance Flexx (isoxaflutole)

EPA Reg. #:	**264-1067**
Rate/A:	3.0–5.0 fl oz
Spray Volume:	10–20 gpa
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear, and c. res. apron
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- Addition of liquid fertilizer can cause corn injury and is not recommended unless typical burn symptoms are acceptable.
- Add atrazine (0.25–0.5 lb/A) for more consistent control.

Timing/Comments

Spike through V2.

Target Weeds

For weed control in corn in AR, AL, CO, DE, GA, IL, IN, IA, KS, KY, LA, MI, MS, MT, NE, NJ, NM, NC, ND, OH, OK, PA, SC, SD, TN, TX, VA, and WY.

CO, DE, KS, MD, MO, NJ, NM, SD, and WV possess a 24c label and have restrictive conditions relating to this product. Check your state regulatory authority prior to use.

Consult label for restrictions on course textured soils with a shallow water table.

Rotation	Crop
0 mo.	Field corn
4 mo.	Wheat, triticale
6 mo.	Barley, soybean, sweet corn, potato, sorghum, and sunflower
10 mo.	Rice, cotton, alfalfa dry bean and sugarbeet east of Mississippi River
18 mo.	Dry bean and sugarbeet west of Mississippi River and all other crops

Basagran (bentazon)

EPA Reg. #:	**7969-45-51036**
Rate/A:	1.5–2.0 pt
Spray Volume:	10–20 gpa
Rainfast:	4 hours
S.O.A.:	Photosystem II Inhibitor (Group 6)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Fixate/Level Best Pro* (2 qt/100 gal)**

or

- **CHS Penetrec** (2 qt/100 gal)**
- May add: **AMS (2.5 lb/A)**
- Use **AMS or CHS Fixate (2 qt/100 gal)** for velvetleaf control

Target Weeds	1 pt	1.5 pt	2 pt
– cocklebur	4″	6″	10″
– lambsquarters	1″	1.5″	2″
– common ragweed	-	-	3″
– giant ragweed	-	-	6″
– annual smartweed	4″	6″	10″
– velvetleaf	2″	2″	5″
– venice mallow	2″	2″	4″
– wild buckwheat	-	3″	5″
– wild mustard	2″	4″	8″
– wild sunflower	3″	5″	8″

Timing/Comments

Split applications needed for Canada thistle.

*CHS Endurium can be used at equivalent rates.

**Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.

Bromoxynil Products

Brand Name:	EPA Reg. #:
Buctril	**264-437**
Maestro 2EC	**71368-29**
Brox 2EC	**42750-48**
Rate/A:	1.0–1.5 pt
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	Photosystem II Inhibitor (Group 6)
P.P.E.:	coveralls over l.s. shirt and l. pants, c.r. gloves, apron, headgear, eyewear, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/ Comments

- **CHS Hypertonic* (1 qt/100 gal)**

*Adjuvant not required. May make weed control more consistent but can increase leaf burn on corn.

Target Weeds	1 pt	1.5 pt
– black nightshade	6″	6″
– common ragweed	4″	6″
– cocklebur	8″	10″
– giant ragweed	4″	6″
– lambsquarters	6″	8″
– pigweed	-	2″
– venice mallow	-	2″
– velvetleaf	3″	5″

Cadet (fluthiacet–methyl)

EPA Reg. #:	**279-3338**
Rate/A:	0.6–0.9 oz
Spray Volume:	min 10 gpa
Rainfast:	4 hours
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/ Comments

- **CHS Fixate/ CHS Level Best Pro* (2 qt/100 gal)**

or

- **CHS Penetrec** (0.5–1 pt/A)**

When tank mixing, use the adjuvant that is recommended for the tank mix partner.

Target Weeds	0.6 oz	0.9 oz
– burcucumber	2″	2″
– nightshade	2″*	2″*
– common lambsquarters	2″*	2″
– kochia	2″	2″
– pigweed	2″*	4″
– velvetleaf	36″	36″
– waterhemp	-	2″

Suppression only

Timing/ Comments

Can be applied from spike to 48″ corn.

*CHS Endurium can be used at equivalent rates.
**Crop Oil @ 1–2 pt/A or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.

Callisto (mesotrione)

EPA Reg. #:	**100-1131**
Rate/A:	3.0 fl oz
Spray Volume:	10–30 gpa
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/ Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS** (8.5 lb/100 gal)**

Note: Do not use MSO as severe crop injury may occur.

Add atrazine @ (0.25–0.5 lb/A) for more consistent control.

Do not use oil adjuvant when tank mixing with Liberty.

Target Weeds

Controls many broadleaf weeds including pigweed, lambsquarters, giant ragweed, cocklebur, nightshade, sunflower, and smartweed.

Timing/ Comments

Apply when weeds < 5″.

Callisto used without an herbicide tank mix can be applied to corn up to 30″.

When applied with atrazine, can be applied to corn up to 12″.

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.
**CHS Fixate @ 2 qt/100 gal or Encloax @ 2.5 gal/100 gal can be substituted for AMS.

Callisto Xtra (mesotrione + atrazine)

EPA Reg. #:	**100-1359**
Rate/A:	20–24 fl oz
Spray Volume:	10–30 gpa
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27) Photosystem II Inhibitor (Group 5)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, c.r. footwear, socks, coveralls
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS** (8.5 lb/100 gal)**

Note: Do not use MSO as severe crop injury may occur.

- Do not use oil adjuvant when tank mixing with Liberty.
- Follow local specifications relating to the use of atrazine or atrazine products.

Target Weeds

Controls many broadleaf weeds including pigweed, lambsquarters, giant ragweed, cocklebur, nightshade, sunflower, and smartweed.

Timing/Comments

20 oz when weeds < 5″.

24 oz when weeds 5–10″.

Can be applied to corn up to 12″.

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.
**CHS Fixate @ 2 qt/100 gal or Encloax @ 2.5 gal/100 gal can be substituted for AMS.

Capreno (tembotrione + thiencarbazone–methyl)

EPA Reg. #:	**264-1063**
Rate/A:	3.0 fl oz
Spray Volume:	10–20 gpa
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS** (8.5–17 lb/100 gal)**
- Add atrazine (0.25–0.5 lb/A) for more consistent control.

Timing/Comments

Emergence to V6.

Target Weeds	3 fl oz	with atrazine
– cocklebur	< 6″ C	< 6″ C
– lambsquarters	< 6″ C	< 6″ C
– nightshade	< 6″ C	< 6″ C
– common ragweed	< 6″ C	< 6″ C
– giant ragweed	< 6″ C	< 6″ C
– smartweed	< 6″ C	< 6″ C
– giant foxtail	3″ C	4″ C
– green foxtail	2″ PC	2″ PC
– yellow foxtail	3″ C	4″ C
– barnyardgrass	5″ C	6″ C

C = Control
PC = Partial Control

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.
**CHS Fixate @ 2 qt/100 gal or Encloax @ 2.5 gal/100 gal can be substituted for AMS.

Corvus (thiencarbazone–methyl + isoxaflutole)

EPA Reg. #:	**264-1066**
Rate/A:	3.33–4.5 fl oz
Spray Volume:	10–20 gpa
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- Addition of liquid fertilizer can cause corn injury and is not recommended unless typical burn symptoms are acceptable.
- Add atrazine (0.25–0.5 lb/A) for more consistent control.

Timing/Comments

Spike through V2.

Target Weeds

For weed control in corn in AR, AL, CO, DE, GA, IL, IN, IA, KS, KY, LA, MI, MS, MT, NE, NJ, NM, NC, ND, OH, OK, PA, SC, SD, TN, TX, VA, and WY.

CO, DE, KS, MD, MO, NJ, NM, SD, and WV possess a 24c label and have restrictive conditions relating to this product. Check your state regulatory authority prior to use.

Consult label for restrictions on course textured soils with a shallow water table.

Rotation	Crop
0 mo.	Field corn
4 mo.	Wheat, triticale
9 mo.	Barley, soybean, sweet corn
10 mo.	Rice, cotton
17 mo.	Alfalfa, dry bean, oat, canola, sorghum, sunflower, potato, sugarbeet, all other crops

Curtail (clopyralid + 2,4–D amine)

EPA Reg. #:	**62719-48**
Rate/A:	2.0 pt
Spray Volume:	min 10 gpa
Rainfast:	6 hours
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Danger

*CHS Wheelhouse Pro can be used at equivalent rates.

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**

or

- **CHS Fixate/ CHS Level Best Pro* (1 qt/100 gal)**
- Adjuvant not required but may enhance weed control.

Target Weeds

Curtail is labeled for use in corn in MN, ND, SD, CO, ID, KS, MI, MT, NE, OR, UT, WA, IN, OH, PA, WI, and WY.

Controls Canada thistle and many other broadleaf weeds.

Timing/Comments

Corn: up to 4 leaf collars or 8″, whichever comes first.

Dicamba Products

Brand Name:	EPA Reg. #:
Banvel	**51036-289**
Clarity	**7969-137**
Detonate	**7969-137-55467**
DMA	**42750-40**
HD	**42750-209**
Rate/A:	0.5–1.0 pt
Spray Volume:	3–50 gpa
Rainfast:	4 hours
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, s.p. gloves, shoes, socks, eyewear
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

*CHS Wheelhouse Pro can be used at equivalent rates.

Adjuvant(s)/Comments

- **CHS Fixate/ CHS Level Best Pro* (1 qt/100 gal)**

or

- **CHS Hypertonic (1 qt/100 gal)**

Target Weeds

- black nightshade
- common ragweed
- Canada thistle
- cocklebur
- giant ragweed
- kochia
- lambsquarters
- pigweed
- venice mallow
- velvetleaf

Timing/Comments

Apply spike through 8″ corn.

DiFlexx (dicamba+safener)

EPA Reg. #:	**264-1173**
Rate/A:	8–16 fl oz
Spray Volume:	3–50 gpa
Rainfast:	4 hours
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS***(8.5–17 lb/100 gal)**

or

- **CHS Endurium (1 qt/100 gal) plus AMS***(8.5–17 lb/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **Tapran (2 qt/100 gal)**

Timing/Comments

Apply spike through V10 or 36″.

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.

**CHS Emulate @ 1 gal/100 can be substituted for CHS Aggrestrol.

***CHS Fixate/CHS Endurium at 2 qt/100 gal can be substituted for AMS.

DiFlexx DUO (dicamba+Tembotrione+safener)

EPA Reg. #:	**264-1184**
Rate/A:	20–40 fl oz
Spray Volume:	3–20 gpa
Rainfast:	4 hours
S.O.A.:	Plant Growth Regulator (Group 4) HPPD Inhibitor (Group 27)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/ Comments

- **CHS Endurium (1 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **Tapran (2 qt/100 gal)**

Timing/ Comments

Apply spike through V7 or 36″.
V7-V10 Directed Spray.

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec
**CHS Emulate @ 1 gal/100 can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Endurium at 2 qt/100 gal can be substituted for AMS.

Enlist Duo (Glyphosate + 2,4-D Choline)

EPA Reg. #:	**62719-649**
Rate/A:	3.5–4.75 qt
Spray Volume:	min 10 gpa
Rainfast:	24 hours
S.O.A.:	EPSP Synthase Inhibitor (Group 9) Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks, p. eyewear
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/ Comments

Refer to www.enlisttankmix.com for approved CHS adjuvants.

Timing/ Comments

Corn: Emergence through V8 or 30″.

Enlist Corn Only

DO NOT tank mix any tank mix partner not listed on www.enlisttankmix.com.

Enlist One (2,4-D Choline)

EPA Reg. #:	**62719-695**
Rate/A:	1.5–2.0 pt
Spray Volume:	min 10 gpa
Rainfast:	24 hours
S.O.A.:	Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/ Comments

Refer to www.enlisttankmix.com for approved CHS adjuvants.

Timing/ Comments

Corn: Emergence through V8 or 30″.

Enlist Corn Only

DO NOT tank mix any tank mix partner not listed on www.enlisttankmix.com.

Glufosinate

Brand Name:	EPA Reg. #:
Liberty 280 SL	**264-829**
Autonomy	**7969-448-55467**
Cheetah	**71368-112**
Noventa	**7696-448**
Interline	**70506-310**
Spray Volume:	15–20 gpa
Rainfast:	4 hours
M.O.A.:	Glutamine Synthase Inhibitor
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments	Target Weeds	32 fl oz
• **CHS Level Best Pro (1 qt/100) plus AMS (1.5-3.0 lb/A)**	– wild buckwheat	6″
or	– cocklebur	6″
• **CHS Fixate (3 qt/100)**	– kochia	4″
or	– morning glory	6″
• **Encloax (3.5 pt/A)**	– wild mustard	4″
	– nightshade	6″
	– pigweed species	3″
	– ragweed species	6″
	– velvetleaf	6″
	– waterhemp	3″
	– barnyardgrass	4″
	– foxtail species	3″
	– wild oat	3″
	– volunteer corn	6″
	– crabgrass	3″

Glufosinate – High Load

Brand Name:	EPA Reg. #:
Surmise 5	**42750-401**
Spray Volume:	15–20 gpa
Rainfast:	4 hours
M.O.A.:	Glutamine Synthase Inhibitor
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments	Target Weeds	16.3 fl oz
• **CHS Level Best Pro (1 qt/100) plus AMS (1.5-3.0 lb/A)**	– wild buckwheat	6″
or	– cocklebur	6″
• **CHS Fixate (3 qt/100)**	– kochia	4″
or	– morning glory	6″
• **Encloax (3.5 pt/A)**	– wild mustard	4″
	– nightshade	6″
	– pigweed species	3″
	– ragweed species	6″
	– velvetleaf	6″
	– waterhemp	3″
	– barnyardgrass	4″
	– foxtail species	3″
	– wild oat	3″
	– volunteer corn	6″
	– crabgrass	3″

Glufosinate – Liberty Ultra

EPA Reg. #:	**7969-500**
Rate/A:	24-29 fl oz
Spray Volume:	15 gpa minimum
Rainfast:	
M.O.A.:	Glutamine Synthase Inhibitor (Group 10)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks, p eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Danger

Adjuvant(s)/Comments	Target Weeds	24 fl oz
• **CHS Level Best Pro (1 qt/100 gal) plus AMS (1.5 lb/A)**	– wild buckwheat	6″
or	– cocklebur	6″
• **Encloax (3.5 pt/A)**	– kochia	4″
or	– morning glory	6″
• **CHS Fixate (3 qt/100 gal)**	– wild mustard	4″
	– Nightshade	6″
	– pigweed species	3″
	– Ragweed species	6″
	– Velvetleaf	6″
	– waterhemp	3″
	– barnyardgrass-	4″
	– Foxtail species	3″
	– wild oat	6″
	– crabgrass	3″

Glyphosate

Brand Name:	EPA Reg. #:	# A.E.	=0.75 AE
Buccaneer Plus	**55467-9**	3.00	32.0
Gly Star Original	**42750-60**	3.00	32.0
Gly Star Plus	**42750-61**	3.00	32.0
Durango DMA	**62719-556**	4.00	24.0
Buccaneer 5 Extra	**55467-15**	4.00	24.0
Gly Star 5 Extra	**42750-59**	4.00	24.0
Gly Star K-Plus	**42750-122**	4.50	21.3
Buccaneer K	**42750-122-55467**	4.50	21.3
Roundup RT 3	**524-544**	4.50	21.3
Roundup PowerMax 3	**524-659**	4.80	19.7
Rate/A:	Variable		
Spray Volume:	5–20 gpa		
Rainfast:	1–6 hours		
M.O.A.:	EPSP Inhibitor		
P.P.E.:	l.s. shirt, l. pants, shoes, socks		
R.E.I.:	12 hours		
W. Notification:	Oral		
S. Word:	Caution		

Surfactant/Comments

- **CHS Level Best Pro (1 qt/100) plus AMS (8.5-17 lb/100)**

or

- **CHS Fixate (2-3 qt/100)**

or

- **Encloax (2.5-5 gal/100)**

or

- **CHS Hypertonic (1 qt/100) plus AMS (8.5-17 lb/100)**

Halex GT (s-metolachlor + glyphosate + mesotrione)

EPA Reg. #:	**100-1282**
Rate/A:	3.6–4.0 pt
Spray Volume:	10–30 gpa
Rainfast:	1 hour
S.O.A.:	Very Long Chain Fatty Acid Inhibitor (Group 15) EPSP Synthase Inhibitor (Group 9) HPPD Inhibitor (Group 27)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, apron
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (2 pt/100 gal) plus AMS (8.5–17 lb/100 gal)**

or

- **CHS Fixate/ CHS Level Best Pro* (2 pt/100 gal)**

Timing/Comments

Apply to corn from emergence up to V8 (8 leaves with collars) or until corn reaches 30", whichever comes first.

Roundup Ready Corn Only

*CHS Endurium can be used at equivalent rates.

*CHS Level Best Pro can be added to any adjuvant program at 1 qt/100 gal for maximum efficiency.

Impact Core (topramezone+acetochlor)

EPA Reg. #:	**5481-648**
Rate/A:	20-40 fl oz
Spray Volume:	10 gpa minimum
Rainfast:	
S.O.A.:	HPPD Inhibitor (Group 27) Very Long Chain Fatty Acid Inhibitor (Group 15)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks, p eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

- **CHS Aggrestrol* or Tapran* (2 qt/100 gal) plus AMS (8.5 lb/100 gal)**

or

- **CHS Level Best Pro/ CHS Hypertonic (1 qt/100 gal) plus AMS (8.5 lb/100 gal)**

Timing/Comments

Apply to corn from spike to 11″ corn.

Note: 4 month rotation restriction to wheat.

9 month rotation restriction to barley, oat, rye, alfalfa, and grain sorghum.

10 month rotation restriction to cotton, peanut, potato, soybean and sunflower.

18 month rotation to all other crops.

When oil-based adjuvants are used in tank mixtures with other herbicides leaf burn may occur.

*CHS Emulate @ 1.0 gal/100 gal can be substituted for CHS Aggrestrol or Tapran.

Impact Z

EPA Reg. #:	**5481-612**
Rate/A:	8.0–10.7 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27) Photosystem II Inhibitor (Group 5)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, and chemical resistant apron
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Penetrec* (2–3 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **CHS Aggrestrol** (2–3 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **Tapran (2 qt/100 gal)**

Add atrazine (0.02–0.5 lb/A) for more consistent control.

Target Weeds

– cocklebur	8″
– lambsquarters	6″
– nightshade	6″
– pigweeds	6″
– common ragweed	6″
– giant ragweed	8″
– smartweed	3″

Suppression of certain grasses

Timing/Comments

Note: 9 month rotation restriction to alfalfa, barley, cotton, peanut, potato, rye, sorghum, soybean, sunflower and wheat.

9 month rotation restriction to canola and flax at 8.0 fl oz rate.

18 month rotation to all other crops.

Do not apply to corn that exceeds 12 inches.

*Crop Oil @ 1.0–1.5 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.

**CHS Emulate @ 1.0–1.5 gal/100 can be substituted for CHS Aggrestrol.

***CHS Fixate or CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

Kyro (topramezone+clopyralid+acetochlor)

EPA Reg. #:	**62719-766**
Rate/A:	20-40 fl oz
Spray Volume:	10 gpa minimum
Rainfast:	
S.O.A.:	HPPD Inhibitor (Group 27) Plant Growth Regulator (Group 4) Very Long Chain Fatty Acid Inhibitor (Group 15)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Aggrestrol* or Tapran* (2 qt/100 gal) plus AMS (8.5 lb/100 gal)**

or

- **CHS Penetrec** (2 qt/100 gal) plus AMS (8.5 lb/100 gal)**

Timing/Comments

Apply to corn up to 24".

Oil-based adjuvants are not recommended when tank mixing with Atrazine. Use CHS Level Best Pro or CHS Hypertonic at 1 qt/100 when tank mixing with Atrazine.

*CHS Emulate @ 1.0 gal/100 gal can be substituted for CHS Aggrestrol or Tapran.
**Crop Oil @ 1.0 gal/100 gal can be substituted for CHS Penetrec.

Laudis (tembotrione)

EPA Reg. #:	**264-860**
Rate/A:	3 fl oz
Spray Volume:	10–20 gpa
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **Tapran (2 qt/100 gal)**

Target Weeds

	3 fl oz	3 fl oz + atrazine 0.5 lb/A
– cocklebur	< 6" C	< 6" C
– lambsquarters	< 6" C	< 6" C
– nightshade	< 6" C	< 6" C
– common ragweed	< 6" C	< 6" C
– giant ragweed	< 6" C	< 6" C
– smartweed	< 6" C	< 6" C
– giant foxtail	3" C	4" C
– green foxtail	2" PC	2" PC
– yellow foxtail	3" C	4" C
– barnyardgrass	5" C	6" C

C = Control
PC = Partial Control

Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 can be substituted for CHS Aggrestrol.
***CHS Fixate or CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

Timing/Comments

Field corn, popcorn: emergence to V8.

Sweet corn: emergence to V7.

Lexar EZ (mesotrione + s-metolachlor + atrazine)

EPA Reg. #:	**100-1414**
Rate/A:	3.0–3.5 qt
Spray Volume:	10–30 gpa
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27) Very Long Chain Fatty Acid Inhibitor (Group 15) Photosystem II Inhibitor (Group 5)
P.P.E.:	l.s shirt, l. pants, c.r. gloves, shoes, socks, c.r. apron
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution
PHI:	60 days

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal)**
- Oil may be used if cosmetic crop injury is acceptable to control more difficult-to-control weeds.
- Use of AMS or UAN is not recommended with POST apps.
- **Lexar and Lexar EZ may also be applied PRE.**

Target Weeds

– buffalobur	1–3"
– black nightshade	1–3"
– common ragweed	1–3"
– cocklebur	1–3"
– giant ragweed	1–3"
– kochia	1–3"
– lambsquarters	1–3"
– morning glory	1–3"
– pigweed	1–3"
– smartweed	1–3"
– velvetleaf	1–3"
– waterhemp	1–3"

Timing/Comments

Corn: emergence to 12" tall.

Follow local specifications relating to the use of atrazine or atrazine products.

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

Lumax EZ (mesotrione + s–metolachlor + atrazine)

EPA Reg. #:	**100-1442**
Rate/A:	2.7–3.25 qt
Spray Volume:	10–30 gpa
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27) Very Long Chain Fatty Acid Inhibitor (Group 15) Photosystem II Inhibitor (Group 5)
P.P.E.:	coveralls, l.s. shirt and l. pants, shoes, socks, apron, Cat. A c.r. gloves
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution
PHI:	60 days

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal)**
- Oil may be used if cosmetic crop injury is acceptable to control more difficult-to-control weeds.
- **Lumax EZ may also be applied PRE.**

Target Weeds

– buffalobur	1–3″
– black nightshade	1–3″
– common ragweed	1–3″
– cocklebur	1–3″
– giant ragweed	1–3″
– kochia	1–3″
– lambsquarters	1–3″
– morning glory	1–3″
– pigweed	1–3″
– smartweed	1–3″
– velvetleaf	1–3″
– waterhemp	1–3″

Timing/Comments

Corn: emergence to 12″ tall.

Follow local specifications relating to the use of atrazine or atrazine products.

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

Maverick (Mesotrione+clopyralid+Pyroxasulfone)

EPA Reg. #:	**59639-255**
Rate/A:	14 fl oz
Spray Volume:	10-30 gpa
Rainfast:	6 hours
S.O.A.:	HPPD Inhibitor (Group 27) Plant Growth Regulator (Group 4) Very Long Chain Fatty Acid Inhibitor (Group 15)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks, p. eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic or CHS Level Best Pro (1 qt/100 gal) plus AMS (8.5 lb/100 gal)**

Timing/Comments

Apply to corn up to V6 or 18″, whichever comes first.

Do not use oil-based adjuvants or crop injury may occur.

Do not apply to popcorn post.

To achieve best weed control include atrazine as a tank mix partner.

Metribuzin Products

Brand Name:	EPA Reg. #:
Metribuzin 75DF	**66222-106**
Glory	**66222-106**
Tricor DF	**70506-103**
Rate/A:	1.6–2.0 oz
Spray Volume:	min 10 gpa
Rainfast:	Refer to tank mix partner label
S.O.A.:	Photosystem II Inhibitor (Group 5)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- Use NIS and AMS as allowed or prescribed by the labeled tank mix partner.

Tank mixes:

- Atrazine, Banvel, Basagran, 2,4–D, Clarity, Marksman Laddok, Pursuit (IMI Corn), Buctril, Resource, Tough, Butril/Atrazine

Target Weeds

Metribuzin may be used for control of selected broadleaf weeds when applied as a tank mix combination with certain other broadleaf herbicides presently registered for use in field corn.

Permit (halosulfuron–methyl)

Brand Name:	EPA Reg. #:
Sandea	**81880-18-10163**
Permit	**81880-2-10163**
Rate/A:	0.67–1.33 oz DF
Spray Volume:	min 10 gpa
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 4)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS*** (2 lb/A)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (2 lb/A)**

or

- **Tapran (2 qt/100 gal)**

See label for a complete list of tank mix partners.

Target Weeds	0.66 fl oz	1.33 fl oz
– common ragweed	1–9″	9–12″
– cocklebur	1–9″	9–14″
– giant ragweed	1–3″	4–6″
– pigweed	1–3″	4–6″
– velvetleaf	1–9″	9–12″
– yellow nutsedge	-	4–12″

Timing/Comments

For lambsquarter control, must add 2 oz Banvel or Clarity.

Corn: up to 36″.

Use drop nozzles when corn is 24–36″.

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.

**CHS Emulate @ 1 gal/100 can be substituted for CHS Aggrestrol.

***CHS Fixate or CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

Realm Q (rimsulfuron + mesotrione)

EPA Reg. #:	**352-837**
Rate/A:	4.0 oz
Spray Volume:	min 15 gpa
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2) HPPD Inhibitor (Group 27)
P.P.E.:	l.s shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS** (2 lb/A)**

or

- **CHS Endurium (1 qt/100 gal) plus AMS** (2 lb/A)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS** (2 lb/A)**

Target Weeds

– barnyardgrass	1–2″
– large crabgrass	1/2″
– woolly cupgrass	1″
– foxtail	1–2″
– wild proso millet	suppression
– quackgrass	suppression
– kochia	< 5″
– pigweed	< 5″
– cocklebur	< 5″
– lambsquarters	< 5″
– common ragweed	< 5″
– velvetleaf	< 5″

*Crop Oil @ 1 gal/100 can be substituted for CHS Penetrec.

**CHS Fixate/CHS Wheelhouse Pro at 2 qt/100 can be substituted for AMS.

Timing/Comments

Corn: up to 20″ or 7 leaf collars.

Resicore (acetochlor+mesotrione+clopyralid)

EPA Reg. #:	**62719-693**
Rate/A:	2.25–3.0 qt
Spray Volume:	10–30 gpa
S.O.A.:	Very Long Chain Fatty Acid Inhibitor (Group 15) HPPD Inhibitor (Group 27) Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Endurium (1 qt/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal)**

Target Weeds

– Weeds < 3″.

Timing/Comments

Corn: up to 11″.

*Crop Oil @ 1 gal/100 can be substituted for CHS Penetrec.

Resicore Rev (acetochlor+mesotrione+clopyralid)

EPA Reg. #:	**62719-756**
Rate/A:	2.25–3.0 qt
Spray Volume:	10–30 gpa
S.O.A.:	Very Long Chain Fatty Acid Inhibitor (Group 15) HPPD Inhibitor (Group 27) Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Endurium (1 qt/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal)**

Target Weeds

– Weeds < 3″

Timing/Comments

Corn: up to 24″.

*Crop Oil @ 1 gal/100 can be substituted for CHS Penetrec.

Resolve Q (rimsulfuron + thifensulfuron-methyl)

EPA Reg. #:	**352-759**
Rate/A:	1.25 oz
Spray Volume:	min 10 gpa
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS*** (2 lb/A)**

or

- **CHS Endurium (1 qt/100 gal) plus AMS*** (2 lb/A)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (2 qt/100) plus AMS*** (2 lb/A)**

or

- **CHS Aggrestrol** (1qt/100 gal) plus AMS*** (2 lb/A)**

or

- **Tapran (2 qt/100 gal)**

Target Weeds

– barnyardgrass
– large crabgrass
– woolly cupgrass
– foxtail
– wild proso millet
– quackgrass
– kochia
– pigweed
– cocklebur
– lambsquarters
– common ragweed
– velvetleaf

Timing/Comments

Corn: up to 20″ or 7 leaf collars.

*Crop Oil @ 1 gal/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 2 qt/100 can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Resource (flumiclorac pentyl ester)

EPA Reg. #:	**59639-82**
Rate/A:	2.0–4.0 oz in tank mix
Spray Volume:	min 15 gpa
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	coveralls over l.s. shirt and l. pants, c.r. gloves, eyewear, c.r. footwear, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

- **CHS Penetrec* (1 pt/A) plus AMS*** (2–2.5 lb/A)**

or

- **CHS Aggrestrol** or Tapran** (1 pt/A) plus AMS*** (2–2.5 lb/A)**
- Use the surfactant required by the tank mix partner.

Target Weeds

Adjuvant recommendations refer to Resource as a tank mix partner with glyphosate or other approved tank mix partners for corn.

Resource helps on buckwheat, morning glory, pigweed, waterhemp, common lambsquarters, common ragweed, and velvetleaf.

Timing/Comments

Apply to 2–10 leaf stage corn.

*Crop Oil @ 1 qt/A or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.
**CHS Emulate @ 1 qt/A can be substituted for CHS Aggrestrol or Tapran.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

Revulin Q (nicosulfuron + mesotrione)

EPA Reg. #:	**352-900**
Rate/A:	3.4-4 oz
Spray Volume:	min 10 gpa
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2) HPPD Inhibitor (Group 27)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS** (2–4 lb/A)**

Do not use MSO.

Target Weeds

- barnyardgrass
- nightshade
- foxtail
- sunflower
- pigweed
- cocklebur
- quackgrass
- wild proso millet
- woolly cup
- lambsquarter
- g. ragweed

Timing/Comments

Apply to corn less than 12 inches.

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.
**Encloax @ 2.5 gal/100 gal can be substituted for AMS.

Sequence (glyphosate + s-metolachlor)

EPA Reg. #:	**100-1185**
Rate/A:	2.5 pt
Spray Volume:	10–40 gpa
Rainfast:	2 hours
S.O.A.:	EPSP Synthase Inhibitor (Group 9) Very Long Chain Fatty Acid Inhibitor (Group 15)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **AMS* (8.5–17 lb/100 gal)**

Timing/Comments

Apply to corn from emergence up to V8 (8 leaves with collars) or until corn reaches 30", whichever comes first.

Use drop nozzles for 30–48" corn.

Roundup Ready Corn Only

*CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

Solstice (Fluthiacet + Mesotrione)

EPA Reg. #:	**279-3461**
Rate/A:	2.5–3.15 fl oz
Spray Volume:	10–30 gpa
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14) HPPD Inhibitor (Group 27)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Endurium plus AMS** (8.5 lb/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS** (8.5 lb/100 gal)**

Target Weeds

– common waterhemp	3″
– morning glory	3″
– giant ragweed	3″
– common ragweed	PC
– lambsquarters	C
– velvetleaf	C

Timing/Comments

Apply to corn V8 to 30″ corn.

PHI 45 day forage.

PHI 70 day grain or fodder.

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.

**CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

Status (dicamba + diflufenopyr + safener)

EPA Reg. #:	**7969-242**
Rate/A:	2.5–5.0 oz
Spray Volume:	10–20 gpa
Rainfast:	4 hours
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

*Crop Oil @ 1 qt/A or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.

**CHS Emulate @ 1 qt/A can be substituted for CHS Aggrestrol or Tapran.

***CHS Fixate @ 2 qt/100 can be substituted for AMS.

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS*** (5–17 lb/100 gal)**

or

- **CHS Penetrec* (1 pt/A) plus AMS*** (5–17 lb/100 gal)**

or

- **CHS Aggrestrol** or Tapran**(1 pt/A) plus AMS*** (5–17 lb/100 gal)**
- If tank mixing with glyphosate, Veracity (3 qt/100 gal) is only adjuvant needed.

Target Weeds

Controls most annual broadleaf weeds and suppresses many perennial broadleaf weeds.

Provides some suppression of small annual grasses.

Timing/Comments

Apply to corn between 4″ (V2) to 36″ (V10).

Addition of a drift control product such as Sedate Max is recommended.

Steadfast Q (nicosulfuron + rimsulfuron + safener)

EPA Reg. #:	**352-774**
Rate/A:	1.5 oz
Spray Volume:	min 10 gpa
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS*** (2–4 lb/A)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (1 qt/100 gal) plus AMS*** (2–4 lb/A)**

or

- **Tapran (2 qt/100 gal)**
- Use adjuvant system as required by tank mix partner.

Target Weeds

– barnyardgrass	4″
– volunteer cereals	2″
– large crabgrass	1″
– woolly cupgrass	3″
– foxtail	4″
– wild proso millet	4″
– quackgrass	8″
– sandbur	2″
– wild oat	2″
– wild mustard	4″
– pigweed	4″
– morning glory	4″

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.

**CHS Emulate @ 1 gal/100 can be substituted for CHS Aggrestrol.

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

Timing/Comments

Apply to corn up to 20″ or V6. For best results, target corn that is less than 12″ tall.

Tank mix recommendations include: Clarity (2–4 oz), Marksman (8–16 oz), Hornet WDG (2–3 oz), Atrazine (0.5 lb) or Callisto (1.5–3.0 fl oz).

Stinger (clopyralid)

EPA Reg. #:	**62719-73**
Rate/A:	1/3–2/3 pt
Spray Volume:	min 10 gpa
Rainfast:	6 hours
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, eyewear, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (2 pt/100 gal)**

or

- **CHS Fixate/CHS Level Best Pro* (1–2 qt/100 gal)**

or

- **CHS Endurium (1 qt/100 gal)**

Adjuvants are not usually necessary. They may increase effectiveness on weeds, but may reduce selectivity to the crop.

Target Weeds

– common/giant ragweed	5 leaf
– Canada thistle	5 leaf
– cocklebur	5 leaf
– sunflower	5 leaf

Timing/Comments

Apply to corn from emergence to 24″ tall.

Topramezone Products

Brand Name:	EPA Reg. #:
Impact	**5481-524**
Armezon	**7969-262**
Rate/A:	0.75 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Penetrec* (2–3 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **CHS Aggrestrol** (2–3 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **Tapran (2 qt/100 gal)**

Add atrazine (0.02–0.5 lb/A) for more consistent control.

Target Weeds

– cocklebur	5″
– lambsquarters	4″
– nightshade	4″
– pigweeds	4″
– common ragweed	4″
– giant ragweed	5″
– smartweed	2″

Suppression of certain grasses

Timing/Comments

Note: A 9 mo. rotation restriction to alfalfa, canola, cotton, flax, peanut, pea, potato, sorghum, soybean, and sunflower at the 0.75 fl oz rate.

All corn: emergence to 45 days prior to harvest.

*Crop Oil @ 1.0–1.5 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.

**CHS Emulate @ 1.0–1.5 gal/100 can be substituted for CHS Aggrestrol.

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

*CHS Wheelhouse Pro can be used at equivalent rates.

Widematch (fluroxypyr + clopyralid)

EPA Reg. #:	**62719-512**
Rate/A:	1.33 pt
Spray Volume:	min 10 gpa
Rainfast:	6 hours
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Fixate/ CHS Level Best Pro* (1 qt/100)**

Addition of adjuvant may increase efficacy but could increase crop response.

Target Weeds

Controls many annual and perennial broadleaf weeds but is weak on mustard species and does not control pigweed or lambsquarters.

Timing/Comments

Apply to corn up to and including V5 leaf.

*CHS Wheelhouse Pro can be used at equivalent rates.

Yukon (halosulfuron + dicamba)

EPA Reg. #:	**81880-6-10163**
Rate/A:	4 oz
Spray Volume:	min 10 gpa
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2) Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/ Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS** (2–4 lb/A)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS** (2–4 lb/A)**

Target Weeds

– kochia	1–6″
– jimsonweed	1–4″
– lambsquarters	1–6″
– venice mallow	1–12″
– milkweed	1–6″
– morning glory	1–6″
– wild mustard	1–6″
– nightshade species	1–6″
– redroot pigweed	1–12″
– ragweed species	1–6″
– smartweed	1–3″
– sunflower	1–15″
– velvetleaf	1–12″

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.
**CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 can be substituted for AMS.

Timing/ Comments

Corn: apply from spike to 36″ in height.

Drop nozzles recommended for corn > 20″.

Zemax (mesotrione + s-metolachlor)

EPA Reg. #:	**100-1410**
Rate/A:	2.0–2.4 qt
Spray Volume:	10–30 gpa
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27) Very Long Chain Fatty Acid Inhibitor (Group 15)
P.P.E.:	p. eyewear, l.s. shirt, l. pants, Cat. A c.r. gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution
PHI:	45 days

Adjuvant(s)/ Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal)**
- Oil may be used if cosmetic crop injury is acceptable to obtain more consistent weed control.
- AMS may also be added to NIS or COC to increase weed control consistency but also risks crop injury.

Target Weeds

Recommended rate controls Palmer amaranth, Powell amaranth, barnyardgrass, buffalobur, crabgrass, foxtail, common lambsquarters, black nightshade, fall panicum, smartweed species, velvetleaf, and tall waterhemp.

Timing/ Comments

Corn: apply up to 30″ tall or V8 stage.

Zemax may also be applied PRE

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 can be substituted for CHS Penetrec.

Fungicides can improve corn yield by improving plant health through preventing disease, improving stress tolerance, increasing water use efficiency, CO_2 assimilation and extending the grain fill period. Few plant health fungicides can be applied at planting, and most are typically applied post emergence. The two most common foliar application timings are vegetative (V4-V8) for protection against early season yield robbing diseases and at tassel to R2 (blister) for continued protection during critical stages of pollination and grain fill.

Fungicides				Anthracnose Leaf Blight	Common Rust	Eyespot	Gray Leaf Spot	Northern Leaf Blight	Southern Rust	Tar Spot	Harvest Restriction[1]
	Trade Name	Active Ingredient (Fungicide Group)	Rate/A (fl oz)[2]	Efficacy Ratings							
TRIAZOLES (GROUP 3)											
At Planting	**Xyway LFR 1.92 SC Xyway 3D 2.5 SC**	Flutriafol	LFR: 7.6-15.2 3D: 5.8 - 11.8	NL	U	NL	G	VG	NL	NL	N/A
Foliar	**Domark® 230 ME**	Tetraconazole	4.0-6.0	U	U	U	E	VG	G	G[3]	R3 (milk)
Foliar	**Proline® 480 SC**	Prothioconazole	5.7	U	VG	E	U	VG	G	NL	14 days
Foliar	**Tilt® Many Generics**	Propiconazole	2.0-4.0	NL	VG	E	G	G	F	NL	30 days
Foliar	**Toledo® Many Generics**	Tebuconazole	4.0-6.0	NL	F*	NL	VG*	VG*	F*	NL	36 days
STROBILURINS (GROUP 11)											
Foliar	**Quadris® Aframe® Many Generics**	Azoxystrobin	6.0-15.5	VG	E	VG	E	G	VG	NL	7 days
Foliar	**Aproach®**	Picoxystrobin	3.0-12.0	VG	VG-E	VG	F-VG	VG	G	G[3]	7 days
Foliar	**Evito® 480 SC**	Fluoxastrobin	2.0-5.7	VG*	E*	VG*	E*	G*	G*	NL	30 days
Foliar	**Headline® EC/SC**	Pyraclostrobin	6.0-12.0	VG	E	E	E	VG	VG	NL	7 days
MIXED MODES OF ACTION											
Foliar	**Adastrio**	Flutriafol (3) Fluindapyr (7) Azoxystrobin (11)	7.0-9.0	U	VG-E*	U*	E*	VG-E*	VG-E*	G-VG[3]*	30 days
Foliar	**Delaro® Complete 3.83 SC**	Prothioconazole (3) Fluopyram (7) Trifloxystrobin (11)	8.0-12.0	U	U	U	E	VG	G-VG	G-VG	35 days
Foliar	**Miravis® Neo**	Propiconazole (3) Pydiflumetofen (7) Azoxystrobin (11)	13.7	U	U	U	E	VG-E	VG	G-VG	30 days
Foliar	**Revytek™**	Mefentrifluconazole(3) Fluxapyroxad (7) Pyraclostrobin (11)	8.0-15.0	U	U	U	VG-E	VG-E	VG	VG	21 days
Foliar	**Trivapro®**	Propiconazole (3) Benzovindiflupyr (7) Azoxystrobin (11)	13.7	U	U	U	E	VG	E	G-VG	30 days
Foliar	**Lucento™**	Flutriafol (3) Bixafen (7)	3.0-5.5	U	U	U	VG-E	VG	VG	G[3]	R4
Foliar	**Priaxor®**	Fluxapyroxad (7) Pyraclostrobin (11)	4.0-8.0	U	VG	U	VG	VG-E	VG	G-VG[3]	21 days

	Fungicides			Anthracnose Leaf Blight	Common Rust	Eyespot	Gray Leaf Spot	Northern Leaf Blight	Southern Rust	Tar Spot	Harvest Restriction[1]
	Trade Name	Active Ingredient (Fungicide Group)	Rate/A (fl oz)[2]	Efficacy Ratings							
MIXED MODES OF ACTION CONTINUED											
Foliar	**Headline AMP®**	Metconazole (3) Pyraclostrobin (11)	10.0-14.4	U	E	E	E	VG	G	G-VG	20 days
	Aproach® Prima	Cyproconazole (3) Picoxystrobin (11)	3.4-6.8	U	U	U	E	VG	G	G-VG[3]	30 days
	Preemptor™ SC	Flutriafol (3) Fluoxastrobin (11)	4.0-6.0	U	U	U	E	VG	VG	G-VG[3]	R4 (dough)
	Topguard® EQ	Flutriafol (3) Azoxystrobin (11)	5.0-7.0	U	F	U	VG	G-VG	G-VG	G-VG[3]	7 days
	Veltyma™	Mefentrifluconazole (3) Pyraclostrobin (11)	7.0-10.0	U	U	U	VG-E	VG-E	VG	VG	21 days
	Quilt Xcel® MiCrop™	Propiconazole (3) Azoxystrobin (11)	10.5-14.0	VG	VG-E	VG-E	E	VG	VG	G-VG[3]*	30 days
	Aframe® Plus	Propiconazole (3) Azoxystrobin (11)	10.5-14.0	VG	VG-E	VG-E	E	VG	VG	NL	30 days
	Delaro® 325 SC	Prothioconazole (3) Trifloxystrobin (11)	8.0-12.0	VG	E	VG	E	VG	VG	G-VG	14 days
	Stratego® YLD	Prothioconazole (3) Trifloxystrobin (11)	4.0-5.0	VG	E	VG	E	VG	G	NL	14 days
	Affiance®	Tetraconazole (3) Azoxystrobin (11)	10.0-14.0	U	G-VG	U	G-VG	G-VG	G	G[3]	7 days
	Zolera® FX	Tetraconazole (3) Fluoxastrobin (11)	4.4-6.8 (5-6.8 for tarspot)	VG*	E*	VG*	E*	VG*	VG*	G[3]*	30 days

Efficacy Ratings: F=Fair G=Good VG=Very Good E=Excellent

U=Unknown efficacy or insufficient data to rank product

NL= Not labeled for use against disease

Efficacy Ratings were developed by the Corn Disease Working Group (CDWG). The CDWG determined the efficacy ratings for each fungicide by field-testing the materials over multiple years and locations. Each rating is based on the product's level of disease control and does not necessarily reflect yield increases obtained from applying the product.

*Due to lack of data and ratings available from CDWG, these specific ratings were supplied by manufacturers.

CHS Acuvant and CHS Endurium are APE/NPE free and can be used for drift control and deposition.

Refer to labels for ground and aerial application recommendations.

[1] Harvest restrictions are for field corn harvested for grain. Restrictions may vary for other types of corn (such as sweet, seed, popcorn), and corn for other uses (such as forage or fodder).

[2] General Recommended Rates. Always read and follow all use restrictions before applying any fungicide.

[3] A 2(ee) label is available for several fungicides for control of tar spot, however efficacy data are limited. Check 2(ee) labels carefully, as not all products have 2(ee) labels in all states.

Corn Rootworm Lifecycle (CRW)

Both Western Corn Rootworm (WCRW) and Northern Corn Rootworm (NCRW) eggs overwinter in the soil and hatch as larvae in the spring. After hatching the larvae burrow into the roots to feed and can severely damage the corn's root system. Severe damage is more likely if the corn plant is suffering from other stresses including moisture or fertility issues. Following the larval stage CRW will go into a pupal stage, followed by an adult stage which occurs mid to late summer. During this time the adult CRW can cause serious yield losses by feeding on silks during pollination. Controlling CRW early in the soil with Bt traits and/or insecticides is the best way to alleviate losses.

Corn Rootworm Soil Applied Insecticides

With CRW resistance issues on the rise, there has been a renewed interest in soil applied insecticides for controlling resistant CRW bio-types. Traditionally, CRW insecticides were applied as a granular product, however, in-furrow applications of liquid insecticides in combination with starter fertilizer have grown in popularity because they can be applied easily and accurately through a single system. Some insecticides mix readily with commonly used pop-up fertilizers such as XLR-Rate, 10-34-0 and Levesol Zn. Be sure to jar test and check insecticide compatibility with liquid fertilizer before mixing.



Larva feeding on corn root.
Photo by J. Obermeyer. University of Purdue Extension

Granular Formulations	IRAC*	Oz/1,000 ft of row	lb/A 30" Row
Aztec HC[a]	1B + 3A	1.5	1.63
Aztec 4.67G[a]	1B + 3A	3.0	3.3
Counter 20G[a]	1B	4.5–6.0	4.9–6.5
Force 6.5G[a]	3A	1.8–2.3	1.5–2.5
Force 10G HL[a]	3A	1.25–1.5	1.4–1.6
Thimet 20G[a]	1B	4.5–6.0	4.9–6.5
Smart Choice HC[a]	1B + 3A	1.0–1.67	1.1–1.8

Liquid Formulations	IRAC*	Fl oz/1,000 ft of Row	Fl oz/A 30" Row
Bifender FC[a]	3A	0.34–0.84	5.9–14.6
Brigade 2EC[a]	3A	0.30	5.1
Capture LFR[a]	3A	0.39–0.98	6.8–17.0
Capture 3RIVE 3D[a/b]	3A	0.46–0.92	8.0–16.0
Ethos 3D[a]	3A	0.52–1.05	9.1–18.3
Ethos XB[a/b]	3A	0.39–0.98	6.8–17.0
Force Evo[a]	3A	0.46–0.57	8.0–10.0
Index[a]	1B + 3A	0.65–0.72	11.3–12.5
Temitry LFR[a]	3A	0.49–1.09	8.5–19.0
Xpedient Plus V	3A	0.3–0.74	5.12–12.8

[a] Restricted Use Pesticide

[b] For use with 3RIVE 3D system only

*IRAC MOA Classification: 1B = Organophosphates, 3A = Synthetic Pyrethroid

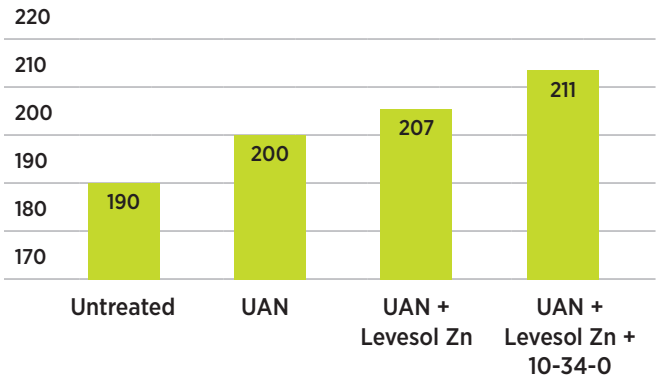
For most growers, Side-Dressing or Y-Dropping corn is the last opportunity to apply additional fertilizer during the growing season. These later applications are efficient and effective because the timing coincides with the highest uptake periods for many nutrients. The corn plant is also entering pollination which is one of the most critical times for yield determination. Seventy five percent or more of many macro and micronutrients still must be taken up at this point. If the fertility is not present at this time, pollination and grain fill will be affected and yields reduced.

During periods of rapid growth, corn plants take up 7.8 lbs. of nitrogen, 2.1 lbs. of phosphorus and 0.21 oz of zinc per day (University of Illinois Department of Plant Physiology). Recent research has shown that adding Levesol Zn to your Y-drop program can increase macro and micro-nutrient availability during these periods of high uptake. This work has shown that Y-dropping Levesol Zn + UAN to V-8 corn increased yields by 7 bushels over UAN alone.

Zinc (Zn) is an essential component of enzymes involved with important crop growth and development processes. University research has identified that corn is a crop that can be relatively sensitive to Zn deficiency and can result in yield losses even if all other nutrients are present in adequate amounts. In addition to Zn, late season phosphorus can push yields even further. The addition of 10-34-0 increased yields by an additional 4 bushels.

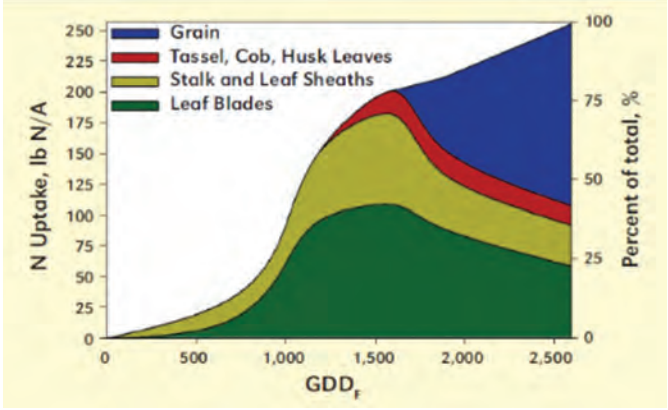
Using late season fertilizer applications like side-dress and Y-drop can reduce nutrient tie-up, loss and improves overall efficiencies by timing fertilizer application as close as possible to nutrient uptake.

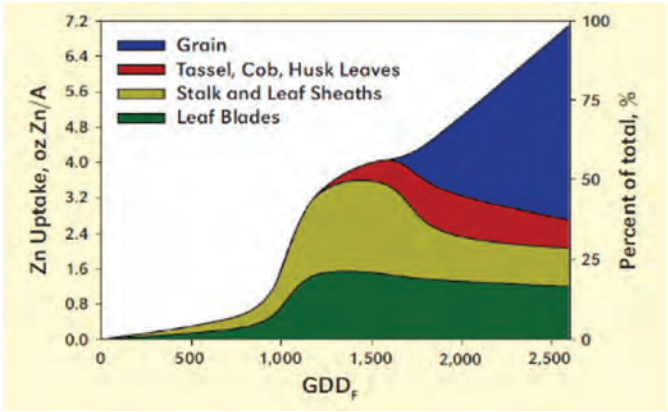
2019 Y-Drop Corn – Dr. Fred Below – Champaign, Ill.

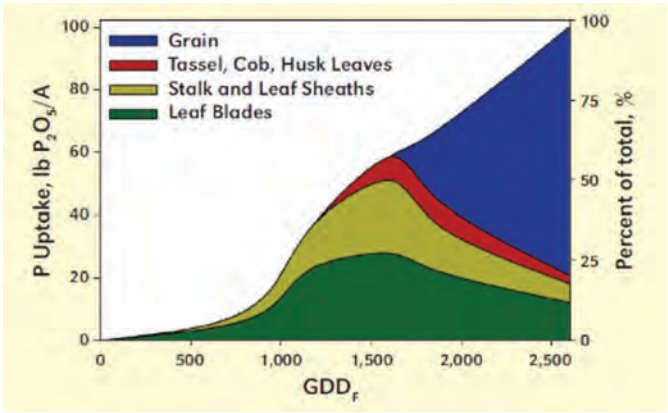


Organic Matter = 4.8%; CEC = 20.7; pH = 5.4

180 lb of Preplant Nitrogen was applied to all treatments







Corn requires 7.2 oz/A of Zn to produce a 230 bushel crop. Adapted from "Modern Corn Hybrids' Nutrient Uptake Patterns". Ross R. Bender and Fred E. Below

Trivar Premium Dry Phosphate Fertilizer Enhancer For Corn
Phosphorus is one of three macronutrients plants use in large quantities and is a critical component in multiple plant processes and pathways. One of phosphorus's primary roles is the production of ATP. When ATP is broken down it releases energy which is used by the plant to fuel growth and other necessary functions.

In the soil, phosphorus is relatively immobile and inefficient. Generally, < 20% of phosphate-based fertilizers applied will be available to the plant due to precipitation, adsorption and immobilization. The rate at which tie-up occurs depends on soil factors such as texture, CEC, pH and OM. Therefore, placement of phosphorus and source is important for increased plant accessibility and/or efficiency.

Broadcast applications are fast and economical ways to apply large amounts of phosphate fertilizer. This can be beneficial for crops that demand large amounts of phosphorus; in particular, corn. However, the disadvantage of broadcast applications is phosphorus efficiency, which can be 25 to 33% that of banding. To increase the efficiency of your broadcast application, Trivar should be utilized.

Trivar is the first-of-its-kind phosphorus efficiency agent that can be impregnated directly to a dry phosphate fertilizer and broadcast on the field. It's a proprietary blend of the strongest and most effective chelate, nutrient focused enzyme, and plant critical micronutrients.

TRIVAR®

ANALYSIS:

Phosphatase Enzyme

GRADE 4-0-0

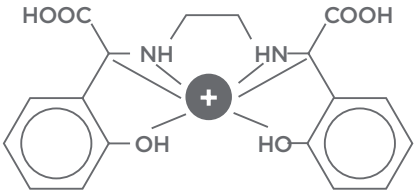
Boron (B) 0.10%

Zinc (Zn) 5.00%

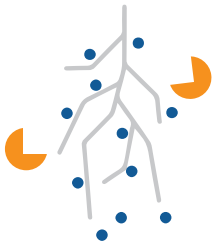
Derived from: Aqua Ammonia, Boric Acid, Zinc EDDHA, Zinc EDTA, and Ortho-Ortho EDDHA

Trivar Contains Three Unique Modes of Action:

1. Helps unlock nutrients that exist in your fertilizer and in the soil by utilizing a highly concentrated ortho-ortho EDDHA chelate.



2. Utilizes a phosphatase enzyme that readily converts organic phosphorus into a form ready for uptake by the crop.



3. Contains two critical micronutrients, which when impregnated on the phosphate granules, evenly distributes Zn and B across the phosphate blend.



Trivar Application Directions:

Application rates range from 3-4 qt/ton of **dry phosphate fertilizer ONLY.** Trivar is readily absorbed by many phosphate fertilizers including: 11-52-0 (MAP), 18-46-0 (DAP), 0-45-0 (TSP), MESZ, and others. See Agronomy Update "TRIVAR BMPs" for additional blending instructions.

Trivar impregnated fertilizer is labeled to be applied as a broadcast application. Do not apply fertilizer treated with Trivar as a starter within 2 inches of the seed. Trivar treated phosphate should be incorporated by tillage or rainfall within 10 days of being broadcast.

Phosphorus or zinc deficiency in corn can be caused by fallow syndrome. Crops such as corn and soybeans form symbiotic relationships with certain soil fungi called vesicular arbuscular mycorrhiza (VAM). This symbiotic relationship helps the plant with absorption of phosphorus (P) and zinc (Zn) into the roots. In fallow situations, there is no crop planted and the symbiotic relationship is not formed which causes VAM populations to dramatically decrease. Due to the reduction in VAM populations, corn planted the year after fallow will not be able to successfully form these symbiotic relationships and phosphorous and zinc uptake may be reduced.

Sugarbeets and canola are non-host crops to VAM; therefore, corn planted after these crops may also suffer from fallow syndrome. Flooded, saturated soils can also be responsible for the reduction of VAM populations. Common symptoms include stunting, shortened internodes, purpling, and reduced vigor. Symptoms tend to be more pronounced under cool, wet conditions.

If corn is being planted after fallow, sugarbeets, canola, or flooded soils, it is important to consider implementing a good starter fertilizer program. Even at high or very high soil test levels, starter fertilizer is recommended in these rotations. Starter fertilizers should contain adequate amounts of phosphorus and zinc and be placed near the seed so plant roots can intercept the nutrients as quickly as possible following emergence. Be aware of the salt index of the fertilizer to determine how much you can safely apply. Salt index is a relative value in comparison to NaNo3. High salt levels can be toxic to the seed and negatively impact germination.

Using CHS Lumen as a starter fertilizer program can help manage fallow syndrome in these situations. It is the most advanced liquid in-furrow starter fertilizer with a balance of macro and micronutrients (5-15-3 + Zn + Fe) plus a hemicellulase enzyme. When introducing hemicellulase enzymes to the soil, microbial health is improved by providing food in the form of simple sugars. More microbial activity means mineralization increases, creating more available nutrients for plant uptake. CHS Lumen also uses the patented Levesol chelate technology (ortho-ortho EDDHA) preventing "tie up" and keeping nutrients within the fertilizer and soil more soluble for uptake and translocation.



Phosphorus deficient corn caused by fallow syndrome. The previous crop was sugarbeets.



Zinc deficiency.



No starter vs. starter.

Corn Herbicide Postemergence Efficacy Chart

	Annual Grasses														Perennial Grasses			Annual Broadleaves																		Perennial Broadleaves		
HERBICIDE	Crop Tolerance	Barnyardgrass*	Crabgrass	Fall Panicum	Giant Foxtail*	Green Foxtail*	Sandbur	Shattercane	Volunteer Cereals	Wild Oat	Wild Proso Millet	Witchgrass	Woolly Cupgrass	Yellow Foxtail	Johnsongrass*	Quackgrass	Wirestem Muhly	Burcucumber	Cocklebur*	Jimsonweed	Kochia*	Lambsquarters*	Morning Glory (An.)	Nightshade, Black*	Palmer Amaranth*	Pigweed, Redroot	Prickly Sida	Ragweed, Common*	Ragweed, Giant*	Russian Thistle*	Smartweed	Sunflower	Velvetleaf	Waterhemp Sp.*	Wild Buckwheat	Wild Mustard	Wormwood, B.	Bindweed, Field	Canada Thistle*	Yellow Nutsedge
2, 4-D / Enlist One[3]	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	G	F	F	G	E	F	G	G	G	E	E	G	P	G	F	G	F	E	F	F	F	N
Accent Q	G	E	P	E	E	E	G	E	G	E	G	E	G	E	G	G	F	G	P	G	F	P	F	N	N	E	P	P	P	P	G	P	P	F	P	G	P	P	F	F
Acuron	G	G	G	F	G	G	F	F	G	G	G	F	F	G	F	F	P	E	G	E	E	E	E	E	E	E	F	E	E	E	E	E	E	E	E	E	G	F	P	G
Acuron Flexi	G	G	G	F	G	G	F	F	G	G	G	F	F	G	F	F	P	E	G	E	E	E	E	E	G	E	F	E	E	E	E	E	E	E	E	E	G	F	P	G
Acuron GT	G	G	G	G	G	G	G	E	E	E	G	G	G	G	E	G	G	E	G	E	E	E	E	E	E	E	G	E	E	E	E	E	E	E	E	E	G	G	G	G
Aim	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	F	F	G	G	F	G	N	G	P	F	F	F	P	P	G	G	P	G	P	P	P	P
Atrazine	G	G	P	P	F	G	P	P	F	G	P	P	P	G	N	F	P	G	G	E	E	E	E	E	G	E	E	E	G	E	E	E	G	E	G	E	-	P	F	F
Anthem Maxx	G	G	G	G	G	G	F	F	F	F	F	G	F	G	G	P	-	P	P	F	F	F	F	G	G	G	G	F	P	P	P	P	F	G	F	P	-	P	N	N
Anthem ATZ	G	G	G	G	G	G	F	F	F	F	F	G	F	G	G	P	-	F	F	G	G	G	F	G	G	G	G	G	F	F	P	P	F	G	F	G	-	P	N	F
Armezon/Pro Impact/Core	E	E	F	F	F	G	N	G	N	N	G	-	F	G	N	N	N	P	G	G	E	E	P	E	G	G	-	G	G	-	E	E	E	G	P	E	-	-	N	P
Balance Flexx	E	G	G	G	G	G	F	P	P	P	G	G	G	F	F	P	P	G	P	G	G	E	F	G	G	E	G	E	F	G	G	F	E	E	P	E	-	N	N	P
Banvel / Clarity / Dicamba	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	G	E	E	G	E	E	E	G	E	G	E	E	G	E	E	G	G	E	F	G	G	F	N
Banvel + 2,4-D	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	G	E	E	G	E	E	E	G	E	G	E	E	G	E	E	G	G	E	E	G	G	F	N
Basagran	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	E	G	P	F	P	P	N	P	-	F	F	G	G	G	G	G	P	E	F	N	G	G
Basis Blend	G	G	F	G	E	G	P	G	G	G	F	F	F	F	G	F	F	F	P	F	F	E	F	P	N	E	F	P	P	P	E	G	G	F	F	E	P	P	F	F
Bromoxynil + Atrazine	G	P	P	P	P	F	P	P	F	F	P	P	P	F	N	P	P	G	E	E	E	E	E	E	G	E	E	E	G	E	E	E	E	G	E	E	F	P	P	P
Buctril / Brox 2EC / Maestro 2 EC	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	F	E	E	G	G	G	E	-	F	P	E	F	E	E	G	G	G	E	F	F	P	F	N
Cadet	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	G	F	G	P	G	G	G	N	G	-	F	F	-	P	P	E	G	F	F	-	P	P	P
Callisto	E	N	G	N	P	P	N	N	N	N	N	N	N	F	N	N	N	E	E	E	G	E	F	E	G	E	P	G	G	G	G	E	E	E	F	E	-	F	P	N
Callisto GT[1]	E	G	E	G	E	E	G	G	E	E	G	G	G	E	N	N	N	E	E	E	E	E	G	E	G	E	G	E	E	E	E	E	E	E	G	E	E	F	G	P
Callisto Xtra	E	N	F	N	P	P	N	N	N	N	N	N	N	F	N	N	N	E	E	E	E	E	F	E	E	E	F	E	E	E	E	E	E	E	G	E	E	F	P	N
Capreno	G	G	F	G	G	G	G	G	G	G	G	G	G	G	G	-	-	F	G	G	E	E	F	E	G	E	F	E	E	G	E	G	E	G	F	E	-	-	F	-
Corvus	G	E	E	G	E	E	F	E	F	G	E	G	G	G	G	-	P	G	P	G	E	E	F	E	G	E	G	E	F	G	E	F	E	E	P	E	-	-	-	G
Curtail	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	E	G	E	G	E	F	-	G	G	E	E	G	F	E	F	G	F	E	E	F	G	N

Weed control table key: E = Excellent G = Good F = Fair P = Poor N = No Control - = Insufficient Information

[1]Apply to Glyphosate-Resistant (Glyphosate-Resistant) corn only.
[2]Apply to Liberty Link or Enlist (Glufosinate-Resistant) corn only.
[3]Apply to Enlist corn only (Resistant to Glyphosate and 2,4-D).

*Biotypes of weeds with an asterisk have developed resistance to one or multiple modes of action. Weeds that are resistant to a specific herbicide will not be controlled.

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Corn Herbicide Postemergence Efficacy Chart

HERBICIDE	Annual Grasses														Perennial Grasses			Annual Broadleaves																			Perennial Broadleaves		
	Crop Tolerance	Barnyardgrass*	Crabgrass	Fall Panicum	Giant Foxtail*	Green Foxtail*	Sandbur	Shattercane	Volunteer Cereals	Wild Oat	Wild Proso Millet	Witchgrass	Woolly Cupgrass	Yellow Foxtail	Johnsongrass*	Quackgrass	Wirestem Muhly	Burcucumber	Cocklebur*	Jimsonweed	Kochia*	Lambsquarters*	Morning Glory (An.)	Nightshade, Black*	Palmer Amaranth*	Pigweed, Redroot	Prickly Sida	Ragweed, Common*	Ragweed, Giant*	Russian Thistle*	Smartweed	Sunflower	Velvetleaf	Waterhemp Sp.*	Wild Buckwheat	Wild Mustard	Wormwood, B.	Bindweed, Field	Canada Thistle*	Yellow Nutsedge
DiFlexx	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	G	E	E	G	E	E	E	G	E	G	E	E	G	E	E	G	G	E	F	G	G	F	N
DiFlexx DUO	G	G	F	G	G	F	F	G	F	F	G	F	F	G	P	P	P	E	E	E	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E	G	G	G	F	N
Enlist Duo[3]	E	E	G	G	E	E	E	E	E	E	-	-	E	E	E	E	-	G	G	E	G	E	E	G	G	E	E	E	E	G	G	E	E	E	F	E	F	E	G	F
Glyphosate Products[1]	E	G	G	G	G	G	G	E	E	E	G	G	G	G	E	G	G	G	E	G	G	E	G	G	N	E	G	E	G	E	G	G	G	G	G	E	F	G	G	G
Halex GT[1]	E	G	G	G	G	G	G	E	E	E	G	G	G	G	E	G	G	G	E	G	G	E	G	G	G	E	G	E	G	E	G	G	G	G	G	E	F	G	G	G
ImpactZ	E	G	G	P	G	-	N	P	-	-	-	-	P	F	F	N	-	G	E	E	E	E	G	E	E	E	-	E	E	-	E	-	E	E	-	-	-	-	-	N
Laudis	E	G	F	F	F	F	N	G	N	N	G	-	F	F	N	N	N	P	G	G	G	E	P	E	G	G	-	G	G	-	E	E	E	G	F	E	-	-	N	P
Lexar EZ	G	G	G	F	G	G	F	F	F	F	F	F	F	G	F	-	-	G	G	E	E	E	E	E	G	E	F	E	E	E	E	E	E	E	E	E	G	F	P	G
Liberty[2] / Cheetah[2] / Interline[2]	G	F	G	F	G	G	F	G	F	G	E	-	G	G	F	F	G	F	E	E	G	G	G	E	G	E	-	G	G	G	G	G	G	G	E	E	E	F	F	P
Lumax EZ	G	G	G	F	G	G	F	F	G	G	G	F	F	G	F	F	P	E	G	E	E	E	E	E	G	E	F	E	E	E	E	E	E	E	E	E	G	F	P	G
Maverick	G	G	G	F	G	G	F	F	G	G	G	F	F	G	F	F	P	E	E	E	E	E	E	E	G	E	F	E	E	F	E	E	E	E	E	E	E	F	P	G
Metribuzin / Tricor 75DF /Glory	G	P	P	N	P	P	N	N	P	N	N	N	N	P	N	N	N	P	P	F	P	G	P	N	-	G	P	P	P	F	F	P	F	F	G	G	-	F	P	P
Permit	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	-	P	G	N	G	E	P	E	-	G	G	G	G	-	G	G	G	G	P	E	P	N	N	E
Realm Q	E	G	G	G	E	G	F	E	G	G	G	G	G	G	G	G	F	E	E	E	G	E	G	E	G	E	F	G	F	E	E	E	E	E	G	E	G	F	G	G
Resicore XL	G	G	G	F	G	G	F	F	G	G	G	F	F	G	F	F	P	E	E	E	E	E	E	E	G	E	F	E	E	F	E	E	E	E	E	E	E	F	P	G
Resolve Q	G	G	F	F	G	G	F	G	G	F	F	F	F	G	F	F	-	-	F	F	G	G	F	P	N	G	-	F	F	P	F	F	G	F	F	E	N	P	P	P
Resource	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	P	F	P	F	P	P	N	G	F	F	P	N	P	P	E	F	P	P	P	F	G	F
Revulin Q	G	G	F	G	E	G	G	E	G	G	-	-	G	E	E	E	-	G	F	E	G	E	G	E	G	E	-	F	G	N	E	E	E	G	-	E	-	-	-	P
Sequence[1]	G	G	G	G	G	G	G	E	E	E	G	G	G	G	E	G	G	G	E	G	G	E	G	G	-	E	G	E	G	E	G	G	G	G	G	E	F	G	G	G
Solstice	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	G	E	G	E	E	G	G	G	E	G	E	G	G	E	G	G	G	G	E	F	P	P	P
Starane / Comet	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	P	F	E	P	E	F	N	P	-	P	P	P	P	F	G	P	F	F	-	P	P	N
Status	G	F	F	F	F	F	N	N	N	N	N	N	N	F	N	N	N	G	E	E	E	E	E	E	G	E	G	E	E	G	E	E	G	G	E	G	G	F	G	N
Steadfast Q	E	E	F	G	E	E	G	E	G	E	G	-	G	G	G	G	F	N	N	F	N	F	G	N	N	G	N	N	N	N	G	G	P	P	N	G	N	N	N	N
Stinger	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	N	N	G	G	N	N	N	P	N	P	N	E	E	F	G	G	F	G	F	P	E	P	G	N
Widematch	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	-	E	-	E	P	-	G	N	P	-	E	E	P	G	E	E	P	E	P	E	-	E	N
Yukon	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	F	E	G	G	G	G	G	F	E	G	G	G	F	G	E	G	G	F	E	F	F	P	E
Zemax / Palace	G	G	G	G	F	F	F	F	F	F	F	F	F	G	N	N	N	F	G	G	F	E	F	E	-	E	P	G	F	F	G	G	E	E	F	G	P	P	P	N

Weed control table key: E = Excellent G = Good F = Fair P = Poor N = No Control - = Insufficient Information

[1]Apply to Glyphosate-Resistant (Glyphosate-Resistant) corn only.

[2]Apply to Liberty Link or Enlist (Glufosinate-Resistant) corn only.

[3]Apply to Enlist corn only (Resistant to Glyphosate and 2,4-D).

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2,4-D ester and amine

Brand Name:	EPA Reg. #:
Tenkoz Amine 4	**42750-19-55467**
Tenkoz Lo-Vol 6	**42750-20-55467**
Rate/A:	1–4 pt (Amine 4) 0.66–2.66 pt (Lo-Vol 6)
Application Timing:	Fall, Preplant
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, c.r. apron, eyewear, shoes, socks
R.E.I.:	12 hours (Lo-Vol 6) 48 hours (Amine 4)
W. Notification:	Oral
S. Word:	Danger (Amine 4) Caution (Lo-Vol 6)

Adjuvant(s)/Comments

- **CHS Hypertonic (1–2 pt/100 gal) plus CHS Fixate/ CHS Wheelhouse Pro (1 qt/100 gal)**

or

- **AMS (2.5 lb/A)**
- **CHS Axon (2 qt/100 gal)**

or

- **CHS Level Best Pro (1 qt/100 gal) plus AMS (1.5–2 lb/A)**

Timing/Comments

For amine and ester formulations, wait at least 30 days after the application and at least 1″ rainfall or irrigation before planting.

AIM EC (carfentrazone)

EPA Reg. #:	**279-3241**
Rate/A:	0.5–2 fl oz
Application Timing:	Post-direct/hood, Defoliation
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Fixate/ CHS Wheelhouse Pro (2 qt/100 gal)**
- **CHS Hypertonic (1–2 pt/100 gal)**

or

- **CHS Penetrec* (0.5 gal/100 gal) plus AMS (2.5 lb/A)**
- Use as directed, spray to cotton that is 6″ or taller.
- Use a hooded sprayer if cotton has 5–6 nodes or more.
- Use in a lay-by application once cotton is 12″+ tall.

Target Weeds

0.5–1 fl oz

Controlled

- lambsquarters
- black nightshade
- pigweed
- velvetleaf

Suppression

- wild buckwheat
- kochia
- mustards
- Russian thistle

Split applications needed for Canada thistle.

1.5–2 fl oz

Controlled

- lambsquarters
- black nightshade
- pigweed
- velvetleaf
- wild buckwheat
- kochia
- Russian thistle

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

Assure II / Targa (quizalofop P-ethyl)

EPA Reg. #:	**352-541 / 33906-9-81880**
Rate/A:	4–10 fl oz
Application Timing:	Post-emerge broadcast
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Danger
P.H.I.:	80 days

Adjuvant(s)/Comments

- **CHS Penetrec* (0.5–1 gal/100 gal) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (0.5 gal/100 gal) plus AMS (2–4 lb/A)**
- Maximum use rate is 18 fl oz/A per year.
- Application intervals should be 7+ days apart.

Target Weeds	4 fl oz	6 fl oz	8 fl oz
– barnyardgrass	-	-	2–6″
– field sandbur	-	-	2–6″
– crabgrass	-	-	2–6″
– giant foxtail	-	-	2–8″
– green foxtail	-	-	2–4″
– volunteer corn	6–24″	24″+	-
– wild proso millet	-	-	2–6″
– yellow foxtail	-	-	2–4″
– wild oat	-	-	2–6″

	9 fl oz	10 fl oz
– woolly cupgrass	2–4″	-
– quackgrass	-	6–10″

*Crop Oil @ 1–2 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

**CHS Emulate @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Aggrestrol.

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

BAPMA Dicamba (over the top applications on DT Cotton)

Brand Name:	EPA Reg. #:
Engenia	**7969-345**
Rate/A:	12.8 oz/A
Application Timing:	Preplant, at planting, pre, post
Spray Volume:	12.8 oz/A 10 + gpa (15 gpa preferred)
Rainfast:	4 hrs
S.O.A.:	Plant growth Regulator (group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes plus socks, respirator w/ R, P, or HE filter
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	7 days

Adjuvant(s)/Comments

Refer to: www.engeniatankmix.com for a full listing of approved CHS adjuvants to be used with Engenia Herbicide.

Timing/Comments

ONLY for use with Dicamba Tolerant Cotton

Best performance use on weeds 4 inches or less
OTT Application Rate: 12.8 oz/A.

Allow 7 days between applications.

Max of 51.2 oz/A per season.

Label and associated websites are very specific concerning application requirements. These include, but not limited to: spray nozzles, tank mix partners, adjuvants and physical application requirements.

Brake FX (Fluridone + Flurometuron)

EPA Reg. #:	**67690-74**
Rate/A:	up to 42 fl oz
Application Timing:	Preplant or Pre-Emerge
Spray Volume:	20 gpa
Rainfast:	NA
S.O.A.:	Inhibition of carotenoid biosynthesis at (PDS) + Photosystem II Inhibitor (Group 7 and Group 12)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	NA

Adjuvant(s)/Comments

- Selective herbicide for use in cotton to control amaranth species (i.e. Palmer amaranth). Product is active on a range of annual grasses and small seeded broadleaf weeds.
- Brake FX has numerous use restrictions dependent on location and soil characteristics. Consult label for uses, limitations and restrictions. Brake FX should be part of an overall weed control strategy and not be used as a stand-alone program.

Caparol 4L (prometryn)

EPA Reg. #:	**100-620**
Rate/A:	1.6–3.2 pt
Application Timing:	At planting, post-direct/hood
Spray Volume:	20 gpa
Rainfast:	NA
S.O.A.:	Photosystem II Inhibitor (Group 5)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	NA

Adjuvant(s)/Comments

- Caparol 4L may be applied preplant incorporated, pre-emerge, and/or post-emerge.
- Post-emerge applications can follow pre-emerge applications.
- Post-emerge applications should be made in a manner to avoid contact with cotton foliage.
- A surfactant may be added at 1–2 qt/100 gal to enhance weed control.

Target Weeds

Caparol 4L applied according to directions will selectively control annual weeds in cotton. Weeds include, but are not limited to:

Annual Grasses

- crabgrass
- foxtail
- goosegrass
- junglerice

Annual Broadleaf

- annual morning glory
- black nightshade
- pigweed
- smartweed

Clethodim products

Brand Name:	EPA Reg. #:
Arrow	**66222-60**
Shadow	**66330-353**
Volunteer	**59639-3-55467**
Rate/A:	6–16 fl oz
Application Timing:	Post
Spray Volume:	5–40 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning
P.H.I.:	60 days

Adjuvant(s)/Comments

- **Crop Oil* (1 qt/A) plus AMS*** (2.5–4 lb/A)**

or

- **CHS Emulate** (1 qt/A) plus AMS*** (2.5–4 lb/A)**

Target Weeds	6 fl oz	8 fl oz
– barnyardgrass	6″	8″
– crabgrass	2″	6″
– giant foxtail	6″	12″
– green foxtail	6″	8″
– quackgrass (2nd application may be needed)	-	4–12″
– volunteer cereals	6″	8″
– volunteer corn	12″	18″
– wild proso millet	8″	10″
– woolly cupgrass	6″	8″
– yellow foxtail	6″	8″

*CHS Penetrec @ 1 pt/A or Trophy Gold / CHS Endurium @ 1 qt/100 gal can be substituted for Crop Oil.
**CHS Aggrestrol @ 1 pt/A can be substituted for CHS Emulate.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Cobra (lactofen)

EPA Reg. #:	**59639-34**
Rate/A:	12.5 fl oz
Application Timing:	Post-direct
Spray Volume:	10–30 gpa
Rainfast:	30 minutes
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	coveralls over l.s. shirt, l.s. pants, c.r. gloves, c.r. footwear, socks, apron, eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Danger

Adjuvant(s)/Comments

- **CHS Penetrec* (0.5–1 pt/A)**

Timing/Comments

Cobra to be used only in a post directed or lay-by application. Cotton must be 6″ or taller for a post-directed application and 12″ or taller for a lay-by application.

Calibrate sprayer for banded applications.

Multiple tank mixes are available with Cobra.

See label for specific directions.

Misapplication will result in crop injury.

*Crop Oil @ 1–2 pt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

Cotoran 4L (fluometuron)

EPA Reg. #:	**66222-181**
Rate/A:	2–4 pt
Application Timing:	At planting, post-direct/hood
Spray Volume:	10–20 gpa
Rainfast:	NA
S.O.A.:	Photosystem II Inhibitor (Group 7)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	60 days

Adjuvant(s)/Comments

- Cotoran 4L can be applied pre-plant, preplant incorporated, pre-emerge or post-emerge. Not recommended on sandy soils.
- Preplant applications may require a surfactant or a tank mix partner if weeds are present at time of application.
- Post-emerge applications can be made from 3″ tall cotton to lay-by applications. Surfactant at 1–2 qt/100 gal may be added to enhance activity on emerged weeds.

Target Weeds

Cotoran 4L applied according to directions will selectively control annual weeds in cotton. Weeds include, but are not limited to:

Annual Grasses	Annual Broadleaf
– barnyardgrass	– cocklebur
– fall panicum	– pigweed
– foxtail	– prickly sida
– signalgrass	– lambsquarters

DGA Dicamba (over the top applications on XtendFlex)

Brand Name:	EPA Reg. #:
XtendiMax w/ Vapor Grip	**524-617**
FeXapan + Vapor Grip	**352-913**
Rate/A:	22 or 44 oz/A 22 oz/A
Application Timing:	Preplant, at planting, pre, post
Spray Volume:	15 + gpa
Rainfast:	4 hour, do not apply within 24 hrs if rain is expected
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes plus socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	7 days

Adjuvant(s)/Comments

Refer to: www.xtendimaxapplicationrequirements.com for a full listing of approved CHS adjuvants to be used with XtendiMax with Vapor Grip

Refer to http://www.dupont.com/products-and-services/crop-protection/soybean-protection/articles/fexapan-tank mix-partner.html for a full listing of approved CHS adjuvants to be used with FeXapan plus Vapor Grip.

Timing/Comments

ONLY for use with XTENDFLEX Technology.

Best performance use on weeds 4 inches or less.

OTT Application Rate: 22 oz/A.

Allow 7 days between applications.

Max of 88 oz/A per season.

Label and associated websites are very specific concerning application requirements. These include, but not limited to: spray nozzles, tank mix partners, adjuvants and physical application requirements.

Dicamba products

Brand Name:	EPA Reg. #:
Banvel	**51036-289**
Clarity	**7969-137**
Dicamba	**42750-40**
Rate/A:	up to 8 fl oz
Application Timing:	Fall application, preplant burndown
Spray Volume:	3–50 gpa
Rainfast:	4 hours
S.O.A.:	Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Fixate/ CHS Wheelhouse Pro (1 qt/100 gal)**
- **CHS Hypertonic may be used (1 qt/100 gal)**

or

- **CHS Level Best Pro (1 qt/100 gal) plus AMS (1.5–2 lb/A)**
- Apply fall or winter when weeds are 2–4 leaf stage and rosettes are less than 2″ across.
- Plant crop only after 1″ rainfall or irrigation and 21 days after application.

Timing/Comments

Use caution in arid areas of TX, NM, OK, and KS: Allow for ample rainfall or irrigation and additional time between Dicamba application and cotton planting.

Diuron products

Brand Name:	EPA Reg. #:
Determine 4L	**66222-54**
Karmex DF	**68222-51**
Rate/A:	0.8–2.2 qt (Determine 4L) 1–2.75 lb (Karmex DF)
Application Timing:	Pre, post-direct/hood
Spray Volume:	3–50 gpa
Rainfast:	NA
S.O.A.:	Photosystem II Inhibitor (Group 7)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, c.r. apron, respirator W/N, R or P filter
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic may be used (1 qt/100 gal) if needed for post applications**
- Use on sandy loam or heavier soils.
- Do not apply to sand or loamy-sand soils.
- Do not use with furrow planted cotton.
- Do not use on soils with less than 1% organic matter.
- Do not allow livestock to graze treated land.
- Cotton may be replanted through treated bands or rework beds before planting.

Timing/Comments

Consult label very closely concerning replanting of cotton and subsequent crops. The label is very specific about application method and timing and the allowable planting window and crop type restrictions.

Do not use as a preplant/pre-emerge application where soil-applied organophosphate insecticides are used because of potential severe crop injury and possible stand loss.

Enlist One (2,4, D Choline)

EPA Reg. #:	**62719-695**
Rate/A:	1.5–2.0 pt
Spray Volume:	10 gpa minimum
Rainfast:	24 hours
S.O.A.:	Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants
R.E.I.:	48 Hours
W. Notification:	Oral
S. Word:	Warning
P.H.I.:	30 days

Adjuvant(s)/Comments

- **CHS Level Best Pro (1 qt/100 gal) plus AMS (1.5–2 lb/A)**

Refer to www.enlisttankmix.com for approved CHS adjuvants.

Timing/Comments

Cotton: Emergence up to Full Flowering.
Enlist Cotton Only
DO NOT tank mix any tank mix partner not listed on www.enlisttankmix.com.
Max of 6.0 pt/A per season.
Max of 2.0 pt/A per application.

Enlist Duo (Glyphosate + 2,4-D Choline)

EPA Reg. #:	**62719-649**
Rate/A:	3.5– 4.75 pt
Spray Volume:	10 gpa minimum
Rainfast:	24 hours
S.O.A.:	EPSP Synthase Inhibitor (Group 9) Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks, p. eyewear
R.E.I.:	48 Hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

Refer to www.enlisttankmix.com for approved CHS adjuvants.

Timing/Comments

Cotton: Emergence up to Full Flowering.
Enlist Cotton Only
DO NOT tank mix any tank mix partner not listed on www.enlisttankmix.com.
Only one pre-emerge application per season.
Max two post-emerge applications per season.
Max 14.75 pt/A per season.
Max 4.75 pt/A per application.

Fierce (flumioxazin + pyroxasulfone)

EPA Reg. #:	**59639-193**
Directed Rate/A:	3 oz/A
Application Timing:	Postemergence or Directed
Spray Volume:	Min. 15 gpa
Rainfast:	1 hour
S.O.A.:	Group 14 and 15
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes plus socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	60 Days

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

Timing/Comments

ONLY for use with Dicamba Tolerant Cotton.
Best performance use on weeds 4 inches or less.
OTT Application Rate: 12.8 oz/A.
Allow 7 days between applications.
Max of 51.2 oz/A per season.
Label and associated websites are very specific concerning application requirements. These include, but not limted to: spray nozzles, tank mix partners, adjuvants and physical application requirements.

FirstShot (thifensulfuron-methyl + tribenuron-methyl)

EPA Reg. #:	**352-755**
Rate/A:	0.5–0.8 oz
Application Timing:	Preplant burndown
Spray Volume:	5–20 gpa
Rainfast:	4 hours
S.O.A.:	ALS Enzyme Inhibitors (Group 2)
P.P.E.:	l.s. shirt, l. pants, shoes, socks, c.r. gloves
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **Crop Oil (1 gal/100 gal) or CHS Penetrec (2 qt/100 gal) plus AMS* (2–4 lb/A)**

or

- **CHS Emulate (1 gal/100 gal)**

or

- **CHS Aggrestrol (2 qt/100 gal) plus AMS* (2–4 lb/A)**

Timing/Comments

Use as a preplant burndown tank mix partner to assist in control of winter annual broadleaf weeds.

Allow 30 days before planting cotton.

Allow 37 days on sands, loamy sands, sandy loams, and high-pH soils (> 7.9) before planting.

*CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Fomesafen products

Brand Name:	EPA Reg. #:
Reflex	**100-993**
Preplant Rate/A:	1–1.5 pt*
Post-Directed Rate/A:	1 pt**
Spray Volume:	10–20 gpa
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	coveralls over l.s. shirt, l. pants, c.r. gloves, c.r. footwear, socks, apron
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning
P.H.I.:	70 days

Adjuvant(s)/Comments

- **Crop Oil (1 gal/100 gal)**

or

- **CHS Penetrec (2 qt/100 gal) plus AMS*** (10 lb/100 gal)**

or

- **CHS Emulate (1 gal/100 gal)**

or

- **CHS Aggrestrol (2 pt/100 gal) plus AMS*** (10 lb/100 gal)**

Timing/Comments

See label for planting rotations and rate restrictions.

Specific conditions must be met to reduce the plant back restrictions when using Reflex.

Reflex will cause serious injury to cotton if used as a post-emerge broadcast application.

*Apply 14–21 days prior to planting at a minimum of 0.5" irrigation or rainfall.

**Post-directed sprays should be made in a minimum of 10 gpa. Follow the label recommendations for post-directed sprays.

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Fusilade DX (fluazifop-P-butyl)

EPA Reg. #:	**100-1070**
Rate/A:	6–12 fl oz
Application Timing:	Post
Spray Volume:	5–40 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear, apron
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	90 days

Adjuvant(s)/Comments

- **CHS Aggrestrol* (0.75–1 pt/A)**

or

- **CHS Penetrec** (1 pt/A)**
- Add AMS*** when weeds are stressed.
- Use the surfactant required by the broadleaf herbicide tank mix.

Target Weeds	8 fl oz	12 fl oz
– barnyardgrass	-	1–2"
– crabgrass	-	1–2"
– giant foxtail	-	2–6"
– seedling johnsongrass	2–4"	-
– volunteer milo	-	2–4"
– volunteer cereals	-	2–4"
– volunteer corn	-	12–18"
– fall panicum	-	2–6"
– Texas panicum	-	2–8"

Fusilade DX can be tank mixed with glyphosate to control volunteer glyphosate-tolerant crops in cotton.

Max 48 fl oz/A per year.

Do not apply after boll set.

*CHS Emulate @ 1.5–2 pt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Aggrestrol.

**Crop Oil @ 1 qt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Fusion (fluazifop-P-butyl + fenoxyprop-P-ethyl)

EPA Reg. #:	**100-1059**
Rate/A:	4–12 fl oz
Application Timing:	Post
Spray Volume:	5–40 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	90 days

Adjuvant(s)/Comments

- **CHS Aggrestrol* (0.75–1 pt/A) plus AMS*** (1–4 lb/A)**

or

- **CHS Penetrec** (1 pt/A) plus AMS*** (1–4 lb/A)**
- Use the surfactant required by the broadleaf herbicide tank mix.

Target Weeds	8 fl oz	12 fl oz
– barnyardgrass	-	1–2″
– crabgrass	-	1–2″
– seedling johnsongrass	2–4″	-
– fall panicum	-	2–6″
– Texas panicum	-	8″
– volunteer corn	-	12–18″
– volunteer cereals	-	2–4″

Apply 24 fl oz/A max per growing season.
Do not apply after boll set.

*CHS Emulate @ 1.5–2 pt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Aggrestrol.
**Crop Oil @ 1 qt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Glufosinate

Brand Name:	EPA Reg. #:
Liberty 280 SL	**264-829**
Autonomy	**7969-448-55467**
Cheetah	**71368-112**
Noventa	**7696-448**
Interline	**70506-310**
Spray Volume:	15–20 gpa
Rainfast:	4 hours
M.O.A.:	Glutamine Synthase Inhibitor
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

- **CHS Level Best Pro plus AMS (1.5-3.0 lb/A)**

or

- **CHS Fixate (3 qt/100)**

or

- **Encloax (3.5 pt/A)**

Target Weeds	32 fl oz
– wild buckwheat	6″
– cocklebur	6″
– kochia	4″
– morning glory	6″
– wild mustard	4″
– nightshade	6″
– pigweed species	3″
– ragweed species	6″
– velvetleaf	6″
– waterhemp	3″
– barnyardgrass	4″
– foxtail species	3″
– wild oat	3″
– volunteer corn	6″
– crabgrass	3″

Glufosinate – High Load

Brand Name:	EPA Reg. #:
Surmise 5	**42750-401**
Spray Volume:	15–20 gpa
Rainfast:	4 hours
M.O.A.:	Glutamine Synthase Inhibitor
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

- **CHS Level Best Pro plus AMS (1.5-3.0 lb/A)**

or

- **CHS Fixate (3 qt/100)**

or

- **Encloax (3.5 pt/A)**

Target Weeds	16.3 fl oz
– wild buckwheat	6″
– cocklebur	6″
– kochia	4″
– morning glory	6″
– wild mustard	4″
– nightshade	6″
– pigweed species	3″
– ragweed species	6″
– velvetleaf	6″
– waterhemp	3″
– barnyardgrass	4″
– foxtail species	3″
– wild oat	3″
– volunteer corn	6″
– crabgrass	3″

Glyphosate

Brand Name:	EPA Reg. #:	# A.E.	=0.75 AE
Buccaneer Plus	**55467-9**	3.00	32.0
Gly Star Original	**42750-60**	3.00	32.0
Gly Star Plus	**42750-61**	3.00	32.0
Durango DMA	**62719-556**	4.00	24.0
Buccaneer 5 Extra	**55467-15**	4.00	24.0
Gly Star 5 Extra	**42750-59**	4.00	24.0
Gly Star K-Plus	**42750-122**	4.50	21.3
Buccaneer K	**42750-122-55467**	4.50	21.3
Roundup RT 3	**524-544**	4.50	21.3
Roundup PowerMax 3	**524-659**	4.80	19.7

Surfactant/Comments

- **CHS Level Best Pro (1 qt/100) plus AMS (8.5-17 lb/100)**

or

- **CHS Fixate/CHS Wheelhouse Pro (2-3 qt/100)**

or

- **Encloax (2.5-5 gal/100)**

or

- **CHS Hypertonic (1 qt/100) plus AMS (8.5-17 lb/100)**

Rate/A:	Variable
Spray Volume:	5–20 gpa
Rainfast:	1–6 hours
M.O.A.:	EPSP Inhibitor
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

MSMA

EPA Reg. #:	**19713-42**
Postemergence Rate/A:	2.5 pt/A over the top
Directed Rate/A:	2.66 pt/A directed
Application Timing:	Postemergence or Directed
Spray Volume:	40 gpa (ground) 5-10 gpa (air)
Rainfast:	None Listed
S.O.A.:	Group 17
P.P.E.:	coveralls over, l.s. shirt, l. pants, c.r. gloves, shoes plus socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	None Listed

Target Weeds

For control of many grasses and broadleaves including: barnyardgrass, cocklebur, dayflower, johnsongrass, morning glory, nutsedge, pigweed, and sicklepod.

Only one application at 2 lb/A per season is allowed, except in a salvage situation where a second app can be made.

Paraquat

Brand Name:	EPA Reg. #:
Parazone 3 SL	**5481-615**
Quik-Quat	**19713-617**
Helmquat 3 SL	**74530-48**
Paraquat Concentrate	**82542-3**
Gramoxone	**100-1652**
Spray Volume:	10–20 gpa
Rainfast:	30 minutes
M.O.A.:	Photosystem 1 inhibitor (22)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, faceshield, c.r. apron, sust mist NIOSH approved respirator, W/N, R, P or HE filter
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Danger Poison
P.H.I.:	3 days when used for late-season desiccation or suppression of regrowth

Adjuvant Rec

- **CHS Level Best Pro (1 qt/100)**

or

- **CHS Hypertonic (1 qt/100)**

or

- **CHS Fixate (2 qt/100)**

or

- **CHS Penetrec/CHS Aggrestrol (2 qt/100)**

or

- **Encloax (2.5 gal/100)**

Timing/Comments

Paraquat can be applied preplant, pre-emerge, or post-emerge as a directed spray. Paraquat is labeled as a harvest aid for boll opening, desiccation, and suppression of regrowth. See label for specific location recommendations and rates.

Pendimethalin

Brand Name:	EPA Reg. #:
Prowl H_2O (3.8 lb/gal a.i.)	**241-418**
Acumen (3.3 lb/gal a.i.)	**241-337-55467**
Rate/A:	1–4 pt (Prowl H_2O) 1.2–4.8 pt (Acumen)
Application Timing:	PPI, pre, post, at planting, post-direct
Spray Volume:	5–20 gpa
Rainfast:	1 hour
S.O.A.:	Mitotic Inhibitor (Group 3)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	allow spray to dry
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	60 days

Comments

- Preplant Surface: Apply up to 15 days prior to planting.
- Preplant Incorporated: Apply up to 60 days prior to planting, incorporate within 7 days.
- Pre-emergence: Apply at or up to 2 days after planting.
- Lay-by Application: Apply directly to the soil between rows as a directed spray.
- Do not apply as broadcast post-emerge application.
- **Soiltrate (1-2 pt/A)**

Timing/Comments

Pendimethalin applied according to directions will selectively control annual weeds in cotton. Weeds include, but are not limited to:

Annual Grasses

- barnyardgrass
- fall panicum
- foxtail
- field sandbur

Annual Broadleaf

- common lambsquarters
- Palmer amaranth
- prickly sida
- waterhemp species

Adjuvants have little impact on the performance of pendimethalin. If used in a tank mix, follow the adjuvant recommendations of the tank mix partner.

Poast (sethoxydim)

EPA Reg. #:	**7969-58-51036**
Rate/A:	0.5–1.5 pt
Application Timing:	Post
Spray Volume:	5–20 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	coveralls, l.s. shirt, l. pants, c.r. gloves, c.r. footwear, head gear, eyewear, shoes, socks, apron
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

- **Crop Oil* (1 qt/A) plus AMS*** (2.5 lb/A)**

or

- **CHS Emulate** (1.5–2 pt/A) plus AMS*** (2.5 lb/A)**
- Use the surfactant required by the broadleaf herbicide for the tank mix.

Target Weeds	0.5 pt	1 pt	1.5 pt
– barnyardgrass	-	8″	-
– crabgrass	-	6″	-
– field sandbur	-	-	3″
– foxtails	-	8″	-
– volunteer cereals	-	-	4″
– volunteer corn	-	20″	-
– wild proso millet	10″	-	-
– wild oat	-	4″	-
– woolly cupgrass	-	8″	-

*CHS Penetrec @ 2 pt/A or Trophy Gold/CHS Endurium @ 1 qt/100 gal can be substituted for Crop Oil.

**CHS Aggrestrol @ 1 pt/A can be substituted for CHS Emulate.

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

S-metolachlor

Brand Name:	EPA Reg. #:
Dual Magnum/ Brawl	**100-816/100-816-55467**
Dual II Magnum/ Brawl II	**100-818/100-818-55467**
Rate/A:	1–1.33 pt
Application Timing:	PPI, pre
Spray Volume:	10+ gpa
Rainfast:	NA
S.O.A.:	Very Long-chain Fatty Acid Inhibitors (Group 15)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Comments

- Apply product preplant incorporated or pre-emerge in NM, OK, and TX at rates from 1 pt/A on sandy loams to 1–1.33 pt/A on medium soils and 1.33 pt/A on fine soils.
- Do not use on sand or loamy-sand soils.
- Product can be used as a post-emerge or post-directed treatment. Rates for NM, OK, and TX are 1–1.33 pt/A applied before August 1. Over-the-top applications -100 day PHI. Post-directed applications -80 day PHI.
- Product does not control emerged weeds. Use tank mix partners as described in label to control emerged weeds.

Target Weeds

Partial List of Weeds Controlled

Grasses	Broadleaf
– barnyardgrass	– Palmer amaranth
– large crabgrass	– prostrate pigweed
– smooth crabgrass	– redroot pigweed
– green foxtail	– smooth pigweed
– fall panicum	– common waterhemp

Product can be tank mixed with glyphosate herbicides and used as broadcast post or post-directed application on glyphosate-tolerant cotton. Follow label for timing and rates.

Select Max (clethodim)

EPA Reg. #:	**59639-132**
Rate/A:	9–32 fl oz*
Application Timing:	Post
Spray Volume:	5–40 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	60 days

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS**** (2.5–4 lb/A)**

or

- **CHS Penetrec** (1 pt/A)**

or

- **CHS Aggrestrol*** (1 pt/A) plus AMS**** (2.5–4 lb/A)**
- Max 32 fl oz/A per application.
- Max 64 fl oz/A per season.

Target Weeds	9 fl oz	12 fl oz
– barnyardgrass	6″	8″
– crabgrass	2″	6″
– giant foxtail	6″	12″
– green foxtail	6″	8″
– quackgrass (second app. may be needed)	-	4″–12″
– volunteer cereals	6″	8″
– volunteer corn	12″	18″
– wild proso millet	8″	10″
– woolly cupgrass	6″	8″
– yellow foxtail	6″	8″

*9–16 fl oz/A for annual grasses, 12–32 oz/A for perennial grasses.

**Crop Oil @ 1 qt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

***CHS Emulate @ 1 qt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Aggrestrol.

****CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Sequence (glyphosate + S-metolachlor)

EPA Reg. #:	**100-1185**
Rate/A:	2.5–4 pt
Application Timing:	Preplant burndown, PP, pre, post, post-direct
Spray Volume:	10–40 gpa
Rainfast:	2 hours
S.O.A.:	EPSP Synthase Inhibitor + Long Chain Fatty Acid Inhibitor (Group 9 + Group 15)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	100 days

Adjuvant(s)/Comments

- **AMS* (8.5–17 lb/100 gal)**
- Sequence can be applied to conventional cotton preplant and pre-emerge. Sequence can be applied preplant, pre-emerge, and post-emerge to Roundup Ready and Roundup Ready Flex cotton.
- Post-emerge applications on Roundup Ready cotton can be made from 3″ to the 4-leaf stage. Do not exceed 2.5 pt/A per application.

Timing/Comments

Post-emerge applications on Roundup Ready Flex cotton can be made from cotyledon stage to the 10-leaf stage (not to exceed 12″) of cotton development. Do not exceed 2.5 pt/A per application.

*CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Sharpen (saflufenacil)

EPA Reg. #:	**7969-278**
Rate/A:	1 fl oz
Application Timing:	Preplant burndown
Spray Volume:	5–20 gpa
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- For optimum activity with Sharpen, an adjuvant system must be used.
- **CHS Emulate* (1 gal/100 gal) plus AMS (8.5–17 lb/100 gal)**

or

- **UAN (1.25–2.5 gal/100 gal)**
- Sharpen can be used for cotton harvest aid/desiccation. Apply in minimum of 10 gpa of water (ground) or a minimum of 5 gpa (air). Use the label-recommended adjuvant package.
- Allow 10 days for optimum desiccation.
- Large plants, heavy foliage may require a 2nd application in 5–7 days.
- Single application rates: 0.5–2 fl oz/A.
- 2 fl oz/A total is maximum for desiccation per cropping season.

Timing/Comments

Use Sharpen as an early preplant burndown treatment.

Wait to plant cotton until at least 42 days and an accumulation of 1" of rainfall or irrigation.

Do not apply more than a maximum cumulative amount of 2 fl oz/A of Sharpen per cropping season.

Potential for carryover exists in arid climates when using maximum rates of Sharpen.

Please consult your local supplier or BASF representative when using Sharpen in arid climates for cotton production.

*MSO must contain at least 60% methylated seed oil or poor performance is possible.

Staple LX (pyrithiobac sodium)

EPA Reg. #:	**352-613**
Rate/A:	2.6–3.8 fl oz
Application Timing:	Pre, post
Spray Volume:	10–40 gpa
Rainfast:	4 hours
S.O.A.:	ALS Enzyme Inhibitors (Group 2)
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	60 days

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (1–2 qt/100 gal)**

or

- **Crop Oil (1–2 gal/100 gal)**
- Staple LX can be applied pre-emerge, maximum rate of 2.1 fl oz/A. Will need rainfall or irrigation to activate.
- Apply to cotton as post-emerge broadcast or post-directed spray, from cotyledon stage up to 60 days preharvest. In west Texas, do not apply more than 3.2 fl oz/A per year if rotating crops.
- Staple LX can be applied as a tank mix partner with glufosinate or glyphosate herbicides and applied to LibertyLink and Roundup Ready/Roundup Ready Flex traited cotton. Consult label for directions.

Timing/Comments

Partial List of Weeds Controlled

- cocklebur
- common sunflower
- devils claw
- morning glory species
- pigweed species
- nightshade species
- common waterhemp
- Russian thistle
- smell melon
- velvetleaf

Carryover restrictions exist with Staple LX. Please consult local supplier and refer to herbicide label for specific restrictions.

Trifluralin

Brand Name:	EPA Reg. #:
Treflan 4D	**68156-4**
Triflurex HFP	**66222-46**
Trifluralin (Cornbelt Brand)	**11773-17**
Multiple Brands	
Rate/A:	Spring applied: 1–2 pt Fall applied: 1.5–2.5 pt
Application Timing:	PPI, pre, post-direct
Spray Volume:	5–40 gpa
Rainfast:	NA
S.O.A.:	Mitotic Inhibitor (Group 3)
P.P.E.:	l.s. shirt, l. pants, eyewear, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution (Treflan, Triflurex HFP) Warning (Trifluralin)
P.H.I.:	60 days

Comments

- For best results, incorporate within 24 hours.
- Do not expose untreated soil during field operations.
- Can be applied through sprinkler irrigation systems as directed by the label.
- Do not plant sorghum or oats for 18 months if less than 20" of rainfall or irrigation is received.

Timing/Comments

Trifluralin applied according to directions will selectively control annual weeds in cotton.

Annual Grasses

– barnyardgrass
– fall panicum
– foxtail
– field sandbur

Annual Broadleaf

– common lambsquarters
– henbit
– kochia
– Russian thistle

Valor SX (flumioxazin)

EPA Reg. #:	**59639-99**
Postemergence Rate/A:	2.0 oz/A
Application Timing:	Postemergence or Directed
Spray Volume:	15–30 gpa
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	coveralls over, l.s. shirt, l. pants, c.r. gloves, c.r. footwear, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	60 days

Comments

- **CHS Hypertonic (1 qt/100 gal)**

Timing/Comments

Addition of MSMA, glyphosate, or glufosinate can assist in weed control. Good residual control of pigweed and morning glory.

Apply under conditions favoring active weed growth, to cotton with at least 4 inches of bark.

Warrant (acetochlor)

EPA Reg. #:	**524-591**
Rate/A:	1.25–2 qt
Application Timing:	Pre, Post
Spray Volume:	10+ gpa
Rainfast:	NA
S.O.A.:	Very Long-chain Fatty Acid Inhibitors (Group 15)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Comments

- Apply Warrant post-emerge to cotton and prior to weed emergence. Applications should be made before cotton reaches first bloom.
- Follow label instructions for rates based on soil texture and O.M.
- Warrant can be tank mixed with glyphosate herbicides and applied up to 4-leaf (node) stage on Roundup Ready cotton.
- Warrant can be tank mixed with glyphosate herbicides labeled for Roundup Ready Flex cotton and applied up to first bloom stage on Roundup Ready Flex cotton.

Timing/Comments

Partial List of Weeds Controlled

Grasses

– barnyardgrass
– crabgrass
– foxtail species
– fall panicum
– witchgrass

Broadleaf

– carpetwood
– pigweed species
– purslane
– lambsquarters
– smartweed

Cotton Fertility and Nutrient Information

A major factor affecting both cotton yield and quality is the availability of adequate and balanced nutrition. Soil pH is also a major factor affecting nutrient availability. Optimum soil pH ranges from 6 to 7.5.

Nitrogen is essential for the development of shoots, buds, leaves, roots, and bolls. Cotton takes up about 60 lb of N for each 480 lb bale produced, although it should be noted that N uptake figures can vary considerably (Table 1). Uptake is limited early in the season prior to squaring, with the majority of N taken up after first bloom.

Phosphorus is important in early root development, photosynthesis, cell division, energy transfer, early boll development, and hastening of maturity. About 25 to 30 lb of P2O5 is taken up per bale of cotton produced (Table 1).

Potassium is an especially important nutrient in cotton production. Cotton takes up about 60 lb of K2O per bale (Table 1). The need for K increases dramatically during early boll set, and about 70% of uptake occurs after first bloom. Preplant applications of K fertilizer, and in some cases mid-season foliar applications, are effective in correcting deficiencies.

Secondary elements calcium, sulfur, and magnesium are mostly applied to soil, but some is applied foliar as well. Use of soil tests and in-season foliar sampling can help producers to avoid deficiencies before and in-season (Table 1). Calcium is used foliar for boll retention along with a PGR like CHS Unlocked.

Micronutrients may also be critical to profitable cotton production. For example, cotton responds to trace elements like calcium, zinc and boron where these nutrients are deficient (Table 1).

ANALYSIS

- Soil Analysis (forms the base for a strong nutritional program)
- Petiole Analysis: Best done by taking 3-4 samples about 10 days apart to assess nitrate-N and potassium from 1-2 leaf stage to around early flowering.
- Leaf Analysis (flowering and cut-out): Helps monitor all critical levels throughout the growing season.

Table 1. University of Alabama and Texas A and M cotton crop nutrient removal information.

State University	Yield Bales/A	N lb/a	P	K	S	CA	Mg	Zn	B	Mn	Fe	Cu
Alabama	2	63	25	31	5	4	7	0.96	0.03	0.33	0.06	0.18
Texas A&M	4	134	61	120	20	26	23	0.12	0.5	0.2	0.14	0.3

Information was collected from University of Alabama and Texas A&M University extension publications, Alabama ANR 0449 and B 6053 Texas A&M Extension.

Products For Foliar and Soil Application In Cotton

CHS AVENTINE®

CHS Aventine is a mix of nitrogen 4%, potash 5%, sulfur 3%, boron 0.5%, manganese 1%, and zinc 4.5%. CHS Aventine is a foliar fertilizer that is recommended for many crops including food & fiber crops such as cotton. CHS Aventine can be tanked mixed with many herbicides, see website for most up to date tank mix options. Apply 1-2 qts/a to cotton at 1st true leaf and boll fill. CHS Aventine has been shown to be compatible with most pesticides and liquid fertilizers. Conducting a jar test is always recommended. CHS Aventine can be applied both soil and foliar.

SOYSHOT®

Soyshot is primarily used as a starter fertilizer but can have utility as a foliar fertilizer as it contains a 10% P and 10% K and 0.1 % Zn micronutrient along with the ortho-ortho EDDHA chelate. When applied to cotton as starter fertilizer use 1-2 gal/A and as a foliar fertilizer use 1-2 gal/A at 1st bloom and early boll set.

Releaf® OS contains potassium 15%, zinc 1%, boron 1%, manganese 1%, cobalt 0.001%, molybdenum. 0.01%. When targeting micro-nutrient deficiencies and boll retention use Releaf OS at 1 to 1.5 Qts/A as foliar application.

Releaf® OS is a Trademark of CHS & ATP

CHS LUMEN®

CHS Lumen is a starter fertilizer and has an analysis of nitrogen 5%, phosphorous 15%, & potassium 3% with micros zinc 0.8% and iron 0.1% and the ortho-ortho EDDHA chelate. In addition, CHS Lumen includes the enzyme hemicellulase which aids in the breakdown of hemicellulose to release additional nutrients into the soil for in season crop use.

LEVESOL®·ZN

Levesol Zn is an ortho-ortho EDDHA chelated solution that contains zinc 4.5% and nitrogen 4%. Levesol Zn provides zinc along with the Levesol chelate that works for 90+ days to keep micronutrients available. Use rate is 1-1.5 qt/a.

CHS UNLOCKED®

CHS Unlocked is a PGR that aids in bloom retention as pollination takes place during early bloom period.

Levesol Zn & CHS Lumen both have increased lint yields significantly in research trials in W Texas.

Active Ingredient	Brand Names	Rates	Adjuvant Recommendation	PHI	Comments
Ethephon (2-chloroethyl) phosphonic acid	**SuperBoll, Ethephon 6 Finish 6 PRO, Prep**	1.33–2.33 pt/A Max 2#/yr	CHS Hypertonic	7 days	30 day planting restriction. Apply 6 hrs. or more before rain. Multiple tank mix partners, see label.
Carfentrazone-ethyl	**Aim EC**	1–2 oz/A	CHS Hypertonic CHS Emulate Crop Oil	7 days	10 gal/A by ground, 5 gal/A by air. NIS, MSO or COC is recommended. Addition of a nitrogen source (2–4% v/v) or AMS (2–4 #/A) is recommended.
Fluthiacet-methyl + Carfentrazone-ethyl	**Display Cotton Harvest Aid**	1 oz/A Max 2 applications	Crop Oil CHS Hypertonic Cadence™	7 days	Use COC, NIS or Silicone-based surfactant. Application at 60–70% open bolls. Multiple tank mix partners are available 10 gal/A by ground, 5 gal/A by air.
Diuron plus Thidiazuron	**Cutout, Ginstar EC Cotton Defoliant**	6.4 oz/A–16 oz/A	CHS Hypertonic	5 days	10–25 gal/A by ground, 2–10 gal/A by air. Max total use per season of 16 oz/A. 12 hour rain free interval increases activity. Extended rotation restrictions are listed, consult label.
S,S,S-Tributyl phosphorotrithioate	**Folex 6 EC, Def® 6 Emulsifiable Defoliant**	1–1.5 pt/A	Crop Oil CHS Emulate CHS Hypertonic	7 days	Minimum of 10 gal/A by ground, 5 gal/A by air. Addition of COC, MSO and NIS adjuvants are allowed. 1 hour rain free interval recommended.
Paraquat Dichloride	**Helmquat 3 SL**	3.7–5.4 oz/A 5.4–10.7 oz/A 2.1–7.5 oz/A 0.7–1.3 pt/A 0.75–1.25 pt/A Max 1.3 pt/yr	CHS Hypertonic	7 days 3 days 3 days 3 days 3 days	Boll opening/early defoliation. Boll opening/mid to late defoliation. Tank mix use/spindle or stripper for boll opening/ defoliation. Late season desiccation. Suppression of regrowth.

Pest	Active Ingredient (MOA)	Brand Names	Rates	Recommended Adjuvant	PHI (days)	Comments
spider mites	Abamectin (6)	**Abemectin 0.15 EC***	4.0–16.0 oz/A	CHS Hypertonic CHS Endurium	20	Max 32 oz/A per year Min 5 gpa air or ground
stink bug, thrips, c.fleahopper, lygus	Acephate (1B)	**Orthene 90S** **Orthene 97**	2.5 oz–1.1 lb/A 2.5–16.0 oz/A		7	No more than 4 lb ai/A/crop cycle 3–10 gpa air 10–25 gpa ground
c.fleahopper, cotton aphid	Acetamiprid (4A)	**Intruder 70 Max WSP**	0.6–2.3 oz/A	CHS Emulate WCS COC	28	Max 9.2 oz/A per season Min 2 gpa air Min 5 gpa ground
lygus, bollworm, c.fleahopper, pink bollworm, stinkbug, plant bug	Alpha-Cypermethrin (3)	**Fastec EC**	1.3–3.8 oz/A	CHS Endurium	14	Max 11.4 oz/A per season
stinkbug, lygus, bollworm	Bifenthrin (3)	**Brigade 2 EC***	1.3–6.4 oz/A	CHS Endurium	14	Min 1 gpa air Min 5 gpa ground
pink bollworm, lygus, bollworm, whitefly (supps)	Beta-cyfluthrin (3)	**Baythroid XL***	0.8–3.2 oz/A	CHS Endurium	0	Max 19.2 oz/A per season Min 2 gpa air Min 10 gpa ground
armyworm species bollworm/budworm cabbage looper	Chlorantraniliprole (28)	**Prevathon®**	14–27 oz/A	CHS Endurium	21	Max 4 applications per season Max 60 oz/A per season
lygus, bollworm, c.fleahopper, pink bollworm, stinkbug, plant bug	Alpha-Cypermethrin (3)	**Fastec EC***	1.3–3.8 oz/A	CHS Endurium	14	Max 11.4 oz/A per season Max 3.8 oz/A per appplication
thrips, c.fleahopper, lygus, cotton aphid, plant bugs	Dicrotophos (1B)	**Bidrin 8***	1.6–3.2 oz/A (early season) 4.0–8.0 oz/A (late season)	CHS Endurium	30	Only ONE Early Season application Max 16.0 oz/A during late season
cotton aphid, bollworm, pink bollworm, plant bug	Dicrotophos + bifenthrin	**Bidrin XP II***	8.0–12.8 oz/A	CHS Endurium	30	Use after 1st bloom crop stage Min 2 gpa air Min 5 gpa ground
aphids, mites, thrips, lygus c.fleahopper	Dimethoate (1B)	**Dimethoate 4E**	0.25–0.5 pt/A	Use water acidifier if water is > 7.0 pH	14	Max 0.5pt/A per application Max 1.0 qt/A per season
beet armyworm, tobacco budworm, cotton bollworm	Emamectin benzoate (6)	**Denim 0.16EC***	6.0–12.0 oz/A	CHS Endurium	21	Max 48 oz/A per season Min 2 gpa air Min 5 gpa ground
pink bollworm, lygus, bollworm, thrips	Esfenvalerate (3)	**Asana XL*** **S-FenvaloStar**	3.9–9.6 oz/A	CHS Endurium	21	Max 0.5 lb ai/A per season Min 2 gpa air Min 4 gpa ground
c.fleahopper, lygus, cotton aphid	Flonicamid (9C)	**Carbine 50 WG**	1.4–2.8 oz/A	CHS Endurium	30	Max 8.4 oz/A per season Min 3 gpa air Min 5 gpa ground
c.fleahopper, plant bugs, cotton aphid	Imidacloprid (4A)	**Provado 1.6 F**	3.75 oz/A	Clarion™ MSO Organosilicone	14	Max 0.5 lb ai/A per season Min 5 gpa application

Pest	Active Ingredient (MOA)	Brand Names	Rates	Recommended Adjuvant	PHI (days)	Comments
cabbage looper, c.fleahopper, beet armyworm, bollworm, tobacco budworm	Indoxacarb (22)	**Steward 1.25 EC**	6.7–11.3 oz/A	CHS Endurium	14	Max 45 oz/A per season Min 3 gpa air
pink bollworm, stink bug, lygus, bollworm	Lambda- cyhalothrin (3)	**Warrior II** **LambdaStar** **Silencer**	0.96–2.56 oz/A	CHS Hypertonic Crop Oil CHS Emulate	21	Max 0.2 lb ai/A per season Min 2 gpa air Min 10 gpa ground
pink bollworm, stink bug, c.fleahopper, lygus, bollworm, cotton aphid	Lambda-cyhalothrin + Thiamethoxam (3 + 4A)	**Endigo ZC***	4.5–6.0 oz/A	Crop Oil CHS Hypertonic CHS Emulate CHS Endurium	21	Max 13.5 oz/A per season Min 2 gpa air Min 10 gpa ground
c.fleahopper, beet armyworm, lygus, bollworm, tobacco bollworm, cotton aphid	Methomyl (1A)	**Lannate***	0.75–2.25 pt/A	CHS Endurium	15	Max 6.0 pt/A per season Min 2 gpa air
cabbage looper, beet armyworm	Methoxyfenozide (18)	**Intrepid 2F**	4–10 oz/A	CHS Endurium	14	Max 64 oz/A per season Ingestion by insect larvae to be fully effective. Min 3 gpa air Min 5 gpa ground
stink bug, c.fleahopper, lygus	Oxamyl (1A)	**Vydate 3.77 C-LV***	4.24–17 oz/A	CHS Endurium	14	Max 68 oz/A per season (Texas) Application solution should be slightly acidic (< 7 pH)
spider mites	Propargite (14)	**Comite*/ Comite II**	16–32 oz/A		50	Max 64 oz/A per season Coverage is key, see label for application instructions. Application solution should be slightly acidic (< 7 pH)
spider mites	Spiromesifen (23)	**Oberon 4 SC**	3–8 oz/A (Early Season) 4–8 oz/A (Late Season)	CHS Endurium	30	Max 16 oz/A per season Min 5 gpa air Min 10 gpa ground
cabbage looper, beet armyworm, bollworm, tobacco bollworm	Spinosad (5)	**Tracer 4 SC**	1.4–2.9 oz/A	Crop Oil CHS Emulate	28	Max 0.45 lb ai/A per season pH 6.0–9.0 Min 5 gpa air Min 5–10 ground
armyworm, cabbage looper	Tebufenozide (18)	**Confirm 2F**	8–16 oz/A	CHS Endurium	14	Max 0.25 lb AI/A per season Min 2 gpa air Min 5 v ground
c.fleahopper, cotton aphid, thrips, brown/ green/ southern stink bug	Thiamethoxam (4A)	**Centric 40 WG**	1.25–2.5 oz/A	CHS Endurium	21	Max 0.125 lb ai/A per season Min 3 gpa air Min 3–10 gpa ground
pink bollworm, stink bug, lygus, bollworm, armyworm, thrips, cotton aphid	Zeta-cypermethrin (3)	**Mustang 1.5 E** **Mustang Maxx 0.8E**	1.4–4.3 oz/A (1.5E) 1.28–4.0 oz/A (Maxx)	CHS Endurium	14	Max 0.3 lb ai/A per season Min 1 gpa air Min 5 gpa ground
pink bollworm, stink bug, lygus, bollworm	Zeta-cypermethrin + bifenthrin (3)	**Hero 1.24 EC**	3.6–10.3 oz/A	CHS Endurium	14	Max 0.45 oz ai/A per season Min 1 gpa air Min 5 gpa ground

Cotton Harvest Products to Prepare the Plant for Mechanical Harvest

The following factors should be considered as the season winds down and the plant begins to mature. Good yielding cotton will begin to drop leaves at about the time 60% of the bolls are open. Generally, bolls are located 4 to 5 nodes below the terminal depending on end of season stresses and weather. Bolls are mature when they are difficult to cut and a cross section of the seed reveals folded cotyledons, an absence of jelly-like substance in seed, and darkened seed coats.

What are the main benefits from defoliation and harvest aid?

1. Removing leaves and lint staining trash to ensure better lint grades.
2. Preventing boll rot, managing maturity, allowing earlier harvest.
3. Faster and more efficient picker operation and better storage life of lint prior to ginning.
4. Increased air movement in canopy which enables quicker drying, allowing earlier harvest days.

Table 1

Harvest Aid Trade Name	Harvest Aid Common Name	Labeled Broadcast Rate/A	Max Use/ Season	Adjuvants	Rain Free Period (Hours)	Pre Harvest Interval (Days)	Est. Min. Temp (°F)	Mature Leaves	Juvenile Leaves	Re-growth Prevention	Boll Opening
FreeFall SC	Thidiazuron	1.6-6.4 oz	9.6 oz	CHS Level Best Pro	24	5	65	Excellent	Excellent	Excellent	None
Ginstar, Cut Out, Adios	Diruron Thidiazuron	6.4-16 oz	16 oz	CHS Level Best Pro	12	5	60	Excellent	Excellent	Excellent	None
Folex 6 Def 6	Sss T Phosph	16-24 oz	24 oz	CHS Level Best Pro	1	7	60	Excellent	Fair	Poor	None
Aim	Carfentazone	0.5-1.6 oz	3.2 oz	CHS Level Best Pro	8	7	55	Excellent	Excellent	Poor	None
Display	Fluthiacet Carfentrazone	1 oz	2 oz	CHS Level Best Pro	8	7	55	Excellent	Excellent	Poor	None
ET ETX	Pyraflufen	1.5-2.7 oz	5.5 oz	CHS Level Best Pro	1	7	55	Excellent	Excellent	Poor	None
Sharpen	Salflufenacil	2 oz	2 oz	CHS Level Best Pro	1	5	55	Excellent	Excellent	Poor	None
Ethephone 6, Prep, Super Bowl	Ethephon	21-42 oz	42 oz	CHS Level Best Pro	6	7	60	Fair	Poor	Poor	Excellent
Finish 6	Ethephon, Cyclanilide	21-42 oz	42 oz	CHS Level Best Pro	6	7	60	Excellent	Poor	Fair	Excellent
Glyphos Rdup	Glyphosate	11-44 oz	44 oz	CHS Level Best Pro	4	7	55	Fair	Fair	Excellent	None
Desiccants											
Helmquat 3L	Paraquat	4-32 oz	32 oz	CHS Level Best Pro	1	3	55	Fair	Excellent	Poor	Fair
Defol 5	Sodium Chlorate	4.5 Lbs AI	9 lb	CHS Level Best Pro	24	7	55	Fair	Fair	Poor	None

See 2016 Mid-South Cotton Defoliation Guide W376 (University of Tennessee, Mississippi State University, University of Arkansas). Numerous options and combinations can be put together to meet the specific needs of each field and growing conditions. Conditions and needs will vary across all regions. Refer to Table 1 and your CHS agronomy technical representative for more information.

Harvest Aid Example: Late season, plants beginning to cut-out, 65-70% bolls open and mature.

- 1st spray, Free Fall 4-5 oz/A + 1 qt/A Super Boll + Tapran 4-6 oz/a or CHS Level Best Pro 4-5 oz/A & 12-15 gpa.
- 2nd Paraquat 2 pts/A + Aim 1 oz/A + CHS Level Best Pro or Tapran at 4-6 oz/A & 12-15 gpa.
- 3rd When using Sharpen or Aim, Tapran with MSO is required. 1-1.5 pts/A 12-15 gpa.

Fungicides

Product	PHI	REI	Key Diseases or Pest Controlled	FRAC	Comments
Headline (Pyraclostrobin)	30 days	24 hrs	**6-12 fl oz/A** at or near bloom for Target Spot (*Corynespora cassiicola*). Also use in-furrow at **6 oz/A** for seedling diseases caused by *Pythium* and *Rhizoctonia* spp.	11	Use as preventative when weather conditions favor disease development.
Quadris (Azoxystrobin)	45 days	24 hrs	Use **6-9 fl oz/A** at or near bloom for Target Spot. Also use in-furrow at **6 oz/A** for seedling diseases caused by *Pythium* and *Rhizoctonia* spp.	11	Use as preventative when weather conditions favor disease development.
Topguard (Azoxystrobin + Flutriafol)	45 days	24 hrs	**5-7 fl oz/A** at or near bloom for Target spot.	11 + 3	Use as preventative when weather conditions favor disease development.
Priaxor (Pyraclostrobin + Fluxapyroxad)	30 days	24 hrs	**4-8 fl oz/A** at or near bloom for Target spot. Also use in-furrow at **6 oz/A** for seedling diseases caused by *Pythium* and *Rhizoctonia* spp.	11 + 7	Use as preventative when weather conditions favor disease development.
Oxidate 2.0 H2O2	0 days	Until dry	**0.5-1.5 gal/A** at 3-10-day intervals as disease pressure determines. Works well on bacterial and fungal diseases.	UK	Very toxic to bees. OMRI Approved
Reason (Fenamidone)	14 days	24 hrs	Use in-furrow at **3-4 fl oz/A** for seedling diseases caused by *Pythium* and *Rhizoctonia* spp.	11	Use to promote a complete seedling stand.
Uniform (Azoxystrobin + Mefenoxam)	14 days	24 hrs	Use in-furrow at **3-4 fl oz/A** for seedling diseases caused by *Pythium* and *Rhizoctonia* spp.	11 + 4	Use to promote a complete seedling stand. Provides 2 modes of action.

Nematicides

Product	PHI	REI	Key Diseases or Pest Controlled	FRAC	Comments
AgLogic 15G * (Aldicarb)	90 days	48 hrs	Use **3.5-7 lb/A** for root knot and reniform nematodes. Apply granules into the seed furrow and cover seed and granules with at least 1" soil.	1A	Very toxic to humans.
Velum Total (Fluopyram + Imidachloprid)	30 days	12 hrs	Use **14-18 fl oz/A** for root knot and reniform nematodes. Apply as an in-furrow spray in **5 to 6 gal/A** water.	4A + 7	Only in-furrow or chemigation use are labeled.
Telone II 9.85 L* (1,3 chloropropene)	7-10 days **See label	5 days	Use **3-6 gal/A** for root knot and reniform nematodes. Inject 12" below planting depth, seal ground, and wait 7 to 14 days before planting.	Gas	Use for severe nematode pressure. Very toxic to humans.
Vydate C LV * (Oxamyl)	14 days	48 hrs	For lance, reniform, and root knot nematode use **17 fl oz/A** at 2 to 5 leaf stage and again 14 days later if needed. Apply as foliar or drip irrigation method only.	1A	Very toxic to humans.
Trunemco	Use PPE	Use PPE	For use as a seed treatment	UK	Corn soybeans and cotton only.

* Restricted Use Pesticide

Utilizing CHS Endurium at 1 qt/100 gal water for foliar fungicides can aid in coverage and control.

All trademarks and registered trademarks are the property of their respective owners.

Irrigated cotton responds well to careful management, resulting in consistently higher yields. As the efficiency of the irrigation system increases so does the plants opportunity for yield. Cotton has shown outstanding response to Subsurface Drip Irrigation (SDI) which give growers control of inputs, such as liquid fertilizers and many other crop protection products, resulting in higher crop quality and returns. Yields with SDI have increased as compared to other forms of irrigation setting higher yield levels on farms with high management strategies.

Fertigation in SDI Systems

Plant tissue testing is the most effective method of determining the nutrient needs of cotton in season. Not all fertilizer formulations are suitable for injecting through your SDI system. Fertilizers must be soluble and have a low propensity for reacting with water and forming precipitates. Local water quality issues can be an issue when mixing and applying through drip systems, so be aware of water hardness and other water quality factors before application. A fertilizer compatibility test should always be conducted prior to mixing and fertilizers should always be injected up stream of the SDI filter system. Check with your local drip irrigation dealer/technician for specific questions about fertilizer blends.

Benefits of Fertigation

- Application of nutrients (nitrogen, phosphorus, potassium, zinc, manganese, boron, and iron) when needed
- Less equipment across the field
- More uniform delivery to roots
- Application of systemic chemicals for early pest control
- Mid-season P applications injected through drip system
- Potassium injected at later stages according to petiole tests
- Nitrogen can be managed throughout the growing season

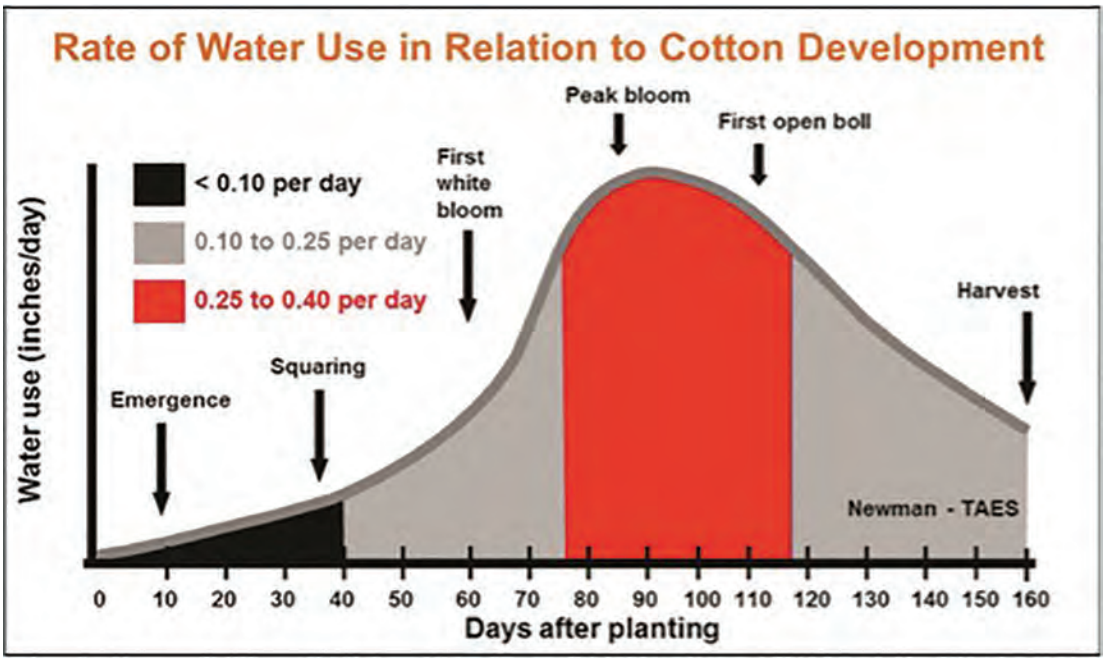


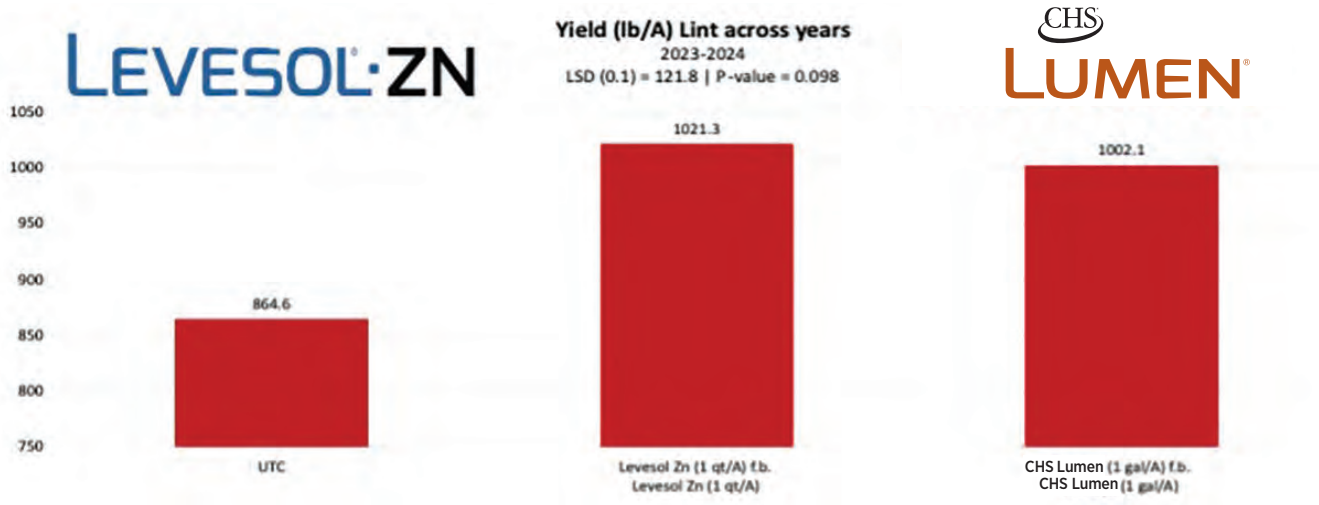
Figure 1. The seasonal water demand curve of cotton.

Table 1: Product Options for Subsurface Drop Irrigation (SDI) Systems

Product	Form	Use in Drip Tape	Comments
32% N & 28-0-0-5S	Liquid	Yes	Most all types of Liquid Nitrogen
XLR-Rate 7-23-5	Liquid	Yes	Most all ortho blends
KCL	Pre-dissolved in water	NO	Could crystalize
Calcium Nitrate (16-0-0)	Water Soluble	Yes	Fully Dissolve
Potassium Nitrate (13-0-46)	Water Soluble	Yes	Fully Dissolve
MAP (12-61-0)	Water Soluble	Yes	Fully Dissolve
Potassium sulphate (0-0-50)	Water Soluble	Yes	Fully Dissolve
Rapid Up 10-52-10 WSG	Water Soluble	Yes	Fully Dissolve
Rapid Up 20-20-20 WSG	Water Soluble	Yes	Fully Dissolve
Levesol Zn	Liquid	Yes	4%N 4.5%Zn EDDHA Chelate
10-34-0 (Poly Phosphorus)	Liquid	NO	Reacts with Calcium & others
Potassium-19	Liquid	Yes	Add 1 quart of water/A
Anhydrous Ammonia	Any form	NO	Never
Sulfate Sulfur (ATS & AMS)	Liquid	Yes	Works fine
Elemental Sulfur	Liquid Slurry	NO	Can clog emitters
CHS Aventine	Liquid	Yes	EDTA chelated 4%N 5%K 3%S 0.5%B 1%Mn 4.5%Zn
Levesol	Liquid	Yes	2%N EDDHA Chelate
Soyshot	Liquid	Yes	0-10-10-0.1%Zn EDDHA Chelate
CHS Lumen	Liquid	Yes	5-15-3-0.8%Zn EDTA & EDDHA Chelate + Hemicellulase Enzyme
Soygreen	Liquid	NO	Iron may cause solids to form
Others as testing confirms			

Table data was collected by CHS Technical Specialists and Texas A&M researchers Lubbock, Tx.

Two years of research data - Nutrient Drip-Irrigation Research Cotton W. Texas



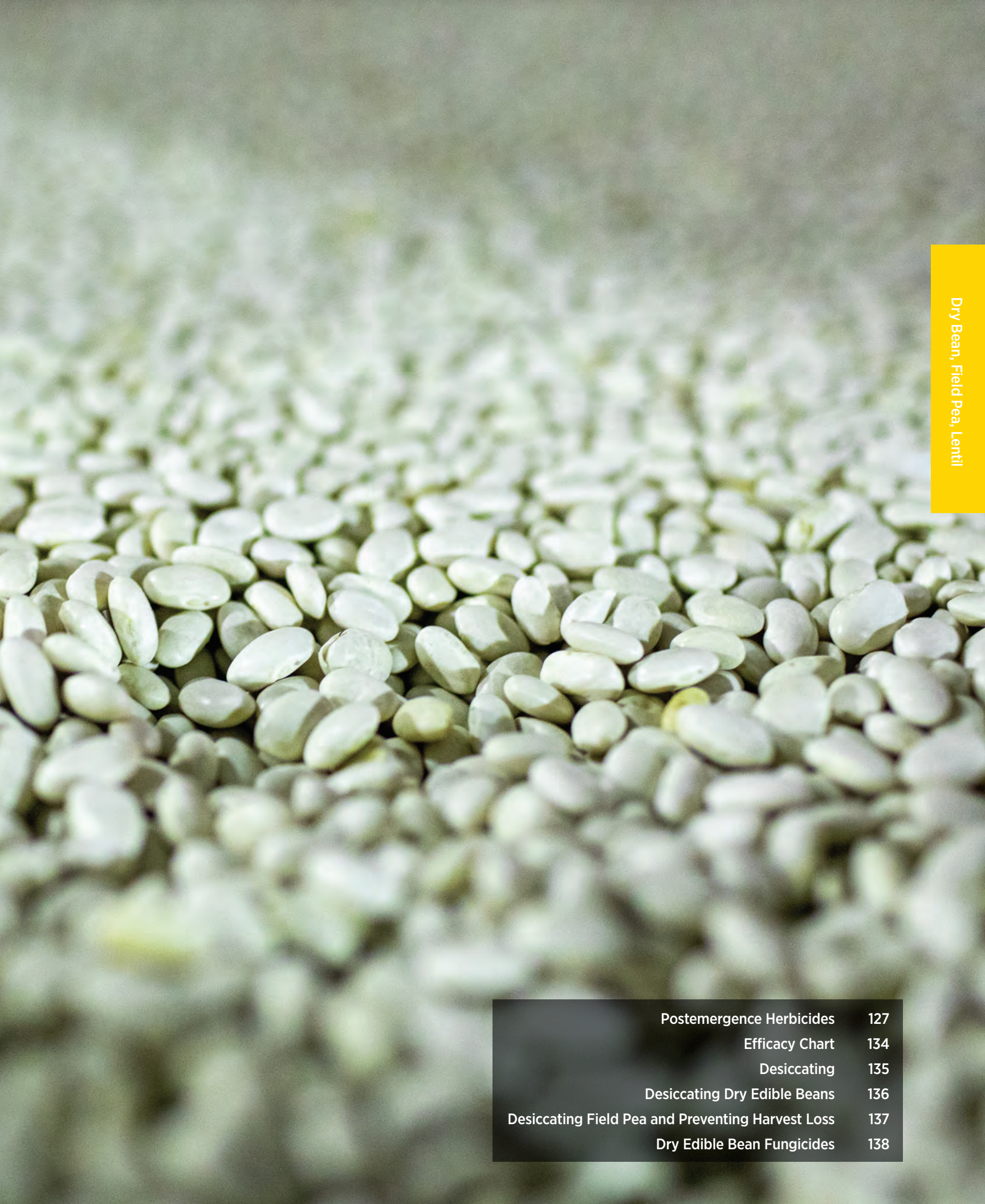
Insecticide	PHI	REI	Use Rate	Key Insects Controlled	IRAC	Comments
Baythroid XL* (Beta Cyfluthrin)	0 days	12 hrs	1.6-2.6 fl oz/A	bollworm, budworm, cutworms, green cloverworm, leafhopper, other caterpillar, plant bug, loopers, lygus bug, grasshoppers, stink bugs	3A	Do not depend solely on pyrethroids throughout season.
Besiege* (Chlorantraniliprol, Lambda-cyhalothrin)	21 days	24 hrs	6.5-12.5 fl oz/A	budworm, bollworm leafhopper, cutworm sp., looper sp., armyworm, fall armyworm, pea aphid, grasshoppers, beet armyworm, spider mites	3A 28	Use higher rates for bollworm and budworm.
Blackhawk (Spinosad)	28 days	24 hrs	2.3-3.2 fl oz/A	budworm, bollworm leafhopper, cutworm species, looper species armyworm, fall armyworm, leafminer beet armyworm	3A 1B	Do not use more than 20 oz per year.
Belt (Flubendiamide)	28 days	12 hrs	2-3 fl oz/A	budworm, bollworm leafhopper, cutworm species, looper species armyworm, fall armyworm, beet armyworm	3A	Do not apply more than 3 times per season.
Intrepid Edge (Methoxyfenozide+ Spinetoram)	28 days	48 hrs	0.5–1.0 pt	aphids, grasshopper, leafhoppers, lygus bugs, plant bugs, reduction of alfalfa weevil larvae	1B	Highly toxic to bees.
Orthene 97 (Acephate Dimethoate)	21 and 14 days	48 hrs	1.25 lb/A Orthene or 8-16 oz/A Dimethoate	thrips, grasshopper, leafhopper, lygus bugs, stinkbugs	1B	Use with other registered insecticides for control of pests not listed under key insects controlled section.
Ammo (Cypermethrin)	14 days	24 hrs	3-5 fl oz/A	bollworm, budworm, cutworms, green cloverworm, leafhopper, other caterpillar, plant bug, loopers, lygus bug, grasshoppers, stink bugs,		Do not depend solely on pyrethroids throughout season.
Lannate LV* (Methomyl Larvin Thiodicarb)	15 and 28 days	48 hrs	1.25-2.25 pt/A	aphid, lygus bug, leafminer, loopers, armyworm sp. budworms	1A	Do not apply to dormant or semidormant alfalfa when low daily temp is under 50° F.
Centric (Thiamethoxam) OR **Provado** (Imidachloprid)	21 and 14 days	12 hrs	2.5 fl oz/A	aphids, lygus bug, potato leafhopper, spider mite, spittle bug	1B	Use early before aphid populations get too high.
Mustang Max EC* (Zeta cypermethrin)	14 days	12 hrs	3-4 fl oz/A	bollworm, budworm, cutworms, green cloverworm, leafhopper, other caterpillar, plant bug, loopers, lygus bug, grasshoppers, stink bugs	3A	Do not depend solely on pyrethroids throughout season.
Asana* (Esfenvalerate)	21 days	24 hrs	6-9.6 fl oz/A	bollworm, budworm, cutworms, green cloverworm, leafhopper, other caterpillar, plant bug, loopers, lygus bug, grasshoppers, stink bugs	3A	Do not depend solely on pyrethroids throughout season.
Brigade* (Bifenthrin)	14 days	24 hrs	2.6-6.4 fl oz/A	bollworm, budworm, cutworms, green cloverworm, leafhopper, other caterpillar, plant bug, loopers, lygus bug, grasshoppers, stink bugs	3A	Do not depend solely on pyrethroids throughout season and consider another class in tank mix for bollworms.
Vantacor (Chlorantraniliprole)	0 days	4 hrs	8-20 fl oz/A 1.2-2.5 fl oz/A	budworm, bollworm leafhopper, cutworm species, looper species armyworm, fall armyworm, leafminer, grasshoppers, beet armyworm	28	Rotate to a different class of chemistry after 2 applications.
DiPel DF OMRI Apr (Bt formulation, Bacillus thuringiensis)	0 days	4 hrs	1.5-2 lb/A	budworm, bollworm cutworm species, looper species armyworm, fall armyworm, beet armyworm		More effective when mixed with another class of chemistry.
Denim (Emamectin benzoate)	7 days	24 hrs	2.3-3.2 fl oz/A	budworm, bollworm leafhopper, cutworm species, looper species armyworm, fall armyworm, leafminer beet armyworm, spider mite suppression		Use on small neonate larvae.
Steward EC (Indoxacarb)	7 days	12 hrs	6.7-11.3 fl oz/A	cabbage loopers (6.7-9.2 fl oz), beet armyworm (9.2-11.3 fl oz), tarnish plant bug, lygus bugs (9.2-11.3 fl oz), cotton bollworm, budworm and transgenic Bt cotton (9.2-11.3 fl oz/A)	22	Do not apply more than 45 fl oz per year.
Karate Z, Lambda Cy EC*, (Lambda Cyhalothrin)	21 days	24 hrs	1-1.28 fl oz/A Karate Z or 2-3 oz/A Lambda Cy	bollworm, budworm, cutworms, green cloverworm, leafhoppers, loopers, webworm species, weevil, armyworm, bean leaf beetle, aphid sp., grasshoppers, plant bugs, thrips, beet armyworm, leafminer, stink bug	3A	Do not depend solely on pyrethroids throughout season and consider another class in tank mix for bollworms.
Zeal (Etoxazole) **Comite** (Proargite)	28 days 50 days	24 hrs 24 hrs	Check label for rates and conditions	Spider mites only. See each miticide label for surfactant use. Adjuvant use only CHS Aggrestrol 3-4 oz/A. Read and follow Comite II label.		Do not apply Comite until cotton is 12 inches tall. High populations may require 2 applications.

The addition of CHS Aggrestrol @ 0.5% v/v or CHS Endurium @ 0.25% v/v may improve control by increasing coverage in dense canopies and preventing evaporation of small spray droplets in hot conditions.

* Restricted Use Pesticide

IRAC MoA Classification: 3A=Pyrethroid, 1B=Organophosphate, 1A=Carbamate, 28=Diamides, 22=Oxadiazines

Applications of insecticides in hot conditions have been improved by the addition of adjuvants.



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Assure II (quizalofop P-ethyl)

EPA Reg. #:	**352-541**
Rate/A:	5–12 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
M.O.A.:	ACC-ase Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Danger

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal.
**CHS Emulate @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Labeled Crops

- Dry bean, Field pea, Lentil

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (2–4 lb/A)**

Target Weeds	4 fl oz	6 fl oz	8 fl oz
– barnyardgrass	-	-	2–6″
– field sandbur	-	-	2–6″
– crabgrass	-	-	2–6″
– giant foxtail	-	-	2–8″
– green foxtail	-	-	2–4″
– volunteer corn	6–24″	24″+	-
– wild proso millet	-	-	2–6″
– yellow foxtail	-	-	2–4″
– wild oat	-	-	2–6″
– woolly cupgrass		2–4″ @ 9 oz	
– quackgrass		6–10″ @ 10 oz	

Timing/Comments

Dry bean and field pea: apply up to 30 day PHI.
Lentil: apply up to 60 day PHI.

Basagran (bentazon)

EPA Reg. #:	**7969-45-66330**
Rate/A:	1–2 pt
Spray Volume:	10–20 gpa
Rainfast:	1 hour
M.O.A.:	Photosystem II Inhibitor
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Dry bean, Field pea

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Endurium (1 qt/100 gal)**

or

- **CHS Axon (1 gal/100 gal)**
- Use AMS for velvetleaf control.
- May use Crop Oil in dry bean.

Target Weeds	1 pt	1.5 pt	2 pt
– cocklebur	4″	6″	10″
– lambsquarters	1″	1.5″	2″
– common ragweed	-	-	3″
– giant ragweed	-	-	6″
– annual smartweed	4″	6″	10″
– velvetleaf	2″	2″	5″
– venice mallow	2″	2″	4″
– wild buckwheat	-	3″	5″
– wild mustard	2″	4″	8″
– wild sunflower	3	5″	8″
– woolly cupgrass		2–4″ @ 9 oz	
– quackgrass		6–10″ @ 10 oz	

Timing/Comments

Dry bean: apply after first trifoliate.
Field pea: apply at 3 leaf pairs or more.
Split applications needed for C. Thistle.

Beyond (imazamox)

EPA Reg. #:	**241-441**
Rate/A:	4–6 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
M.O.A.:	ALS Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Clearfield lentil

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Aggrestrol** (0.75–1 pt/A)**
  plus
  AMS* (12–15 lb/100 gal)**

or

- **CHS Penetrec* (1 pt/A)**
  plus
  AMS* (12–15 lb/100 gal)**

Target Weeds

4″ or less

– black nightshade
– common cocklebur
– foxtail
– giant ragweed
– lambsquarters
– pigweed
– sunflower
– volunteer corn
– venice mallow

Timing/Comments

Apply to 2 leaf-before flower bud formation.

*Crop Oil @ 2 pt/100 gal or CHS Endurium @ 1 qt/100 gal.
**CHS Emulate @ 2 pt/100 gal or CHS Endurium @ 1 qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Beyond Xtra (imazamox)

EPA Reg. #:	**241-441**
Rate/A:	4–6 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
M.O.A.:	ALS Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Clearfield lentil, Dry bean, Field pea

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Aggrestrol** (0.75–1 pt/A)**
  plus
- **AMS*** (12–15 lb/100 gal)**

or

- **CHS Penetrec* (1 pt/A)**
  plus
  AMS* (12–15 lb/100 gal**

Target Weeds

4″ or less

– black nightshade
– common cocklebur
– foxtail
– giant ragweed
– lambsquarters
– pigweed
– sunflower
– volunteer corn
– venice mallow

Timing/Comments

Apply to 2 leaf-before flower bud formation.

*Crop Oil @ 2 pt/100 gal or CHS Endurium @ 1 qt/100 gal.
**CHS Emulate @ 2 pt/100 gal or CHS Endurium @ 1 qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Clethodim Products

Brand Name	EPA Reg. #
Arrow	**66222-60**
Select Max	**59639-132**
Shadow 3EC	**66330-414**
Volunteer	**59639-3-55467**
Rate/A:	6–8 fl oz 9–16 fl oz 4–5.33 fl oz 6–16 fl oz
Spray Volume:	5–40 gpa
Rainfast:	1 hour
M.O.A.:	ACC-ase Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Dry bean, Field pea, Lentil

Adjuvant(s)/Comments

- **CHS Penetrec* (1 pt/A) plus AMS*** (2.5–4 lb/A)**

or

- **CHS Aggrestrol** (1 pt/A) plus AMS*** (2.5–4 lb/A)**

Target Weeds	Clethodim 2E, Arrow, Volunteer 6 fl oz	Clethodim 2E, Arrow, Volunteer 8 fl oz	Shadow 3EC 5.33 fl oz
– barnyardgrass	6″	8″	8″
– crabgrass	2″	6″	6″
– giant foxtail	6″	12″	12″
– green foxtail	6″	8″	8″
– quackgrass	-	4–12″	4–12″
2nd application may be needed			
– volunteer cereals	6″	8″	8″
– volunteer corn	12″	18″	18″
– wild proso millet	8″	10″	10″
– woolly cupgrass	6″	8″	8″
– yellow foxtail	6″	8″	8″
– cheat	6″	6″	6″
– downy brome	6″	6″	6″

Timing/Comments

Apply up to 30 day PHI.

*Crop Oil @ 1.5–2 pt/A or CHS Endurium @ 1 qt/100 gal.
**CHS Emulate @ 1.5–2 pt/A or CHS Endurium @ 1 qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Glyphosate

Brand Name:	EPA Reg. #:	# A.E.	=0.75 AE
Buccaneer Plus	**55467-9**	3.00	32.0
Gly Star Original	**42750-60**	3.00	32.0
Gly Star Plus	**42750-61**	3.00	32.0
Durango DMA	**62719-556**	4.00	24.0
Buccaneer 5 Extra	**55467-15**	4.00	24.0
Gly Star 5 Extra	**42750-59**	4.00	24.0
Gly Star K-Plus	**42750-122**	4.50	21.3
Buccaneer K	**42750-122-55467**	4.50	21.3
Roundup RT 3	**524-544**	4.50	21.3
Roundup PowerMax 3	**524-659**	4.80	19.7
Rate/A:	Variable		
Spray Volume:	5–20 gpa		
Rainfast:	1–6 hours		
M.O.A.:	EPSP Inhibitor		
P.P.E.:	l.s. shirt, l. pants, shoes, socks		
R.E.I.:	12 hours		
W. Notification:	Oral		
S. Word:	Caution		

Surfactant/Comments

- **CHS Level Best Pro (1 qt/100) plus AMS (8.5-17 lb/100)**

or

- **CHS Fixate/CHS Wheelhouse Pro (2-3 qt/100)**

or

- **Encloax (2.5-5 gal/100)**

or

- **CHS Hypertonic (1 qt/100) plus AMS (8.5-17 lb/100)**

Metribuzin 75 DF (metribuzin)

EPA Reg. #: **66222-106**
Rate/A: 0.25–0.5 lb
Spray Volume: 2–10 gpa (air)
min 10 gpa (ground)
Rainfast: 2 hours
M.O.A.: Photosystem II Inhibitor
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.: 12 hours
W. Notification: Oral
S. Word: Caution

Labeled Crops

- Lentil, Field pea

Target Weeds

Suppression of lambsquarters, henbit, chickweed, and mustard.

Control of kochia, Russian thistle, venice mallow.

Permit (halosulfuron)

EPA Reg. #: **81880-2-10163**
Rate/A: 0.5–0.67 oz
Spray Volume: 3–15 gpa (air)
min 10 gpa (ground)
Rainfast: 4 hours
M.O.A.: ALS Inhibitor
P.P.E.: l.s. shirt, l. pants, shoes, socks
R.E.I.: 12 hours
W. Notification: Oral
S. Word: Caution

Labeled Crops

- Dry bean

Adjuvant(s)/Comments

- **CHS Hypertonic (1–2 qt/100 gal) plus AMS (2–4 lb/A)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS (2–4 lb/A)**

Target Weeds

6″ or less

– cocklebur
– wild mustard
– common ragweed
– sunflower
– venice mallow
– velvetleaf
– giant ragweed

Timing/Comments

Apply 1st trifoliate and prior to flowering.

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal.

Poast (sethoxydim)

EPA Reg. #: **7969-58-51036**
Rate/A: 0.5–1.5 pt
Spray Volume: min 5 gpa (air)
min 10 gpa (ground)
Rainfast: 1 hour
M.O.A.: ACC-ase Inhibitor
P.P.E.: coveralls, l.s. shirt, l. pants, c.r. gloves, c.r. footwear, headgear, eyewear, shoes, socks, apron
R.E.I.: 12 hours
W. Notification: Oral
S. Word: Warning

Labeled Crops

- Dry bean, Field pea, Lentil

Adjuvant(s)/Comments

- **CHS Aggrestrol** (0.75–1 pt/A) plus AMS*** (2.5 lb/A)**

or

- **CHS Penetrec* (1 pt/A) plus AMS*** (2.5 lb/A)**
- Use the surfactant required by the broadleaf herbicide.

Target Weeds	0.5 pt	1 pt	1.5 pt
– barnyardgrass	-	8″	-
– crabgrass	-	6″	-
– field sandbur	-	-	3″
– foxtail	-	8″	-
– volunteer cereals	-	-	4″
– volunteer corn	-	20″	-
– wild proso millet	10″	-	-
– wild oat	-	4″	-
– woolly cupgrass	-	8″	-

*Crop Oil @ 1 qt/A or CHS Endurium @ 1 qt/100 gal.
**CHS Emulate @ 1 qt/A or CHS Endurium @ 1 qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Dry bean and field pea: apply up to 30 day PHI.
Lentil: apply up to 50 day PHI.

Pursuit 2EC (imazethapyr)

EPA Reg. #:	**241-310**
Rate/A:	2 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
M.O.A.:	ALS Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Labeled Crops

- Dry bean, Field pea, Lentil

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS*** (12–15 lb/100 gal)**

or

- **CHS Endurium (1 qt/100 gal)**

or

- **CHS Axon (2 qt/100 gal)**

or

- Risk of injury. See label.

Target Weeds

2–6″ weeds

- foxtail
- common cocklebur
- kochia
- wild mustard
- black nightshade
- pigweed

Timing/Comments

Dry bean: Apply to 1st trifoliate and prior to flowering.

Field pea: Apply to 3″ and prior to flowering.

Lentil: Refer to label for geographies prohibiting foliar application of Pursuit 2EC.

Raptor (imazamox)

EPA Reg. #:	**241-379**
Rate/A:	4 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
M.O.A.:	ALS Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Labeled Crops

- Dry bean, Field pea

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS*** (12–15 lb/100 gal)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Endurium (1 qt/100 gal)**
- Risk of injury. See label.

Target Weeds

- black nightshade
- common cocklebur
- foxtail
- giant ragweed
- kochia
- lambsquarters
- pigweed
- sunflower
- volunteer corn
- venice mallow
- velvetleaf

Timing/Comments

Dry bean: apply to 1st trifoliate and prior to flowering.

Field pea: apply to 3″ and prior to flowering.

Add 6 oz of Basagran to reduce injury.

Reflex (fomesafen)

EPA Reg. #:	**100-993**
Rate/A:	0.75–1.5 pt
Spray Volume:	min 15 gpa
Rainfast:	1 hour
M.O.A.:	PPO Inhibitor
P.P.E.:	coveralls over l.s. shirt, l. pants, c.r. gloves, socks, c.r. footwear, apron
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning

*Crop Oil @ 1 qt/A or CHS Endurium @ 1 qt/100 gal.

**CHS Emulate @ 1 qt/A or CHS Endurium @ 1 qt/100 gal.

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Labeled Crops

- Dry bean

Adjuvant(s)/Comments

- **CHS Penetrec* (1 pt/A) plus AMS*** (2.5 lb/A)**

or

- **CHS Aggrestrol** (0.75–1 pt/A) plus AMS*** (2.5 lb/A)**

Target Weeds	Leaf Stage	
– black nightshade	2″	4″
– common ragweed	-	4″
– common waterhemp	2″	2″
– cocklebur	2″	4″
– giant ragweed	2″	4″
– lambsquarters	-	2″
– morning glory	-	3″
– pigweed	2″	4″
– smartweed	-	4″
– venice mallow	4″	6″
– wild mustard	4″	6″

Timing/Comments

Apply to 1st trifoliate and prior to flowering.

*See label for geographical and rate restrictions.

Rezult (bentazon + sethoxydim)

EPA Reg. #:	**7969-194**
Rate/A:	3.2 pt
Spray Volume:	min 5 gpa (air) min 10 gpa (ground)
Rainfast:	1 hour
M.O.A.:	Photosystem II Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Dry bean, Field pea

Adjuvant(s)/Comments

- **CHS Penetrec* (0.5 pt/A) plus AMS*** (1 lb/A)**

Target Weeds

– cocklebur	10″
– lambsquarters	2″
– common ragweed	3″
– wild buckwheat	5″
– wild mustard	8″
– crabgrass	4″
– foxtail	4″
– volunteer corn	10″
– wild proso millet	8″
– barnyardgrass	4″
– woolly cupgrass	4″

*Crop Oil @ 1 pt/A or CHS Endurium @ 1 qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Dry bean: apply after first trifoliate.
Field pea: apply at 3 leaf pairs or more.

Select Max (clethodim)

EPA Reg. #:	**59639-132**
Rate/A:	6–12 fl oz
Spray Volume:	5–40 gpa
Rainfast:	1 hour
M.O.A.:	ACC-ase Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Dry bean, Field pea, Lentil

Adjuvant(s)/Comments

- **CHS Penetrec* (1 pt/A) plus AMS*** (2.5–4 lb/A)**

or

- **CHS Aggrestrol** (1 pt/A) plus AMS*** (2.5–4 lb/A)**

Target Weeds	9 fl oz	12 fl oz
– barnyardgrass	6″	8″
– crabgrass	2″	6″
– giant foxtail	6″	12″
– green foxtail	6″	8″
– quackgrass	-	4–12″
2nd application may be needed		
– volunteer cereals	6″	8″
– volunteer corn	12″	18″
– wild proso millet	8″	10″
– woolly cupgrass	6″	8″
– yellow foxtail	6″	8″

*Crop Oil @ 1 pt/A or CHS Endurium @ 1 qt/100 gal.
**CHS Emulate @ 1 qt/A or CHS Endurium @ 1 qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply up to 30 day PHI.

Targa (quizalofop P-ethyl)

EPA Reg. #:	**33906-9-81880**
Rate/A:	5–10 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
M.O.A.:	ACC-ase Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Danger

Labeled Crops

- Dry bean, Field pea, Lentil

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (2–4 lb/A)**

Target Weeds	4 fl oz	6 fl oz	8 fl oz
– barnyardgrass	-	-	2–6″
– field sandbur	-	-	2–6″
– crabgrass	-	-	2–6″
– giant foxtail	-	-	2–8″
– green foxtail	-	-	2–4″
– volunteer corn	6–24″	24″+	-
– wild proso millet	-	-	2–6″
– yellow foxtail	-	-	2–4″
– wild oat	-	-	2–6″
– woolly cupgrass	2–4″ @ 9 oz		
– quackgrass	6–10″ @ 10 oz		

*Crop Oil @ 1 pt/A or CHS Endurium @ 1 qt/100 gal.
**CHS Emulate @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply up to 30 day PHI for dry beans.
Apply up to 60 day PHI for field pea and lentil.

Varisto (imazamox + bentazon)

EPA Reg. #:	**241-447**
Rate/A:	16–21 fl oz
Spray Volume:	10–20 gpa
Rainfast:	4 hours
M.O.A.:	ALS Inhibitor Photosystem II Inhibitor
P.P.E.:	l.s shirt, l.pants, w.p. gloves, shoes, socks
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Dry bean, Field pea

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (12–15 lb/100 gal)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (12–15 lb/100 gal)**

Target Weeds	16 oz	21 oz
– cocklebur	4″	4″
– lambsquarter	-	1.5″
– redroot pigweed	3″	3″
– velvetleaf	2″	3″
– annual smartweed	4″	4″
– black nightshade	3″	3″
– venice mallow	2″	3″
– wild mustard	3″	3″
– cheatgrass	-	3″
– downy brome	-	3″
– quackgrass	-	3″
– Persian darnel	-	3″
– foxtail	-	3″
– Italian ryegrass	-	3″
– Japanese brome	-	3″

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal.
**CHS Emulate @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Dry bean: apply to 1st trifoliate and prior to flowering.
Field pea: apply to 3 leaf pairs and prior to flowering.

Dry Bean, Field Pea, and Lentil Herbicide Postemergence Efficacy Chart

| | Annual Grasses | | | | | | | | | | | | | | | Perennial Grasses | | | Broadleaves | | | | | | | | | | | | | | |

Dry Bean, Field Pea, Lentil, and Chickpea Desiccation and Harvest Aid

Herbicide	Rate/A	Application Timing	PHI	Rotation Restrictions	Comments
Aim EC	1–6 fl oz/A	Physiological maturity, at least 80% of pods are yellowing and no more than 30% (vine type) and 40% (bush type) leaves are still green.	0 Days	None	Apply a minimum of 15 gpa by ground and 5 gpa by air. 1 hour rainfast. NOT LABELED FOR CHICKPEA OR LENTIL.
Glyphosate	0.75 lb/A	Seed is hard dough stage with < 30% moisture.	7 Days	30 Day See label.	Use only labeled formulations. Apply at 10 to 20 gpa. 1 hour rainfast. Do not apply to crops grown for seed. Do not feed treated vines or hay to livestock.
Gramoxone 2.0* OR **Parazone* + CHS Fixate**	1.2–2 pt/A OR 0.8–1.3 pt/A + 0.5% v/v	Physiological maturity, at least 80% of pods are yellowing and no more than 30% (vine type) and 40% (bush type) leaves are still green.	7 Days	None	Apply 20 gpa by ground or 5 gpa by air. Most active in hot and sunny conditions. 7 day interval to graze. 1 hour rainfast.
Sharpen + CHS Emulate + AMS	1–2 fl oz/A + 1 pt/A + 8.5–17 lb/100 gal	Physiological maturity, at least 80% of the pods are yellowing and no more than 30% (vine type) and 40% (bush type) leaves are still green.	2 Days	2 fl oz/A Rate: Corn, Sorghum, Cereals, Chickpea, Dry Field Pea = 0 months Soybean = 1–1.5 months Lentil = 2 months Cotton = 3 months Sugarbeet, Sunflower, Potato and All Other Crops = 5 months	2 fl oz/A is most common use rate. Apply a minimum of 10 gpa by ground (> 15 gpa preferred) and 5 gpa by air. Do not apply to crops grown for seed. Do not graze or feed treated hay or straw to livestock. Apply with glyphosate for increased weed desiccation. 1 hour rainfast.
Valor + CHS Emulate + AMS	1.5–3 oz/A + 1 qt/A + 2–2.5 lb/100 gal	Physiological maturity, at least 80% of the pods are yellow/brown and no more than 30% (vine type) and 40% (bush type) leaves are still green.	5 Days	2 oz/A Rate or less: Cotton, Field Corn (conv. tillage), Sorghum, Sunflower, Wheat = 30 days Barley, Flax, Lentils, Peas, Rye, Safflower = 3 months. Alfalfa, Canola, Oats, Sugarbeet, and other crops = 4 months tilled soil, 8 months if no tillage.	2 oz/A is most common use rate. Apply 15 to 30 gpa by ground and 7 to 10 gpa by air. Most active in hot and sunny conditions. Apply with glyphosate for increased weed desiccation. AMS does not replace MSO. 1 hour rainfast.

* Restricted Use Pesticide.

Desiccating Field Pea, Lentil, Chickpea And Preventing Harvest Loss

Field pea, lentil, and chickpea often requires the use of a desiccant to dry vines and kill weeds that interfere with harvest. Desiccation does not hasten maturity, but is often used to reduce harvest time and help retain the bright green color for dry green pea varieties that is demanded by the food market. Desiccants should be applied when the crop is fully mature. **Always read and follow label directions.**

Desiccating dry edible beans provides a more even drydown of the crop and escaped weeds, making harvest more efficient. However, desiccants will not speed the maturity of the plants or decrease seed moisture but can shorten the time between crop maturity and harvest.

Desiccant	Adjuvants	PHI
Buccaneer Plus @ 32 fl oz/A OR **Roundup Powermax** @ 21 fl oz/A OR **Multiple Others** @ 0.75 lb ae/A	CHS Fixate @ 0.5% v/v + CHS Level Best Pro @ 0.25% v/v	7 days – Do not apply to dry beans intended for seed production
Gramoxone SL / 2.0 @ 1.2–2 pt/A OR **Helmquat 3SL / Parazone 3SL** @ 0.8–1.3 pt/A	CHS Fixate @ 0.5% v/v OR CHS Level Best Pro @ 0.25% v/v	7 days
Aim @ 1–6 fl oz/A	CHS Emulate @ 1 qt/A	0 days
Sharpen @ 1–2 fl oz/A	CHS Fixate @ 0.5% v/v + CHS Emulate @ 1 qt/A	2 days – Do not apply to dry beans intended for seed production
Valor SX/EZ @ 2–3 oz/A	CHS Fixate @ 0.5% v/v + CHS Emulate @ 1 qt/A	5 days

Timing of desiccation is critical as application prior to physiological maturity can lead to decreased quality, seed size, and test weight. Pod color change is the best indicator of physiological maturity. Optimal timing for desiccants such as Aim, Paraquat, Sharpen, or Valor is when 80% of pods have turned color. Optimal timing for glyphosate as a desiccant is when pods are yellow and have a leathery texture and when seed is at "hard dough" stage with < 30% moisture.





Figures. Black bean used as an example of 80% pod color change (the optimal time for desiccant application).

Desiccating field pea is often necessary to dry vines and kill weeds that interfere with harvest. Desiccating does not hasten maturity, but is often used to reduce the time in combining and to help retain the bright green color for dry green pea varieties that is demanded by the food market. Desiccants should be applied when the field peas are fully mature.

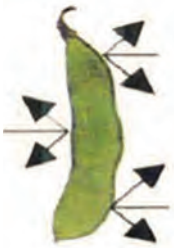
Desiccant	Adjuvant	PHI	Stage of Application*
Glyphosate @ up to 2.25 lb ae	CHS Fixate @ 0.5% v/v + CHS Level Best Pro @ 0.25% v/v	7 days	Apply when physiologically mature and < 15% green pods. Use higher rates where crops or weeds are dense or where faster desiccation is required. Do not apply to peas grown for seed.
Sharpen @ 1–2 fl oz/A	CHS Emulate @ 1 qt/A	3 days	Physiologically mature crop and a minimum of 80% of the pods are yellowing and mostly ripe with no more than 30% (vine type) and 40% (bush type) leaves are still green. Do not apply to peas grown for seed.
Valor @ 2–3 oz/A	CHS Emulate @ 1 qt/A	5 days	Physiologically mature crop and a minimum of 80% of the pods are yellow to tan in color and 20% are yellow in color.
Gramoxone SL 3.0, Helmquat 3SL, OR **Parazone 3SL** @ 0.8–1.3 pt/A	CHS Fixate @ 0.5% v/v OR CHS Level Best Pro @ 0.25% v/v	7 days	Physiologically mature crop and a minimum of 80% of the pods are yellowing and mostly ripe with no more than 30% (vine type) and 40% (bush type) leaves are still green.

*When a harvest management aid is used in combination with a desiccant, there are additional crop timing considerations that are important to assure successful application and efficacy of the pod protectant product in addition to obtaining leaf and stem desiccation. When Pod Ceal is used as a harvest management aid, apply when vein pattern of uppermost pods is easily recognized and 75 to 90% of the pods have turned to yellow tan. Seeds should be firm but no longer penetrable with a thumbnail.

Utilizing a harvest management product such as Pod Ceal DC™ can be beneficial in helping to prevent shatter losses and protect the quality of the seed. Pod Ceal DC extends harvesting time, keeps the pod filling longer, while controlling shattering before and at combining. Rotting, staining and loss of germination quality are preserved.

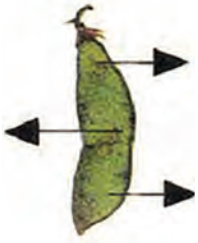
Pod Ceal DC can be applied in combination with desiccants. Pod Ceal DC should be applied at a rate of 1 pt/A at the timing of the desiccant or applied alone when peas are a light green color and the outline of the seed can be seen through the pod case.

How Pod Ceal DC™ Works on Pod Crops



RAIN/DEW KEPT OUT

By spraying with Pod Ceal a uniquely elastic, semi-permeable membrane, the absorption of moisture is prevented. The dry pod case does not expand, and disease is controlled.



INTERNAL MOISTURE LET OUT

Moisture passes out through the semi-permeable membrane and allows the crop to dry to the required moisture level.



RESULT

No expansion or contraction. This prevents strain on the join. The join holds, extends harvesting time, keeps the pod filling longer while controlling shatter before and at combining. Rotting, staining and loss of germination quality are preserved.

Disease is the most critical pest management issue for dry beans, and many of the diseases that reduce both yield and quality of dry edible beans can be prevented and/or controlled with fungicide applications. Key dry edible bean diseases that can be managed with foliar fungicides include anthracnose, halo blight, brown spot, rust, and white mold. Many fungicides need to be applied prior to the onset of disease and then repeated at a set interval (usually 7-14 days). Additionally, strobilurin products may provide plant health effects and increase yield, regardless of disease pressure, by increasing water use efficiency, increasing plant respiration, decreasing ethylene production, improving growth efficiency, and improving plant's tolerance to stress. For best disease control use IPM practices in conjunction with fungicides as a three-year crop rotation reducing the carryover of many pathogens (4 or more years for white mold).

Fungicide	Chemical Group	Rate/A	Stage Of Application	Adjuvant	Diseases
Aproach	Picoxystrobin (11)	6-12 oz	Preventative application at beginning of bloom, continue on a 7 to 14 day interval.	CHS Endurium*	Anthracnose, Rust, White Mold
Aprovia Top	Difenconazole (3) + Benzovindiflupyr (7)	10.5-11 oz	Apply prior to the onset of disease.	CHS Endurium*	Anthracnose, Rust
AzoxyStar	Azoxystrobin (11)	6-15 fl oz	Apply prior to the onset of disease, continue on a 7 to 14 day interval.	CHS Endurium*	Anthracnose, Rust
Bravo Ultrex	Chlorothalonil (M5)	1.25-1.80 lb	Apply prior to the onset of disease.	CHS Endurium*	Anthracnose, Rust
Bravo WeatherStik, Echo 720	Chlorothalonil (M5)	1.4-2.0 pt	Apply prior to the onset of disease.	CHS Endurium*	Anthracnose, Rust
Bravo ZN	Chlorothalonil (M5)	2-3 pt	Apply prior to the onset of disease.	CHS Endurium*	Anthracnose, Rust
Cannonball	Fludioxonil (12)	7 oz	Apply application at 10-20% bloom.	CHS Endurium*	White Mold
Endura	Boscalid (7)	8-11 oz	Apply at the beginning of flowering.	CHS Endurium*	White Mold
Evito	Fluoxastrobin (11)	2-4.75 oz	Apply prior to onset of disease.	CHS Endurium*	Anthracnose, Rust
Orius, TebuStar, Tebuzol, Toledo	Tebuconazole (3)	4-6 oz	Apply prior to the onset of disease.	CHS Endurium*	Rust
Headline / SC	Pyraclostrobin (11)	6-9 oz	Apply prior to onset of disease.	CHS Endurium*	Anthracnose, Rust, Powdery Mildew
Incognito 4.5	Thiophanate-methyl (1)	20-30 oz (2 applications) 30-40 oz (1 application)	**Two applications:** Apply first when 10-30% of plants have an open bloom. Apply next 4 to 7 days later. **One application:** Apply when all plants have at least one open bloom or when conditions favor disease development.	CHS Endurium*	Anthracnose, White Mold
Kocide 3000	Copper (M1)	0.50-1.25 lb	Apply prior to the onset of disease and repeat on a 7 to 14 day schedule.	CHS Endurium*	Common and Halo Blight, Brown Spot
Miravis Top	Pydiflumetofen (7) + Difenconazole (3)	13.7 oz	Apply prior to the onset of disease and continue on 14 day interval.	CHS Endurium*	Anthracnose**, Rust, White Mold**
Miravis Neo	Pydiflumetofen (7) + Azoxystrobin (11) + Propiconazole (3)	13.7 oz	Apply prior to the onset of disease and continue on 14 day interval.	CHS Endurium*	Anthracnose, Rust, White Mold**
Omega	Fluazinam (29)	0.50-0.85 pt	Apply prior to the onset of disease or at 10-30% flowering when conditions favor disease development.	CHS Endurium*	White Mold
Priaxor	Fluxapyroxad (7) + Pyraclostrobin (11)	4-8 oz	Apply prior to the disease onset, and continue on a 7 to 14 day interval.	CHS Endurium*	Anthracnose, Rust, White Mold*
Proline	Prothioconazole (3)	5.7 oz	Apply prior to the onset of disease or at 15-25% flowering when conditions favor disease development.	CHS Endurium*	Rust, White Mold

Adjuvants are generally used to increase disease control of fungicide applications. CHS Endurium is a unique surfactant with oil mimicking properties that improves plant canopy penetration both vertically and horizontally for more uniform fungicide coverage.

*CHS Endurium at 1 qt/100 gal.

**Disease suppression only.

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Fungicide	Chemical Group	Rate/A	Stage Of Application	Adjuvant	Diseases
Propulse	Fluopyram (7) + Prothioconazole (3)	10.3 oz	Apply at early flowering or the first sign of disease. Continue as needed on a 10 to 14 day interval.	CHS Endurium*	White Mold
Provysol	Mefentrifluconozole (3)	2.5-5 oz	Apply prior to onset of disease	CHS Endurium*	Anthracnose, Rust, Alternaria leaf and pod spot, powdery mildew
Quadris	Azoxystrobin (11)	6.2-15.4 oz	Apply prior to onset of disease.	CHS Endurium*	Anthracnose (6.2-15.4 oz) Rust (6.2 oz)
Quadris Opti	Azoxystrobin (11) + Chlorothalonil (M5)	1.6-2.4 pt	Apply prior to onset of disease.	CHS Endurium*	Anthracnose, Rust
Quash	Metconazole (3)	4 oz	Apply prior to onset of disease.	CHS Endurium*	White Mold
Quilt / Xcel	Azoxystrobin (11) + Propiconazole (3)	14 oz	Apply preventatively for best results. Apply additional applications on a 7 to 14 day interval.	CHS Endurium*	Anthracnose, Rust
Rovral	Iprodione (2)	1.5-2 pt	Apply at first bloom (10% of plants with 1 open bloom) and at peak bloom if needed. Do not apply at full bloom.	CHS Endurium*	White Mold
Switch	Cyprodinil (9) + Fludioxonil (12)	11-14 oz	Apply application at 10-20% bloom. Can be tank mixed with Topsin or T-Methyl for improved control.	CHS Endurium*	White Mold
Tebustar 3.6L	Tebuconazole (3)	4-6 oz	Apply prior to onset of disease	CHS Endurium*	Rust
Topsin 4.5L, T-Methyl 4.5F	Thiophanate-methyl (1)	20-30 oz (2 applications) 30-40 oz (1 application)	**Two applications:** Apply first when 10-30% of the plants have an open blossom. Apply second 5 to 7 days later. **One Application:** Apply when all plants have at least one open bloom.	CHS Endurium*	Anthracnose, White Mold
Vertisan	Penthiopyrad (7)	14-20 oz	Apply prior to onset of disease.	CHS Endurium*	Anthracnose, Rust, White Mold
Vetyma	Metentrifluconazole (3) + Pyraclostrobin (11)	7-10 oz	Apply prior to onset of disease.	CHS Endurium*	Anthracnose, Rust, Alternaria leaf and pod spot, powdery mildew
Viathon	Potassium phosphite (33) + Tebuconazole (3)	2-3 pt	Apply prior to onset of disease.	CHS Endurium*	Rust

Adjuvants are generally used to increase disease control of fungicide applications. CHS Endurium is a unique surfactant with oil mimicking properties that improves plant canopy penetration both vertically and horizontally for more uniform fungicide coverage.

*CHS Endurium at 1 qt/100 gal.

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Burndown Herbicide	Active Ingredient	Rate/A	Weeds Controlled	SOA	Time of Application	Notes
2,4-D Amine	2,4-D Amine	1–2 pt	Emerged broadleaf weeds.	Plant Growth Regulator (Group 4)	Refer to label for plant back intervals.	Some plants are sensitive to off-target movement. Drift control is necessary. Add 0.25% v/v nonionic surfactant.
Glyphosate*	Glyphosate	32 fl oz	Emerged weeds.	EPSP Synthase Inhibitor (Group 9)	Apply at least 7 days before seedbed preparation.	Field must be free of standing water.
Glyphosate* + Command 3 ME	Glyphosate + Clomazone	32 fl oz + 0.8–1.6 pt (Refer to label for Command rates based on soil type)	Emerged weeds and residual grass.	EPSP Synthase Inhibitor (Group 9) Diterpene Synthesis Inhibitor (Group 13)	Up to 14 days prior to planting.	Field must be free of standing water. Use full rate of glyphosate. Antagonism has been documented with this tank mix.
Glyphosate* + FirstShot 50 SG	Glyphosate + Thifensulfuron	32 fl oz + 0.5–0.8 oz	Improved control of curly dock, smartweed, henbit, and garlic.	EPSP Synthase Inhibitor (Group 9) ALS Inhibitor (Group 2)	Prior to planting.	Field must be free of standing water.
Glyphosate* + Gambit 79 WG	Glyphosate + Halosulfuron + Prosulfuron	2 pt + 1–2 oz	Grasses, sedges, smartweed, and other broadleaf weeds.	EPSP Synthase Inhibitor (Group 9) + ALS Inhibitor (Group 2)	Prior to planting.	Applications at or immediately following planting may result in rice injury. Do not apply in pH > 8.0.
Glyphosate* + Londax 60 DF	Glyphosate + Bensulfuron	32 fl oz + 0.5 oz	Improved control of yellow nutsedge, morning glory, and hemp sesbania.	EPSP Synthase Inhibitor (Group 9) ALS Inhibitor (Group 2)	Apply at least 7 days before seedbed preparation.	Field must be free of standing water.
Glyphosate* + Permit or Permit Plus	Glyphosate + Halosulfuron + Thifensulfuron	32 fl oz + 1.0 oz or 0.75 oz	Emerged weeds + enhanced sedge control. Will suppress other broadleaf weeds.	EPSP Synthase Inhibitor (Group 9) ALS Inhibitor (Group 2)	Up to 14 days prior to planting.	Field must be free of standing water. pH must be less than 8.0.
Paraquat formulations 3 lb/gal	Paraquat	32–40 fl oz	Emerged weeds.	Photosystem I Electron Diverter (Group 22)	Use high rate on weeds larger than 2 inches.	Paraquat is sensitive to off-target movement. Drift control is necessary. Add 0.25% v/v nonionic surfactant.
Sharpen	Saflufenacil	1–4 fl oz	Pigweeds, marestail, morning glory, and other small seeded broadleaf weeds.	PPO Inhibitor (Group 14)	Apply prior to rice emergence.	Apply to small weeds or prior to weed emergence for optimum control. Sharpen should be tank mixed with glyphosate or paraquat, while using high water volumes for best coverage and control. Must use minimum of 1% v/v of MSO + AMS.

* Glyphosate rate based on 4lb/gal formulations.

Preemergence Herbicide	Active Ingredient	Rate/A	Weeds Controlled	SOA	Time of Application	Notes
Facet 75 DF or Facet L	Quinclorac	0.33–0.67 lb or 22–43 fl oz (Refer to label for Facet rates based on soil type)	Barnyardgrass, broadleaf signalgrass, morning glory, hemp sesbania, northern jointvetch.	Growth Regulator (Group 4)	Apply to smooth seedbed with rice seed covered by soil. Rice seed exposed to spray may be severely injured. Low rates on sandy soils and high rates on clays.	**Tomatoes and cotton are extremely sensitive to Facet.**
Command 3 ME	Clomazone	0.8–1.6 pt (Refer to label for Command rates based on soil type)	Barnyardgrass, broadleaf signalgrass, sprangletop and other annual grasses.	Diterpene Synthesis Inhibitor (Group 13)	Apply from planting to rice emergence to smooth seedbed with rice seed covered by soil. Add 4 lb/gal Glyphosate at 1 qt/A or Paraquat at 1.67 pt/A to control emerged vegetation. Add Permit Plus for emerged sedges.	Applications on newly cut ground can result in severe injury and stand loss. Do not exceed 0.8 lb ai/A per year of clomazone.
Command 3 ME + League 75 WG	Clomazone + Imazosulfuron	0.8–1.6 pt + 6.4 oz (Refer to label for Command rates based on soil type)	Grasses, nutsedge, and other broadleaf weeds.	Diterpene Synthesis Inhibitor (Group 13) ALS Inhibitor (Group 2)	Apply from planting to rice emergence to smooth seedbed with rice seed covered by soil. Add 4 lb/gal Glyphosate at 1 qt/A or Paraquat at 1.67 pt/A to control emerged vegetation. Add Permit Plus for emerged sedges.	Keep away from soybeans and ground to be planted to soybean. DO NOT exceed 6.4 oz League per season.

Delayed Preemergence	Active Ingredient	Rate/A	Weeds Controlled	SOA	Time of Application	Notes
Facet 75 DF or Facet L	Quinclorac	0.33–0.67 lb or 22–43 fl oz	Barnyardgrass, broadleaf signal grass, morning glory, hemp sesbania, northern jointvetch.	Growth Regulator (Group 4)	Apply before or after rain or flushing. Rice exposed to spray may be severely injured.	**Tomatoes and cotton are extremely sensitive to Facet.**
Prowl H2O	Pendimethalin	1.6–2.1 pt	Barnyardgrass, sprangletop, broadleaf signalgrass, crabgrass.	Microtubule Inhibitor (Group 3)	Apply 1 to 5 days before emergence. DO NOT apply preplant incorporated or immediately after planting. Use low use rate for sandy loam soils and high rate for all others.	**Dry drill-seeded rice only.**

Always read and follow the label directions.

All trademarks and registered trademarks are the property of the respective manufacturers.

The recommended rate for a specific PRE herbicide product for rice can vary by herbicide formulation, geography, soil type, and cropping system. Refer to label.

Refer to product label for crop rotation limitations for specific crops.

Most PRE products require moisture to activate product. If moisture is not received in 7–10 days, flush for activation.

Clearfield Rice System	Active Ingredient	Rate/A	Weeds Controlled	SOA	Time of Application	Notes
Newpath	Imazethapyr	4–6 fl oz Pre-plant incorporated. Follow with 4–6 fl oz post-emergence	Red rice, barnyardgrass, broadleaf signalgrass, sprangletop, fall panicum, yellow nutsedge. Suppresses some aquatic broadleaf species.	ALS Inhibitor (Group 2)	Preplant incorporated or pre-emergence followed by postemergence. Apply 4 oz/A preplant incorporated up to 7 days prior to planting or pre-emergence immediately following planting. Apply post treatment when rice is 3 to 5 leaf stage.	**Use on Clearfield rice varieties only.** Flush for activation if rainfall does not occur within a few days of planting. Under cloudy, cool, wet conditions, Newpath may injure hybrid rice. **Conventional rice varieties cannot be planted the year following Clearfield rice due to the carryover of Newpath.**
Clearfield Sequential Post System						
Newpath	Imazethapyr	4–6 fl oz followed by 4–6 fl oz	Same as above. Suppression of sprangletop and improved control of barndyardgrass and red rice.	ALS Inhibitor (Group 2)	4 fl oz/A on 1 leaf to 2 leaf red rice. Followed by 4 fl oz/A approximately 2 weeks later.	Same as above. A soil-applied herbicide such as Command should be used for sprangletop control and to aid in control of annual grass. Add a nonionic surfactant at 0.25% v/v.
Clearpath followed by Newpath	Imazethapyr/ Quinclorac followed by Imazethapyr	0.5 lb followed by 4–6 fl oz	Same as above with improved barnyardgrass, hemp sesbania and northern jointvetch control.	ALS Inhibitor (Group 2) Growth Regulator (Group 4)	4 fl oz/A on 1 leaf to 2 leaf red rice. Followed by 4 fl oz/A approximately 2 weeks later.	Same as above. See Facet restrictions and precautions. Add a crop oil concentrate at 1% v/v with Clearpath.
Beyond	Imazamox	5 fl oz	Late-season suppression of red rice.	ALS Inhibitor (Group 2)	After Newpath or Clearpath has been applied. Apply to red rice prior to seedhead emergence.	Do not apply more than 10 oz per year. **Apply to conventional Clearfield rice not later than 14 days past panicle initiation. Apply to hybrid Clearfield rice no later than panicle initiation. NIS or COC required.**
FullPage Rice System						
Preface	Imazethapyr	4–6 oz/A PPI fb 4–6 oz/A POST	Red rice, barnyardgrass, broadleaf signalgrass, sprangletop, fall panicum, yellow nutsedge. Suppresses some aquatic broadleaf species.	ALS Inhibitor (Group 2)	Preplant incorporated up to 7 days prior to plant or at plant followed by post application at 3–5 leaf stage.	Use only FullPage rice varieties. Flush for activiation if no rainfall within a few days. Repeat if needed to maintain activity from soil-applied treatment. Add NIS at 0.25% v/v.
FullPage Sequential Post System						
Preface	Imazethapyr	4–6 oz/A PPI fb 4–6 oz/A POST	Red rice, barnyardgrass, broadleaf signalgrass, sprangletop, fall panicum, yellow nutsedge. Suppresses some aquatic broadleaf species.	ALS Inhibitor (Group 2)	Preplant incorporated up to 7 days prior to plant or at plant followed by post application at 3–5 leaf stage.	Use only FullPage rice varieties. Flush for activation if no rainfall within a few days. Repeat if needed to maintain activity from soil-applied treatment. Add NIS at 0.25% v/v.
Postscript	Imazamox	5 fl oz/A	Late-Season suppression of red rice.	ALS Inhibitor (Group 2)	After Preface has been applied, apply prior to red rice seedhead emergence.	Do not apply more than 15 oz per year.
Provisia Rice System						
Provisia 0.88 EC	quizalofop	15.5 fl oz/A fb 15.5 fl oz/A	Annual grasses and weedy rice.	ACCase Inhibitor (Group 1)	1-2 leaf fb 4-5 leaf preflood.	Use in combination with a good broadleaf and grass program in the first tank mix. Do not mix with Propanil or Grandstand. Add 1% v/v COC.
Provisia 0.88 EC + Loyant 0.21 EC	quizalofop + florpyrauxifen-benzyl	15.5 fl oz/A + 8 fl oz/A	Control of grasses, weedy rice, and broadleaves.	ACCase Inhibitor (Group 1) + Synthetic Auxin (Group 4)	4-5 leaf preflood, second application in program.	See above notes. Add 0.5 pt/A MSO.

AIM EC (carfentrazone)

EPA Reg. #:	**279-3241**
Rate/Acre:	1.25 oz/A
Spray Volume:	Min. 10 gpa
Rainfast:	1 hour
S.O.A.:	PPO inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/ Comments

- **CHS Fixate/ CHS Wheelhouse Pro (1–2 qt/100 gal)**

or

- **CHS Hypertonic* (1 qt/100)**

or

- **CHS Penetrec** (2 qt/100 gal)**

Target Weeds

For control of morning glory, hemp sesbania, groundcherry, and smartweed.

Timing/Comments

Apply after rice reaches 2-leaf stage through flag leaf. Leaf speckling may occur.

*CHS Endurium (1 qt/100) can be substituted for CHS Hypertonic.
**Crop Oil (1 gal/100) can be substituted for CHS Penetrec.

Basagran 5L (bentazon)

EPA Reg. #:	**7969-112**
Rate/Acre:	1.2-1.6 pt/A
Spray Volume:	Min. 10 gpa up to 20 gpa
Rainfast:	4 hours
S.O.A.:	Photosystem II Inhibitor (Group 6)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves shoes, socks, p. eyewear
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Danger
P.H.I.:	None Listed

Adjuvant(s)/ Comments

- **CHS Hypertonic* (1–2 qt/100)**

or

- **CHS Penetrec** (2 qt/100)**

or

- **CHS Aggrestrol*** (2 qt/100)**

Target Weeds

For control of up to 6″ broadleaves, except 10″ cocklebur and 4″ redstem, others listed include dayflower, flatsedge, smartweed, yellow nutsedge.

Timing/Comments

Do not cultivate within 5 days prior until 7 days after application. Can be applied in flood, but do not raise water levels for 24 hours after application.

*CHS Endurium (1 qt/100) can be substituted for CHS Hypertonic.
**Crop Oil (1 gal/100) can be substituted for CHS Penetrec.
***CHS Emulate (1 gal/100) can be substituted for CHS Aggrestrol.

Clincher (cyhalofop)

EPA Reg. #:	**62719-357**
Rate/A:	15 oz/A
Spray Volume:	10 gpa or more
Rainfast:	None Listed
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	Coveralls over, l.s. shirt, l. pants, c.r. gloves, shoes plus socks, p. eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	60 days

Adjuvant(s)/ Comments

- **CHS Penetrec* (1 pt/A)**

or

- **CHS Aggrestrol** (1 pt/A)**

Target Weeds

Many grasses and broadleaves including: barnyardgrass, cocklebur, dayflower, Johnsongrass, morning glory, nutsedge, pigweed, and sicklepod.

Timing/Comments

Only one application at 2 lb/A per season is allowed, except in a salvage situation where a second app can be made.

*Crop Oil (1 qt/A) can be substituted for CHS Penetrec.
**CHS Emulate (1 qt/A) can be substituted for CHS Aggrestrol.

Gambit (halosulfuron + prosulfuron)

EPA Reg. #:	**81880-27-10163**
Rate/Acre:	16 oz/A
Spray Volume:	Min. 10 gpa
Rainfast:	2 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	Coveralls, shoes, socks, gloves, p. eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	48 days

*CHS Endurium (1 pt/A) can be substituted for CHS Hypertonic.
**Crop Oil (1-2 qt/100) can be substituted for CHS Penetrec.
***AMS 1–2 lb/A or 2.5 lb if not using NIS or COC.

Adjuvant(s)/Comments

- **CHS Hypertonic* (1–2 qt/100)**

or

- **CHS Penetrec** (2 qt/100)**

or

- **CHS Aggrestrol*** (2 qt/100)**

Target Weeds

Weeds Controlled: Grasses, sedges, smartweed, and other broadleaf weeds.

Timing/Comments

Avoid drift on non STS or BOLT soybeans. Do not plant soybeans within 10 months. No applications 10 days before or 7 days after an organophosphate application.

Grandstand 3L (triclopyr)

EPA Reg. #:	**62719-215**
Rate/Acre:	0.67–1.0 pt/A
Spray Volume:	Min. 10 gpa
Rainfast:	None Listed
S.O.A.:	Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves shoes, socks, p. eyewear
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Danger
P.H.I.:	60 days

*CHS Endurium (1 qt/100) can be substituted for CHS Hypertonic.
**Crop Oil (1 gal/100) can be substituted for CHS Penetrec.

Adjuvant(s)/Comments

- **CHS Hypertonic* (1–2 qt/100)**

or

- **CHS Penetrec** (2 qt/100)**

Target Weeds

For control of cocklebur, jointvetch spp., morning glory spp., hemp sesbania, eclipta, sicklepod, smartweed, and redstem.

Timing/Comments

Do not apply to non-flooded rice or apply prior to the 2-3-leaf or after 1/2″ internode elongation.

Grasp Xtra (penoxsulam + triclopyr)

EPA Reg. #:	**62719-610**
Rate/Acre:	16–22 oz/A
Spray Volume:	Min. 10 gpa
Rainfast:	1 hour
S.O.A.:	ALS Inhibitor (Group 2) & Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves shoes, socks, p. eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning
P.H.I.:	60 days

*Crop Oil (1 gal/100) can be substituted for CHS Penetrec.
**CHS Emulate (1 gal/100) can be substituted for CHS Aggrestrol.

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100)**

or

- **CHS Aggrestrol** (2 qt/100)**

Target Weeds

For control of broadleaves including pigweed, morning glory, hemp sesbania, smartweed, and day flower. Also controls barnyardgrass.

Timing/Comments

Apply from 2-3 leaf to 1/2″ internode elongation stage, do not apply past booting stage.

Avoid soil pH > 7.8 and soils with salt related problems.

Loyant (florpyrauxifen-benzyl)

EPA Reg. #:	**62719-698**
Rate/Acre:	16 oz/A
Spray Volume:	Min. 10 gpa
Rainfast:	2 hours
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, waterproof gloves, p. eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	60 days

*CHS Emulate (0.5 pt/A) can be substituted for CHS Aggrestrol.

Adjuvant(s)/Comments

- **CHS Aggrestrol* (0.25 pt/A)**

Target Weeds

For selective postemergence control of grass, sedge, and broadleaf control in the states of Arkansas, Louisiana, Mississippi, Tennessee, and Texas.

Timing/Comments

Loyant may be applied to rice from 2 leaf with no roots exposed to 60 days PHI. Fields must be drained so that weeds are 70% exposed, begin returning flood after 3 hours.

Permit (halosulfuron)

EPA Reg. #:	**81880-2-10163**
Rate/Acre:	1 oz/A
Spray Volume:	Enough to ensure uniform coverage
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	48 days

*CHS Endurium (1 qt/100) can be substituted for CHS Hypertonic.
**Crop Oil (1 gal/100)can be substituted for CHS Penetrec.
***CHS Emulate (1 gal/100) can be substituted for CHS Aggrestrol.

Adjuvant(s)/Comments

- **CHS Hypertonic* (1–2 qt/100)**

or

- **CHS Penetrec** (2 qt/100)**

or

- **CHS Aggrestrol*** (2 qt/100)**

Target Weeds

For control of sedges, including yellow nutsedge and flatsedge, as well as hemp sesbania, and northern jointvetch.

Timing/Comments

Temporary yellowing or stunting of the crop may be observed following application.

Avoid drift on non STS/BOLT soybeans.

Permit Plus (halosulfuron + thifensulfuron)

EPA Reg. #:	**81880-26-10163**
Rate/Acre:	0.75 oz/A
Spray Volume:	10 or more gpa
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves shoes, socks, p. eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning
P.H.I.:	48 days

*CHS Endurium (1 qt/100) can be substituted for CHS Hypertonic.
**Crop Oil (1 gal/100)can be substituted for CHS Penetrec.
***CHS Emulate (1 gal/100) can be substituted for CHS Aggrestrol.

Adjuvant(s)/Comments

- **CHS Hypertonic* (1–2 qt/100)**

or

- **CHS Penetrec** (2 qt/100)**

or

- **CHS Aggrestrol*** (2 qt/100)**

Target Weeds

Same weeds controlled as Permit, but with better broadleaf weed control.

Timing/Comments

Control us usually seen within 7-14 days of application. Avoid applications under stressed conditions.

Avoid drift on non STS/BOLT soybeans.

Propanil (4lb formulations)

EPA Reg. #:	**Multiple**
Rate/A:	3–4 qt/A
Spray Volume:	15–20 gpa
Rainfast:	6 hours
S.O.A.:	Photosystem II Inhibitor (Group 7)
P.P.E.:	Coveralls over, l.s. shirt, l. pants, c.r. gloves, c.r. apron c.r. footwear, socks, eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	60 days

Adjuvant(s)/Comments

Target Weeds

Postemergence control of sedges, barnyardgrass, fall panicum, hemp sesbania, northern jointvetch, spike rushes, flat sedges, morning glory, aquatics.

Timing/Comments

Do not exceed 6 lb/A in a single application or 8 lb/A in a season.

Repeat treatment if needed for hard to kill weeds.

Rebel EX (penoxsulam + cyhalofop)

EPA Reg. #:	**62719-607**
Rate/Acre:	16-20 oz/A
Spray Volume:	Min. 10 gpa
Rainfast:	12 hours
S.O.A.:	ACC-ase Inhibitor (Group 1) & ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, gloves shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	60 days

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100)**

or

- **CHS Aggrestrol** (2 qt/100)**

Target Weeds

For control of sprangletop, barnyardgrass, junglerice, hemp sesbania, rice flatsedge, jointvetch, redstem, alligatorweed, eclipta, and smartweed.

Timing/Comments

Make applications from 1-leaf to 60 days PHI. Following NewPath or Quinclorac application, wait a minimum of 7 days after establishment of permanent flood for Rebel EX application.

*Crop Oil (1 gal/100) can be substituted for CHS Penetrec.
**CHS Emulate (1 gal/100) can be substituted for CHS Aggrestrol.

Regiment 80 WP (bispyribac)

EPA Reg. #:	**59639-105**
Rate/Acre:	0.4–0.63 oz/A
Spray Volume:	Min. 15–20 gpa
Rainfast:	8 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning
P.H.I.:	None listed

Adjuvant(s)/Comments

- **Concord (1% v/v ground or 3-6 oz/A aerial)**

Target Weeds

Lower flood to 70% weeds above the water surface prior to application. For control of duck salad, barnyardgrass, smartweed, and Johnsongrass.

Timing/Comments

Apply from 4-leaf to joint movement, but do not apply past joint movement. Injury may be observed, but does not affect yield.

Ricebeaux (propanil + thiobencarb)

EPA Reg. #:	**71085-30**
Rate/Acre:	4 qt/A
Spray Volume:	10 or more gpa
Rainfast:	24 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves & apron shoes, socks, p. eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	60 days

Adjuvant(s)/ Comments

Target Weeds

Grasses including sprangletop, barnyardgrass, signalgrass, and flatsedge as well as hemp sesbania and other listed broadleaves.

Timing/Comments

At least 8 hours of sunlight is normally required following application. Temperatures should be above 75° F and below 100° F.

Ricestar HT (fenoxaprop)

EPA Reg. #:	**264-682**
Directed Rate/A:	13–17 oz/A
Spray Volume:	Min. 10 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes plus socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning
P.H.I.:	65 days

Adjuvant(s)/ Comments

Target Weeds

For control of barnyardgrass, broadleaf signalgrass, fall panicum, Johnsongrass (seedling), and sprangletop. Use low rate on 1–2 leaf weeds and high rate on 3–4 leaf weeds.

Timing/Comments

Visible injury of grasses may be visible in 4–10 days, but may take up to 21 days to completely kill weeds. Spray from 2-leaf to late tillering.

Sharpen (saflufenacil)

EPA Reg. #:	**7969-278**
Rate/Acre:	1 oz/A
Spray Volume:	Min. 5 gpa
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves shoes, socks, p. eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	None Listed

Adjuvant(s)/ Comments

- **CHS Penetrec* (2 qt/100)**

Target Weeds

For control of pigweed, groundcherry, marestail, and other broadleaf weeds.

Timing/Comments

Apply from 2-3 leaf rice to internode elongation stage. Do not apply in the spiking and 2-leaf stages.

*Crop Oil (1 gal/100) can be substituted for CHS Penetrec.

Storm (bentazon + acifluorfen)

EPA Reg. #:	**70605-09**
Rate/Acre:	1.5 pt
Spray Volume:	10-20 gpa, up to 50 gpa
Rainfast:	4 hours
S.O.A.:	Photosystem II Inhibitor (Group 6) & PPO Inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves shoes, socks, goggles/face shield
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Danger
P.H.I.:	50 days

*CHS Endurium (1 pt/A) can be substituted for CHS Hypertonic.
**Crop Oil (1–2 qt/100) can be substituted for CHS Penetrec.
***AMS 1–2 lb/A or 2.5 lb if not using NIS or COC.

Adjuvant(s)/Comments

- **CHS Hypertonic* (1–2 pt/100)**

or

- **CHS Penetrec** (1–2 pt/A) plus CHS Fixate/ CHS Wheelhouse Pro*** (2 qt/100 gal)**

Target Weeds

For control of small actively growing weeds, except cocklebur (10″), hemp sesbania (1-4′) & redstem (4″). Also controls barnyardgrass, morning glory, smartweed, & eclipta.

Timing/Comments

Leaf speckling may occur, but plants generally outgrow in 10 days. AMS may be used but not with less than 10 gpa. Apply when rice is late tillering to early boot, must be past 3-leaf.

Strada Pro (orthosulfamuron + halosulfuron-methyl)

EPA Reg. #:	**71711-47**
Rate/Acre:	2.08–2.5 oz/A
Spray Volume:	Min. 10 gpa
Rainfast:	6 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves shoes, socks, p. eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution
P.H.I.:	48 days

*CHS Endurium (1 qt/100) can be substituted for CHS Hypertonic.
**Crop Oil (1 gal/100) can be substituted for CHS Penetrec.

Adjuvant(s)/Comments

- **CHS Hypertonic* (1–2 qt/100)**

or

- **CHS Penetrec* (2 qt/100)**

Target Weeds

For control of yellow nutsedge, hemp sesbania, flatsedge, and northern jointvetch.

Timing/Comments

Apply from 2–4 leaf rice and 4-leaf weeds. Results usually seen in 10–20 days. Do not make more than 1 application per year.

Ultra Blazer (acifluorfen)

EPA Reg. #:	**70506-60**
Rate/Acre:	0.5–1.0 pt
Spray Volume:	10-20 gpa, up to 50 gpa
Rainfast:	4 hours
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves shoes, socks, goggles/face shield
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Danger
P.H.I.:	50 days

*CHS Endurium (1 qt/100) can be substituted for CHS Hypertonic.
**Crop Oil (1–2 qt/100) can be substituted for CHS Penetrec.
***AMS 1–2 lb/A or 2.5 lb if not using NIS or COC.

Adjuvant(s)/Comments

- **CHS Hypertonic* (1–2 pt/100)**

or

- **CHS Penetrec** (1–2 pt/A) plus CHS Fixate/ CHS Wheelhouse Pro*** (2 qt/100 gal)**

Target Weeds

For control of pigweed species, smartweed, hemp sesbania, morning glory.

Timing/Comments

Leaf speckling may occur, but plants generally outgrow in 10 days. AMS may be used but not with less than 10 gpa. Max 1 pt/season.

Herbicide	Common Use Rate	Crops Labeled	Traditional Surfactant and Oil Adjuvants: CHS Hypertonic	Traditional Surfactant and Oil Adjuvants: Crop Oil	Traditional Surfactant and Oil Adjuvants: CHS Emulate	Surfactant/ Oil Replacement: CHS Endurium	High Surfactant Oil Concentrates: CHS Penetrec	High Surfactant Oil Concentrates: CHS Aggrestrol	AMS	NIS/AMS Replacement: CHS Fixate/ CHS Wheelhouse Pro	Invert Oil Emulsion/ DRT: CHS Acuvant	Invert Oil Emulsion/ DRT: Parachute II	Other Adjuvants or Comments
Aim EC	1.25 oz/A	Rice	1 qt/100	1 gal/100		1 qt/100	2 qt/100		+2.5 lb/A	1–2 qt/100	3 oz/A	3 oz/A	
Basagran 5L	1.2–1.6 pt/A	Rice	1–2 qt/100	1 gal/100	1 gal/100	1 qt/100	2 qt/100	2 qt/100			3 oz/A	3 oz/A	
Beyond	4 fl oz	Clearfield Rice	1 qt/100	1–2 gal/100	1–2 gal/100	1 qt/100	0.5 gal/100	0.5 gal/100	12–15 lb/100	+2 qt/100	3 oz/A	3 oz/A	
Clearpath	0.5 lb	Clearfield Rice	1 qt/A			1 qt/100					3 oz/A	3 oz/A	1 gal/100 use rate for aerial applications of CHS Hypertonic
Clincher	15 oz/A	Rice		1 qt/A	1 qt/A	1 pt/A	1pt /A				3 oz/A	3 oz/A	
Facet L	22–43 fl oz	Rice	1 qt/100	2 pt/A	1–2 pt/A	1 qt/100	1pt /A	0.5 pt/A	+ 8.5 lb/ 100 gal		3 oz/A	3 oz/A	
Gambit	16 fl oz/A	Rice	1–2 qt/100	1 gal/100	1 gal/100	1 qt/100	0.5 gal/100	0.5 gal/100			3 oz/A	3 oz/A	
Grandstand 3L	0.67–1.0 pt/A	Rice	1–2 pt/100	1 gal/100		1 pt/100		2 qt/100			3 oz/A	3 oz/A	
Grasp Xtra	16–22 oz/A	Rice		1 gal/100	1 gal/100	1 qt/100	2 qt/100	2 qt/100			3 oz/A	3 oz/A	
Loyant	16 oz/A	Rice			0.5 pt/A			0.25 pt/A			3 oz/A	3 oz/A	
Newpath	4–6 fl oz	Clearfield Rice	0.5–1 qt/A	1–2 pt/A		1 qt/100	0.5–1 pt/A				3 oz/A	3 oz/A	Use CHS Hypertonic at 0.25% v/v when tank mixed with Aim
Permit	1 oz/A	Rice	1–2 qt/100	1 gal/100	1 gal/100	1 qt/100	2 qt/100	2 qt/100			3 oz/A	3 oz/A	
Permit Plus	0.75 oz/A	Rice	1–2 qt/100	1 gal/100	1 gal/100	1 qt/100	2 qt/100	2 qt/100			3 oz/A	3 oz/A	
Postscript	5 fl oz/A	Rice		1 gal/100			0.5 gal/100	0.5 gal/100			3 oz/A	3 oz/A	
Preface	4–6 fl oz/A	Rice		1 gal/100			0.5 gal/100	0.5 gal/100			3 oz/A	3 oz/A	See label for tank-mixes
Propanil	3–4 qt/A	Rice									3 oz/A	3 oz/A	
Provisia	13–18 fl oz/A	Rice		1 gal/100							3 oz/A	3 oz/A	
Rebel EX	16–20 oz/A	Rice		1 gal/100	1 gal/100	1 qt/100	2 qt/100	2 qt/100			3 oz/A	3 oz/A	
Regiment 80 WP	0.4–0.63 oz/A	Rice				1 qt/100					3 oz/A	3 oz/A	Concord at 1% v/v Ground or 3-6 oz/A aerial
Ricebeaux	4 qt/A	Rice									3 oz/A	3 oz/A	
Ricestar HT	13–17 oz/A	Rice									3 oz/A	3 oz/A	
Sharpen	1 oz/A	Rice		1 gal/100		1 qt/100	2 qt/100				3 oz/A	3 oz/A	
Storm	1.5 pt	Rice	1–2 pt/100	1–2 pt/A		1 qt/100 or A	1 qt/A		+1–2.5 lb/A	2 qt/100	3 oz/A	3 oz/A	
Strada Pro	2.08–2.5 oz/A	Rice	1–2 qt/100	1 gal/100		1 qt/100	2 qt/100				3 oz/A	3 oz/A	
Ultra Blazer	0.5–1.0 pt/A	Rice	1–2 pt/100	1–2 pt/A		1 qt/100 or A	1 qt/A		+1–2.5 lb/A	2 qt/100	3 oz/A	3 oz/A	

Fungicides				Sheath Blight	Kernel and False Smut	Neck Blast	Harvest Restriction	Notes
Class	Active Ingredient (Fungicide Group)	Trade Name	Rate/A (fl oz)	Disease Controlled				
DMI Triazoles (Group 3)	Propiconazole (3)	Tilt® / PropiMax® EC / Many Generics	6.0		X		35 days	Do not apply more than 12 fl oz/A in a year. Use 5–10 gpa aerially. Most effective when applied and allowed to dry prior to rainfall. For best results sufficient water should be used and must be applied by air.
SDHI Carboximides (Group 7)	Fluxapyroxad (7)	Sercadis™	4.5–6.8	X			28 days	Maximum of 2 applications per year. Under hot conditions use 1% COC. Minimum 15 gpa (ground) and 7–10 gpa (aerial).
	Flutolanil (7)	Elegia®	32	X			30 days[3]	Minimum 10 gpa (ground) and 5 gpa (aerial). Do not apply more than 32.0 fl oz/A in a season.
QoI Strobilurins (Group 11)	Azoxystrobin (11)	Quadris® / Many Generics	8.0–12.5	X		X	28 days	Use 5–10 gpa for aerial applications. For Sheath Blight control use 9–12 fl oz/A depending on growth stage and severity.
	Trifloxystrobin (11)	GEM	3.8–4.7	X		X	35 days	Do not apply more than 9.4 fl oz/A per crop. Up to two applications may be made, use higher rates under severe disease pressure.
Mixed Modes of Action	Azoxystrobin (11) + Propiconazole (3)	Quilt Xcel®	14.0–27.0	X	X	X	35 days	Do not apply more than 42 fl oz/A in a season or more than 2 applications of Group 11 fungicide. Do not release floodwater for 14 days following application.
	Trifloxystrobin (11) + Propiconazole (3)	Stratego®	16.0–19.0	X	X	X	45 days	Minimum 10 gpa (ground) and 5 gpa (aerial). Begin application prior to disease presence, usually at or near panicle differentiation. Minimum 10 days between applications.
	Flutolanil (7) + Propiconazole (3)	Artisan®	40.0	X			40 days	Minimum 10 GPA (Ground) and 5 GPA (Aerial). Do not apply more than 84 fl oz/A in a growing season. Make sequential applications at 10–14 day intervals.

[1] CHS Endurium is recommended @ 1 qt/100 gal (Ground) or 4–6 fl oz/A (Aerial) for increased fungicide efficacy, and drift control/deposition.

[2] General Recommended Rates. Always read and follow all use restrictions before applying any fungicide.

[3] Do not apply within 30 days of harvest or beyond 75% heading development stage, whichever occurs first.

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4 lb Amine / 4 lb LOVOL Ester (2,4-D)/6 lb LOVOL Ester (2, 4-D)-Tenkoz

EPA Reg. #:	**71368-1-55467 (4 lb Amine)** **228-139-55467 (4 lb Ester)** **71368-11-55467 (6 lb Ester)**
Rate/A:	0.5–1 pt
Spray Volume:	10 gpa min
Rainfast:	Ester: 1 hour Amine: 6–8 hours
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear, apron
R.E.I.:	48 hours (Amine) 12 hours (Ester)
W. Notification:	Oral
S. Word:	Amine: Danger Ester: Caution

Labeled Crops

- Barley, Oat, Wheat

Target Weeds

– Controls most broadleaf weeds.

Timing/Comments

Apply from tillering until prior to boot.

Affinity BroadSpec / Audit 1:1 (thifensulfuron + tribenuron, 1:1 ratio)

EPA Reg. #:	**352-661 Affinity BroadSpec** **66330-418 Audit 1:1**
Rate/A:	0.4–1 oz 0.4 oz (oat)
Spray Volume:	3 gpa min
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Wheat, Barley, Oat, Rye, Triticale (Audit 1:1 not labeled in Oat, Rye, Triticale)

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (2–4 pt/100 gal) plus AMS (2 lb/A)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS (2 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS (2 lb/A)**

Target Weeds

– Controls most broadleaf weeds.

Timing/Comments

Apply to crop from 2 leaf to prior to flag leaf emergence.

Apply to oat before jointing.

*Crop Oil at 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

**CHS Emulate at 1 gal/100 gal can be substituted for CHS Aggrestrol.

Affinity Tank mix / Audit 4:1 (thifensulfuron + tribenuron, 4:1 ratio)

EPA Reg. #:	**352-641 Affinity Tank mix** **66330-419 Audit 4:1**
Rate/A:	0.6–1 oz 0.6–0.75 oz (oat)
Spray Volume:	3 gpa min
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Wheat, Barley, Oat, Rye, Triticale (Audit 4:1 not labeled in Oat)

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (2–4 pt/100 gal) plus AMS (2 lb/A)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS (2 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS (2 lb/A)**

Target Weeds

– Controls most broadleaf weeds.

Timing/Comments

Apply to crop from 2 leaf to prior to flag leaf emergence.

Apply to oat before jointing.

*Crop Oil at 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

**CHS Emulate at 1 gal/100 gal can be substituted for CHS Aggrestrol.

Agility SG (dicamba + thifensulfuron + tribenuron + metsulfuron)

EPA Reg. #:	**352-751**
Rate/A:	1.6–3.2 oz
Spray Volume:	5 gpa min (ground) 1–5 gpa (air)
Rainfast:	6 hours
S.O.A.:	ALS Inhibitor (Group2) Growth Regulator (Group 4)
P.P.E.:	coveralls, l.s. shirt, pants, c.r. socks footwear and socks, waterproof c.r. gloves, c.r. headgear and eyewear
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning

Labeled Crops

- Wheat, Barley, Triticale

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS (2 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS (2 lb/A)**

or

- **CHS Hypertonic (1–4 pt/100 gal) plus AMS (2 lb/A)**

Target Weeds

– common buckwheat
– common cocklebur
– common lambsquarters
– common ragweed
– common sunflower
– field pennycress
– marshelder
– pigweeds (excluding Palmer)
– tansy mustard
– volunteer lentils, peas, sunflower
– wild buckwheat
– wild mustard

Timing/Comments

Fall seeded wheat, barley, triticale: 2 leaf but before jointing.

Spring wheat and triticale: 2 leaf but before exceeds 6 leaf.

Spring barley: 2 leaf but before exceeds 4 leaf.

See label for rotational restrictions.

*Crop Oil at 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

**CHS Emulate at 1 gal/100 gal can be substituted for CHS Aggrestrol.

Aim EC (carfentrazone)

EPA Reg. #:	**279-3241**
Rate/A:	0.5–2.0 fl oz
Spray Volume:	min 3 gpa (air) 10 min gpa (ground)
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	coveralls, w.p. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Millet, Oat, Rye, Triticale, Wheat

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**

or

- **CHS Hypertonic (2 pt/100 gal) plus AMS (2–4 lb/A)**

Target Weeds

0.5–1 fl oz

Control
- lambsquarters (3″)
- black nightshade
- pigweed
- velvetleaf

Suppression
- wild buckwheat
- kochia
- mustards
- Russian thistle

1.5–2 fl oz

Control
- lambsquarters (4″)
- black nightshade
- pigweed
- velvetleaf
- wild buckwheat
- kochia
- Russian thistle

Timing/Comments

Apply to small grain crops up to jointing.

Apply to winter wheat prior to boot.

May cause cosmetic speckling on wheat leaves. Tank mixes with sulfonylurea herbicides may reduce cosmetic speckling.

Ally Extra SG (metsulfron+thifensulfuron+tribenuron)

EPA Reg. #:	**352-715**
Rate/A:	0.3–0.4 oz
Spray Volume:	3–5 gpa (air) 5 gpa min (ground)
Rainfast:	6 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, shoes, socks, c.r. gloves
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Wheat, Triticale

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (0.5–4 pt/100) plus AMS (2–4 lb/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS (2 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS (2 lb/A)**
- Add Tenkoz 4 lb Amine or Tenkoz 4 lb LOVOL Ester @ 4–12 fl oz for increased weed control spectrum and resistant weed management.

Target Weeds

- Canada thistle
- lambsquarters
- pigweed
- Russian thistle
- smartweed
- volunteer sunflower
- wild mustard
- wild buckwheat

Timing/Comments

Apply to crop after 2 leaf until prior to flag leaf emergence.

Treat when weeds are less than 4″ tall, 4″ in diameter, and actively growing.

See label for rotational restrictions.

*Crop Oil at 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

**CHS Emulate at 1 gal/100 gal can be substituted for CHS Aggrestrol.

Ally XP / Plotter (metsulfuron)

EPA Reg. #:	**352-435 Ally XP** **83100-83979 Plotter**
Rate/A:	0.1 oz
Spray Volume:	3 gpa min
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Wheat, Triticale

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (1–2 pt/100 gal) plus AMS (2–4 lb/100 gal)**
- May add AMS (2 lb/A)
- Add Tenkoz 4 lb Amine or Tenkoz 4 lb LOVOL Ester @ 4–12 fl oz for increased weed control spectrum and resistant weed management.

Target Weeds

– common lambsquarters
– pigweed
– smartweed
– volunteer sunflower
– wild mustard

Timing/Comments

Apply to crop from 2 leaf until prior to boot.

Treat when weeds are less than 4″ tall, 4″ in diameter, and actively growing.

See label for rotational restrictions.

CustomPak Amber Herbicide (triasulfuron)

EPA Reg. #:	**100-768**
Rate/A:	0.28–0.56 oz
Spray Volume:	3–20 gpa
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Wheat

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (1–2 qt/100 gal)**
- Note: Use 2 qt/100 gal when applying to dense weed pops or in spray volumes less than 10 gpa.
- Add Tenkoz 4 lb Amine or Tenkoz 4 lb LOVOL Ester @ 4–12 fl oz for increased weed control spectrum and resistant weed management.

Target Weeds

– cocklebur	less than 4″
– common ragweed	less than 6″
– common sunflower	less than 6″
– field pennycress	no size limit
– giant ragweed	less than 4″
– horseweed	less than 6″
– mashelder	less than 4″
– mustards	no size limit
– redroot pigweed	less than 4″

Timing/Comments

Wheat: Any stage up to pre-boot.

Barley: 2 leaf to pre-boot.

See label for soil and rotational restrictions.

Anthem Flex (pyroxasulfone + carfentrazone)

EPA Reg. #: **279–3464**
Rate/A: 2.73–4.55 fl oz
Spray Volume: 3 gpa min (air)
10 gpa min (ground)
Rainfast: 1 hour
S.O.A.: PPO Inhibitor (Group 14)
Very Long Chain Fatty Acid Inhibitor (Group 15)
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.: 12 hours
W. Notification: Oral
S. Word: Caution

Labeled Crops

- Spring and Winter Wheat

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100)**

or

- **CHS Hypertonic (1 qt/100 gal) plus AMS (1.5–3 lb/A)**

or

- **CHS Penetrec* (0.5–1 pt/A) plus AMS (1.5–3 lb/A)**

or

- **CHS Aggrestrol** (0.5–1 pt/A) plus AMS (1.5–3 lb/A)**

or

- **CHS Endurium (1 qt/100 gal) plus AMS (1.5–3 lb/A)**

Target Weeds

– lambsquarters
– morning glory
– eastern black nightshade
– redroot pigweed
– velvetleaf
– waterhemp

Timing/Comments

Apply to crop at spiking up to the 4th tiller growth stage.

*Crop Oil at 1–2 pt/A can be substituted for CHS Penetrec.
**CHS Emulate at 1–2 pt/A can be substituted for CHS Aggrestrol.

Axial Bold (Pinoxaden + fenoxaprop-p-ethyl)

EPA Reg. #: **100-1632**
Rate/A: 15.0 fl oz
Spray Volume: 5–10 gpa max (ground)
Min 5 gpa (air)
Rainfast: 30 minutes
S.O.A.: ACC-ase Inhibitor (Group 1)
P.P.E.: coveralls, s.s. shirt, l. pants, c.r shoes, socks, c.r. gloves
R.E.I.: 48 hours
W. Notification: Oral
S. Word: Caution

Labeled Crops

- Barley, Wheat
- Do not apply to durum

Adjuvant(s)/Comments

- **For drift reduction – CHS Acuvant (3 oz/A)**
- Up to 10 gal/A application rate, no additional adjuvant needed.
- For application volumes equal to or greater than 15 gal/A the addition of CHS Emulate at 1 pt/100 gal is suggested.

Target Weeds

– volunteer/wild oat	1–6 leaf
– foxtail sp.	1–5 leaf
– barnyard grass	1–5 leaf
– wild proso millet	1–5 leaf
– Persian darnel	1–6 leaf
– Italian ryegrass	1–5 leaf
– windgrass	1–5 leaf
– volunteer flax	less than 4″

Timing/Comments

Apply to spring/winter wheat from emergence to pre-boot.

Apply to barley from emergence to jointing stage, DO NOT apply after jointing.

See label for tank mix options and PHI.

Axial Star (pinoxaden + fluroxypyr)

EPA Reg. #:	**100-1389**
Rate/A:	16.4 fl oz
Spray Volume:	5 gpa min (air) 8–10 gpa (ground)
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1) Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, shoes, socks, c.r. gloves, p. eyewear
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Wheat
- **Do not apply to durum**

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**
- **For drift reduction – CHS Acuvant (3 oz/A)**
- See label for a complete list of tank mix partners.

Target Weeds

– wild oat	1–6 leaf
– foxtails	1–5 leaf
– barnyardgrass	1–5 leaf
– wild proso millet	1–5 leaf
– Persian darnel	1–6 leaf
– kochia	less than 4″
– common ragweed	less than 4″
– cocklebur	less than 4″
– volunteer flax	less than 4″
– common sunflower	1–4 leaf

Timing/Comments

Apply to wheat and barley from 2 leaf to preboot stage.

Axial XL (pinoxaden)

EPA Reg. #:	**100-1256**
Rate/A:	16.4 fl oz
Spray Volume:	5 gpa min (air) 5–10 gpa (ground)
Rainfast:	30 minutes
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	coveralls, s.s. shirt, l. pants, c.r. shoes, socks, c.r. gloves
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Warning

Labeled Crops

- Barley, Wheat
- **Do not apply to durum**

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**
- **For drift reduction – CHS Acuvant (3 oz/A)**
- See label for a complete list of tank mix partners.

Target Weeds

– wild oat	1–6 leaf
– foxtails	1–5 leaf
– barnyardgrass	1–5 leaf
– wild proso millet	1–5 leaf
– Persian darnel	1–6 leaf

Timing/Comments

Apply to wheat and barley from 2 leaf to preboot stage.

Batalium (flucarbazone + fluroxypyr + bromoxynil + safener)

EPA Reg. #:	**66330-434**
Rate/A:	13.7 fl.oz.
Spray Volume:	8–15 gpa (ground) 3–5 gpa (air)
Rainfast:	1 hour
S.O.A.:	ALS Inhibitor (Group 2), Growth Regulator (Group 4), Photosystem II Inhibitor (Group 6)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Spring Wheat, Winter Wheat, Durum

Adjuvant(s)/Comments

- **CHS Axon (2–4 qt/100 gal)**

or

- **CHS Hypertonic (1–2 qt/100 gal) plus AMS (8.5–17.5 lb/100 gal)**
- Tank mixes with products containing tribenuron improves control of barnyardgrass, Italian ryegrass, yellow foxtail, Persian darnel, wild oat

Target Weeds

Grass weeds 1–4 leaf

Broadleaf weeds up to 4 inches

Consult label for more information

Timing/Comments

Spring and durum wheat:
From 2 leaf up to 60 days prior to harvest.

Winter wheat:
Apply in the fall or spring from 2 leaf up to 60 days prior to harvest.

Beyond (imazamox)

EPA Reg. #:	**241-379**
Rate/A:	Spring wheat 4–5 fl oz Winter wheat 4–6 fl oz
Spray Volume:	5 gpa min (air) 10 gpa min (ground)
Rainfast:	1 hour
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- **Clearfield wheat varieties only.**

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (1 qt/100 gal) plus AMS (12–15 lb/100 gal)**

Target Weeds

(See label for weed sizes)

- common cocklebur
- foxtail
- giant ragweed
- lambsquarters
- pigweeds
- sunflower
- volunteer corn
- venice mallow
- volunteer canola
- mallows
- mustards
- nightshades
- velvetleaf

Timing/Comments

Spring wheat: apply to 4 leaf prior to jointing.

Winter wheat: apply after tiller initiation prior to jointing.

Bromoxynil Products

EPA Reg. #:	
42750-48	**Brox 2EC**
71368-29	**Maestro 2 EC**
Rate/A:	1–2 pt
Spray Volume:	5 gpa min
Rainfast:	1 hour
S.O.A.:	Photosystem II Inhibitor (Group 6)
P.P.E.:	coveralls over l.s. shirt, l. pants, c.r. gloves, apron, headgear, eyewear, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Labeled Crops

- Barley, Oat, Wheat

Target Weeds

Many broadleaf weeds including:

- wild buckwheat
- common sunflower
- kochia
- Russian thistle

Timing/Comments

Apply from emergence until boot.

Brox M (bromoxynil + MCPA)

EPA Reg. #:	
42750-52	**Brox M**
71368-28	**Maestro MA**
Rate/A:	1–2 pt
Spray Volume:	5 gpa min
Rainfast:	1 hour
S.O.A.:	Photosystem II Inhibitor (Group 6) Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, apron, footwear, socks, p. eyewear
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning

Labeled Crops

- Barley, Oat, Wheat

Target Weeds

Many broadleaf weeds including:

- wild buckwheat
- common sunflower
- kochia
- Russian thistle

Timing/Comments

Apply from 3 leaf until boot.

Cleansweep M (bromoxynil + fluroxypyr + MCPA)

EPA Reg. #:	**71368-89**
Rate/A:	1–2 pt
Spray Volume:	3 gpa min (air) 8 gpa min (ground)
Rainfast:	1 hour
S.O.A.:	Photosystem II Inhibitor (Group 6) Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, apron, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Oat, Wheat

Target Weeds

Controls many broadleaf weeds under 8" including:

- field bindweed
- wild buckwheat
- cocklebur
- lambsquarters
- mustards
- pigweed
- common ragweed
- sunflower
- Russian thistle
- velvetleaf

Timing/Comments

Apply from 2 leaf up to and including flag leaf emergence.

Curtail (clopyralid + 2,4-D)

EPA Reg. #:	**62719-48**
Rate/A:	2–2.66 pt
Spray Volume:	2 gpa min (10 recommended)
Rainfast:	6 hours
S.O.A.:	Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Danger

Labeled Crops

- Wheat, Barley

Target Weeds

Many broadleaf weeds including Canada thistle.

Timing/Comments

Apply from 4 leaf until jointing.

Apply to Canada thistle from rosette to early bolting.

Curtail M (clopyralid + MCPA)

EPA Reg. #:	**62719-86**
Rate/A:	1.75–2.33 pt
Spray Volume:	2 gpa min (10 recommended)
Rainfast:	6 hours
S.O.A.:	Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Oat, Wheat

Target Weeds

Many broadleaf weeds including Canada thistle.

Timing/Comments

Apply from 3 leaf until jointing.

Apply to Canada thistle from rosette to early bolting.

Dicamba Products

EPA Reg. #	
7969-137	**Clarity**
7969-137-55467	**Detonate**
42750-40	**Dicamba DMA**
Rate/A:	2–4 fl oz
Spray Volume:	3–50 gpa
Rainfast:	4 hours
S.O.A.:	Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning

Labeled Crops

- Barley, Oat, Wheat
- See label for a list of tank mix options.

Target Weeds

Many broadleaf weeds including:

– wild buckwheat
– common sunflower
– kochia
– Russian thistle

Timing/Comments

Fall seeded barley, oat or wheat: apply prior to jointing.

Spring seeded barley: apply prior to 4 leaf.

Spring seeded oat: apply prior to 5 leaf.

Spring seeded wheat: apply prior to 6 leaf.

Discover NG / NextStep NG (clodinafop)

EPA Reg. #	
100-1173	**Discover NG**
100-1173-66330	**NextStep NG**
Rate/A:	12.8–16 fl oz
Spray Volume:	3–5 gpa (air) 5–10 gpa (ground)
Rainfast:	30 minutes
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Wheat

Adjuvant(s)/Comments

- **CHS Aggrestrol* (2 qt/100 gal)**

Target Weeds

	12.8 fl oz	16.4 fl oz
– wild oat	1–6 leaf	-
– yellow foxtail	1–5 leaf	-
– green foxtail	1–5 leaf	-
– barnyardgrass	1–5 leaf	-
– Persian darnel	-	1–5 leaf
– annual ryegrass	-	1–5 leaf
– giant foxtail	-	1–5 leaf

Timing/Comments

Apply to crop from 2 leaf until preboot.

*CHS Emulate at 1 qt/100 gal can be substituted for CHS Aggrestrol.

Everest 3.0 (flucarbazone + cloquintocet safener)

EPA Reg. #:	**66330-429**
Rate/A:	2 fl oz (when Pre-Pare is not applied)
Spray Volume:	3–5 gpa min (air) 5-10 gpa (ground)
Rainfast:	1 hour
S.O.A.:	ALS Enzyme Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Wheat, Durum, Winter Wheat

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**
- Tank mixes with products containing tribenuron improves control of barnyardgrass, Italian ryegrass, Persian darnel, yellow foxtail, and wild oat.

Target Weeds

– green foxtail
– wild oat
– volunteer tame oat
– windgrass
– redroot pigweed
– mustards
– field pennycress
– Penn. smartweed
– volunteer canola
– wild buckwheat
– barnyardgrass
– cheat (fall control, spring suppression)
– Italian ryegrass
– Persian darnel
– foxtail barley
– shepherd's purse

Timing/Comments

Spring wheat and durum: apply from 1 leaf up to 60 days prior to harvest.

Winter wheat: apply in the fall or spring from 1 leaf up to 60 days prior to harvest.

Apply to 1 to 4 leaf grasses and less than 4 inch broadleaf weeds.

Express SG (tribenuron)

EPA Reg. #:	**352-632**
Rate/A:	0.25–0.5 oz 0.2 oz (oat)
Spray Volume:	5 gpa min
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Wheat, Oat, Triticale

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**

or

- **CHS Hypertonic (2 pt/100 gal) plus AMS (2–4 lb/A)**
- Add Tenkoz 4 lb Amine or Tenkoz 4 lb LOVOL Ester @ 4–12 fl oz for increased weed control spectrum and resistant weed management.

Target Weeds

– common chickweed
– field pennycress
– common lambsquarters
– Russian thistle
– kochia
– wild mustard

Apply when weeds are past the cotyledon stage and less than 4″ tall or 4″ in diameter.

Timing/Comments

Apply to crop from 2 leaf to prior to flag leaf emergence.

Oat: apply after 3 leaf prior to jointing.

Glean XP (chorsulfuron)

EPA Reg. #:	**352-653**
Rate/A:	1/6–1/3 oz
Spray Volume:	3 gpa min (air) 10 gpa min (ground)
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Oat, Triticale, Wheat

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (1–2 qt/100 gal)**
- Tank mixing 2,4-D or MCPA (ester formulations preferred) to improve control of certain weed species.
- See label for crop rotation restrictions.

Target Weeds

1/6–1/4 fl oz

– curly dock
– field pennycress
– prostrate pigweed
– redroot pigweed
– smooth pigweed
– wild mustard

1/3 fl oz

– common chickweed
– false chamomile
– ladysthumb
– common purslane
– common lambsquarters

Timing/Comments

Apply in the fall or spring after 2 leaf stage but prior to boot.

Triticale: apply in the fall or spring after 2 leaf stage but before flag leaf.

Glyphosate

Brand Name:	EPA Reg. #:	# A.E.	=0.75 AE
Buccaneer Plus	**55467-9**	3.00	32.0
Gly Star Original	**42750-60**	3.00	32.0
Gly Star Plus	**42750-61**	3.00	32.0
Durango DMA	**62719-556**	4.00	24.0
Buccaneer 5 Extra	**55467-15**	4.00	24.0
Gly Star 5 Extra	**42750-59**	4.00	24.0
Gly Star K-Plus	**42750-122**	4.50	21.3
Buccaneer K	**42750-122-55467**	4.50	21.3
Roundup RT 3	**524-544**	4.50	21.3
Roundup PowerMax 3	**524-659**	4.80	19.7

Rate/A:	Variable
Spray Volume:	5–20 gpa
Rainfast:	1–6 hours
M.O.A.:	EPSP Inhibitor
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Surfactant/Comments

- **CHS Level Best Pro (1 qt/100) plus AMS (8.5-17 lb/100)**

or

- **CHS Fixate/CHS Wheelhouse Pro (2-3 qt/100)**

or

- **Encloax (2.5-5 gal/100)**

or

- **CHS Hypertonic (1 qt/100) plus AMS (8.5-17 lb/100)**

GoldSky (pyroxsulam + florasulam + fluroxypyr)

EPA Reg. #:	**62719-582**
Rate/A:	1 pt
Spray Volume:	5 gpa min (air) 10 gpa min (ground)
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2) Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, p. eyewear, c.r. gloves, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning

Labeled Crops

- Wheat

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**
- To improve control of lambsquarters and Russian thistle, tank mix with 8 oz MCPA ester or 2,4-D ester.
- See label for rotational restrictions.

Target Weeds

Grass: 2-lf to 2-tiller

- annual ryegrass
- barnyard grass
- downy brome (fall)
- Japanese brome
- cheat
- yellow foxtail

Target Weeds Spring Applications

Broadleaf: < 2″

- volunteer canola
- mustards
- redroot pigweed
- annual smartweed

Harmony Extra SG (thifensulfuron + tribenuron 2:1)

EPA Reg. #:	**352-714**
Rate/A:	0.45–0.9 oz 0.45–0.6 oz (oat)
Spray Volume:	5 gpa min
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Oat, Wheat

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**

or

- **CHS Hypertonic (2 pt/100 gal) plus AMS (2–4 lb/100)**

Target Weeds

- common chickweed
- field pennycress
- common lambsquarters
- Russian thistle
- kochia
- wild mustard

Apply when weeds are past the cotyledon stage and less than 4″ tall or 4″ in diameter.

Timing/Comments

Wheat, barley, triticale: apply from 2 leaf until prior to flag leaf emergence.

Spring oat: apply after 3 leaf until prior to jointing.

Harmony SG (thifensulfuron)

EPA Reg. #:	**352-633**
Rate/A:	0.75 oz 0.45–0.6 oz (oat)
Spray Volume:	5 gpa min
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Oat, Wheat

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**

or

- **CHS Hypertonic (2 pt/100 gal) plus AMS (2–4 lb/100)**

Target Weeds

- common chickweed
- common purslane
- kochia
- field pennycress
- lambsquarters
- pigweed
- prickly lettuce
- Russian thistle
- shepherd's purse
- smartweed
- volunteer sunflower
- wild buckwheat
- wild mustard

Timing/Comments

Wheat, barley, triticale: apply from 2 leaf until prior to flag leaf emergence.

Spring oat: apply after 3 leaf until prior to jointing.

Apply when weeds are past the cotyledon stage and less than 4″ tall or 4″ in diameter.

Huskie (pyrasulfatole + bromoxynil)

EPA Reg. #: **264-1023**
Rate/A: 11–15 fl oz
Spray Volume: 5 gal min (air)
10 gal min (ground)
Rainfast: 1 hour
S.O.A.: Photosystem II Inhibitor (Group 6)
HPPD Inhibitor (Group 27)
P.P.E.: l.s. shirt, l. pants, c.r. gloves, socks, shoes, p. eyewear
R.E.I.: 24 hours
W. Notification: Oral
S. Word: Warning

Labeled Crops

- Barley, Rye, Triticale, Wheat

Adjuvant(s)/Comments

- **AMS (0.5–1 lb/A)**

or

- **CHS Axon (2 qt/100 gal)**

or

- **CHS Fixate/ CHS Wheelhouse Pro (1–2 qt/100 gal)**

Target Weeds

Most annual broadleaf weeds.

Timing/Comments

Apply between 1 leaf and up to flag leaf emergence.

Huskie Complete (thiencarbazone-methyl + pyrasulfatole + bromoxynil)

EPA Reg. #: **264-1135**
Rate/A: 13.7 fl oz
Spray Volume: 5 gpa min (air)
10 gpa min (ground)
Rainfast: 1 hour
S.O.A.: ALS Inhibitor (Group 2)
HPPD Inhibitor (Group 27)
Photosystem II Inhibitor (Group 6)
P.P.E.: l.s. shirt, l. pants, c.r. gloves, p. eyewear, socks, shoes
R.E.I.: 24 hours
W. Notification: Oral
S. Word: Danger

Labeled Crops

- Wheat

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**

Target Weeds

Grass weeds: 1 leaf to 2-tiller.
Broadleaf weeds: emergence to 4".
Consult label for more information.

Timing/Comments

Apply to crop from 1 leaf up to 60 days prior to harvest in Minn., Mont., N.D. and S.D. 70 days prior to harvest in other states.

Maverick (sulfosulfuron)

EPA Reg. #: **524-500**
Rate/A: 0.67 oz
Spray Volume: 5–15 gpa (air)
5–20 gpa (ground)
Rainfast: 4 hours
S.O.A.: ALS Inhibitor (Group 2)
P.P.E.: coveralls, shoes, socks, c.r. gloves
R.E.I.: 12 hours
W. Notification: Oral
S. Word: Caution

Labeled Crops

- Spring and Winter Wheat (not recommended in Durum)

Adjuvant(s)/Comments

- **CHS Axon (2–4 qt/100 gal)**
- **Rotational Warning:** Bioassay required before rotating to certain crops. See label.

Target Weeds

Spring Wheat	W. Wheat-Fall	W. Wheat-Spring
– wild oat	– downy brome	– mustards
– common sunflower	– Japanese brome	– quackgrass
	– cheat	– shepherd's purse
	– mustards	

Timing/Comments

Spring wheat: apply to crop from emergence until prior to jointing.
Winter wheat: 2 leaf until prior to jointing in Kan., Okla., Texas, and Mont. All other states apply from emergence prior to jointing.

Olympus 70 WDG (propoxycarbazone)

EPA Reg. #:	**264-809**
Rate/A:	0.6–0.9 oz
Spray Volume:	5 gpa min (air) 10 gpa min (ground)
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, p. eyewear, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Wheat, Durum, Triticale

Adjuvant(s)/Comments

- **CHS Axon (2–4 qt/100 gal)**

or

- **CHS Hypertonic (1 qt/100 gal)**

Target Weeds

– wild oat (0.9 oz/A)
– downy brome
– Japanese brome
– foxtail barley
– cheat
– mustards
– volunteer canola
– wild mustard

Timing/Comments

Apply prior to jointing.

OpenSky (fluroxypyr + pyroxsulam)

EPA Reg. #:	**62719-721**
Rate/A:	1 pt (Spring Wheat, Durum) 1-1.25 pt (Winter Wheat, Triticale)
Spray Volume:	10 gpa min (ground) 5 gpa min (air)
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group2) Growth Regulator (Group 4)
P.P.E.:	protective eyewear, l.s. shirt and pants, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Wheat, Durum, Winter Wheat, Triticale

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**

or

- **CHS Hypertonic* (1–2 qt/100 gal) plus AMS (1.5–3 lb/A)**

Target Weeds

Controls many broadleaf weeds including:
– barnyardgrass
– cheat
– Persian darnel
– foxtail, yellow
– ryegrass, Italian
– bedstraw, catchweed
– buckwheat, wild
– volunteer canola
– kochia
– lambsquarters
– mustards
– pigweed, redroot
– smartweed

Timing/Comments

All crops: 3 leaf up to before flag leaf emergence.

*When tank mixed with EC herbicides exceeding 6 oz, do not use CHS Hypertonic.

Osprey (mesosulfuron)

EPA Reg. #:	**264-802**
Rate/A:	3.2–4.75 oz
Spray Volume:	5 gpa min (air) 10 gpa min (ground)
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Winter Wheat only

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (2 qt/100 gal) plus AMS (1.5–3 lb/A)**

or

- **CHS Aggrestrol* (0.65–0.75 pt/A)**
- Not registered for use in Minnesota.
- **See label for rotational restrictions.**

Target Weeds — **4.75 fl oz**

	Grass	Broadleaf
– volunteer canola	-	1–2″
– wild oat	1 lf to 2-tiller	-
– wild mustard	-	1–2″
– Persian darnel	1 lf to 2-tiller	-
– redroot pigweed	-	1–2″
– bromes (suppression)	1 lf to 2-tiller	-
– annual ryegrass	1 lf to 2-tiller	-
– blackgrass	1 lf to 2-tiller	-
– quackgrass (suppression)	1 lf to 2-tiller	-
– cheat (suppression)	1 lf to 2-tiller	-
– goatgrass (suppression)	1 lf to 2-tiller	-

Timing/Comments

Apply from emergence up to jointing.

*CHS Emulate at 1.3–1.5 pt/A can be substituted for CHS Aggrestrol.

Osprey XTRA (Mesosulfuron-methyl + Thiencarbazone-methyl)

EPA Reg. #:	**264-1195**
Rate/A:	4.75 oz
Spray Volume:	10–15+ gpa (ground) Min 5 gpa (air)
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, shoes, socks, c.r. gloves, safety glasses
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Winter Wheat, fall-sown Triticale

Adjuvant(s)/Comments

- **For drift reduction – CHS Acuvant (3 oz/A)**
- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (2 qt/100 gal) plus AMS (1.5–3 lb/A)**

or

- **CHS Aggrestrol* (0.65–0.75 pt/A)**
- Do alter spray solution below 6.0 pH (prefer 6.0–8.0 pH).
- Not registered for use in Minnesota.

Target Weeds

Controlled	Suppressed
– Wild oat: 1 leaf to 2 tiller – Italian ryegrass: 1 leaf to 2 tiller – Persian darnel: 1 leaf to 2 tiller – Wild Mustard: 1–2 inches	– Downy brome: 1 leaf to 2 tiller – Rattail fescue: 1 leaf to 2 tiller

Timing/Comments

Apply to winter wheat or fall-sown triticale from emergence to jointing.

See label for tank mix options, rotational restrictions and PHI.

*CHS Emulate at 1.3–1.5 pt/A can be substituted for CHS Aggrestrol.

Parity (fenoxyprop-p-ethyl)

EPA Reg. #:	**264-666**
Rate/A:	0.33–0.66 pt
Spray Volume:	5 gpa min (air) 10 gpa (ground)
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	coveralls, s.s. shirt, l. pants, socks, c.r. footwear, c.r. gloves, goggles
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning

Labeled Crops

- Barley, Wheat

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**
- CHS Axon may be added when Puma is used alone to improve consistency of control.

Target Weeds

0.33 pt	0.4 pt	0.66 pt
– giant foxtail – foxtail millet – volunteer corn	– yellow foxtail – volunteer proso millet – wild proso millet	– barnyardgrass – wild oat – field sandbar – woolly cupgrass

Timing/Comments

Wheat: emergence to 60 to 70 days prior to harvest, state dependent.

Barley: crop emergence up to 5 leaf.

Peak (prosulfuron)

EPA Reg. #:	**100-763**
Rate/A:	0.38–0.5 oz
Spray Volume:	5 gpa min
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Oat, Rye, Sorghum, Wheat

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (1–2 qt/100 gal) plus AMS (2 lb/A)**

or

- **CHS Penetrec* (0.5–2 pt/A) plus AMS (2 lb/A)**

or

- **CHS Aggrestrol** plus AMS (2 lb/A)**

Target Weeds

Controls many broadleaf weeds including:

- wild buckwheat
- cocklebur
- mustards
- common ragweed
- Russian thistle
- sunflower

Timing/Comments

Emergence before 2nd node, if detectable.

See label for tank mix and rotational restrictions.

*Crop Oil at 1–4 pt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

**CHS Emulate at 1–4 pt/A can be substituted for CHS Aggrestrol.

PerfectMatch (clopyralid + fluroxypyr + pyroxsulam)

EPA Reg. #:	**62719-685**
Rate/A:	1 pt
Spray Volume:	5 gpa min (air) 10 gpa min (ground)
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2) Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Spring and Winter Wheat, Durum, Triticale

Adjuvant(s)/Comments

- **CHS Axon @ 1.0% v/v**

or

- **CHS Hypertonic (2 qt/100 gal) plus AMS (1.5–3 lb/A)**

Target Weeds

Grass

- barnyardgrass
- cheat
- Persian darnel
- yellow foxtail
- wild oat
- Italian ryegrass

Broadleaf

- cocklebur
- dandelion
- kochia
- lambsquarters
- mustards
- nightshades
- ragweeds, common and giant
- redroot pigweed
- Russian thistle
- volunteer canola
- wild buckwheat

Timing/Comments

Apply to crop from 3 leaf to jointing.

Apply to grass weeds at the 2 leaf to 2 tiller stage.

Apply to broadleaf weeds when no longer than 2″ tall or diameter.

Pixxaro (fluroxypyr + Halauxifen-methyl)

EPA Reg. #:	**62719–735**
Rate/A:	6.0 oz
Spray Volume:	8–10+ gpa (ground) Min 5 gpa (air)
Rainfast:	1 hour
S.O.A.:	Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, shoes, socks, c.r. gloves
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Winter Wheat, Spring Wheat, Durum, Barley and Triticale

Adjuvant(s)/Comments

- **CHS Fixate/ CHS Wheelhouse Pro (1 qt/100 gal)**
- **For drift reduction – CHS Acuvant (3 oz/A)**
- Caution with surfactants when fluid fertilizers are applied

Target Weeds Controlled

- catchweed bedstraw
- flixweed
- nightshade sp.
- wild buckwheat

Weeds Suppressed

- Canada thistle
- field pennycress
- Russian thistle

Timing/Comments

Pre-plant and post-emerge use in labeled crops.

Apply on wheat (all), barley and triticale from 2 leaf up to flag leaf emergence.

See label for tank mix options, rotational restrictions and PHI.

PowerFlex HL (pyroxsulam)

EPA Reg. #:	**62719-643**
Rate/A:	2 oz
Spray Volume:	5 gpa min (air) 10 gpa min (ground)
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, p. eyewear, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Winter Wheat, Triticale

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**

or

- **CHS Hypertonic (1–2 qt/100 gal) plus AMS (1.5–3 lb/A)**

or

- **CHS Penetrec* (2–2.5 qt/100 gal)**
- See label for rotational restrictions.
- To improve control of common lambsquarter and Russian thistle tank mix with 8 oz MCPA ester or 2.4-D ester.

Target Weeds

Spring Applications

Grass: 2 leaf to 2-tiller

- annual ryegrass
- barnyardgrass
- downy brome (fall)
- Japanese brome
- cheat
- yellow foxtail

Broadleaf: < 2″

- volunteer canola
- mustards
- redroot pigweed
- annual smartweed

Timing/Comments

Apply from 3 leaf to jointing.

Suppression control other grasses when applied in the fall.

*Crop Oil at 1–1.25 gal/100 gal can be substituted for CHS Penetrec.

Quelex (halauxifen + florasulam)

EPA Reg. #:	**62719-661**
Rate/A:	0.75 oz
Spray Volume:	5 gpa min (air) 8 gpa min (ground)
Rainfast:	4 hours
S.O.A.:	Growth Regulator (Group 4) ALS Enzyme Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, socks, shoes
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Spring and Winter Wheat, Barley, Triticale

Adjuvant(s)/Comments

- **CHS Hypertonic (1–2 pt/100 gal)**

or

- **CHS Penetrec* (2–4 pt/100 gal)**

or

- **CHS Aggrestrol** (2–4 pt/100 gal)**

Target Weeds

– common lambsquarters
– redroot pigweed
– cleavers
– henbit
– wild buckwheat
– mustards
– volunteer canola
– volunteer flax
– smartweeds
– chamomiles
– horseweed/marestail
– field pennycress

Apply to weeds in the 2 to 4 leaf or less than 4 inches tall.

Timing/Comments

Apply from 2-leaf to flag leaf emergence.

*Crop Oil at 4–8 pt/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate at 4–8 pt/100 gal can be substituted for CHS Aggrestrol.

Rave (triasulfuron + dicamba)

EPA Reg. #:	**100-927**
Rate/A:	2 oz (barley) 4 oz (wheat)
Spray Volume:	2–10 gpa (air) 5–20 gpa (ground)
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2) Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, coveralls, c.r. gloves, shoes, socks, p. eyewear
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Wheat

Adjuvant(s)/Comments

- **CHS Hypertonic (1–2 pt/100 gal)**
- Note: Use 2 pt/100 gal when applying to dense weed populations and in spray volumes less than 10 gpa.

Target Weeds

Controls most broadleaf weeds.
See label for crop rate, weeds, and weed sizes.

Timing/Comments

Spring wheat: emergence up to 6 leaf.
Winter wheat: emergence up to jointing.
Spring barley: emergence to 4 leaf.
See label for rotational restrictions and registered states.

Rezuvant (fluroxypyr + halauxifen-methyl + pinoxaden)

EPA Reg. #:	**62719-750**
Rate/A:	16.4 oz
Volume:	5 gpa min (air) 8 gpa min (ground)
Rainfast:	4 hours
S.O.A.:	Growth Regulator (Group 4) ALS Enzyme Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, socks, shoes
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Spring and Winter Wheat, Barley

Adjuvant(s)/Comments

- **CHS Hypertonic (1–2 pt/100 gal)**

or

- **CHS Penetrec* (2–4 pt/100 gal)**

or

- **CHS Aggrestrol** (2–4 pt/100 gal)**

Target Weeds

– common lambsquarters
– redroot pigweed
– kochia
– wild buckwheat
– mustards
– Persian darnel
– wild oat
– yellow foxtail
– green foxtail
– Italian ryegrass
– prickly lettuce

Apply to weeds in the 2 to 4 leaf or less than 4 inches tall.

Timing/Comments

Apply from 2-leaf to flag leaf emergence.

*Crop Oil at 4–8 pt/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate at 4–8 pt/100 gal can be substituted for CHS Aggrestrol.

Rimfire Max (mesosulfuron + propoxycarbazone)

EPA Reg. #:	**264-1099**
Rate/A:	3 oz
Spray Volume:	5 gpa min (air) 10 gpa min (ground)
Rainfast:	4 hours
S.O.A.:	ALS inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Labeled Crops

- Wheat only

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (1–2 qt/100 gal) plus AMS (1.5–3 lb/A)**

or

- **CHS Aggrestrol* (0.6-0.75 pt/A)**
- See label for rotational restrictions.

Target Weeds

Grass: 1 leaf to 2-tiller

- cheat
- barnyardgrass
- foxtail barley
- giant foxtail
- yellow foxtail
- Japanese brome
- wild oat

Broadleaf: < 2″

- mustards
- volunteer canola

Timing/Comments

Apply from 1 leaf to flag leaf emergence.

*CHS Emulate at 1.2–1.5 pt/A can be substituted for CHS Aggrestrol.

Starane Flex (fluroxypyr + florasulam)

EPA Reg. #:	**62719-604**
Rate/A:	13.5 fl oz
Spray Volume:	3 gpa min (air) 8 gpa min (ground)
Rainfast:	4 hour
S.O.A.:	Growth Regulator (Group 4) ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning

Labeled Crops

- Barley, Oat, Wheat

Adjuvant(s)/Comments

- **CHS Fixate/ CHS Wheelhouse Pro (1–2 qt/100 gal)**

Target Weeds

- common ragweed
- common sunflower
- kochia
- morning glory
- mustards
- prickly lettuce
- smartweed
- venice mallow
- volunteer flax
- wild buckwheat

Timing/Comments

Apply to barley, oat or wheat from 3 leaf up to flag leaf emergence.

Starane NXT (fluroxypyr + bromoxynil)

EPA Reg. #:	**62719-557**
Rate/A:	14–21 fl oz
Spray Volume:	3 gpa min (air) 8 gpa min (ground)
Rainfast:	1 hour
S.O.A.:	Growth Regulator (Group 4) Photosystem II Inhibitor (Group 6)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves shoes, socks, p. eyewear
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning

Labeled Crops

- Barley, Oat, Wheat

Adjuvant(s)/Comments

- **CHS Fixate/ CHS Wheelhouse Pro (1 qt/100 gal)**

Target Weeds

Controls most annual broadleaf weeds.

Timing/Comments

Apply to barley, oat or wheat from 3 leaf up to flag leaf emergence.

Starane Ultra (fluroxypyr)

EPA Reg. #: **62719-577**
Rate/A: 0.3–0.4 pt
Spray Volume: 3 gpa min (air)
8 gpa min (ground)
Rainfast: 1 hour
S.O.A.: Growth Regulator (Group 4)
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear
R.E.I.: 24 hours
W. Notification: Oral
S. Word: Warning

Labeled Crops

- Barley, Oat, Wheat

Adjuvant(s)/Comments

- **CHS Fixate/ CHS Wheelhouse Pro (1 qt/100 gal)**

Target Weeds	0.3 pt	0.4 pt
– kochia	4″	8″
– common ragweed	4″	8″
– sunflower	4″	8″

Timing/Comments

Apply to barley, oat or wheat from 2 leaf including flag leaf emergence.

Sentrallas (thifensulfuron + fluroxypyr)

EPA Reg. #: **352-897**
Rate/A: 7–14 fl oz
Spray Volume: 3 to 5 gpa (air)
8 gpa min (ground)
Rainfast: 1 hour
S.O.A.: Growth Regulator (Group 4)
ALS Enzyme Inhibitor (Group 2)
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks, coveralls
R.E.I.: 24 hours
W. Notification: Oral
S. Word: Caution

Labeled Crops

- Wheat, Barley, Oat (refer to label for state registrations)

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100)**

or

- **CHS Hypertonic (1–2 pt/100 gal) plus AMS (2 lb/A)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS (2 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS (2 lb/A)**

Target Weeds

Numerous annual broadleaf weeds. Control is dependent on rate applied. Refer to label.

Apply to weeds less than 4 inches in height or diameter.

Timing/Comments

Wheat and barley: Apply from 2-leaf before flag leaf is visible. Oat: Apply after crop is the 3-leaf stage but before jointing.

*Crop Oil at 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate at 1 gal/100 gal can be substituted for CHS Aggrestrol.

Supremacy (fluroxypyr + thifensulfuron + tribenuron)

EPA Reg. #: **66330-406**
Rate/A: Wheat: 4–6 oz
Oat: 5 oz
Spray Volume: 3 gpa min (air)
8 gpa min (ground)
Rainfast: 2 hours
S.O.A.: Growth Regulator (Group 4)
ALS Inhibitor (Group 2)
P.P.E.: l.s. shirt, l. pants, shoes, socks, c.r. gloves, p. eyewear
R.E.I.: 24 hours
W. Notification: Oral
S. Word: Warning

Labeled Crops

- Barley, Durum, Oat, Triticale, Wheat

Adjuvant(s)/Comments

- **CHS Axon (2–4 qt/100)**

Target Weeds

- wild buckwheat
- Canada thistle
- kochia
- mustards
- pigweed
- volunteer flax
- many other broadleaf weeds
- 4 fl oz for 2″ or less weeds
- 5 fl oz for 2–4″ weeds

Timing/Comments

Barley, durum, triticale, wheat: apply to crop from 2 leaf until before flag leaf emergence.

Oat: apply after 2 leaf stage until prior to jointing.

Talinor (bicyclopyrone + bromoxynil)

EPA Reg. #:	**100-1570**
Rate/A:	13.7–18.2 fl oz
Spray Volume:	5 gpa min (air) 10 gpa min (ground)
Rainfast:	1 hour
S.O.A.:	HPPD Inhibitor (Group 27) Photosystem II Inhibitor (Group 6)
P.P.E.:	coveralls, l.s. shirt, l. pants, shoes, socks, c.r. gloves
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Wheat

Adjuvant(s)/Comments

- **CoAct+ (2.75–3.6 fl oz/A) plus CHS Penetrec* (2 qt/100 gal)**

or

- **CoAct+ (2.75–3.6 fl oz/A) plus CHS Hypertonic (1 qt/100 gal)**
- No AMS containing products.

Target Weeds

– volunteer canola	4″ diameter
– common cocklebur	1–4 leaf
– field pennycress	4″ diameter
– horseweed/marestail	3″ rosette
– kochia	1–5 inch
– common lambsquarters	1–6 leaf
– mustards	4″ diameter
– nighshades	1–4 leaf
– redroot pigweed	2–6″
– common ragweed	2–4″
– sunflower	2–4″
– waterhemps	2–4″

Timing/Comments

PNW Recommendations
Use NIS (CHS Hypertonic) to reduce crop response
Winter wheat - max of 5% UAN in spray solution
Spring wheat - Do not add UAN to spray solution

*Crop Oil at 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

Tarzac (pyroxsulam + halauxifen-methyl)

EPA Reg. #:	**62719-719**
Rate/A:	1 oz (Winter Wheat, Triticale)
Spray Volume:	10 gpa min (ground) 5 gpa min (air)
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group2) Growth Regulator (Group 4)
P.P.E.:	protective eyewear, l.s. shirt and pants, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Winter Wheat, Triticale

Adjuvant(s)/Comments

- **CHS Axon (2 qt/100 gal)**

or

- **CHS Hypertonic* (1–2 qt/100 gal) plus AMS (1.5–3 lb/A)**

Target Weeds

Controls many broadleaf weeds including:
– barnyardgrass
– cheat
– foxtail barley
– foxtail, yellow
– ryegrass, Italian
– Japanese brome
– buckwheat, wild
– field bindweed
– kochia
– lambsquarters
– mustards

Timing/Comments

All crops: 3 leaf up to jointing

*When tank-mixed with EC herbicides exceeding 6 oz, do not use CHS Hypertonic.

Travallas (metsulfuron + thifensulfuron + fluroxypyr)

EPA Reg. #:	**352-896**
Rate/A:	7–12 fl oz
Spray Volume:	3 to 5 gpa (air) 8 gpa min (ground)
Rainfast:	1 hour
S.O.A.:	Growth Regulator (Group 4) ALS Enzyme Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, waterproof gloves, shoes, socks, coveralls
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Spring and Winter Wheat, Barley (refer to label for state registrations)

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100)**

or

- **CHS Hypertonic (1–2 pt/100 gal) plus AMS (2 lb/A)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS (2 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS (2 lb/A)**

Target Weeds

– volunteer lentils
– volunteer peas
– mustards
– cow cockle
– flixweed
– common chickweed
– common lambsquarters
– field pennycress
– kochia

Timing/Comments

Apply to weeds less than 4 inches in height or diameter.
Wheat and barley: Apply from 2-leaf before flag leaf is visible. Long residual herbicide, refer to label for rotational intervals.

*Crop Oil at 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate at 1 gal/100 gal can be substituted for CHS Aggrestrol.

Varro (thiencarbazone-methyl)

EPA Reg. #:	**264-1062**
Rate/A:	6.85 fl oz
Spray Volume:	5 gpa min (air) 5 gpa min (ground)
Rainfast:	1 hour
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, socks, shoes, c.r. gloves
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Wheat—spring and winter, Durum

Adjuvant(s)/Comments

- **CHS Axon (2–4 qt/100 gal)**

or

- **CHS Hypertonic (1–2 qt/100 gal) plus AMS (0.5–1 lb/A)**

or

- **CHS Hypertonic (1 qt/100 gal)**

Target Weeds

Grass: 1 leaf to 2-tiller

– barnyardgrass
– green foxtail
– wild oat
– yellow foxtail

Broadleaf: 1–6 leaf

– common chickweed
– field pennycress
– redroot pigweed
– shepherd's purse
– volunteer canola
– wild mustard

Timing/Comments

Apply to crop from 1 leaf up to 60 days prior to harvest in Minn., Mont., N.D., S.D., and 70 days prior harvest in all other states.

WideMatch (fluroxypyr + clopyralid)

EPA Reg. #:	**62719-512**
Rate/A:	1–1.33 pt
Spray Volume:	3 gpa min (air) 10 gpa min
Rainfast:	6 hour
S.O.A.:	Growth Regulator
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Barley, Oat, Wheat

Adjuvant(s)/Comments

- **CHS Fixate/ CHS Wheelhouse Pro (1 qt/100 gal)**

Target Weeds

Controls most annual and perennial broadleaf weeds.

Timing/Comments

Barley, oat, or wheat: apply from 3 leaf to flag leaf emergence.

Wolverine Advanced (fenoxaprop + pyrasulfotole + bromoxynil)

EPA Reg. #:	**264-1168**
Rate/A:	1.7 pt
Spray Volume:	5 gpa min (air) 10 gpa min (ground)
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1) HPPD Inhibitor (Group 27) Photosystem II Inhibitor (Group 6)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Labeled Crops

- Wheat, Durum, Barley

Target Weeds

Grass	Broadleaf	
– barnyardgrass	– cocklebur	1-4 leaf
– green foxtail	– kochia	1-4 leaf
– yellow foxtail	– lambsquarters	1-6 leaf
– wild oat	– mustards	1-6 leaf, 4″ diameter
	nightshades	1-4 leaf
	– ragweeds, common and giant	1-4 leaf
	– redroot pigweed	1-6 leaf
	– volunteer canola	1-6 leaf, 4″ diameter
	– wild buckwheat	1-6 leaf

Timing/Comments

Apply to wheat, durum from emergence up to 60 days prior to harvest in Minn., Mont., N.D., S.D. 70 days prior to harvest in other states.

Apply to barley from emergence up to the 5 leaf stage.

Apply to grass weeds in the 1 leaf to 2 tiller stage.

Small Grain Herbicide Postemergence Efficacy Chart

	Crop Tolerance				Annual Grasses							Annual Broadleaves																					Perennial Broadleaves		
Herbicide	Barley	Oat	Rye	Wheat	Barnyardgrass	Cheatgrass	Downy Brome	Green/Giant Foxtail	Yellow Foxtail	Volunteer Cereals	Wild Oat	Chickweed	Cocklebur*	Henbit	Horseweed	Kochia*	Lambsquarters	Lanceleaf Sage	Marshelder	Mustard (Tansy)	Mustard (Wild)	Nightshade (Black)*	Pennycress	Pigweed (Redroot)*	Prickly Lettuce*	Ragweed (Common)	Russian Thistle*	Shepherd's Purse	Smartweed (Annual)	Sunflower	Wild Buckwheat	Wormwood, Biennial	Canada Thistle	Field Bindweed	Sowthistle
2,4-D Amine	E	E	E	E	N	N	N	N	N	N	N	F	G	P	F	F	E	F	E	E	E	F	E	E	E	E	F	E	F	G	P	G	G	G	F
2,4-D Ester	E	G	E	E	N	N	N	N	N	N	N	F	E	P	G	F	E	F	E	E	E	F	E	E	E	E	F	E	F	G	P	G	G	G	G
Affinity Broadspec + 2,4-D / MCPA	E	N	N	E	N	N	N	N	N	N	N	E	G	G	F	E	E	F	E	E	E	F	E	G	G	G	E	E	G	G	F	F	G	P	G
Affinity Tank mixW + 2,4-D / MCPA	E	N	N	E	N	N	N	N	N	N	N	E	E	G	F	E	E	G	E	E	E	F	E	E	G	E	E	E	E	E	G	F	F	P	G
Agility SG	E	N	N	E	N	N	N	N	N	N	N	E	E	E	N	E	E	N	E	E	E	E	E	E	E	N	E	E	E	G	E	N	N	P	P
Aim EC	G	G	N	G	N	N	N	N	N	N	N	P	N	P	P	G	G	-	P	P	P	G	G	G	P	F	P	F	P	P	P	-	P	P	P
Ally Extra	E	N	N	E	N	N	N	N	N	N	N	E	F	G	F	G	E	-	G	E	E	P	E	E	E	E	E	E	G	G	G	-	G	P	F
Ally XP / Potter	E	N	N	E	N	N	N	N	N	N	N	E	F	G	F	G	G	-	-	G	G	P	G	E	E	E	G	G	F	G	F	-	F	P	F
Ally XP + 2,4-D / MCPA	E	N	N	E	N	N	N	N	N	N	N	E	G	G	F	E	E	F	G	E	E	F	E	E	E	E	E	E	F	G	F	F	G	F	F
Amber Custom Pak	E	N	N	E	N	N	F	F	F	P	N	E	G	G	F	G	G	-	-	E	E	P	E	E	E	E	G	E	G	E	G	-	P	P	P
Amber Custom Pak + 2,4-D	E	N	N	E	N	N	F	F	F	P	N	E	E	G	F	E	E	F	E	E	E	F	E	E	E	E	E	E	G	E	G	F	F	F	F
Audit 4:1 + 2,4-D / MCPA	E	N	N	E	N	N	N	N	N	N	N	E	E	G	F	E	E	G	E	E	E	F	E	E	G	E	E	E	E	E	G	F	F	P	G
Axial Star**	G	N	N	G	G	P	P	E	E	N	E	E	F	G	P	F	E	F	P	E	E	F	E	G	G	E	F	E	E	E	E	P	F	F	F
Axial XL**	G	N	N	G	G	P	P	E	E	N	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Batalium + tribenuron	N	N	N	E	G	G	G	E	G	G	E	-	E	-	-	E	E	-	-	E	-	E	-	E	E	E	E	E	E	E	E	-	N	N	N
Beyond (Clearfield Wheat Only)	N	N	N	E	G	P	F	G	F	P	G	E	G	E	P	F	F	F	G	E	E	E	E	E	P	F	G	E	E	E	G	P	P	P	P
Brox M / Maestro MA	E	G	G	E	N	N	N	N	N	N	N	E	E	G	F	E	E	E	E	G	E	E	E	G	G	E	E	E	E	E	E	F	F	F	F
Brox 2EC / Maestro 2 EC	E	G	G	E	N	N	N	N	N	N	N	G	E	G	F	G	E	E	E	G	F	E	E	F	F	E	E	E	E	E	E	F	P	P	F
Clarity / Detonate / Dicamba	F	G	N	G	N	N	N	N	N	N	N	E	E	G	G	E	E	F	E	F	F	G	E	E	G	E	E	G	E	E	E	G	G	G	G
Clarity / Detonate / Dicamba + 2,4-D / MCPA	F	G	N	G	N	N	N	N	N	N	N	E	E	F	G	E	E	G	E	F	G	G	E	E	E	E	E	G	E	E	E	G	G	G	G
Cleansweep M	E	E	N	E	N	N	N	N	N	N	N	E	E	F	G	E	E	G	E	F	G	G	E	E	E	E	E	G	E	E	E	G	G	G	G
Curtail / Curtail M	E	N	N	E	N	N	N	N	N	N	N	F	E	F	E	F	E	G	E	G	E	G	E	G	E	E	F	G	F	E	E	E	E	F	F
Discover NG / NextStep NG	N	N	N	E	E	P	P	E	G	P	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Everest 3.0 / Sierra	N	N	N	E	P	G	F	E	G	P	E	N	N	N	N	N	N	N	N	N	E	N	E	F	N	N	N	E	E	N	F	P	N	N	N
Express SG + 2,4-D / MCPA	E	N	N	E	N	N	N	N	N	N	N	E	G	F	F	E	E	F	E	G	E	F	E	G	G	E	E	E	F	F	F	F	G	F	G
Glean XP	E	E	N	E	N	N	G	G	G	N	N	N	N	E	N	G	E	N	N	E	E	N	E	E	G	N	G	E	G	G	G	N	G	N	N
GoldSky	N	N	N	G	P	E	G	G	G	N	E	E	F	G	P	E	G	P	P	E	E	F	E	G	P	F	E	E	G	E	E	P	P	F	P
Harmony Extra SG + 2,4-D / MCPA	E	N	N	E	N	N	N	N	N	N	N	E	E	G	F	E	E	G	E	E	E	F	E	E	G	E	E	E	E	E	G	F	F	P	G
Harmony SG + 2,4-D / MCPA	E	E	N	E	N	N	N	N	N	N	N	P	P	-	F	G	E	N	G	E	E	N	E	E	P	G	G	E	G	G	E	P	F	P	P

Small Grain Herbicide Postemergence Efficacy Chart

Herbicide	Crop Tolerance				Annual Grasses							Annual Broadleaves																			Perennial Broadleaves		
	Barley	Oat	Rye	Wheat	Barnyardgrass	Cheatgrass	Downy Brome	Green/Giant Foxtail	Yellow Foxtail	Volunteer Cereals	Wild Oat	Chickweed	Cocklebur*	Henbit	Horseweed	Kochia*	Lambsquarters	Lanceleaf Sage	Marshelder	Mustard (Tansy)	Mustard (Wild)	Nightshade (Black)*	Pennycress	Pigweed (Redroot)*	Prickly Lettuce*	Ragweed (Common)	Russian Thistle*	Shepherd's Purse	Smartweed (Annual)	Sunflower	Wild Buckwheat	Wormwood, Biennial	Canada Thistle	Field Bindweed	Sowthistle
Huskie	G	G	G	G	N	N	N	N	N	N	N	E	E	G	G	E	E	E	E	G	E	E	E	E	G	E	G	E	G	E	E	G	F	F	G
Huskie Complete	N	N	N	G	E	-	-	E	E	N	G	E	E	G	G	E	E	E	E	G	E	E	E	E	G	E	G	E	G	E	E	G	F	F	G
Maverick	N	N	N	G	P	E	G	F	F	P	E	G	N	P	F	P	P	-	-	G	E	P	G	P	G	P	P	G	P	E	P	P	N	N	N
MCPA Amine	E	E	G	E	N	N	N	N	N	N	N	F	F	P	F	F	E	G	G	F	E	F	E	F	G	E	F	F	F	F	P	F	F	F	F
MCPA Ester	E	G	G	E	N	N	N	N	N	N	N	F	G	P	F	F	E	G	G	F	E	F	E	F	G	E	F	G	F	F	P	F	F	F	F
Olympus 70 WDG	N	N	N	G	P	E	G	P	P	P	G	F	P	F	P	P	P	P	P	E	E	P	E	G	P	P	P	E	P	P	F	P	P	P	P
OpenSky	N	N	N	E	E	E	G	G	E	P	E	E	N	P	N	E	E	N	N	E	E	N	E	E	E	N	E	E	E	E	N	N	N	N	N
Orion	E	E	E	E	N	N	N	N	N	N	N	E	F	G	P	F	E	F	P	E	E	F	E	G	G	E	F	E	E	E	E	P	F	F	F
Osprey***	N	N	N	G	P	F	F	F	F	P	E	P	P	G	P	P	P	P	P	F	E	P	P	G	P	P	P	P	P	P	P	P	P	P	P
Parity	E	N	N	E	E	P	P	E	E	P	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Peak	E	E	E	E	N	N	N	N	N	N	N	G	E	F	F	G	G	F	-	E	E	P	E	E	G	E	G	E	E	E	E	F	F	F	P
PerfectMatch	N	N	N	E	E	E	G	G	E	N	C	E	E	G	E	E	E	-	E	E	E	E	E	E	E	E	E	E	E	E	E	E	G	G	G
Pixarro EC	E	N	N	E	N	N	N	N	N	N	N	E	E	E	E	E	E	N	F	P	P	E	F	E	E	E	F	F	N	E	E	N	P	P	P
PowerFlex HL***	N	N	N	G	P	E	G	F	F	N	E	G	P	G	P	P	F	P	P	E	E	P	E	G	P	P	G	E	G	P	F	P	P	P	P
Quelex	E	N	N	E	N	N	N	N	N	N	N	E	N	E	E	G	E	N	N	E	E	N	E	E	G	N	N	E	E	G	E	N	G	G	G
Rave	F	N	N	G	N	N	N	N	N	N	N	E	E	E	G	E	G	G	E	E	E	E	E	E	E	E	E	E	E	E	E	F	G	G	G
Rezuvant	E	N	N	E	E	N	N	E	E	N	E	E	E	E	E	E	E	N	N	N	N	N	G-F	E	E	E	G	G	N	N	E	N	F	F	F
Rimfire Max	N	N	N	G	E	F	F	G	G	P	E	G	P	G	P	P	P	P	P	E	E	P	G	F	P	P	P	G	P	P	P	P	P	P	P
Sentrallas	E	E	N	E	N	N	N	N	N	N	N	E	G-E	P	P	G-E	E	N	E	P	E	P	E	E	P-G	G-E	E	E	E	G-E	G-E	N	N	N	N
Starane Flex	G	G	N	G	N	N	N	N	N	N	N	E	F	G	P	E	E	F	P	E	E	F	E	E	G	E	F	E	E	E	E	P	F	F	F
Starane NXT	G	G	N	G	N	N	N	N	N	N	N	G	E	G	F	E	G	G	G	F	F	E	G	F	F	E	G	E	E	G	E	F	P	P	P
Starane Ultra	E	E	N	E	N	N	N	N	N	N	N	G	G	P	G	E	P	P	P	F	F	F	G	P	G	G	F	F	P	G	F	P	P	G	P
Supremacy	N	N	N	G	N	N	N	N	N	N	N	E	E	G	F	E	E	G	E	E	E	F	E	E	G	E	E	E	E	E	G	F	F	P	G
Talinor	E	N	N	E	N	N	N	N	N	N	N	E	E	G-E	E	E	N	N	E	E	E	E	E	E	E	G-E	E	E	E	E	E	N	F	N	E
Tarzec	N	N	N	E	E	E	G	G	G	P	E	E	N	E	E	E	N	E	E	E	N	N	E	E	E	N	E	E	N	N	E	N	G	E	E
Travallas	E	N	N	E	N	N	N	N	N	N	N	E	G	G	G	E	E	N	E	G	E	G	E	E	G	G	E	E	E	G	G	N	G	G	G
Varro	N	N	N	E	E	N	N	E	E	N	E	E	N	N	N	N	G	N	N	G	E	N	E	E	N	N	G	E	G	N	G	N	N	N	N
Widematch	G	G	N	G	N	N	N	N	N	N	N	F	E	F	G	E	P	P	E	P	P	G	P	P	E	E	P	P	G	E	E	E	E	F	G
Wolverine Advanced	E	N	N	E	N	N	N	E	E	N	E	E	E	E	E	E	E	-	E	E	E	E	E	E	E	E	E	E	E	E	E	E	N	N	E

*Biotypes of weeds with an asterisk can and have developed resistance to sulfonyl-urea herbicides such as Affinity, Ally XP, Ally Extra, Amber, Express, Harmony SG, Harmony Extra SG, Peak, Beyond, Clearmax, and Finesse.
**Not labeled on durum.
***Winter wheat only. Not labeled in Minnesota.

Small Grain Herbicide Grass Control Weed Ratings

Herbicide[1,2,3]	Rate/A	Crops Labeled	Wild Oat	Green Foxtail	Yellow Foxtail	Downy Brome	Quackgrass	Japanese Brome	Barnyardgrass	Persian Darnel	Foxtail Barley	Annual Ryegrass	Cheat	Rotation Restrictions (in months)				
														Barley	Canola	Field Pea	Garbanzo/ Chickpea	Lentil
Axial XL / Axial Star / Axial Bold	16.4 fl oz	Barley, HRSW, WW	C	C	C				C	C		C		0	4	4	4	4
Beyond / ClearMax	4 fl oz/4fl oz OR 8 fl oz	Clearfield varieties only	C	C	S	S		C	C	C		S	S	18	18	9	9	9
Discover NG / NextStep	12.8 fl oz	All Wheat	C	C	C				C					0	1	1	1	1
Discover NG / NextStep	16 fl oz	All Wheat	C	C	C	C			C	C		C		0	1	1	1	1
Everest / Sierra + CHS Axon	0.5 fl oz	All Wheat		C										9	9	11	24	24
Everest / Sierra + CHS Axon	0.75–1.0 fl oz	All Wheat	C	C	C	S		C/S	C/S	C/S	S	C/S	S	9	9	11	24	24
Everest 3.0 + CHS Axon	2 fl oz	All Wheat	C	C	C	S		C/S	C/S	C/S	S	C/S	S	9	9	11	24	24
GoldSky + CHS Axon	1 pt	Spring Wheat	C	S	C	C/S	S	C			S	C	C	9	9	9/18	9/18	9/18
Huskie Complete + CHS Axon	13.7 fl oz	All Wheat	C	C	C			S	C	S				9	10	10	18	18
Maverick + CHS Axon	0.67 oz	Spring, Winter Wheat	S			S	C	C/S				S	S	22	22	22	17/22	22
Olympus + CHS Axon	0.6–0.9 oz	All Wheat	C/S			C/S	S	C			C		C	10	10	10	10	10
OpenSky / Goldsky	1–1.25 pt	All Wheat	C	S	C	S	S	C	C	C	S	C	C	10	10	10	10	10
Osprey + CHS Axon	4.75 oz	Winter Wheat	C			S	S	S	S	C		C	S	1	10	3	10	3
Parity	0.33 pt	All Wheat, Barley		C										0	0	0	0	0
Parity	0.4 pt	All Wheat, Barley		C	C									0	0	0	0	0
Parity	0.66 pt	All Wheat, Barley	C	C	C				C					0	0	0	0	0
Perfectmatch + CHS Axon	16 oz	All Wheat	C	S	C	S	S	C	C	C	S		S	9	9	10.5	18	18
PowerFlex HL + CHS Axon	2.0 oz	Winter Wheat	C	S	C/S	C/S	S	C			S	C	C	9	9	9	9	9
Pre-Pare	0.15–0.3 oz	Spring, Winter Wheat	C/S	C	S	S		S	S	S	S	S	S	9	9	11/18	11	18/24
Rezuvant	16.4 oz	Spring, Winter, Barley	C	C	C				C	C		C		0	4	9	9	15
Rimfire Max + CHS Axon	3 oz	All Wheat	C	C/S	C/S	S	S	C/S	C/S	S	C/S		C/S	10	10/12	10	10	10
Tarzec + CHS Axon	1 oz	Winter Wheat, Triticale	C	S	C	C/S	S	C	C		S		C	9	9	9	9	15
Varro / Luxxur B + CHS Axon	6.85 fl oz	Spring, Winter Wheat	C	C	C			C/S	C	C/S				9	9	9	9	9
Wolverine Advanced	1.7 pt	All Wheat, Barley	C	C	C				C					1	9	9	9	9

[1] Refer to local State Department of Agriculture to verify state label. Control ratings and rotations may vary depending on geography, soil moisture and soil pH.

[2] All trademarks and registered trademarks are the property of their respective owners.

[3] Typical use rates of CHS Axon are 0.5–1.0% v/v or 2–4 qt/100 gal of spray solution.

The following products are labeled for aerial application. Using good drift management practices, including the use of deposition aids such as CHS Acuvant, CHS Endurium or Parachute, can help maximize proper spray deposition into the crop canopy and minimize off target movement.

Insecticide[1]	IRAC CODE (SOA)	Crops	Major Insects	Rate/A
Actara	(4A)	Barley	Aphids	4.0 fl oz
Baythroid XL[2]	(3A)	Barley, Wheat, Sorghum[3]	Aphid, Alfalfa Weevil, Army Cutworm, Armyworm, Woolly Bear Caterpillar	1.6–2.8 fl oz
			Black Cutworm, Cutworm, Potato Leafhopper	0.8–1.6 fl oz
			Flea Beetle	0.8–2.8 fl oz
			Grasshopper	2.1–2.8 fl oz
			Green Cloverworm	1.0–2.8 fl oz
			White Grub	2.5–2.8 fl oz
			Wireworm	2.0–2.8 fl oz
Besiege[2]	(3A, 28)	Barley, Wheat	Army Cutworm, Cutworm species	5–8 fl oz
			Armyworm, Bird Cherry Oat Aphid, Cereal Leaf Beetle, English Grain Aphid, Fall Armyworm, Flea Beetle sp, Grasshopper sp, Hessian Fly, Russian Wheat Aphid, Stink Bug sp, Yellow-striped Armyworm	6.0–10.0 fl oz
			Grass Sawfly	8.0–10.0 fl oz
			Chinch Bug, Corn Leaf Aphid, Greenbug, Mite species	10.0 fl oz
Blackhawk	(5)	Barley, Wheat, Sorghum[3]	Cereal Leaf Beetle	1.1–3.3 fl oz
			Fall and Yellow-striped Armyworm, Corn EarWorm, Grasshopper (suppression), SW Corn Borer, Webworm	1.7–3.3 fl oz
Dimethoate	(1B)	Wheat, Sorghum[3], not triticale	Aphid, Alfalfa Weevil larvae, Grasshopper, Leafhopper, Lygus	0.5–1 pt
Dimilin 2L -West of Route 281 in N.D., S.D., Neb. -Use in: Colo., Idaho, Mont., Nev., Ore., Utah, Wash., Wyo., N.D., S.D., Neb.	(15)	Barley, Wheat, Triticale, Oats	Grasshopper	1–2 fl oz
			Cereal leaf beetle	4 fl oz
Endigo ZC[2]	(3A, 4A)	Barley	Army Cutworm, Cutworm species	3.5–4 fl oz
			Fall and Yellow-striped Armyworm, Bird Cherry-Oat/ English Grain/Russian Wheat Aphids, Cereal Leaf Beetle, Flea Beetles, Grass Sawfly, Grasshoppers, Orange Blossom Wheat Midge, Stink Bugs	3.5–4.5 fl oz
			Chinch Bug, Corn Leaf Aphid, Greenbug, Mites	4.5 fl oz
Lannate LV[2] -Idaho, Ore., and Wash. Only	(1A)	Barley, Wheat, Sorghum[3] Not triticale	Aphid, Alfalfa Caterpillar, Cutworm	0.75–3 pt
			Alfalfa Weevil larvae	3 pt
			Armyworm, Cereal Leaf Beetle	0.75–1.5 pt
			Green Cloverworm	0.4–1.5 pt
			Leafhopper	1.5–3 pt

Always read and follow label directions.

CHS Endurium @ 1 qt/100 gal will enhance Insecticide deposition and retention when the Insecticide is used alone.

[1] Follow label for PHI, feeding, and grazing restrictions.

[2] Restricted use product.

[3] Sorghum species and rates may vary slightly; reference and follow label.

Insecticide[1]	IRAC CODE (SOA)	Crops	Major Insects	Rate/A
Malathion	(1B)	Barley, Wheat,	Alfalfa Weevil larvae	1.5–2 pt
		Sorghum[3],	Aphid	1.5 pt
		Not triticale	Armyworm	2 pt
			Grasshopper	1–2 pt
			Leafhopper	1.25–4 pt
Mustang Maxx[2]	(3A)	Wheat, not triticale	Alfalfa Caterpillar, Alfalfa Weevil, Flea Beetle, Grasshopper	2.24–4 fl oz
		Sorghum[3]	Aphid, Woolly Bear Caterpillar, Green Cloverworm, Leafhopper	2.8–4 fl oz
			Armyworm	1.76–4 fl oz
			Cutworm, Thistle Caterpillar	1.28–4 fl oz
			White Grub, Wireworm	4 fl oz
Radiant SC	(5)	Barley, Wheat	Cereal Leaf Beetle	2–6 fl oz
			Armyworm, Corn Earworm, Grasshopper (suppression) SW Corn Borer, Webworm	3–6 fl oz
Sevin XLR Plus	(1A)	Sorghum[3]	Armyworm, Leafhopper	1–2 qt
			Colorado Potato Beetle, Green Cloverworm	1 qt
			Cutworm	2 qt
Prevathon **Vantacor**	(28)	Barley, Wheat, Sorghum spp.[3]	Corn earworm, Beet armyworm, Fall armyworm, Sorghum webworm, True armyworm	14–20 fl oz 0.7–2.5 fl oz
			Grasshoppers	8–20 fl oz
Silencer[2] **Province[2]**	(3A)	Barley, Wheat, Sorghum[3]	Alfalfa Caterpillar, Green Cloverworm, Potato Leafhopper,	1.92–3.2 fl oz
			Thistle Caterpillar, Woolly Bear Caterpillar	
LambdaStar[2]			Alfalfa Weevil, Aphid, English Grain Aphid, Head Clipper Weevil, Russian Wheat Aphid	2.56–3.84 fl oz
			Armyworm, Grasshopper	1.92–3.84 fl oz
			Army Cutworm, Cutworm, Leafhopper	1.28–3.2 fl oz
Warrior II[2] **LambdaStar Plus[2]**	(3A)	Barley, Wheat, Sorghum[3]	Alfalfa Caterpillar, Army Cutworm, Cutworm, Green Cloverworm, Leafhopper species	0.96–1.6 fl oz
			Alfalfa Weevil, Aphid species, Armyworm, English Grain Aphid, Grasshopper, Head Clipper Weevil, Russian Wheat Aphid, Thistle Caterpillar, Woolly Bear Caterpillar	1.28–1.92 fl oz
Sivanto Prime	(4D)	Barley, Wheat, Sorghum[3]	Aphids, Leafhoppers	7.0–14.0 fl oz
			Whiteflies	10.5–14.0 fl oz
Transform WG	(4C)	Barley, Wheat	Aphids, Russian wheat aphid, Greenbug	0.75–1.5 oz

Always read and follow label directions.

CHS Endurium @ 1 qt/100 gal will enhance Insecticide deposition and retention when the Insecticide is used alone.

[1] Follow label for PHI, feeding, and grazing restrictions.

[2] Restricted use product.

[3] Sorghum species and rates may vary slightly; reference and follow label.

Fungicides				Leaf Rust	Stem Rust	Stripe Rust	Stagnospora	Septoria Leaf Blotch	Powdery Mildew	Scab (FHB)	Harvest Restriction[2]	Notes[4]
Class	Active Ingredient (Fungicide Group)	Trade Name	Rate/A (fl oz)[3]	Efficacy Ratings[1]								
DMI Triazoles (Group 3)	Flutriafol (3)	Topguard®	10.0-14.0	VG	VG	VG	VG	VG	E	NL	30 days	Do not exceed 2 applications per year or 28 fl oz/year.
	Metconazole (3)	Caramba®	10.0-17.0	VG	VG	VG	E	VG	G	G	30 days	Do not make more than 2 applications per year.
	Prothioconazole (3)	Proline® 480 SC	4.3-5.7	G	VG	VG	VG	VG	G	G	30 days	Do not make more than 2 applications per year.
	Propiconazole (3)	Tilt® / PropiMax® EC / Bumper® 41.8 EC	2.0-4.0	VG	VG	G	VG	VG	VG	F	Feekes 10.54	Do not apply more than 8 fl oz/A per year. Do not apply after Feekes 10.54.
	Tebuconazole (3)	Folicur® / Many Generics	4.0	E	E	E	NL	NL	NL	F	30 days	Do not apply more than 4 fl oz/A per year.
	Prothioconazole (3) + Tebuconazole (3)	Prosaro® 421 SC	6.5-8.2	E	E	E	VG	VG	F-G	VG	30 days	Do not apply more than 8.2 fl oz/A of Prosaro per year.
QoI Strobilurins (Group 11)	Azoxystrobin (11)	Quadris® / Many Generics	6.0-12.0	G	G	VG	G	G	VG	NL	Feekes 10.54	PHI = 45 days for wheat. PHI = 7 days for forage or hay. PHI = 14 days for grazing
	Fluoxastrobin (11)	Evito® 480 SC	2.0-4.0	VG	U	U	U	U	G	NL	Feekes 10.5	Do not apply more than 8 fl oz/year. May continue applications as needed on a 14-21 day interval as preventative measure.
	Picoxystrobin (11)	Aproach®	3.0-6.0	VG	VG	VG	U	VG	G	NL	Feekes 10.5	Do not apply more than 36 fl oz/A per year. For early season disease control/suppression, make a single 3-4 fl oz. PHI = 45 days for wheat. PHI = 7 days for forage and 14 days for hay.
	Pyraclostrobin (11)	Headline® EC	6.0-9.0	G	G	VG	G	VG	VG	NL	Feekes 10.5	No more than 2 applications per season. Apply prior to disease symptoms.

[1] Efficacy Ratings: F=Fair G=Good VG=Very Good E=Excellent U=Unknown efficacy or insufficient data to rank product NL= Not labeled for use against disease

Note: Efficacy Ratings were developed by the North Central Regional Committee on Management of Small Grain Diseases (NCERA - 184). The NCERA determined the efficacy ratings for each fungicide by field-testing the materials over multiple years and locations. Each rating is based on the product's level of disease control and does not necessarily reflect yield increases obtained from applying the product.

[2] Harvest restrictions are for wheat harvested for grain. Restrictions may vary for other types of cereals (such as barley, rye, oats), and small grains for other uses (such as forage).

[3] General Recommended Rates. Always read and follow all use restrictions before applying any fungicide.

[4] CHS Endurium is recommended @ 1 qt/100 gal (Ground) or 4-6 fl oz/A (Aerial) for increased fungicide efficacy, and drift control/deposition.

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Fungicides				Leaf Rust	Stem Rust	Stripe Rust	Stagnospora	Septoria Leaf Blotch	Powdery Mildew	Scab (FHB)	Harvest Restriction[2]	Notes[4]
Class	Active Ingredient (Fungicide Group)	Trade Name	Rate/A (fl oz)[3]	Efficacy Ratings[1]								
Mixed Modes of Action	Azoxystrobin (11) + Propiconazole (3)	Quilt Xcel®	7.0-14.0	E	VG	E	E	VG	VG	NL	Feekes 10.54	May be applied through full head emergence. PHI = 45 days
	Benzovindiflupyr (7) + Azoxystrobin (11)	Trivapro®	9.4-13.7	E	VG	E	E	VG	VG	NL	Feekes 10.54	Apply prior to disease onset. Do not apply more than 27.4 fl oz/A per year.
	Flutriafol (3) + Fluoxastrobin (11)	Fortix® Preemptor™ SC	2.0-6.0	VG	U	E	U	VG	U	NL	Feekes 10.5	Apply prior to disease development. Do not exceed 12 fl oz per season.
	Pyraclostrobin (11) + Fluxapyroxad (7)	Priaxor®	4.0-8.0	VG	VG	VG	VG	VG	G	NL	Feekes 10.5	Do not apply more than 16 fl oz/A per year for optimal disease control, begin foliar applications prior to disease development.
	Tebuconazole (3) + Trifloxystrobin (11)	Absolute Maxx®	5.0	VG	VG	VG	VG	VG	G	NL	35 days	Begin applications preventatively. Do not apply more than 5 fl oz/A per season.
	Pyraclostrobin (11) + Fluxapyroxad (7) + Propiconazole (3)	Nexicor EC®	3.5-13.0	E	VG	E	VG	VG	G	NL	Feekes 10.5	Do not apply more than 26 fl oz/A per year for optimal disease control, begin foliar applications prior to disease development.

[1] Efficacy Ratings: F=Fair G=Good VG=Very Good E=Excellent U=Unknown efficacy or insufficient data to rank product NL= Not labeled for use against disease

Note: Efficacy Ratings were developed by the North Central Regional Committee on Management of Small Grain Diseases (NCERA - 184). The NCERA determined the efficacy ratings for each fungicide by field-testing the materials over multiple years and locations. Each rating is based on the product's level of disease control and does not necessarily reflect yield increases obtained from applying the product.

[2] Harvest restrictions are for wheat harvested for grain. Restrictions may vary for other types of cereals (such as barley, rye, oats), and small grains for other uses (such as forage).

[3] General Recommended Rates. Always read and follow all use restrictions before applying any fungicide.

[4] CHS Endurium is recommended @ 1 qt/100 gal (Ground) or 4-6 fl oz/A (Aerial) for increased fungicide efficacy, and drift control/deposition.

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Fungicides				Leaf Rust	Stem Rust	Stripe Rust	Stagnospora	Septoria Leaf Blotch	Powdery Mildew	Scab (FHB)	Harvest Restriction[2]	Notes[4]
Class	Active Ingredient (Fungicide Group)	Trade Name	Rate/A (fl oz)[3]	Efficacy Ratings[1]								
Mixed Modes of Action	Trifloxystrobin (11) + Prothioconazole (3)	Stratego® YLD Delaro 325 SC	4.0 8.0	VG	VG	VG	VG	VG	G-VG	NL	Feekes 10.5	Do not apply more than 26 fl oz/A per year. Do not make more than 2 applications per year. Do not apply more than 16 fl oz/A per year of Delaro 325 SC. Do not make more than 2 applications per year.
	Pydiflumeofen (7) + Propiconazole (3)	Miravis Ace	13.7	U	U	U	U	VG	VG	G	Feekes 10.5.2	Do not apply more than 27.4 fl oz/A per year.
	Picoxystrobin (11) + Cyproconazole (3)	Aproach Prima	3.4-6.8	VG	VG	U	U	VG	VG	NL	45 days	Do not apply more than 6.8 fl oz/A per season and no more than 2 sequential applications of picoxystrobin containing product.

[1] Efficacy Ratings: F=Fair G=Good VG=Very Good E=Excellent U=Unknown efficacy or insufficient data to rank product NL= Not labeled for use against disease

Note: Efficacy Ratings were developed by the North Central Regional Committee on Management of Small Grain Diseases (NCERA - 184). The NCERA determined the efficacy ratings for each fungicide by field-testing the materials over multiple years and locations. Each rating is based on the product's level of disease control and does not necessarily reflect yield increases obtained from applying the product.

[2] Harvest restrictions are for wheat harvested for grain. Restrictions may vary for other types of cereals (such as barley, rye, oats), and small grains for other uses (such as forage).

[3] General Recommended Rates. Always read and follow all use restrictions before applying any fungicide.

[4] CHS Endurium is recommended @ 1 qt/100 gal (Ground) or 4-6 fl oz/A (Aerial) for increased fungicide efficacy, and drift control/deposition.

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Fungicide	Rate/A	Application Timing(s)	Diseases Controlled	Comments
Alto 100 SL + CHS Endurium	1.5–5.5 fl oz + 1 pt/100	Apply Feekes 5 to leaf emergence.	Powdery Mildew, Runt, Tan Spot, Leaf Blight, Glume Blotch.	Wheat, Triticale.
Aproach + CHS Endurium	3–4 fl oz + 1 pt/100	Apply at tillering through jointing.	Black Point, Leaf and Glume Blotch, Powdery Mildew.	Barley, Oat, Rye, Triticale, Wheat.
	6–12 fl oz + 1 pt/100	Apply at emerged flag leaf (Feekes 9) prior to start of flowering (Feekes 10.5).	Rusts, Spot Blotch, Tan Spot.	
Aproach Prima + CHS Endurium	3.4 fl oz + 1 pt/100 gal	Apply early season for preventative disease control/ suppression.	Leaf and Glume Blotch, Powdery Mildew, Tan Spot.	Wheat, Triticale.
	3.4–6.8 fl oz + 1 pt/100	Prior to disease development, apply at flag leaf emergence (Feekes 9).	Black Point, Leaf and Glume Blotch, Powdery Mildew, Rusts, Tan Spot.	
AzoxyStar + CHS Endurium	6–12 fl oz + 1 pt/100	Prior to disease development.	Kernal Blight, Leaf Rust, Barley Strip, Net Blotch, Powdery Mildew,	Barley, Oats, Rye.
	4–12 fl oz + 1 pt/100	Prior to disease development.	Leaf/Stem/Stripe Rust, Septoria Leaf, Glume Blotch, Tan Spot, Powdery Mildew	Wheat, Triticale.
Bumper, Propimax, Propi-Star or Tilt	2–4 fl oz	Flag leaf emergence (Feekes 8).	Tan Spot, Rust, Powdery Mildew.	Barley, Oats, Rye, Wheat. See state labels.
Caramba + CHS Hypertonic or CHS Endurium	10 fl oz + 1 pt/100	Prior to disease development.	Tan Spot, Rust, Septoria, Blotch, Barley Scald, Powdery Mildew.	Barley, Oats, Rye, Wheat.
Custodia + CHS Hypertonic or CHS Endurium	6.4–8.6 fl oz + 1 pt/100	Prior to disease development up to late head emergence (Feekes 10.5).	Septoria Leaf, Glume Blotch, Kernal Blight, Powdery Mildew, Leaf, Stem, and Stripe Rust, Tan Spot.	Barley, Wheat.
Evito + CHS Hypertonic or CHS Endurium	1–3 fl oz + 1 pt/100	Anytime prior to the start of flowering. (Feekes 10.5).	Tan Spot, Rust, Septoria, Blotch, Barley Scald, Powdery Mildew.	Wheat - Do not use CHS Hypertonic or CHS Endurium when tank mixing with herbicides.
Evito T + CHS Hypertonic or CHS Endurium	1–3 fl oz + 1 pt/100	Anytime prior to the start of flowering. (Feekes 10.5).	Tan Spot, Rust, Septoria, Blotch, Barley Scald, Powdery Mildew.	Wheat - Use caution when tank mixing with herbicides as severe injury can occur.
Folicur, Orius, Toledo or TebuStar + CHS Hypertonic or CHS Endurium	Up to 4 oz + 1 pt/100	Apply at the earliest onset of disease.	Labeled for Rust control. University publications cite control of leaf diseases such as Tan Spot and Septoria.	Wheat or Barley - Use caution when tank mixing with herbicides as severe injury can occur.
Fortix	2–3 fl oz	Do not apply past Feekes 10.5.	Early season suppression of Septoria, Tan Spot, Powdery Mildew, Rust Suppression.	Wheat (Spring and Winter).
Headline SC / EC + CHS Hypertonic or CHS Endurium	3–6 fl oz + 1 pt/100	Prior to the start of flowering (Feekes 10.5) in wheat, prior to 50% head emergence in barley and rye.	Tan Spot, Rust, Septoria, Blotch, Barley Scald, Powdery Mildew.	Barley, Rye or Wheat. Do not use CHS Hypertonic or CHS Endurium when tank mixing with herbicides.
Mancozeb + CHS Endurium	2 lb/acre	Do not apply after Feekes 10.5.	Leaf Rust, Tan Spot	Wheat, Barley, Rye, Oat, Triticale.
Miravis Ace + CHS Endurium	13.7 fl oz + 1 pt/100	Apply between Feekes 10.3 and 10.54	Leaf Spot, Leaf Rust, Stem Rust, Powdery Mildew, Fusarium Head Blight.	Barlye, Oats, Rye, Triticale, Wheat.

CHS Penetrec may be substituted for either CHS Endurium or Crop Oil @ 0.5% v/v.

Some products are not labeled in all states, confirm state registration prior to use.

Fungicide	Rate/A	Application Timing(s)	Diseases Controlled	Comments
Nexicor	3.5–13 fl oz	Apply no later than 50% head emergence.	Leaf Spot, Leaf Rust, Stem Rust, Powdery Mildew.	Barley, Oat, Rye, Triticale, Wheat.
Priaxor + CHS Endurium	4–8 fl oz + 1 pt/100	Apply no later than 50% head emergence (Feekes 10.3).	Black Point, Leaf Rust, Net Blotch, Powdery Mildew, Scald, Septoria Leaf and Glume Blotch, Spot Blotch, Stem Rust, Stripr Rust, Tan Spot.	Barley, Oats, Rye, Triticale, Wheat.
Proline + CHS Hypertonic or CHS Endurium	4.3–5 fl oz + 1 pt/100	Prior to or at earliest sign of disease.	Tan Spot, Rust and Leaf and Glume Blotch.	Wheat or Barley - Do not use adjuvants when tank mixing with herbicides.
Prosaro + CHS Hypertonic or CHS Endurium	6.5–8.2 fl oz + 1 pt/100	Apply when the earliest signs of disease symptoms appear.	Net Blotch, Powdery Mildew, Scald, Septoria and Glume Blotch, Rusts, Spot Blotch, Tan Spot.	Barley, Wheat.
Prosaro PRO + CHS Hypertonic or CHS Endurium	10.3–13.6 fl oz + 1pt/100	Apply as a preventative spray or earliest signs of disease symptoms.	Fusarium Head Blight, Powdery Mildew, Rusts, Tan Spot, Septoria Leaf Blotch.	Barley, Wheat.
Quadris + Crop Oil or CHS Endurium	6.2–10.8 fl oz + 2 qt/100 or 1 pt/100	After jointing up to late head emergence. (Feekes 6 to 10.5).	Leaf and Stem Rust, Septoria Leaf and Glume Blotch, Tan Spot.	Wheat and Barley. COC or CHS Endurium will optimize efficacy.
	7.7–10.8 fl oz + 2 qt/100 or 1 pt/100		Powdery Mildew.	
Quilt + CHS Endurium	7–14 fl oz + 1 pt/100	Apply up to full head emergence. (Feekes 10.5).	Powdery Mildew, Leaf Blight, Tan Spot, Glume Blotch.	Wheat, Triticale, Barley.
	14 fl oz + 1 pt100		Rusts and other diseases.	
Quilt Xcel + CHS Endurium	7–14 fl oz + 1 pt/100	Apply up to full head emergence. (Feekes 10.5).	Powdery Mildew, Leaf Blight, Tan Spot, Glume Blotch.	Wheat, Triticale, Barley.
	10.5–14 fl oz + 1 pt/100		Rusts and other diseases.	
Stratego + CHS Hypertonic or CHS Endurium	4–10 fl oz + 1 pt/100	Prior to ligule emergence of the flag leaf.	Rusts, Powdery Mildew, Leaf Blight, Tan Spot, Glume Blotch.	Barley, Oats, Triticale, Wheat – Avoid adjuvants when mixing with herbicides.
Stratego YLD + CHS Hypertonic or CHS Endurium	2.3–4 fl oz + 1 pt/100	Prior to ligule emergence of the flag leaf.	Rusts, Powdery Mildew, Leaf Blight, Tan Spot, Glume and Spot Blotch, Scald.	Wheat or Barley - Avoid adjuvants when mixing with herbicides.
Twinline + CHS Hypertonic or CHS Endurium	7–9 oz + 1 pt/100	Anytime prior to the start of flowering.	Black Point, Leaf Blotch, Net Blotch, Powdery Mildew, Rust, Scald, Septoria, Spot Blotch, Stripe Rust, Tan Spot.	Barley, Oats, Rye, Triticale, Wheat. Do not use adjuvants when tank mixing with herbicides.
Topguard + CHS Endurium	10–14 fl oz + 1 pt/100	Apply preventatively or when conditions are favorable for disease.	Leaf Spot, Leaf Rust, Stem Rust, Powdery Mildew.	Barley, Triticale, Wheat.
Trivapro + CHS Endurium	9.4–13.7 fl oz + 1 pt/100	Apply prior to disease development. Apply 8-10 for flag leaf protection.	Leaf Spot, Leaf Rust, Stem Rust, Powdery Mildew.	Barley, Oats, Rye, Triticale, Wheat.
Zolera FX + CHS Endurium	2.5–5.0 fl oz + 1 pt/100	Apply Feekes 2 to Feekes 10.5.	Leaf Spot, Leaf Rust, Stem Rust, Powdery Mildew.	Barley, Wheat.

CHS Penetrec may be substituted for either CHS Endurium or Crop Oil @ 0.5% v/v.

Some products are not labeled in all states, confirm state registration prior to use.

Fungicide	Rate/A	Application Timing(s)	Diseases Controlled	Comments
Aproach + CHS Endurium	12 fl oz + 1 pt/100	Flag leaf emerged (Feekes 9).	Scab Suppression.	Wheat, Triticale.
Aproach Prima + CHS Endurium	6.8 fl oz + 1 pt/100	Flag leaf emerged (Feekes 9).	Scab Suppression.	Wheat, Triticale.
Bumper, Propimax, or Tilt + CHS Hypertonic or CHS Endurium	4 oz + 1 pt/100	Heads emerged up to flowering, (Feekes 10.5).	Scab Suppression. Apply at early flowering for best performance.	WHEAT ONLY. See state labels.
Caramba + CHS Hypertonic or CHS Endurium	13.5 oz + 1 pt/100	Apply at the beginning of anthesis.	Fusarium Head Blight (Scab) suppression. Apply at early flowering (10-25%)	Barley, Oats, Rye, Wheat. Do not apply by air at less than 5 GPA.
Custodia + CHS Hypertonic or CHS Endurium	6.4–8.6 fl oz + 1 pt/100	Apply at the beginning of flowering (Feekes 10.5).	Scab Suppression. For barley, apply at Feekes 10.5 on 50% of the plants.	Barley and Wheat.
Folicur, Orius, Toledo or TebuStar + CHS Hypertonic or CHS Endurium	4 oz + 1 pt/100	Apply up to 50% heading stage.	Fusarium Head Blight (Scab) suppression. Apply at early flowering (10-25%)	Wheat or Barley – Do not exceed the tebuconazole equivalent of 4 oz/A of Folicur or generic equivalent) per year.
Proline + CHS Hypertonic or CHS Endurium	5 oz + 1 pt/100	Apply up to 50% heading stage.	Fusarium Head Blight (Scab) suppression. Apply at early flowering (10-25%)	Wheat or Barley.
Proline + Folicur + CHS Hypertonic or CHS Endurium	3 oz + 3 oz + 1 pt/100	Apply up to 50% heading stage.	Fusarium Head Blight (Scab) suppression. Apply at early flowering (10-25%)	Wheat or Barley.
Prosaro + CHS Hypertonic or CHS Endurium	6.5 oz + 1 pt/100	Apply up to 50% heading stage.	Fusarium Head Blight (Scab) suppression. Apply at early flowering (10-25%)	Wheat or Barley.

CHS Penetrec may be substituted for either CHS Endurium or Crop Oil @ 0.5% v/v.

Some products are not labeled in all states, confirm state registration prior to use.

LEVESOL® DFC

LEVESOL® DFC ZN

Levesol DFC and Levesol DFC Zn are two unique products designed for application on dry phosphate fertilizers used for in-furrow fertilization. These two products utilize the high quality chelate ortho-ortho EDDHA to protect applied phosphorus by preventing soil micronutrients from tying up phosphorus once it is in the soil profile. Chelates work by complexing "+" charged ions such as iron, manganese, and zinc. Once the cation molecules are neutralized, they cannot be tied up with negatively charged phosphorus making both more plant available.





Small Grain Importance

Small grains such as spring wheat, winter wheat, and barley benefit from early season access to phosphorus and micronutrients. Soil phosphorus is immobile in the soil and often only fertilized at planting in the furrow. Small grains are usually planted in early spring when conditions are cool and wet which decreases nutrient availability. The benefit of applying Levesol DFC and Levesol DFC Zn to in-furrow fertilizer has shown great benefit for small grains. Better early season access to nutrients using Levesol products benefits root growth and seedling development when conditions would inhibit phosphorus availability otherwise.

Application

For use as fertilizer impregnation:

- Apply 3 qt/ton to dry phosphorus-based starter fertilizer programs for cereals.
- Optimum applications are as an in-furrow, 2x2 or banded application.
- Alternate use rates range from 2-4 qt/ton.
- If blending with urea, AMS, or potash, apply Levesol DFC or Levesol DFC Zn to phosphorus before blending.

Always read and follow label directions.



MOXON™ CU

Principal Functioning Agents

Total Nitrogen (N)	10.0%
N from Urea Nitrogen	10.0%
Copper	0.5%

Derived from urea, copper EDDHA, copper EDTA and ortho-ortho EDDHA

Efficient Nitrogen Application

Moxon CU contains a low salt, highly efficient source of nitrogen that can be used as a foliar application to enhance yield. A Moxon CU application allows for more complete and rapid nitrogen absorption while aiding in the uptake and translocation of other nutrients. Moxon CU also contains copper to improve yield and overall plant health. The combination of nutrients in Moxon CU may reduce the impact of disease and ensure proper flower and grain development.

Application and Use Rate

Moxon CU may be applied as a foliar spray on a wide array of agricultural crops to correct nitrogen deficiencies and/or improve growth.

Application Timing in Wheat should be any of:

a) 2 gal/A at herbicide timing.

b) 2 gal/A at flag leaf.

c) 1 gal/A at herbicide timing followed by 1 gal/A at flag leaf.

As with any foliar nitrogen application, some cosmetic crop response is possible, lower rates and higher spray water volumes increase safety. Please refer to product label and your local dealer representative for specific application guidelines.

Other Crop Uses:

Alfalfa: 1-2 gal/A to regrown foliage after cuttings.

Canola: 1-2 gal/A prior to bloom.

Corn up to V8: Appy 2-4 gal as a foliar application or as part of a side-dress program.

General Information

The nitrogen in Moxon CU of 10-0-0 is comprised of 100% urea nitrogen. Urea nitrogen forms are research-proven to be the most efficient nitrogen form taken up by leaf tissue.

Moxon CU 10-0-0 can be custom blended with other primary, secondary and micronutrients as well as many crop protection chemicals. In the absence of published data, check compatibility by performing a jar test prior to tank mixing.

Package Size

Moxon CU is packaged in bulk and 250 gallon tanks.

Product Density

9.06 lb per gallon at 68° F



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The application of an appropriately timed preemergence herbicide is the foundation of an effective weed management program. A preemergence herbicide followed by a postemergence herbicide will provide the most consistent season-long weed control. The preemergence herbicide application should target tough to kill broadleaf and grass weed species. Fields that benefit most of the application of a preemergence herbicide have moderate to high annual grass populations as well as moderate to high giant ragweed, cocklebur, morning glory, Palmer amaranth, and waterhemp populations. No tillage fields also benefit from the use of a preemergence herbicide. Many preemergence herbicides provide residual control which extends the window of weed control allowing time for the crop to establish. Alternating preemergence herbicide modes of action, especially if a postemergence herbicide application is planned, can help to slow the development of herbicide resistant weed species.

Pre-emergence herbicides with SINGLE MODE OF ACTION

Pre-Emerge Herbicide[1]	MOA[2]	Rate/A[3]	Timing[4]	Tough-to-Kill Target Weeds[4]	Rotation Restrictions (months)[3]						
					Alfalfa	Barley	Corn	Potato	Sugarbeet	Sunflower	Wheat
Acumen / Prowl 3.3	3	3.0–3.6 pt	Apply PPI, PP, or PRE. PRE applications must be made within 2 days after planting. Consult label for specific geographic restrictions.	Palmer amaranth, kochia, lambsquarters, pigweed, smartweed, velvetleaf, waterhemp, barnyard grass, crabgrass, giant foxtail, green foxtail.	0	4	0	0	12	0	4
Canopy EX / Cloak EX	2	1.1–3.3 oz	Apply PP. Timing to crop for PP applications depends on rate. Consult label for specific geographic restrictions.	Ragweed, jimsonweed, lambsquarters, marestail, pigweed, smartweed.	12	4	10	30	30	18	4
Command	13	21.3–42.7 fl oz	Apply PP or PRE. PRE applications must be made within 3 days after planting. Consult label for specific geographic restrictions.	Kochia, lambsquarters, velvetleaf, barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail.	16	16	9	9	9	16	12
FirstRate	2	0.6–0.75 oz	Apply PPI, PP, or PRE. PRE applications must be made within 2 days after planting. Consult label for specific geographic restrictions.	Ragweed, lambsquarters, marestail, pigweed.	9	12	9	18	30ba[5]	30ba	4
Metolachlor / S-Metolachlor	15	1.33–1.67 pt	Apply PPI, PP, PRE, or early POST. POST applications can be made through V3. Consult label for specific geographic restrictions.	Nightshade, pigweed, crabgrass, fall panicum, giant foxtail, yellow foxtail.	4	4.5	12	12	12	12	4.5
Metribuzin DF	5	0.5–1.0 lb	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence. Consult label for specific geographic restrictions.	Lambsquarters, pigweed, smartweed.	4	8	4	12	18	18	4
Outlook	15	14.0–21.0 fl oz	Apply PPI, PP, PRE, or early POST. POST applications can be made through V5. Consult label for specific geographic restrictions.	Nightshade, pigweed, barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail.	6	4	0	0	0	9	4
Prowl H2O	3	2.0–3.0 pt	Apply PPI, PP, or PRE. PRE applications must be made within 2 days after planting. Consult label for specific geographic restrictions.	Palmer amaranth, nightshade, kochia, lambsquarters, pigweed, smartweed, velvetleaf, waterhemp, ryegrass, barnyardgrass, crabgrass, giant foxtail, green foxtail.	0	14	0	0	20	0	14
Pursuit / Thunder	2	4.0 fl oz	Apply PPI, PP, PRE, or early POST. POST applications should be made before R1. Consult label for specific geographic restrictions.	Nightshade, lambsquarters, pigweed, smartweed.	4	9.5	8.5	26	40	18	4
Python/ Accolade	2	0.8–1.33 oz	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence. Consult label for specific geographic restrictions.	Lambsquarters, marestail, smartweed.	4	4	0	12	26	18	4
Scepter	2	1.4–2.8 oz	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence. Consult label for specific geographic restrictions.	Nightshade, jimsonweed, lambsquarters, pigweed, smartweed.	18	18	18	18	40	18	18
Sharpen	14	1.0–2.0 fl oz	Apply PP or PRE. PRE applications must be made prior to emergence.	Palmer amaranth, marestail, jimsonweed, kochia, lambsquarters, morning glory, nightshade, pigweed, ragweed, smartweed, velvetleaf, waterhemp.	5	0	0	5	5	5	0
Spartan/ Shutdown	14	6.0–12.0 fl oz	Apply PPI, PP, or PRE. PRE applications must be made within 3 days after planting. Consult label for specific geographic restrictions.	Nightshade, kochia, lambsquarters, palmer amaranth, pigweed, waterhemp.	12	4	10	12	36	0	4
Valor EZ	14	2.0–3.0 fl oz	Apply PP or PRE. PRE applications must be made within 3 days after planting.	Lambsquarters, marestail, nightshade, pigweed, kochia, morning glory, palmer amaranth, waterhemp.	10	4	1	10	10	2	2
Warrant	15	1.25–2.0 qt	Apply PP or PRE. PRE applications must be made prior to emergence. Consult label for specific geographic restrictions.	Nightshade, lambsquarters, palmer amaranth, pigweed, barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail.	9	12	0	12	12	12	4
Zidua SC	15	2.0–3.0 oz	Apply PPI, PP, PRE, or early POST. POST applications should be made before V3. Consult label for specific geographic restrictions.	Nightshade, kochia, lambsquarters, palmer amaranth, pigweed, waterhemp, barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail.	10	18	0	4	15	3	6

[1] All trademarks and registered trademarks are the property of their respective owners.

[2] MOA = Mode of action designated by the herbicide resistance action committee.

[3] Application rate provided is for medium soil texture. Refer to label for complete rate guidelines.

[4] Refer to label for specific timing guidelines, target weed species, and rotation restrictions. PP = Pre-plant, PPI = Pre-plant incorporated, PRE = Preemergence.

[5] ba: Product label requires the designated rotation period for the crop listed in addition to a successful field bioassay.

Pre-emergence herbicides with MULTIPLE MODES OF ACTION													
Pre-Emerge Herbicide[1]	MOA[2]	Rate/A[3]	Timing[4]	Tough-to-Kill Target Weeds[4]	Rotation Restrictions (months)[3]						
					Alfalfa	Barley	Corn	Potato	Sugarbeet	Sunflower	Wheat
Anthem MAXX	14 and 15	2.5–4.75 fl oz	Apply PPI, PP, PRE, or early POST. POST applications can be made through V6.	Ragweed, kochia, lambsquarters, marestail, pigweed.	10	N/A	0	9	15	2	6
Authority Assist	2 and 14	8.0–12.0 fl oz	Apply PPI, PP, or PRE. PRE applications must be made within 3 days after planting.	Nightshade, kochia, lambsquarters, pigweed.	12	9.5	10	26	40ba[5]	18	4
Authority Edge	14 and 15	7.0–12.0 fl oz	Apply PPI, PP, or PRE. PRE applications must be made within 3 days after planting.	Palmer amaranth, lambsquarters, morning glory, nightshade, pigweed, waterhemp, select grasses.	12	11	4	4	24ba	0	4
Authority Elite / BroadAxe XC	14 and 15	25.0–32.0 fl oz	Apply PPI, PP, or PRE. PRE applications must be made within 3 days after planting.	Nightshade, lambsquarters, palmer amaranth, pigweed, crabgrass.	12	4.5	4	4	24ba	0	4.5
Authority First/ Sonic	2 and 14	6.45–8.0 oz	Apply PPI, PP, or PRE. PRE applications must be made within 3 days after planting.	Waterhemp, lambsquarters, kochia, ragweed, marestail, pigweed, nightshade, crabgrass	12	12	10	18	30ba	30	4
Authority MTZ	5 and 14	14.0–18.0 oz	Apply PPI, PP, or PRE. PRE applications must be made within 3 days after planting.	Ragweed, kochia, lambsquarters, marestail, pigweed.	12	4	4	12	24ba	12	4
Authority MAXX or XL / Zone MAXX	2 and 14	6.5–8.0 oz	Apply PPI, PP, or PRE. PRE applications must be made within 3 days after planting.	Ragweed, jimsonweed, kochia, lambsquarters, marestail, pigweed, smartweed.	12	4	10	36	36	18	4
Authority Supreme	14 and 15	6.0–9.8 fl oz	Apply PPI, PP, or PRE. PRE applications must be made within 3 days after planting.	Nightshade, lambsquarters, Palmer amaranth, pigweed, waterhemp.	12	11	4	4	24	0	4
Boundary / Ledger	5 and 15	1.8–2.4 pt	Apply PPI, PP, or PRE. When used on soils above pH 7.0 soybean injury may occur.	Kochia, lambsquarters, nightshade, pigweed, waterhemp, select grasses.	4.5	8	4	18	18	12	8
Envive	2 and 14	2.5–5.3 oz	Apply PP or PRE. PRE applications must be made within 3 days after planting. Consult label for specific geographic restrictions.	Nightshade, ragweed, jimsonweed, lambsquarters, marestail, pigweed, smartweed.	12	4	10	30	30	18	4
Fierce MTZ / Kyber	5 and 14 and 15	1.0–1.5 pt	Apply PP or PRE. PRE applications must be made within 3 days after planting.	Nightshade, lambsquarters, palmer amaranth, pigweed, smartweed.	10	12	1	9	18	12	8
Fierce XLT	2 and 14 and 15	4.0–5.25 oz	Apply PP or PRE. PRE applications must be made within 3 days after planting. Consult label for specific geographic restrictions.	Nightshade, ragweed, jimsonweed, lambsquarters, marestail, palmer amaranth, pigweed, smartweed, waterhemp.	18	18	10	30	30	30	4

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Pre-emergence herbicides with MULTIPLE MODES OF ACTION												
Pre-Emerge Herbicide[1]	MOA[2]	Rate/A[3]	Timing[4]	Tough-to-Kill Target Weeds[4]	Rotation Restrictions (months)[3]						
					Alfalfa	Barley	Corn	Potato	Sugarbeet	Sunflower	Wheat
Optill	2 and 14	2.0 oz	Apply PP or PRE. PRE applications must be made prior to emergence.	Palmer amaranth, marestail, jimsonweed, kochia, lambsquarters, morning glory, nightshade, pigweed, ragweed, smartweed, velvetleaf, waterhemp, barnyardgrass, crabgrass, foxtail.	4	9.5	8.5	26	40	18	4
Panther Pro	2 and 5 and 14	12.0–15.0 fl oz	Apply PP or PRE. PRE applications must be made within 3 days after planting.	Nightshade, kochia, lambsquarters, pigweed, smartweed, velvetleaf.	4	9.5	8.5	26	40	18	4
Pummel	2 and 15	2.0 pt	Apply PPI, PP, PRE, or POST. POST applications can be made through V5. Consult label for specific geographic restrictions.	Nightshade, lambsquarters, pigweed, smartweed, barnyardgrass, crabgrass, fall panicum, giant foxtail.	4	9.5	8.5	26	40	18	4.5
Torment	2 and 14	0.75–1.0 pt	Apply PPI, PP, PRE, or POST. POST applications can be made up to 14 to 28 days after planting. Consult label for specific geographic restrictions.	Nightshade, lambsquarters, pigweed, smartweed.	18	9.5	10	26	40	18	4
Tripzin ZC	3 and 5	29.0–44.0 fl oz	Apply PPI, PP, or PRE. PRE applications must be made within 2 days after planting. Consult label for specific geographic restrictions.	Nightshade, ragweed, jimsonweed, lambsquarters, marestail, palmer amaranth, pigweed, smartweed, waterhemp, crabgrass, fall panicum, field sandbur, giant foxtail, yellow foxtail.	4	4	4	4	18	18	8
Trivence	2 and 5 and 14	6.0–10.0 oz	Apply PP or PRE. PRE applications must be made within 3 days after planting. Consult label for specific geographic restrictions.	Nightshade, ragweed, jimsonweed, lambsquarters, marestail, palmer amaranth, pigweed, smartweed, waterhemp.	10	4	10	30	30	18	4
Valor XLT	2 and 14	2.5–5.0 oz	Apply PP or PRE. PRE applications must be made within 3 days after planting. Consult label for specific geographic restrictions.	Nightshade, ragweed, jimsonweed, lambsquarters, marestail, pigweed, smartweed.	12	4	10	30	30	18	4
Verdict	14 and 15	5.0–10.0 fl oz	Apply PPI, PP, or PRE. PRE applications must be made prior to emergence. See label for minimum preplant intervals on specific soil types.	Palmer amaranth, marestail, kochia, jimsonweed, lambsquarters, morning glory, nightshade, pigweed, ragweed, smartweed, velvetleaf, waterhemp, barnyardgrass, foxtail, ryegrass.	8	4	0	9	9	9	4
Warrant Ultra	14 and 15	48.0–65.0 fl oz	Apply PP or PRE. Consult label for specific geographic restrictions.	Nightshade, ragweed, lambsquarters, palmer amaranth, pigweed, waterhemp, barnyardgrass, crabgrass, fall panicum, giant foxtail, yellow foxtail.	18	12	10	12	18	18	4
Zidua Pro	2 and 14 and 15	4.5–6.0 fl oz	Apply PP or PRE. PRE applications must be made prior to emergence. See label for minimum preplant intervals on specific soil types.	Nightshade, lambsquarters, pigweed, smartweed, velvetleaf.	10	11	8.5	26	40	18	4

[1] All trademarks and registered trademarks are the property of their respective owners.

[2] MOA = Mode of action designated by the herbicide resistance action committee.

[3] Application rate provided is for medium soil texture. Refer to label for complete rate guidelines.

[4] Refer to label for specific timing guidelines, target weed species, and rotation restrictions. PP = Pre-plant, PPI = Pre-plant incorporated, PRE = Preemergence.

[5] ba: Product label requires the designated rotation period for the crop listed in addition to a successful field bioassay.

Anthem Maxx (pyroxasulfone + fluthiacet)

EPA Reg. #: **279-3468**
Rate/A: 2–5.7 fl oz
Spray Volume: min 5 gpa
Rainfast: 1 hour
S.O.A.: Very Long Chain Fatty Acid (Group 15)
PPO Inhibitor (Group 14)
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear
R.E.I.: 12 hours
W. Notification:
S. Word: Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS (1.5–3 lb/A)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (0.5–1 pt/A) plus AMS*** (1.5–3 lb/A)**

or

- **CHS Aggrestrol** (0.5–1 pt/A) plus AMS*** (1.5–3 lb/A)**

or

- **Tapran (1 gal/100 gal)**

Target Weeds	3.5–4.5 fl oz	5–6 fl oz
– Jimsonweed	2″	2″
– kochia	2″	2″
– lambsquarters	2″	3″
– morning glory, annual	2″	3″
– nightshade (black, Eastern black)	2″*	2″
– pigweed (redroot, smooth)	2″*	4″
– velvetleaf	36″	36″
– waterhemp (common, tall)	2″*	2″

*Partial control or suppression.

Timing/Comments

Apply from planting through the third trifoliate (V3) leaf stage.

*Crop Oil @ 1–2 pt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1–2 pt/A can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Assure II / Targa (quizalofop)

Brand Name: EPA Reg. #:
Assure II **352-541**
Targa **33906-9-81880**
Rate/A: 4–10 fl oz
Spray Volume: min 10 gpa
Rainfast: 1 hour
S.O.A.: ACC-ase Inhibitor (Group 1)
P.P.E.: l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.: 12 hours
W. Notification: Oral
S. Word: Danger

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS*** (2–4 lb/A)**

or

- **CHS Penetrec* (2 qt/100) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100) plus AMS*** (2–4 lb/A)**

or

- **Tapran (1 gal/100 gal)**
- Note: When tank mixing with glyphosate, add CHS Fixate at 2–3 qt/100 gal.

Target Weeds	4 fl oz	6 fl oz	8 fl oz
– barnyardgrass	-	-	2–6″
– field sandbur	-	-	2–6″
– crabgrass	-	-	2–6″
– giant foxtail	-	-	2–8″
– green foxtail	-	-	2–4″
– volunteer corn	6–24″	24″+	-
– wild proso millet	-	-	2–6″
– yellow foxtail	-	-	2–4″
– wild oat	-	-	2–6″
– woolly cupgrass	2–4″ @ 9 oz		
– quackgrass	6–10″ @ 10 oz		

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 gal can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Basagran (bentazon)

EPA Reg. #:	**7969-45-51036**
Rate/A:	1–2 pt
Spray Volume:	10–20 gpa
Rainfast:	1 hour
S.O.A.:	Photosystem II Inhibitor (Group 6)
P.P.E.:	l.s. shirt, l. pants, w.p. gloves, shoes, socks
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Fixate/CHS Endurium (2 qt/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS** (2.5 lb/A)**

Target Weeds	1 pt	1.5 pt	2 pt
– cocklebur	4″	6″	10″
– lambsquarters	1″	1.5″	2″
– common ragweed	-	-	3″
– giant ragweed	-	-	6″
– annual smartweed	4″	6″	10″
– velvetleaf	2″	2″	5″
– venice mallow	2″	2″	4″
– wild buckwheat	-	3″	5″
– wild mustard	2″	4″	8″
– wild sunflower	3″	5″	8″

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Canada thistle: split applications needed.

Cadet (fluthiacet-methyl)

EPA Reg. #:	**279-3338**
Rate/A:	0.6–0.9 fl oz
Spray Volume:	min 10 gpa
Rainfast:	4 hours
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

- **CHS Fixate/ CHS Wheelhouse Pro (2 qt/100 gal)**

or

- **CHS Penetrec* (0.5–1 pt/100 gal)**
- When tank mixing, use the adjuvant for the tank mix partner.

Target Weeds	0.6 fl oz	0.9 fl oz
– burcucumber	2″	2″
– nightshade	2″*	2″*
– lambsquarters	2″*	2″
– kochia	2″	2″
– pigweed	2″*	4″
– velvetleaf	36″	36″
– waterhemp	-	2″

*Suppression only

Timing/Comments

Can be applied from cotyledon to flowering.

*Crop Oil @ 1 qt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

Classic (chlorimuron)

EPA Reg. #:	**5481-681**
Rate/A:	0.5–0.75 oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS** (2–4 lb/A)**

or

- **Tapran (1 gal/100 gal)**

Target Weeds	0.5 oz	0.67 oz	0.75 oz
– common ragweed	-	3″	4″
– cocklebur	6″	8″	12″
– pigweed	2″	3″	4″
– smartweed	2″	3″	4″
– sunflower	5″	6″	8″
– velvetleaf	-	4″	6″
– yellow nutsedge	3″	3″	4″

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Clethodim Products

Brand Name:	EPA Reg. #
Arrow	**66222-60**
Volunteer	**59639-3-55467**
Clethodim 2E	**42750-72**
Shadow 3EC	**66330-414**
Rate/A:	6–8 fl oz (2.67–5.33 fl oz for Shadow 3EC)
Spray Volume:	5–40 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (2.5–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (2.5–4 lb/A)**

or

- **Tapran (1 gal/100 gal)**
- Clethodim products may be used at 4-6 fl oz for volunteer corn control when tank mixed with glyphosate.

Target Weeds	6 fl oz	8 fl oz
– barnyardgrass	6″	8″
– crabgrass	2″	6″
– giant foxtail	6″	12″
– green foxtail	6″	8″
– quackgrass	-	4–12″
2nd application may be needed		
– volunteer cereals	6″	8″
– volunteer corn	12″	18″
– wild proso millet	8″	10″
– woolly cupgrass	6″	8″
– yellow foxtail	6″	8″

*Crop Oil @ 1–2 pt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1–2 pt /A can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Cobra, Phoenix (lactofen)

EPA Reg. #:	**59639-34**
Rate/A:	8–12.5 fl oz
Spray Volume:	20–30 gpa
Rainfast:	30 minutes
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	coveralls over l.s. shirt, l. pants, c.r. gloves, c.r. footwear, socks, apron, eyewear
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Danger

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS*** (2.5 lb/A)**

or

- **CHS Penetrec* (0.5–1 pt/A)**

or

- **CHS Aggrestrol** (0.5–1 pt/A)**

or

- **Tapran (1 gal/100 gal)**
- See label for adjuvant precautions.

Target Weeds	8 fl oz	10 fl oz	12.5 fl oz
– common ragweed	4″	5″	6″
– cocklebur	-	5″	6″
– nightshade	4″	5″	6″
– pigweed	6″	6″	6″
– waterhemp	-	4″	6″

Timing/Comments

5–6 fl oz can suppress white mold.

Use 12.5 fl oz when using Cobra alone to control kochia, morning glory species, velvetleaf, wild mustard, or wild sunflower.

Do not use during periods of stress or weed control will be poor.

*Crop Oil @ 1–2 pt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1–2 pt/A can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Engenia: (BAPMA salt of Dicamba)

EPA Reg. #:	**7969-345**
Rate/A:	12.8 fl oz
Spray Volume:	min 10 gpa
Rainfast:	4 hours
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r gloves, shoes, socks, dust/mist filtering respirator
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution/Precaution

Adjuvant(s)/Comments

- **CHS Traplok (1 gal/100 gal of water)**

or

- **CHS Level Best Pro (1–2 qt/100 gal) plus Cognitive 1 or Mediate (2 qt/100 gal)**

or

- **CHS Wheelhouse Pro (2 qt/100 gal) plus Cognitive 1 or Mediate (2 qt/100 gal)**
- No acidifying water conditioners; DO NOT use ammonium additives (e.g., AMS, UAN), DO NOT use in aerial application
- Pre-harvest interval for application to Roundup Ready 2 Xtend soybeans: 7-10 days for soybean forage and 13-15 days for soybean hay
- Visit www.engeniatankmix.com for a list of approved tank mix partners and adjuvants

Target Weeds

– black nightshade
– common ragweed
– Canada thistle
– cocklebur
– giant ragweed
– kochia
– lambsquarters
– pigweed
– venice mallow
– velvetleaf
– wormwood
– volunteer sunflower
– marestail
– Russian thistle

Timing/Comments

Refer to product label for application timings for different crops.

Enlist Duo (Glyphosate + 2,4-D Choline) with Colex-D technology

EPA Reg. #:	**62719-649**
Rate/A:	3.5–4.75 pt
Spray Volume:	min 10 gpa
Rainfast:	24 hours
S.O.A.:	Plant Growth Regulator (Group 4), EPSP Synthase Inhibitor (Group 9)
P.P.E.:	l.s. shirt, l. pants, c.r gloves, shoes, socks, eyewear
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/ Comments

- **CHS Deppex (2 qt/100 gal)**

or

- **Adium (2.5 gal/100 gal)**

or

- **CHS Fixate (2 qt/100 gal) plus CHS Penetrec (4 oz/A)**

or

- **Encloax (2.5 gal/100 gal) plus CHS Penetrec (4 oz/A)**
- Use only with E3 soybeans
- Refer to www.enlisttankmix.com for approved CHS adjuvants
- Refer to “Allowable nozzles and operating pressure (PSI)” mentioned on product label

Target Weeds

– common lambsquarters
– common ragweed
– Eastern black nightshade
– giant ragweed
– marestail
– morning glory
– Palmer amaranth
– velvetleaf
– waterhemp
– prickly sida

Timing/Comments

Refer to product label for application timings for different crops (corn, soybean and cotton).

Enlist One (2,4-D Choline)

EPA Reg. #:	**62719-695**
Rate/A:	1.5–2.0 pt
Spray Volume:	min 10 gpa
Rainfast:	4 hours
S.O.A.:	Plant Growth Regulator (Group 4)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

- **CHS Deppex (2 qt/100 gal)**

or

- **Adium (2.5 gal/100 gal)**

or

- **CHS Fixate (2 qt/100 gal) plus CHS Penetrec (4 oz/A)**

or

- **Encloax (2.5 gal/100 gal) plus CHS Penetrec (4 oz/A)**
- Use with E3 soybeans.
- Refer to www.enlisttankmix.com for approved CHS adjuvants.
- 30 days of preharvest interval for forage, DO NOT apply more than one preemergence and two postemergence per season. DO NOT apply more than 6.0 pt per year per season.

Target Weeds

– common lambsquarters
– common ragweed
– Eastern black nightshade
– giant ragweed
– marestail
– morning glory
– Palmer amaranth
– velvetleaf
– waterhemp
– prickly sida

Timing/Comments

Refer to product label for application timings for different crops (corn, soybean and cotton).

FirstRate (cloransulam)

EPA Reg. #:	**62719-275**
Rate/A:	0.3 oz
Spray Volume:	min 10 gpa
Rainfast:	2 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1–2 pt/100 gal) plus AMS*** (2 lb/A)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (5 pt/100 gal) plus AMS*** (2 lb/A)**

or

- **CHS Aggrestrol** (5 pt/100 gal) plus AMS*** (2 lb/A)**

or

- **Tapran (1 gal/100 gal)**

Target Weeds

– common ragweed	8″
– common sunflower	12″
– cocklebur	10″
– giant ragweed	10″
– marestail	6″
– morning glory	4″
– Pennsylvania smartweed	6″
– venice mallow	< 3″
– velvetleaf	6″

Timing/Comments

Apply from 1st trifoliate to 50% flowering.

*Crop Oil @ 1–2 pt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 10 pt/100 gal/A can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Flexstar GT 3.5 (fomesafen + glyphosate)

EPA Reg. #:	**100-1385**
Rate/A:	2.68–4.5 pt
Spray Volume:	15–20 gpa
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14) EPSP Synthase Inhibitor (Group 9)
P.P.E.:	l.s. shirt, l. pants, shoes, socks, c.r. gloves, apron
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/ Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)**

or

- **Tapran (1 gal/100 gal)**

Target Weeds

Controls many annual and perennial grass and broadleaf weeds under 8″ tall.

Timing/Comments

See label for geographical rate restrictions.

Apply prior to bloom.

Roundup Ready Soybeans Only.

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 gal can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Flexstar, Reflex, others (fomesafen)

Brand Name:	EPA Reg. #
Reflex	**100-993**
Flexstar	**100-1101**
Rate/A:	0.75–1.3 pt
Spray Volume:	min 15 gpa
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	coveralls, l.s. shirt, l. pants, c.r. gloves, c.r. footwear, socks, apron
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/ Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (10 lb/100 gal)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (10 lb/100 gal)**

or

- **Tapran (1 gal/100 gal)**
- See label for geographical rate restrictions.

Target Weeds	**0.75 pt**	**1 pt**
– black nightshade	2″	4″
– common ragweed	-	4″
– waterhemp	2″	2″
– cocklebur	2″	4″
– giant ragweed	-	4″
– lambsquarters	-	2″
– morning glory	-	3″
– pigweed	2″	4″
– smartweed	-	4″
– venice mallow	4″	6″
– wild mustard	4″	6″

Timing/Comments

Apply prior to bloom.

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 gal can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Fusilade DX (fluazifop-P-butyl)

EPA Reg. #:	**100-1070**
Rate/A:	6–12 fl oz
Spray Volume:	5–40 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear, apron
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/ Comments

- **CHS Hypertonic (1–2 qt/100 gal)**

or

- **CHS Penetrec* (1–2 qt/100 gal)**
- Add: AMS** when weeds are stressed.
- Use the surfactant required by the broadleaf herbicide tank mix.

Target Weeds	**4 fl oz**	**6 fl oz**	**8 fl oz**
– barnyardgrass	-	-	2–4″
– crabgrass	-	-	1–4″
– giant foxtail	-	-	2–4″
– green and yellow foxtail	-	-	2–4″
– wild oat	-	-	2–6″
– volunteer cereals	-	2–6″	-
– volunteer corn	10–24″	2–6″	2–6″
– wild proso millet	-	24″+	2–4″
– woolly cupgrass	-	4–8″	6–8″
– quackgrass *May require a second treatment*	6–10″ @ 12 fl oz		

*Crop Oil @ 0.5–1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Glufosinate

Brand Name:	EPA Reg. #:
Liberty 280 SL	**264-829**
Autonomy	**7969-448-55467**
Cheetah	**71368-112**
Noventa	**7696-448**
Interline	**70506-310**
Spray Volume:	15–20 gpa
Rainfast:	4 hours
M.O.A.:	Glutamine Synthase Inhibitor
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

- **CHS Level Best Pro plus AMS (1.5-3.0 lb/A)**

or

- **CHS Fixate (3 qt/100)**

or

- **Encloax (3.5 pt/A)**

Target Weeds	32 fl oz
– wild buckwheat	6″
– cocklebur	6″
– kochia	4″
– morning glory	6″
– wild mustard	4″
– nightshade	6″
– pigweed species	3″
– ragweed species	6″
– velvetleaf	6″
– waterhemp	3″
– barnyardgrass	4″
– foxtail species	3″
– wild oat	3″
– volunteer corn	6″
– crabgrass	3″

Glufosinate

Brand Name:	EPA Reg. #:
Surmise 5	**42750-401**
Spray Volume:	15–20 gpa
Rainfast:	4 hours
M.O.A.:	Glutamine Synthase Inhibitor
P.P.E.:	l.s. shirt, l. pants, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/Comments

- **CHS Level Best Pro plus AMS (1.5-3.0 lb/A)**

or

- **CHS Fixate (3 qt/100)**

or

- **Encloax (3.5 pt/A)**

Target Weeds	16.3 fl oz
– wild buckwheat	6″
– cocklebur	6″
– kochia	4″
– morning glory	6″
– wild mustard	4″
– nightshade	6″
– pigweed species	3″
– ragweed species	6″
– velvetleaf	6″
– waterhemp	3″
– barnyardgrass	4″
– foxtail species	3″
– wild oat	3″
– volunteer corn	6″
– crabgrass	3″

Glyphosate

Brand Name:	EPA Reg. #:	# A.E.	=0.75 AE
Buccaneer Plus	**55467-9**	3.00	32.0
Gly Star Original	**42750-60**	3.00	32.0
Gly Star Plus	**42750-61**	3.00	32.0
Durango DMA	**62719-556**	4.00	24.0
Buccaneer 5 Extra	**55467-15**	4.00	24.0
Gly Star 5 Extra	**42750-59**	4.00	24.0
Gly Star K-Plus	**42750-122**	4.50	21.3
Buccaneer K	**42750-122-55467**	4.50	21.3
Roundup RT 3	**524-544**	4.50	21.3
Roundup PowerMax 3	**524-659**	4.80	19.7
Rate/A:	Variable		
Spray Volume:	5–20 gpa		
Rainfast:	1–6 hours		
M.O.A.:	EPSP Inhibitor		
P.P.E.:	l.s. shirt, l. pants, shoes, socks		
R.E.I.:	12 hours		
W. Notification:	Oral		
S. Word:	Caution		

Surfactant/Comments

- **CHS Level Best Pro (1 qt/100) plus AMS (8.5-17 lb/100)**

or

- **CHS Fixate/CHS Wheelhouse Pro (2-3 qt/100)**

or

- **Encloax (2.5-5 gal/100)**

or

- **CHS Hypertonic (1 qt/100) plus AMS (8.5-17 lb/100)**

Harmony SG (thifensulfuron-methyl)

EPA Reg. #:	**352-633**
Rate/A:	0.125 (1/8) oz
Spray Volume:	10–25 gpa
Rainfast:	1 hour
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/ Comments

- **CHS Hypertonic (1–2 pt/100 gal) plus AMS** (2–4 lb/A)**

or

- **CHS Axon (1 gal/100 gal)**
- Under dry or cool conditions, replace CHS Hypertonic with: **CHS Penetrec* (1 qt/100 gal)**

Target Weeds

– wild mustard	4″ diameter
– lambsquarters	4″
– pigweed	8–12″ dependent on species
– smartweed	6″
– velvetleaf	6″

Timing/Comments

Apply after 1st trifoliate.

*Crop Oil @ 2 qt/100 gal or CHS Endurium at 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Fixate @ 2 qt/100 gal can be substituted for AMS.

Marvel (fluthiacet methyl + fomesafan)

EPA Reg. #:	**279-3455**
Rate/A:	6–7.25 fl oz
Spray Volume:	10 gpa (ground) 5 gpa (air)
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	coveralls, eyewear, c.r. gloves, footwear, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/ Comments

- **CHS Hypertonic (1–2 qt/100 gal) plus AMS*** (1.5–3 lb/A)**

or

- **CHS Penetrec* (1–2 qt/100 gal) plus AMS*** (1.5–3 lb/A)**

or

- **CHS Aggrestrol** (1–2 qt/100 gal) plus AMS*** (1.5–3 lb/A)**

or

- **Tapran (1 gal/100 gal)**
- See label for geographical restrictions.

Target Weeds	**6 fl oz**	**7.25 fl oz**
– lambsquarters	3″	4″
– nightshade	2″	4″
– redroot pigweed	2″	4″
– waterhemp	2″	4″
– common ragweed	< 2″	2″
– velvetleaf	24″	36″
– venice mallow	3″	4″

Timing/Comments

Apply prior to flowering.

*Crop Oil @ 2–4 qt/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 2–4 qt/100 gal can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Poast (sethoxydim)

EPA Reg. #: **7969-58-51036**
Rate/A: 0.5–1.5 pt
Spray Volume: 5–20 gpa
Rainfast: 1 hour
S.O.A.: ACC-ase Inhibitor (Group 1)
P.P.E.: coveralls, l.s. shirt, l. pants, c.r. gloves, c.r. footwear, headgear, eyewear, shoes, socks, apron
R.E.I.: 12 hours
W. Notification: Oral
S. Word: Warning

Adjuvant(s)/Comments

- **CHS Penetrec* (1 pt/A) plus AMS*** (2.5 lb/A)**

or

- **CHS Aggrestrol** (0.75 pt/A) plus AMS*** (2.5 lb/A)**

or

- **Tapran (1 gal/100 gal)**
- Use the surfactant required by the broadleaf herbicide for the tank mix.
- Use lower rate for most grasses and higher rates for volunteer corn control.

Target Weeds	5 pt	1 pt	1.5 pt
– barnyardgrass	-	8″	-
– crabgrass	-	6″	-
– field sandbur	-	-	3″
– foxtail	-	8″	-
– volunteer cereals	-	-	4″
– volunteer corn	-	20″	-
– wild proso millet	10″	-	-
– wild oat	-	4″	-
– woolly cupgrass	-	8″	-

*Crop Oil @ 1 qt/A gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 0.75–1 pt/A can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Prefix (fomesafen + s-metolachlor)

EPA Reg. #: **100-1268**
Rate/A: 2-2.33 pt
S.O.A.: Very Long Chain Fatty Acid (Group 15), PPO Inhibitor (Group 14)
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear
R.E.I.: 24 hours
S. Word: Warning

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal)**
- Do not apply with COC or MSO.
- Do not apply postemergence to fields that have received a PP/PE treatment of fomesafen.

Target Weeds

– cocklebur
– common ragweed
– giant ragweed
– Palmer amaranth
– waterhemp

Pursuit 2EC, Thunder (imazethapyr)

Brand Name:	EPA Reg. #:
Pursuit 2EC	**241-310**
Thunder	**42750-146**

Rate/A: N.D. and N. of Highway 210: 3 fl oz
S.D. and S. of Highway 210: 4 fl oz
Spray Volume: min 10 gpa
Rainfast: 1 hour
S.O.A.: ALS Inhibitor (Group 2)
P.P.E.: l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.: 4 hours
W. Notification: Oral
S. Word: Caution

Adjuvant(s)/Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (12–15 lb/100 gal)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (12–15 lb/100 gal)**

or

- **Tapran (1 gal/100 gal)**

Target Weeds

See label for complete list of weeds controlled at different rates.

Timing/Comments

Apply after the first fully expanded first trifoliate leaf but prior to flowering.

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 gal can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro at 2 qt/100 gal can be substituted for AMS.

Raptor, Vulture (imazamox)

Brand Name:	EPA Reg. #:
Raptor	**241-379**
Vulture	**42750-305**
Rate/A:	4–5 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/ Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Hypertonic (1 qt/100 gal) plus AMS*** (12–15 lb/100 gal)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (12–15 lb/100 gal)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (12–15 lb/100 gal)**

or

- **Tapran (1 gal/100 gal)**

Target Weeds

– black nightshade	2–5″
– cocklebur	2–8″
– foxtail	2–6″
– giant ragweed	2–5″
– kochia	1–4″
– lambsquarters	2–5″
– pigweed	2–5″
– sunflower	2–8″
– volunteer corn	2–8″
– venice mallow	1–4″
– velvetleaf	2–8″

Timing/Comments

Apply after the first fully expanded first trifoliate leaf but prior to flowering.

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 gal can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Resource (flumiclorac pentyl ester), **Perpetuo** (flumiclorac pentyl ester + pyroxasulfone)

Brand Name:	EPA Reg. #:
Resource	**59639-82**
Perpetuo	**59639-242**
Rate/A:	2–3 fl oz in tank mix
Spray Volume:	min 15 gpa
Rainfast:	1 hour
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	coveralls over l.s. shirt, l. pants, c.r. gloves, eyewear, c.r. footwear, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/ Comments

- **CHS Penetrec* (1 pt/A) plus AMS*** (2–2.5 lb/A)**

or

- **CHS Aggrestrol** (1 pt/A) plus AMS*** (2–2.5 lb/A)**

or

- **Tapran (1 gal/100 gal)**
- As a tank mix partner with glyphosate.
- Resource helps on buckwheat, morning glory, pigweed, waterhemp, lambsquarters, common ragweed, and velvetleaf.
- Use the surfactant required by the tank mix partner.

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 gal can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Select Max (clethodim)

EPA Reg. #:	**59639-132**
Rate/A:	6–12 fl oz
Spray Volume:	5–40 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (2.5–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100) plus AMS*** (2.5–4 lb/A)**

or

- **Tapran (1 gal/100 gal)**
- Select Max may be used at 6 fl oz for volunteer corn control when tank mixing with glyphosate.

Target Weeds	9 fl oz	12 fl oz
– barnyardgrass	6″	8″
– crabgrass	2″	6″
– giant foxtail	6″	12″
– green foxtail	6″	8″
– quackgrass *2nd application may be needed*	-	4–12″
– volunteer cereals	6″	8″
– volunteer corn	12″	18″
– wild proso millet	8″	10″
– woolly cupgrass	6″	8″
– yellow foxtail	6″	8″

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

**CHS Emulate @ 1 gal/100 gal can be substituted for CHS Aggrestrol.

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Synchrony XP (chlorimuron ethyl + thifensulfuron methyl)

EPA Reg. #:	**352-648**
Rate/A:	0.375 oz (max conv. soybean rate) 1.125 oz (max STS soybean rate)
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Danger

Adjuvant(s)/Comments

- **CHS Hypertonic (2 qt/100 gal) plus AMS* (2–4 lb/A)**

or

- **CHS Axon (1 gal/100 gal)**
- **See label for geographical rate restrictions.**

Target Weeds

Target 1–4″ weeds.

Cocklebur, pigweed, wild sunflower.

*CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Tavium Plus VaporGrip Technology (dicamba + s-metolachlor)

EPA Reg. #:	**100-1623**
Rate/A:	56.5 fl oz
Rainfast:	4 hours
S.O.A.:	Very Long Chain Fatty Acid (Group 15), Plant Growth Regulator (Group 4)
P.P.E.:	coveralls over s.s. shirt and s. pants, c.r. gloves, c.r. footwear plus socks, c.r. headgear, p. eyewear
R.E.I.:	24 hours
S. Word:	Caution

Adjuvant(s)/ Comments

- **CHS Traplok (5 pt/100 gal)**

or

- **CHS Level Best Pro (1–2 qt/100 gal) plus Cognitive 1 or Mediate (2 qt/100 gal)**

Target Weeds

- Palmer amaranth
- Powell amaranth
- spiny amaranth
- burcucumber
- cocklebur
- cooperleaf, hophornbeam
- horseweed/marestail
- Jimsonweed
- kochia
- lambsquarter, common
- morning glory, ivyleaf and tall
- nightshade, black and cutleaf
- pigweed, prostrate, redroot, smooth, tumble
- prickly sida (teaweed)
- ragweed, common
- ragweed, giant
- sesbania, hemp
- smartweed, ladysthumb and Pennsylvania
- sunflower, common
- thistle, Canada
- thistle, Russian
- waterhemp, common and tall

Timing/Comments

In-crop applications can be made over top of dicamba tolerant soybeans through V4 or within 45 days of planting, whichever comes first. No applications can be made to double crop soybeans.

Do not exceed annual rate of s-metolachlor or dicamba.

Read the product label carefully and observe all precautions and limitations. Visit www.tavium-application-stewardship.com for updated application requirements including approved tank mix partners. See additional restrictions at state levels.

Thundermaster (imazethapyr + glyphosate)

EPA Reg. #:	**42750-147**
Rate/A:	2.25–3 pt*
Spray Volume:	10–20 gpa
Rainfast:	1 hour
S.O.A.:	ALS Inhibitor (Group 2) EPSP Synthase Inhibitor (Group 9)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Warning

Adjuvant(s)/ Comments

- **CHS Hypertonic (1 pt/100 gal) plus AMS (8.5–17 lb/100 gal)**

or

- **CHS Fixate/ CHS Wheelhouse Pro (2 qt/100 gal)**
- Use 2.25 pt/A in N.D. and north of Highway 210 in Minn.
- Use 3 pt/A in S.D. and south of Highway 210 in Minn.

Target Weeds

Controls many annual and perennial grass and broadleaf weeds under 8" tall.

Roundup Ready Soybeans Only.

Torment (imazethapyr + fomesafen)

EPA Reg. #:	**66222-249**
Rate/A:	12-16 fl oz (see label for geographical restrictions)
Rainfast:	1 hour
S.O.A.:	ALS Inhibitor (2), PPO Inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, shoes, socks, p. eyewear, c.r. gloves
R.E.I.:	24 hours
W. Notification:	
S. Word:	Danger

Adjuvant(s)/Comments

- **CHS Hypertonic (1–2 qt/100 gal) plus AMS*** (8.5 lb/A)**

or

- **CHS Penetrec* (2 qt/100 gal) plus AMS*** (10 lb/100 gal)**

or

- **CHS Aggrestrol** (2 qt/100 gal) plus AMS*** (10 lb/100 gal)**

or

- **Tapran (1 gal/100 gal)**
- Use of COC or MSO permitted but may slightly reduce crop tolerance.
- See label for geographical restrictions of fomesafen and imazethapyr rates.

Target Weeds	12 fl oz (# of true leaves)	16 fl oz (# of true leaves)
– balloonvine	2	2
– cocklebur	2	4
– copperleaf, hophornbeam	-	4
– eclipta	-	2
– foxtail species		
giant	PC	3
green	PC	3
yellow	PC	PC
– Jimsonweed	4	6
– ladysthumb	S	2
– morning glory species		
entireleaf	S	3
ivyleaf	S	3
pitted	S	4
tall	S	2
– mustard, wild	4	6
– nightshade, black	2	4
– pigweed		
Palmer amaranth	2	4
spiny amaranth	2	2
redroot	2	4
smooth	2	4
waterhemp, tall/common	S	2
– ragweed, common	PC	4
– ragweed, giant		
– smartweed, Pennsylvania	S	4
– sesbania, hemp	-	8
– sunflower, common	-	4
– venice mallow	4	6
– yellow rocket	4	4

*Crop Oil @ 1 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.

**CHS Emulate @ 1 gal/100 gal can be substituted for CHS Aggrestrol.

***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

TIMING/COMMENTS

Application should be made to weeds < 3″ in height.

Ultra Blazer (acifluorfen)

EPA Reg. #:	**70506-60**
Rate/A:	0.5–1.5 pt
Spray Volume:	10–20 gpa
Rainfast:	4 hours
S.O.A.:	PPO Inhibitor (Group 14)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Danger

Adjuvant(s)/Comments

- **CHS Hypertonic (1–2 pt/100 gal) plus AMS** (1–2 lb/A)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (0.5 pt/A) plus AMS** (1–2 lb/A)**

or

- **Tapran (1 gal/100 gal)**
- See label for additives to use with various tank mixes.

Target Weeds

Controls many annual broadleaves, including:

- cocklebur
- nightshade
- pigweed
- smartweed
- wild mustard

Timing/Comments

Apply to weeds 1"–4" tall.

*Crop Oil @ 1 pt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Varisto (imazamox + bentazon)

EPA Reg. #:	**241-447**
Rate/A:	21–27 fl oz
Spray Volume:	10–20 gpa
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2) Photosystem II Inhibitor (Group 6)
P.P.E.:	l.s shirt, l.pants, w.p. gloves, shoes, socks
R.E.I.:	48 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Hypertonic (1 qt/100 gal) plus AMS*** (12–15 lb/100 gal)**

or

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (2–4 qt/100) plus AMS*** (12–15 lb/100 gal)**

or

- **CHS Aggrestrol** (2 qt/100) plus AMS*** (12–15 lb/100 gal)**

or

- **Tapran (1 gal/100 gal)**

Target Weeds	21 oz	27 oz
– cocklebur	4"	2–8"
– lambsquarters	1.5"	2–8"
– redroot pigweed	3"	4"
– velvetleaf	3"	3"
– annual smartweed	4"	6"
– black nightshade	3"	3"
– venice mallow	2"	3"
– wild mustard	3"	1–4"
– cheatgrass	3"	3"
– downy brome	3"	3"
– quackgrass	3"	3"
– Persian darnel	3"	3"
– foxtails	3"	3"
– Italian ryegrass	3"	3"
– Japanese brome	3"	3"
– volunteer canola		

*Crop Oil @ 1-2 gal/100 gal or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 gal can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply after emergence, but before crop bloom.

Warrant Ultra (acetochlor + fomesafen)

EPA Reg. #: **524-620**
Rate/A: 48-70 fl oz (see label for soil texture and OM restrictions)
Rainfast: 1 hour
S.O.A.: Very Long Chain Fatty Acid (Group 15), PPO Inhibitor (Group 14)
P.P.E.: l.s. shirt, l. pants, shoes, socks, p. eyewear
R.E.I.: 24 hours
W. Notification:
S. Word: Danger

Adjuvant(s)/Comments

- **CHS Hypertonic (1-2 qt/100 gal)**
- Use of COC or MSO permitted but may reduce crop tolerance.
- Reduced postemergence weed control for glyphosate may result from tank mixtures with Warrant Ultra and oil-based adjuvants.
- Do not apply postemergence to fields that have received a PP/PE treatment of fomesafen.
- Do not exceed the maximum annual rate of 3 lb/A of acetochlor.

Target Weeds	50 fl oz (# of true leaves)	60 fl oz (# of true leaves)
– copperleaf, hophornbeam	2	2
– eclipta	2	2
– Jimsonweed	4	6
– ladysthumb	2	2
– morning glory (ivyleaf, entireleaf, tall)	2	2
– nightshade, black	4	4
– pigweed		
Palmer amaranth	4	4
spiny amaranth	2	2
redroot	4	6
smooth	4	4
– ragweed, common	4	4
– smartweed, Pennsylvania	4	4
– sesbania, hemp	6	6
– venice mallow	4	4
– waterhemp, common/tall	2	2
– yellow rocket	4	6

Timing/Comments

Application should be made before soybeans reach growth stage R2.

Optimum timing is V2-V3 soybeans.

Xtendimax with VaporGrip Technology (Diglycolamine salt of dicamba)

EPA Reg. #: **524-617**
Rate/A: 22 fl oz
Spray Volume: min 10 gpa
Rainfast: 4 hours
S.O.A.: Plant Growth Regulator (Group 4)
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear
R.E.I.: 24 hours
W. Notification: Oral
S. Word: Caution

Adjuvant(s)/Comments

- **CHS Traplok (1 gal/100 gal of water)**

or

- **CHS Level Best Pro (1–2 qt/100 gal) plus Cognitive 1 or Mediate (2 qt/100 gal)**

or

- **CHS Wheelhouse Pro (2 qt/100 gal) plus Cognitive 1 or Mediate (2 qt/100 gal)**
- No acidifying water conditioners; Do NOT use ammonium additives (e.g. AMS, UAN).
- Do not use in aerial applications.
- Maxium seasonal use rate is 88 fl oz (2 lb a.i) per acre per year.
- Selection of right nozzle is one of the most important aspects of drift control, use only spray nozzle that produce very coarse to ultra coarse spray droplets.
- Read the product label carefully and observe all precautions and limitations, visit www.xtendimaxapplicationrequirements.com for updated application requirements including approved tank mix partners. See additional restrictions at state levels.

Target Weeds

– black nightshade
– common ragweed
– Canada thistle
– cocklebur
– giant ragweed
– kochia
– lambsquarters
– pigweed
– venice mallow
– velvetleaf
– wormwood
– volunteer sunflower
– marestail
– Russian thistle

Timing/Comments

POST application from emergence up to and including R1 stage of dicamba tolerant/Xtend soybean.

Weed should be less than 4 inches tall.

The best weed management practice in soybeans is to use overlapping residual herbicide applications starting with a preplant or pre-emergent residual herbicide followed by a timely post emergent (POST) application combined with a residual herbicide to extend weed control until canopy closure. The herbicides in the table below offer POST options to provide additional residual activity which is especially important for control of waterhemp and Palmer amaranth that can emerge throughout the growing season.

Many of these herbicides rely on Group 15 SOA to extend residual control and to control pigweed species resistant to PPO or Group 14 SOA. However, Group 15 herbicides do not have POST activity so any weeds present at time of application will need to be controlled by either another component in the premix or the addition of an effective tank mix partner. With the recent development of resistance of some pigweed populations to Group 15 chemistry, it is wise to rotate chemistry within this group and to use the highest labeled rates to delay the further selection of resistant biotypes.



Waterhemp emergence in August

Product*	SOA	Rate	Timing	Comments
Soil Residual Only				
Dual II Magnum/ Brawl II / Priority 8E / Moccasin / Moccasin II Plus	15	1.0–1.33 pt/A	VE-V3	Application made with COC or UAN may cause temporary leaf burn or stunting. 2.5 pt/yr maximum.
Dual Magnum / EverpreX / Brawl / Parallel / Stalwart C / Me-too-Lachlor	15	1.0–1.33 pt/A	90-day PHI	Application made with COC or UAN may cause temporary leaf burn or stunting. 2.5 pt/yr maximum.
Outlook	15	12–21 fl oz/A	VE-V5	Check label for soil type restrictions and rates. 24 fl oz/yr maximum.
Warrant	15	1.25–2.0 qt/A	VE-R2	V2-V3 optimum timing. 4 qt/yr maximum.
Zidua SC	15	1.75–5.75 fl oz/A	VE – V6	May cause some stunting or leaf burn. See label for use rates and maximum yearly amounts based on soil type.
Soil Residual Herbicides with Post-Emergent Activity				
Anthem Maxx	14, 15	2.0–5.7 fl oz/A	Through V6	Check label for soil type restrictions and rates. Use CHS Penetrec or CHS Aggrestrol @ 2 qt/100 gal or CHS Hypertonic @ 1 qt/100 gal.
Perpetuo	14, 15	6–10 fl oz/A	Up to V6	Apply once per year. See label for maximum use rates. Use CHS Penetrec or CHS Aggrestrol @ 2 qt/100 gal plus UAN or AMS.
Prefix	14, 15	2–2.33 pt/A	90-day PHI	Check label for regional guidelines for maximum use rates. Use CHS Hypertonic @ 1 qt/100 gal. Do not use COC or MSO.
Pummel	2, 15	2 pt/A	Through V5	Fomesafen can be added to increase pigweed and ragweed species control. Check label restrictions for maximum annual use rates.
Sequence	9, 15	2.25–3.5 pt/A	90-day PHI	For use in glyphosate tolerant soybeans. Check label for soil type restrictions and rates.
Tavium	4, 15	56.5 fl oz/A	Through V4 75-day PHI	**For use on dicamba tolerant soybeans only.** Use CHS Traplok @ 19.2 fl oz/A or Suralta @ 20 fl oz/A + CHS Trapline Pro 2 @ 5 pt/100 gal.
Torment	2, 14	0.75–1.0 pt/A	Weeds < 3"	This product is less effective for residual control of waterhemp or Palmer amaranth. Add CHS Penetrec or CHS Aggrestrol @ 2 qt/100 gal or CHS Hypertonic @ 1 qt/100 gal plus UAN or AMS. See label for regional restriction pertaining to maximum fomesafen rates.
Warrant Ultra	14, 15	48–70 fl oz/A	VE-R2 45-day PHI	Check label for regional guidelines for maximum use rates. Use CHS Penetrec or CHS Aggrestrol @ 2 qt/100 gal or CHS Hypertonic @ 1 qt/100 gal.

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Soybean Postemergence Herbicide Efficacy Chart

		Annual Grasses[2]												Perennial Grasses[2]			Broadleaves[2]																										
Herbicide[1]	Crop Tolerance[2]	Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Goosegrass	Sandbur	Shattercane	Volunteer Corn	Volunteer Wheat	Wild Oat	Wild Proso Millet	Woolly Cupgrass	Johnsongrass (Seedlings)	Johnsongrass (Rhizomes)	Quackgrass	Bindweed, Field	Buffalobur	Canada Thistle	Cocklebur	Kochia	Lambsquarters	Lanceleaf Sage	Marshelder	Morning Glory (Annual)	Nightshade, Black	Pigweed, Redroot	Prickly Sida	Ragweed, Common	Ragweed, Giant	Russian Thistle	Smartweed	Sunflower	Velvetleaf	Venice Mallow	Waterhemp Species*	Wild Mustard	Wild Buckwheat	Wormwood, Biennial	Yellow Nutsedge
Anthem Maxx	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E	E	N	N	E	E	E	N	N	N	F	G	N	E	N	G	N	F	N	N
Assure II / Targa	E	G	E	E	E	E	E	G	E	G	E	E	E	E	E	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	N	N	N
Basagran 5L	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	P	G	E	F	F	P	G	P	P	P	G	G	G	G	E	G	G	E	P	E	F	F	G
Cadet	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	P	P	P	G	G	-	P	P	G	G	P	P	P	P	P	P	E	P	G	P	P	P	P
Classic	E	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	F	P	F	E	P	P	P	-	G	P	G	P	G	F	P	G	E	G	P	F	E	P	P	G
Cobra/Phoenix	G	P	P	P	P	P	N	P	P	P	N	N	N	P	N	N	F	F	P	E	F	F	E	G	G	E	E	F	E	G	P	F	G	F	G	G	E	F	P	P
Enlist Duo[3]	E	G	G	G	E	-	E	G	N	-	-	-	E	E	G	G	-	-	-	E	G	E	-	-	E	G	E	-	E	E	-	G	-	E	-	G	-	-	-	F
Enlist One[3]	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E	N	N	E	P	E	P	N	E	E	E	E	E	E	G	G	G	E	G	E	E	P	G	N
FirstRate	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	P	P	E	P	P	G	E	G	P	P	-	E	E	P	G	E	G	E	P	E	P	P	P
Flexstar GT 3.5	G	G	E	G	E	E	G	E	E	E	E	E	G	E	E	E	G	E	G	E	G	G	G	G	F	G	E	F	G	G	G	E	E	G	G	G	E	G	F	F
Fusilade DX	E	G	G	G	G	G	E	E	E	G	E	E	E	E	E	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Harmony SG	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	P	P	F	P	G	P	P	P	P	G	P	F	P	P	G	F	G	F	G	G	P	P	N
Liberty 280 SL[4]	E	G	G	G	E	G	F	G	E	G	E	E	G	P	-	P	F	G	P	F	E	E	E	E	F	E	E	G	G	G	G	E	E	G	G	F	E	G	E	P
Marvel	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	-	-	N	G	F	G	F	E	E	E	E	F	E	F	F	E	F	E	G	E	E	P	P	N
Poast	E	E	E	E	E	E	F	F	N	N	P	P	E	P	P	P	N	N	N	F	N	E	N	N	G	E	E	N	E	F	N	E	G	G	N	E	N	N	N	G
Prefix	F	G	-	-	G	-	F	-	-	-	-	-	F	-	-	-	-	-	-	G	N	N	-	-	G	G	E	-	G	G	-	G	-	F	G	G	G	P	-	-
Pursuit 2EC / Thunder	G	G	F	F	G	P	P	G	P	P	P	F	P	F	P	P	P	F	P	G	G	P	E	E	G	E	E	F	G	G	G	G	G	F	P	G	E	F	P	P
Raptor / Vulture	G	E	F	F	E	P	P	G	P	P	P	G	P	F	P	F	P	F	P	G	G	F	E	G	G	E	E	F	G	G	G	G	G	F	P	G	E	G	P	P
Reflex	G	N	N	N	N	N	N	P	P	P	N	N	N	N	N	N	F	F	P	G	F	F	E	G	G	G	E	P	G	G	P	G	F	G	F	E	E	F	P	P
Resource / Perpetuo	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	P	N	P	P	F	-	-	P	P	F	F	F	P	P	P	P	E	P	P	P	P	P	N
RoundUp PowerMax 3[5]	E	G	G	G	E	-	E	G	N	-	-	-	-	E	E	E	-	-	-	E	G	G	-	-	F	G	E	-	G	G	-	G	-	G	E	G	E	F	-	F
Select Max	E	E	E	E	E	E	G	G	G	G	E	E	E	E	E	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P
Synchrony XP	E	N	N	N	N	N	N	N	P	P	N	N	N	N	N	N	P	P	P	E	F	G	P	-	F	P	G	P	G	F	F	E	E	E	P	F	E	P	P	G
Torment	G	F	G	G	G	-	N	G	N	-	-	-	N	G	N	N	-	-	-	G	F	F	-	-	G	E	E	-	E	G	-	E	-	E	-	G	-	-	-	N
Ultra Blazer	G	P	P	P	P	N	N	P	P	P	N	N	N	P	N	N	F	F	F	F	F	F	F	F	G	E	E	P	E	F	G	G	F	F	F	E	E	G	P	P
Varisto	E	E	F	G	E	F	N	E	E	E	E	G	F	N	F	F	F	N	F	G	G	G	E	G	G	E	E	G	F	F	E	E	E	N	E	E	G	G	G	G
Volunteer / Many generics	E	E	G	E	E	E	-	E	E	-	-	-	E	E	E	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
XtendiMax / Engenia / Tavium[6]	E	-	P	P	P	-	-	P	-	-	-	-	P	-	-	P	-	-	G	E	G	G	-	-	E	G	G	-	E	E	-	G	-	G	-	G	-	-	-	P

1 All trademarks and registered trademarks are the property of their respective owners.

2 Crop tolerance and weed control key: E = Excellent, G = Good, F = Fair, P = Poor, N = No Control.

3 Apply to Enlist soybeans only.

4 Apply to glufosinate-resistant soybeans only.

5 Apply to glyphosate-resistant soybeans only.

6 Apply to Xtend soybeans only; XtendiMax, Engenia, and Tavium are the only herbicides approved for this use.

Conventional Soybean Postemergence Protoporphyrinogen Oxidase (PPO) Herbicide Comparison

Protoporphyrinogen Oxidase (PPO) herbicides are contact-type herbicides which make up the Group 14 mode of action. PPO herbicides inhibit the protoporphyrinogen oxidase enzyme resulting in the buildup of reactive oxygen species which disrupt cell membrane integrity. PPO herbicides are an excellent option for conventional soybean when targeting broadleaf weed species such as morning glory, Palmer amaranth, waterhemp, and velvetleaf in a postemergence herbicide application. Mild injury can occur after application. Symptoms include bronzing and temporary stunting. The addition of an adjuvant is recommended increase canopy coverage and penetration.

PPO Herbicide[1]	Rate/A[2]	Timing[3]	Tough-to-Kill Target Weeds[3]	Recommended Adjuvants[4]
Cadet	0.6–0.9 fl oz	Apply PP through R2. Can be applied in a tank mix with glyphosate or other postemergence herbicides.	Morning glory, kochia, lambsquarters, pigweed, velvetleaf.	CHS Endurium (2 qt/100 gal) or CHS Penetrec (0.5-1 pt/100 gal)
Cobra	8.0–12.5 fl oz	Apply PP through R6. Can be applied in a tank mix with 2,4-DB, glyphosate, or other postemergence herbicides.	Nightshade, ragweed, jimsonweed, pigweed.	CHS Endurium (1 qt/100 gal) or CHS Penetrec (0.5-1 pt/A) or CHS Aggrestrol (0.5-1 pt/A) + AMS (2.5 lb/A)
Flexstar	0.75–1.6 pt	Apply PP, PRE, or POST. Can be applied in a tank mix with glyphosate or other postemergence herbicides. Consult label for specific geographic restrictions.	Cocklebur, jimsonweed, pigweed, ragweed.	CHS Penetrec (2 qt/100 gal) or CHS Aggrestrol (2 qt/100 gal) + AMS (8.5 lb/100 gal)
Marvel	5.0–7.25 fl oz	Apply PP through R3. Can be applied in a tank mix with glyphosate, glufosinate, or other postemergence herbicides. Consult label for specific geographic restrictions.	Morning glory, jimsonweed, pigweed, smartweed, velvetleaf.	CHS Endurium (1 qt/100 gal) or CHS Penetrec (1-2 qt/100 gal) or CHS Aggrestrol (1-2 qt/100 gal) + AMS (1.5-3 lb/A)
Resource	4.0–8.0 fl oz	Apply PP, PRE, or POST. Can be applied in a tank mix with glyphosate or other postemergence herbicides.	Velvetleaf, cocklebur, ragweed, jimsonweed, lambsquarters, pigweed.	CHS Penetrec (1 pt/A) or CHS Aggrestrol (1 pt/A) + AMS (2-2.5 lb/A)
Ultra-Blazer	0.5–1.5 pt	Apply PP, PRE, or POST. Can be applied in a tank mix with 2,4-DB, glyphosate, or other postemergence herbicides.	Ragweed, jimsonweed, pigweed, smartweed.	CHS Endurium (1 qt /100 gal) or CHS Penetrec (0.5 pt/A) + AMS (1-2 lb/A)

[1] All trademarks and registered trademarks are the property of their respective owners.

[2] Refer to label for complete application rate guidelines.

[3] Refer to label for specific timing guidelines, target weed species, and rotation restrictions. PP = Pre-plant, PRE = Preemergence, POST = Postemergence, R2 = Full bloom, R3 = Beginning pod, R6 = Full seed.

[4] Crop Oil can be substituted for CHS Penetrec. Tapran or CHS Emulate can be substituted for CHS Aggrestrol. CHS Fixate can be substituted for AMS.

Fungicides			Aerial Web Blight	Anthracnose	Brown Spot	Cercospora Leaf Blight	Frogeye Leaf Spot	Phomopsis / Pod and Stem Blight	Soybean Rust	Target Spot	White Mold	Harvest Restriction[1]
Active Ingredient (%)	Trade Name	Rate/A (fl oz)[2]	Efficacy Ratings									
MIXED MODES OF ACTION												
Azoxystrobin 18.2% Difenoconazole 11.4%	Quadris® Top	8.0–14.0	U	U	G-VG	P-G	VG	F-G	VG	P	NL	14 days
Azoxystrobin 19.8% Difenoconazole 19.8%	Quadris Top® SBX	7.0–7.5	VG	U	G-VG	P-G	VG	F-G	VG	F-G	U	14 days
Azoxystrobin 7.0% Propiconazole 11.7%	Quilt®	14.0–20.5	U	U	G	F	F	U	VG	P	NL	21 days
Azoxystrobin 13.5% Propiconazole 11.7%	Quilt Xcel®	10.5–21.0	E	VG	G	F	F	U	VG	P	NL	R6
Azoxystrobin 25.3% Flutriafol 18.63%	Topguard EQ	5.0–7.0	VG	U	VG	U	G-VG	U	E	P	U	21 days
Benzovindiflupyr 2.9% Azoxystrobin 10.5% Propiconazole 11.9%	Trivapro®	13.7–20.7	E	U	VG	P-G	F-G	G	VG-E	U	NL	14 days R6
Cyproconazole 7.17% Picoxystrobin 17.94%	Aproach® Prima	5.0–6.8	VG	U	G	P-G	F-G	U	VG	F-G	NL	14 days
Fluopyram 17.4% Prothiconazole 17.4%	Propulse®	6.0–10.2	NL	NL	U	NL	U	U	U	NL	G	21 days
Flutriafol 19.3% Fluoxastrobin 14.84%	Fortix® Preemptor®	4.0–6.0	U	U	G-VG	P-G	G-VG	U	U	P	U	R5
Prothioconazole 16.0% Trifloxystrobin 13.7%	Delaro®	8.0–11.0	VG	U	VG	U	G-VG	U	U	NL	NL	21 days

Efficacy Ratings: P=Poor F=Fair G=Good VG=Very Good E=Excellent U=Unknown efficacy or insufficient data to rank product NL= Not labeled for use against disease

CHS Acuvant and Parachute II are APE/NPE free and can be used at 3 fl oz/A for all application timings for drift control and deposition. CHS Endurium is recommended at 1 qt/100 gal (Ground) and 4-6 fl oz/A (Aerial) for increased fungicide efficacy and drift control/deposition.

Note: This publication was developed by members of NCERA-137. It was compiled by Kiersten Wise, University of Kentucky. Efficacy ratings were determined for each fungicide by field-testing the materials over multiple years and locations. Each rating is based on the product's level of disease control and does not necessarily reflect yield increases obtained from applying the product.

[1] Harvest restrictions are listed for soybean harvested grain. Restrictions may vary for other types of soybean (edamame, etc.) and soybean for other uses such as forage or fodder.

[2] General Recommended Rates. Always read and follow all use restrictions before applying any fungicide.

[3] Rating is based on two applications of 9 fl oz/A rate of Picoxystrobin at R1 and R3.

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Fungicides			Aerial Web Blight	Anthracnose	Brown Spot	Cercospora Leaf Blight	Frogeye Leaf Spot	Phomopsis / Pod and Stem Blight	Soybean Rust	Target Spot	White Mold	Harvest Restriction[1]
Active Ingredient (%)	Trade Name	Rate/A (fl oz)[2]	Efficacy Ratings									
MIXED MODES OF ACTION CONTINUED												
Pyraclostrobin 28.58% Fluxapyroxad 14.33%	Priaxor®	4.0–8.0	E	VG	G-VG	P-G	P-F	U	VG	F-G	P	21 days
Pydiflumetofen 6.9% Difenoconazole 11.5%	Miravis Top®	13.7	VG	U	VG	F-G	VG	G	NL	F-G	U	14 days
Trifloxystrobin 32.3% Prothioconazole 10.8%	Stratego® YLD	4.0–4.6	VG	VG	G	F	F-G	U	VG	P	NL	21 days
Tetraconazole 7.48% Azoxystrobin 9.35%	Affiance™	10.0–14.0	U	VG	VG	F	F-G	U	U	P	NL	14 days R5
Flutriafol 26.47% Bixafen 15.5 %	Lucento	3.0–5.5	VG	U	VG	F-G	VG	U	VG-E	F-G	U	21 days
Tetraconazole 17.76% Fluoxastrobin 17.76%	Zolera FX	4.4–6.8	U	U	U	U	F-G	U	U	U	U	30 days R5
Mefentrifluconazole 11.61% Pyraclostrobin 15.49% Fluxapuroxad 7.74%	Revytek	8.0–15.0	VG	U	VG	F-VG	VG	U	E	F-VG	P	21 days
Thiophanate-methyl 21.3% Tetraconazole 4.2%	Acropolis	20.0–23.0	NL	U	U	U	VG	U	E	U	U	R5
Fluopyram 10.9% Trifloxystrobin 13.1% Prothioconazole 14.9%	Delaro Complete	8.0–11.0	U	U	VG	U	U	U	U	NL	U	21 days

Efficacy Ratings: P=Poor F=Fair G=Good VG=Very Good E=Excellent U=Unknown efficacy or insufficient data to rank product NL= Not labeled for use against disease

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[1] Harvest restrictions are listed for soybean harvested grain. Restrictions may vary for other types of soybean (edamame, etc.) and soybean for other uses such as forage or fodder.

[2] General Recommended Rates. Always read and follow all use restrictions before applying any fungicide.

[3] Rating is based on two applications of 9 fl oz/A rate of Picoxystrobin at R1 and R3.

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Fungicides			Aerial Web Blight	Anthracnose	Brown Spot	Cercospora Leaf Blight	Frogeye Leaf Spot	Phomopsis / Pod and Stem Blight	Soybean Rust	Target Spot	White Mold	Harvest Restriction[1]
Active Ingredient (%)	Trade Name	Rate/A (fl oz)[2]	Efficacy Ratings									
STROBILURINS (GROUP 11)												
Azoxystrobin 22.9%	Quadris®	6.0–15.5	VG	VG	P-G	P	P	U	G-VG	P-F	P	14 days
Fluoxastrobin 40.3%	Evito®	2.0–5.7	VG	G	P-G	P	P	U	U	U	NL	30 days R5
Picoxystrobin[3] 22.5%	Aproach®	6.0–12.0	VG	G	P-G	P	P	U	G	U	G	14 days
Pyraclostrobin 23.6%	Headline®	7–15	VG	VG	P-G	P	P	U	VG	P-F	NL	21 days
TRIAZOLES (GROUP 3)												
Cyproconazole 8.9%	Alto® 100 SL	2.75–5.5	U	U	VG	F	F	U	VG	U	NL	30 days
Flutriafol 11.8%	TopGuard®	7.0–14.0	U	VG	VG	P-G	G-VG	U	VG-E	P	F	21 days
Propiconazole 41.8%	Tilt®	4.0–6.0	P	VG	G	NL	F	NL	VG	U	NL	R6
Prothioconazole 41%	Proline®	2.5–5.0	NL	NL	NL	NL	G-VG	NL	VG	U	F	21 days
Tetraconazole 20.5%	Domark®	4.0–5.0	NL	VG	VG	P-G	F-G	U	VG-E	P	F	R5
MBC THIOPHANATES (GROUP 1)												
Thiophanate-methyl 45%	Topsin®	10.0–20.0	U	U	U	F	VG	U	G	U	F	21 days
Inpyrfluxam 31.25%	Excalia SC	2.0	P	NL	NL	NL	NL	NL	U	NL	NL	R5
SDHI CARBOXIMIDES (GROUP 7)												
Boscalid 70%	Endura® 0.7	3.5–11.0	U	NL	VG	U	P	NL	NL	U	VG	21 days
2,6-DINITROANILINES (29)												
Fluazinam 40%	Omega®	12.0–16.0	NL	NL	NL	NL	NL	NL	NL	U	G	R3

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[1] Harvest restrictions are listed for soybean harvested grain. Restrictions may vary for other types of soybean (edamame, etc.) and soybean for other uses such as forage or fodder.

[2] General Recommended Rates. Always read and follow all use restrictions before applying any fungicide.

[3] Rating is based on two applications of 9 fl oz/A rate of Picoxystrobin at R1 and R3.

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In-season threats from various insects make it a good recommendation to include a broad-spectrum insecticide in postemergence tank mixes. Newer herbicide-tolerant traits require all tank mix components be tested to determine if they adversely affect the spray drift properties. *Applicators must check the appropriate product tank mix website within 7 days prior to making applications to ensure the product is on the approved list.*

Below are the various insecticides currently approved on the different herbicide tolerant trait websites and available through CHS. It is important to note that commonly used products may not be on the approved lists. To achieve effective coverage for insect control, smaller droplets are preferred over the larger droplets necessary to minimize off target movement of the herbicide. In general, as droplet size increases, percent insect control decreases. A separate application may be needed to maximize insect control especially when using drift control agents that are guar or polyacrylamide based and intended to produce large droplets.

Active Ingredient	Insecticides	Dicamba Tolerant Technology			Enlist Trait	
		Xtendimax	Engenia	Tavium	Enlist One	Enlist Duo
acephate	Acephate 97 WDG (Adama)	x	x			
acephate	Acephate 97UP	x[1]	x[1]		x	
acephate	Orthene 97	x	x	x[1]		
abamectin	Agri-Mek SC			x[1]	x	x
abamectin + cyantraniliprole	Minecto-Pro			x[1]		
afidopyropen	Sefina Inscalis		x[1]		x	
beta-cyfluthrin	Baythroid XL	x[1]				
bifenthrin	Bifenture EC	x[1]	x[1]			x
bifenthrin	Brigade 2EC	x		x[1]	x	x
bifenthrin	Fanfare EC		x		x	x
Bifenthrin + sulfoxaflor	Ridgeback				x	x
chlorantraniliprole	Prevathon	x	x		x	x
chlorantraniliprole	Vantacor	x[1]		x[1]	x	x
chlorantraniliprole + lambda-cyhalothrin	Besiege			x[1]	x	x
chlorantraniliprole + bifenthrin	Elevest	x[1]	x[1]	x[1]	x	x
cypermethrin	Fastac CS		x			
cypermethrin	Fastac EC		x[1]			
dicrotophos	Bidrin 8	x[1]	x[1]	x[1]	x	
diflubenzuron	Dimilin 2L				x	x
dimethoate	Dimethoate 4EC				x	

[1] Must be used with DRA on approved list.

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ALWAYS REFER TO SPECIFIC HERBICIDE TANK MIX APPROVAL WEBSITE PRIOR TO APPLICATION

Active Ingredient	Insecticides	Dicamba Tolerant Technology			Enlist Trait	
		Xtendimax	Engenia	Tavium	Enlist One	Enlist Duo
dimethoate	Dimethoate 400	x[1]	x[1]			
dimethoate	Dimethoate LV-4	x[1]				
esfenvalerate	Asana XL	x[1]	x[1]	x[1]	x	x
flupyradifurone	Sivanto Prime	x[1]				
imidacloprid	Macho 2FL	x				
imidacloprid	Macho 4.0	x	x	x[1]	x	x
imidacloprid	Nuprid 4F Max	x	x	x[1]	x	
imidacloprid + beta-cyfluthrin	Leverage 360	x[1]	x			
indoxacarb	Steward EC				x	
lambda-cyhalothrin	Lambda-cyhalothrin 1EC (Nufarm)	x[1]	x[1]	x[1]	x	x
lambda-cyhalothrin	Lambda-Cy EC				x	
lambda-cyhalothrin	Province II	x[1]	x	x[1]	x	x
lambda-cyhalothrin	Silencer	x[1]			x	x
lambda-cyhalothrin	Warrior II with Zeon Technology	x[1]	x	x[1]	x	x
lambda-cyhalothrin	Crusader 1EC	x[1]	x[1]			
lambda-cyhalothrin + thiamethoxam	Endigo ZC			x[1]	x	
novaluron	Diamond	x[1]	x[1]		x	
oxamyl	Vydate CLV				x	x
permethrin	Perm-UP 3.2EC	x[1]	x[1]			x
spinetoram	Radiant SC				x	x
spinetoram + methoxyfenozide	Intrepid Edge				x	x
sulfoxaflor	Transform WG				x	
thiamethoxam	Centric 40WG			x[1]	x	
zeta-cypermethrin + bifenthrin	Hero	x[1]	x	x[1]	x	x
zeta-cypermethrin	Mustang Max	x[1]	x[1]	x[1]	x	x

[1] Must be used with DRA on approved list.

All trademarks and registered trademarks are the property of their respective owner.

ALWAYS REFER TO SPECIFIC HERBICIDE TANK MIX APPROVAL WEBSITE PRIOR TO APPLICATION

The Soybean Gall Midge is the latest pest threatening the soybean industry. The pest currently affects growers in Iowa, Minnesota, Missouri, Nebraska, and South Dakota. The Soybean Gall Midge was identified as a new species in 2018 but was first discovered in Nebraska in 2011. They were first thought to feed only on injured or diseased plants but later were found infecting healthy soybean plants. The Soybean Gall Midge has been found infecting soybean plants in over 65 counties, making it an economic concern that needs to be managed.

The life cycle of a gall midge is complete metamorphosis: egg, larva, pupae and adult. They emerge in June as adults and lay eggs in the cracks or "fissures" of soybean stems. Based on other species of midges, it is thought that the eggs hatch within two to three days. Once they hatch, they go through three stages or instars. The first 2 instars are white maggot like larva and can be difficult to identify because they are similar to other species. The larvae resemble those of the white mold gall midge that feeds on soybean root fungi, making it non-economic. At the third instar stage, the larva change to a bright orange color and will eventually fall to the ground to pupate and emerge as adults.

The Soybean Gall Midge is only damaging to the soybean plant in the larva stage. The larvae eat the stem tissue causing the infested plants to wither and die. The larvae mature at different intervals and produce two to three generations per year. New adults emerge almost every day throughout the season which constantly continues the life cycle and makes managing the pest very difficult.

Soybean plants are usually infested on the outer edges of the field and will work their way inwards. The adults are poor flyers, so infestation will move inward only a few rows at a time. The infestation on few of the outside rows is a typical symptom of a Soybean Gall Midge infestation. Scout for gall midge after V-2 where you see withering or dying plants on the outer edge of the field. If a plant is dying, cracked, brittle or blackening at the base of the stem, peel back the outer layer of the stem and most likely you will see larvae.

The mature larvae have been shown to overwinter in the top 1-2 inches of topsoil of a field that was soybeans the year prior. It is thought the population suffers greatly from the extreme cold temperatures, but they reproduce so quickly in the summer, that economic impact levels can be reached early in the season.

Many treatments have been tried such as insecticidal seed treatments, foliar insecticide treatments with different timings, changing planting dates, planting 20 feet from the edge of the field and tilling fields to destroy pupae. University studies have shown that a seed treatment including an insecticide, followed by drop nozzle sprayings of an insecticide at V-3 and again at V-5, have had some success controlling the Soybean Gall Midge in high infestations, but more studies are needed. Dry granular insecticides have been applied in a T-Band with mixed results as well. Pyrethroid foliar treatments have had good control, but with the larvae inside the soybean stem tissue, efficacy is poor, and they will emerge unharmed and resume the reproduction cycle. Applying pyrethroids foliar throughout the season is not a good practice since many of a soybean's beneficial insects will perish with the application.

If you do have an infestation of Soybean Gall Midge, please contact your local extension agent, so the field can be documented, and further research can be expanded to help eradicate the pest.



Soybean Gall Midge larvae feeding on a soybean plant stem
Photo courtesy of SDSU Extension.

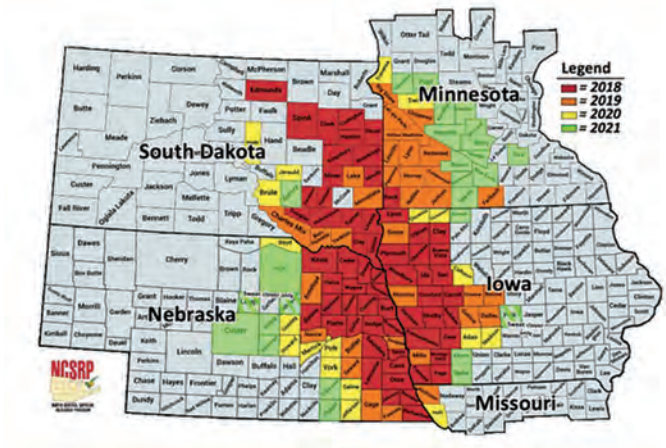


Figure 1. Counties identified as infested with SGM through larval prescence on soybean and sweet clover for 2018 (red), 2019 (orange), 2020 (yellow), and 2021 (green)
Photo courtesy of cropwatch.unl

White mold (*Sclerotinia sclerotiorum*) is difficult to control. A management plan should first focus on variety selection, and then consider plant population, row width, tillage, and fertility management. Fungicides can also help reduce the severity of the disease. Adequate results from fungicides only happen when applications are made early, at the R1–R2 growth stage. Best control is achieved when two applications are made with the first at R1 (beginning bloom), followed with a second application 7-14 days later at R3. Most fungicide applications only provide suppression, and effectiveness is dependent on the level of white mold pressure and the weather present during and after infection. White mold favors wetter and cooler environments. Fungicide use for white mold is a preventative approach, not a curative treatment. By the time white mold symptoms are seen, control measures are already ineffective. Cobra or Phoenix herbicides are labeled for and can provide suppression of white mold in soybeans. Apply herbicide prior to infection and before soybeans are past R2 (full bloom). Crop response may occur.





FUNGICIDE OPTIONS						
Product	**Rate/A**	**Max. Rate per Year**	**Ground Volume**	**Aerial Volume**	**Active Ingredient**	**Efficacy Rating**
Affiance	10–14 fl oz	28 fl oz	10 GPA	5 GPA	Tetraconozole Azoxystrobin	U
Aproach	8–12 fl oz	36 fl oz	Not stated	5 GPA	Picoxystrobin	G*
Delaro 325 SC	8–11 fl oz	33 fl oz	10 GPA	3 GPA	Prothioconazole Trifloxystrobin	F
Delaro Complete	8–11 fl oz	33 fl oz	10 GPA	2 GPA	Prothioconazole Trifloxystrobin Fluopyram	F
Domark 230 ME	4–5 fl oz	10 fl oz	10 GPA	5 GPA	Tetraconozole	F
Endura	5.5–11 oz	22 fl oz	Not stated	5 GPA	Boscalid	VG
Lucento	4–5.5 fl oz	22 fl oz	10 GPA	2 GPA	Flutriafol Bixafen	U
Miravis Neo	13.7–20.8 fl oz	41.6 fl oz	10 GPA	2 GPA	Pydiflumetofen Propiconazole Azoxystrobin	P
Omega 500F	12–16 fl oz	32 fl oz	10 GPA	5 GPA	Fluazinam	G
Priaxor	4–8 fl oz	16 fl oz	10 GPA	5 GPA	Pyraclostrobin Fluxapyroxad	P
Proline	3–5 fl oz	12.9 fl oz	10 GPA	2 GPA	Prothioconazole	F
Propulse	6–8 fl oz	16 fl oz	10 GPA	2 GPA	Fluopyram Prothioconazole	G
Revytek	8.0–15 fl oz	30 fl oz	10 GPA	2 GPA	Fluxapyroxad Pyraclostrobin Mefentrifluconazole	P
Topsin 4.5FL	15–20 fl oz	40 fl oz	Not stated	5 GPA	Thiophanate-methyl	F
Viatude	10–16 fl oz	48 fl oz	10 GPA	5 GPA	Prothioconazole Picoxystrobin	U
Zolera FX	4.4–6.8 fl oz	6.8 fl oz	10 GPA	5 GPA	Fluoxastrobin Tetraconozole	U

Efficacy Ratings: P=Poor F=Fair G=Good VG=Very Good U=Unknown efficacy or insufficient data to rank product

* Products ranked Poor or Fair only provide suppression.

** Rating is based on two applications of a 9 fl oz/A rate of Aproach at Rl and R3.

The white mold fungicide ratings were adapted from information developed by the members of the North Central Regional Committee on Soybean Diseases (NCERA-137). Each rating is based on the fungicide's level of disease control and does not necessarily reflect efficacy of fungicide active ingredient combinations and/or yield increases obtained from applying the active ingredient. https://cropprotectionnetwork.org/publications/fungicide-efficacy-for-control-of-soybean-foliar-diseases

Include CHS Endurium @ 0.25% v/v or CHS Acuvant @ 3.0 fl oz/A to reduce driftable fines and increase deposition into the soybean canopy.

HERBICIDE OPTIONS					
Product	**Rate/A**	**Max. Rate**	**Adjuvants**		
Cobra/Phoenix	6.0–12.5 fl oz	12.5 fl oz	CHS Penetrec or CHS Aggrestrol or Tapran (0.5-1.0% v/v)	or	CHS Endurium 0.25% v/v

Iron deficiency chlorosis (IDC) is a nutrient deficiency affecting many crops, especially soybeans. Iron is important for many plant processes including chlorophyll production. Soybeans with IDC display interveinal chlorosis of the upper leaves. If the IDC is severe, leaf chlorosis can eventually become necrotic leading to growing point mortality and eventually plant death.

Predicting IDC With Soil Test Info

The best predictor for the occurrence and location of IDC in a field is by using a soil test. Iron is least available for plant uptake when soil pH is between 7.8 and 8.2. However, calcium carbonate equivalency (CCE) and salinity values are better predictors of IDC. Plants in saline soil have difficulty taking up nutrients and water. When calcium carbonate reacts with water in the soil, it produces bicarbonate, and bicarbonate inhibits the uptake and translocation of iron through the plant. Generally, IDC should be managed when salinity values (electrical conductivity) of 0.26-1.0 mmhos/cm and CCE values of 2.6-5.0% and higher occur.

Managing IDC in Soybean

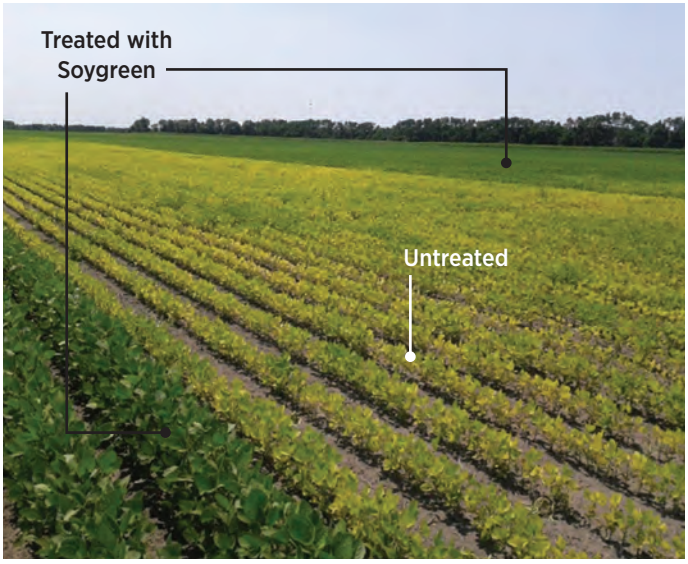
IDC is best controlled by implementing many best management practices. Selecting IDC tolerant soybean varieties may help; however, IDC tolerant soybeans often have less yield potential than susceptible varieties. Therefore, consider both IDC score as well as yield potential when selecting a soybean variety. Planting soybeans in rows using higher planting populations may also help. When soybeans are row planted with high populations, excessive bicarbonates and salts are distributed over a greater number of plants, decreasing the impact on individual plants. Also, this increased row population concentrates the plants' natural iron-stress response which enhances its effectiveness. Generally, soil applied or foliar applied iron fertilizers have not been effective in managing iron chlorosis except for soil applied Soygreen. Soygreen is a high quality and long lasting FeEDDHA that is effective at managing IDC when applied in-furrow with the planter at 2-4 lb/A.



Necrotic leaf speckling and dead growing points



Interveinal chlorosis



Soybean field with iron deficiency chlorosis

Two of the most common barriers to a nutrient entering a plant from a foliar application are: maintaining it in a form that is soluble with water and, at the same time, having the ability to pass through the waxy leaf cuticle. A product must be both water soluble and oil soluble at different times during the process of nutrient uptake. Methylated seed oils (CHS Emulate), surfactants with oil-like properties (CHS Endurium), and/or adjuvants capable of mild acidification of the spray solution (CHS Fixate) can address one or both of these particular barriers. Research shows adjuvants containing MSO and acidifying adjuvants enhance foliar uptake of post-emergent Soygreen products. Nonionic surfactants and ammonium sulfate did not provide the same beneficial results.

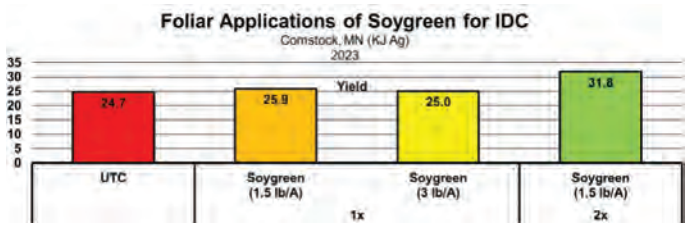
Best Recommendations for Post-Emergent Applications of Soygreen Products:

A. If the field is determined to have IDC, Soygreen or Soygreen Pro should be applied as soon as possible. Foliar applications of Soygreen products are effective under the right conditions. Apply the first application at the first sign of chlorosis. The longer IDC is left unchecked, the greater potential for yield loss. A rainfall event after application is needed to aid the uptake of Soygreen products through plant roots. Even though some Soygreen may be taken up through the leaves, the majority needs to be taken up by the roots to be most effective. Soygreen products in all situations are the only products on the market with proven results and track record.

B. Use higher application volumes of 15 gpa or greater
   1. Soygreen products are very stable in the environment, on the plant, or in the ground. It is beneficial to apply foliar applications of Soygreen products before a rain (or with irrigation). Soygreen products are very water soluble and easily washed off the plants into the root zone. Root uptake of iron is by far the most beneficial way to get iron into the plant to combat IDC.
   2. Soygreen products plus conventional chemistry will depend on the adjuvant recommendation for the tank-mix partner but will likely be similar to Soygreen products applied alone.



Figure 1. Iron Deficiency Chlorosis is expressed in new tissue as an interveinal yellowing while the veins themselves remain green.



Soygreen Products Applied Alone:

Soygreen Product	Rate	Application Interval	Adjuvant Recommendation[2]
Soygreen (Dry)	1.5 lb/A	1 Repeat Application: 10 to 14 Days	CHS Emulate @ 1% v/v + CHS Fixate @ 0.25% v/v **OR** CHS Aggrestrol @ 0.5% v/v + CHS Fixate @ 0.25% v/v **OR** CHS Endurium @ 0.25% v/v + CHS Fixate @ 0.25% v/v
	1 lb/A	2 Repeat Applications: 7 to 10 Days	
Soygreen Pro	3 pt/A	1 Repeat Application: 10 to 14 Days	CHS Emulate @ 1% v/v + CHS Fixate @ 0.25% v/v **OR** CHS Aggrestrol @ 0.5% v/v + CHS Fixate @ 0.25% v/v **OR** CHS Endurium @ 0.25% v/v + CHS Fixate @ 0.25% v/v
	2 pt/A	2 Repeat Applications: 7 to 10 Days	

Soygreen Products Plus Glyphosate[1]

Soygreen Product	Rate	Application Interval	Adjuvant Recommendation[2]
Soygreen (Dry)	1.5 lb/A	1 Repeat Application: 10 to 14 Days	CHS Aggrestrol @ 0.5% v/v + CHS Fixate @ 0.75% v/v **OR** CHS Endurium @ 0.25% v/v + CHS Fixate @ 0.75% v/v
	1 lb/A	2 Repeat Applications: 7 to 10 Days	
Soygreen Pro	3 pt/A	1 Repeat Application: 10 to 14 Days	CHS Aggrestrol @ 0.5% v/v + CHS Fixate @ 0.75% v/v **OR** CHS Endurium @ 0.25% v/v + CHS Fixate @ 0.75% v/v
	2 pt/A	2 Repeat Applications: 7 to 10 Days	

[1] Note: Risk of weed control antagonism is possible. Apply to small weeds and use full rates herbicides and adjuvants.

[2] Note: CHS Fixate rates are dependent on mixing with or without glyphosate.

SOYGREEN®

Equipment
Configure your equipment in the following order: water supply tank, inductor, and transfer pump. The inductor needs to sit directly over the suction hose between the water supply tank and the transfer pump. Make sure the planter tank is cleaned of previously used products such as 10-34-0 or any other liquid fertilizer before adding Soygreen to the tank. Mixing liquid phosphate fertilizers and Soygreen will result in plugging.

Mixing
Put Soygreen into the inductor **DRY (DO NOT MAKE A SLURRY)** and run it through the transfer pump. This will put Soygreen into the solution by the high speed and shearing of the transfer pump impellors.

1. Determine how many acres you will be treating with each batch of Soygreen. Multiply the number of acres by the number of pounds/acre to determine how many total pounds of Soygreen you will need per batch. Fill the inductor with the desired amount of Soygreen. If the inductor will not hold all the Soygreen needed for the batch at one time, have additional bags open and ready to dump into the inductor once the process begins.
2. Open valve on the water supply tank 1/2 to 2/3 open. This starves the transfer pump for water to create a vacuum (suction) once the transfer pump has been started.
3. Run the transfer pump at least 3/4 of full throttle to create the necessary speed for impellors to put the Soygreen into solution.
4. With the transfer pump running and the water flowing, open the valve on the bottom of the inductor wide open, allowing Soygreen to drop freely into the line below and through the transfer pump.
5. The total amount of Soygreen should be run through the inductor and transfer pump before the tank on your planter or tractor is full. This will allow for additional agitation as the remaining water is filled into the tank.
6. You **DO NOT** need to agitate the Soygreen in the planter or saddle tanks while planting. Once mixed, Soygreen will stay in solution, even if it sits for 4 or 5 days, should you get rained out while planting.

For More Information
Please feel free to watch a three-minute instructional video on how to properly mix Soygreen found at https://www.youtube.com/watch?v=b2phJVGePY8 or call your local Account Manager or Technical Specialist for more assistance.

SOYGREEN®

Soygreen is an iron fertilizer chelated with ortho, ortho-EDDHA that helps manage iron deficiency chlorosis (IDC) in soybean by increasing the availability of iron. The o, o-EDDHA is superior to most chelates because it protects iron from soil tie-up under even high pH conditions making iron more available to the plant.

Three Formulations of Soygreen:

Soygreen – A water-soluble powder formulation of 6% Fe chelated with ortho-ortho Fe-EDDHA. Soygreen is recommended as an in-furrow applied fertilizer. Rates of 2-4 lb/A mixed with water at a ratio of 1 lb:2 gal are most effective at alleviating IDC. However, for "rescue treatments," POST applications can be used. Two split applications of 1-3 lb/A each. Apply the first application right before or right after onset of IDC symptoms followed by a second application 1-2 weeks after the first application. For best POST application results, apply right before a heavy rain to ensure Soygreen is incorporated down into the rooting zone for optimum plant uptake.

Soygreen Granular 2.4 – A peat-based granular formulation of 2.4% Fe chelated with o, o-EDDHA. Soygreen Granular 2.4 is applied only in-furrow at 5-10 lb/A depending on degree of iron deficiency chlorosis. It is most commonly utilized by air-seeders placing fertilizer in-furrow next to the seed and is not meant for broadcast applications. Use small rollers (canola roller) for more precise rates. The density of this product (63 lb/ft^3) is similar to other dry fertilizers so it can be easily mixed without causing separation in the bin. However, the addition of extra salt from other fertilizers can increase IDC responses.

Soygreen Pro – A liquid formulation of 2.4% iron chelated with o, o-EDDHA and utilizes a soil stabilizer. The soil stabilizer properties help hold iron in a bond that is less prone to leaching which allows iron to be available in the root zone for a longer period. Like Soygreen, Soygreen Pro is recommended as an in-furrow applied fertilizer. Rates of 1-3 qt/A mixed with water for a total of 4-10 gallons of solution are most effective at alleviating IDC. For POST applications, apply 2-3 pt/A prior to or immediately after IDC symptoms occur followed by another application 1-3 weeks later. The most common use rate is 3 pt/A. For best results use spray carrier (water) volumes of 10-20 gal/A (ground) or 5 gal/A (air).

Field Observation:

In replicated field trials, Soygreen Pro provided the most consistent yield out of the three formulations. Untreated soybeans provided an average of 15.6 bushels/A while the addition of Soygreen Pro at 3 qt/A provided the highest average yield of 37.3 bushels/A. Soygreen (water soluble powder) at 3 lb/A provided the 2nd highest yield with 35.6 bushels/A followed by competitor products that provided an average of 28.1 bushels/A.

Pictured to the right, you can see 4 strips of Soygreen Pro treated soybeans and 2 untreated "check strips" to show the IDC severity of the plot.



SOYSHOT®

Soyshot is a proven in-furrow starter fertilizer specifically developed for soybeans. It has a low salt index for maximum seed safety and emergence. Soyshot contains ortho-ortho EDDHA chelate for increased nutrient efficiency. This chelate prevents micronutrients from being tied up with phosphorous in both the fertilizer and soil there by increasing the overall nutrient availability. Soyshot is also highly stable in the soil under all pH's thus keeping nutrients available well into the growing season.

While soybeans take up phosphorous (P) throughout the growing season, over 50% of the total P is used during the critical grain fill period. The unique chelated compound in Soyshot ensures that P is available to the plants when it's needed. Soyshot contains potassium (K) that soybeans need in large amounts early in the season (75% of K is taken up before grain fill).

Soyshot increases early growth, overall plant health, and ultimately, yield through enhanced nutrient availability. In 2020, replicated research trials in Minn. and S.D. showed an average 6 bu/A yield response compared to soybeans where no starter fertilizer was used. An average yield increase of 4-8 bu/A is typical when using Soyshot.

Guaranteed Analysis:

Total Nitrogen (N)	0%
Total Phosphorus (P2O5)	10%
Total Potassium (K2O)	10%
Total Zinc (Zn)	0.1%

Derived from: Phosphoric acid, potassium hydroxide, zinc ortho-ortho EDDHA and zinc EDTA.



Soyshot | No starter fertilizer



Soyshot

Key Features

- Maximizes crop safety and performance with a low salt index.
- Increases available phosphorus by reducing "tie-up" and supplies critical early potassium.
- Keeps micronutrients in the soil such as zinc, manganese and iron, more soluble increasing uptake to the plant.
- Gets soybeans off to a good start with the correct ratio of nutrients soybeans need all season long.

Application Directions

- For use as an in-furrow starter fertilizer, combine 1-2 gal/A of Soyshot with water for a total application volume of 3-5 gal/A. This solution ensures consistent and uniform application of the product.
- 1.5-2 gal/A is the recommended rate for most situations, but many variables influence rate. For best results, follow local agronomic practices and use soil test results to create a balanced fertility plan.

Package Size

- Mini-bulk - 250 gal
- Bulk

Product Weight Per Gallon

- 10.32 lb/gal

MOXON™ MN



The Importance of Manganese in Crops

- Manganese (Mn) is critical for healthy plant growth; Mn plays a critical role in photosynthesis by facilitating the splitting of H_2O molecules in photosystem II which provides essential for the photosynthesis process.
- Mn is also important in reducing pathogen infections. Mn is a co-factor or "helper molecule" for over 35 enzymes, many of which are important for lignin synthesis that enhance protection from pathogen infection. In addition, Mn is needed in the production of the peroxidase enzyme which enhances plant tolerance to disease infection.

Mn Increases Stress Tolerance

- Mn is required to reduce oxidative stress factors and is one of the metal cofactors in superoxide dismutase enzymes.
- Mn enhances plant tolerance to stresses such as: drought, heat, winter hardiness, ozone stress.
- Mn is important in fatty acid production, leading to greater cuticular wax deposition also enhancing tolerance to stress.

Mn Deficiency

- Mn deficiencies can result in lower dry matter accumulation and lower yield.
- Mn has low mobility in the plant, with visual deficiencies developing in new leaves especially under dry soil conditions.
- Deficiency symptoms tend to be significantly different across fields. Most frequently symptoms are found in spotty areas that follow soil types such as sandy soils or darker colored soils high in organic matter.
- Tissue test Mn levels for plants of 20 to 500 ppm is considered adequate.

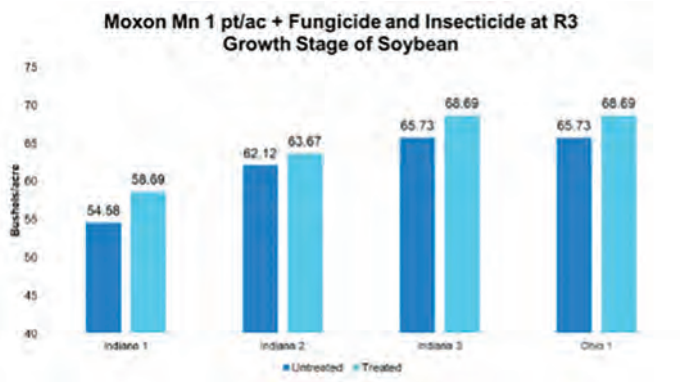
Mn Management

Moxon Mn is a 5% Manganese (2-0-0-5 Mn) equipped with the patented Levesol chelate. Moxon Mn has a low use rate of 1-2 pt/acre, with 1 pint being used in hidden hunger situations and the 2 pints use rate where visual deficiencies are evident. Multiple applications may be needed through the growing season in severely deficient soils.

The Levesol chelate works synergistically to increase nutrient availability and translocation into the plant. Deficiencies leading to yield losses commonly occur with no foliar symptomology.

Application: Apply 1-4 pt/A, as a foliar application, to prevent or alleviate manganese deficiency. As with any application follow good agronomic practices.

Compatibility: Chelated with EDTA and EDDHA (Levesol) to increase tank-mix compatibility, however, a jar test is recommended if compatibility is unknown.





Postemergence Herbicides 221
Efficacy Chart 224
Insecticides 225
Desiccation 226

Assure II / Targa (quizalofop P-ethyl)

EPA Reg. #:	**352-541/33906-9-81880**
Rate/A:	7–12 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Danger

Adjuvant(s)/ Comments

- **CHS Penetrec* (2 qt/100) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100) plus AMS*** (2–4 lb/A)**
- Use **CHS Hypertonic (1 qt/100 gal)** in certain tank mixes.

Target Weeds	4 fl oz	6 fl oz	8 fl oz
– barnyardgrass	-	-	2–6″
– field sandbur	-	-	2–6″
– crabgrass	-	-	2–6″
– giant foxtail	-	-	2–8″
– green foxtail	-	-	2–4″
– volunteer corn	6–24″	24″+	
– wild proso millet	-	-	2–6″
– yellow foxtail	-	-	2–4″
– wild oat	-	-	2–6″
– woolly cupgrass	2–4″ @ 9 oz		
– quackgrass	6–10″ @ 10 oz		

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply up to 60 day PHI.

Beyond Xtra (imazamox)

EPA Reg. #:	**241-441**
Rate/A:	4 fl oz
Spray Volume:	min 10 gpa
Rainfast:	1 hour
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	4 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/ Comments

- **CHS Axon (1 gal/100 gal)**

or

- **CHS Penetrec* (2 qt/100) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100) plus AMS*** (2–4 lb/A)**
- Use **CHS Hypertonic (1 qt/100 gal)** in certain tank mixes.

Target Weeds

Apply to weeds 3″ or less:

- black nightshade
- common cocklebur
- foxtail
- giant ragweed
- lambsquarters
- pigweed
- sunflower
- volunteer corn
- venice mallow

Timing/Comments

Apply to 2–8 leaf sunflower.

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Clethodim Products

Brand Name:	EPA Reg. #:
Arrow	**66222-60**
Shadow 3EC	**66330-414**
Clethodim 2E	**42750-72**
Volunteer	**59639-3-55467**
Rate/A:	6–16 fl oz (Arrow, Clethodim 2E, Volunteer) 4–10.67 fl oz (Shadow 3EC)
Spray Volume:	5–40 gpa
Rainfast:	1 hour
S.O.A.:	ACC-ase Inhibitor (Group 1)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.:	24 hours
W. Notification:	Oral
S. Word:	Caution (Arrow, Clethodim 2E, Shadow 3EC) Warning (Volunteer)

Adjuvant(s)/Comments

- **CHS Penetrec* (2 qt/100) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100) plus AMS*** (2–4 lb/A)**
- Use **CHS Hypertonic (1 qt/100 gal)** in certain tank mixes.

Target Weeds	Clethodim 2E, Arrow, Volunteer		Shadow 3EC
	6 fl oz	8 fl oz	5.33 fl oz
– barnyardgrass	6″	8″	8″
– crabgrass	2″	6″	8″
– giant foxtail	6″	12″	12″
– green foxtail	6″	8″	8″
– quackgrass *2nd application may be needed*	-	4–12″	4–12″
– volunteer cereals	6″	8″	8″
– volunteer corn	12″	18″	18″
– wild proso millet	8″	10″	10″
– woolly cupgrass	6″	8″	8″
– yellow foxtail	6″	8″	8″
– cheat	6″	6″	6″
– downy brome	6″	6″	6″

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply up to 70 day PHI.

Express SG (tribenuron)

EPA Reg. #:	**352-632**
Rate/A:	0.25–0.5 oz
Spray Volume:	min 5 gpa
Rainfast:	4 hours
S.O.A.:	ALS Inhibitor (Group 2)
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks
R.E.I.:	12 hours
W. Notification:	Oral
S. Word:	Caution

Adjuvant(s)/Comments

- **CHS Axon (2–4 qt/100 gal)**

or

- **CHS Penetrec* (2 qt/100) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100) plus AMS*** (2–4 lb/A)**
- Use **CHS Hypertonic (1 qt/100 gal)** in certain tank mixes.

Target Weeds

– common chickweed
– field pennycress
– lambsquarters
– Russian thistle
– kochia
– wild mustard

Timing/Comments

Apply from 1 leaf until prior to bud formation.

Apply when weeds are past the cotyledon stage and less than 3″ tall or 3″ in diameter.

Apply up to 70 day PHI.

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Glyphosate

Brand Name:	EPA Reg. #:	# A.E.	=0.75 AE
Buccaneer Plus	**55467-9**	3.00	32.0
Gly Star Original	**42750-60**	3.00	32.0
Gly Star Plus	**42750-61**	3.00	32.0
Durango DMA	**62719-556**	4.00	24.0
Buccaneer 5 Extra	**55467-15**	4.00	24.0
Gly Star 5 Extra	**42750-59**	4.00	24.0
Gly Star K-Plus	**42750-122**	4.50	21.3
Buccaneer K	**42750-122-55467**	4.50	21.3
Roundup RT 3	**524-544**	4.50	21.3
Roundup PowerMax 3	**524-659**	4.80	19.7

Rate/A: Variable
Spray Volume: 5–20 gpa
Rainfast: 1–6 hours
M.O.A.: EPSP Inhibitor
P.P.E.: l.s. shirt, l. pants, shoes, socks
R.E.I.: 12 hours
W. Notification: Oral
S. Word: Caution

Surfactant/Comments

- **CHS Level Best Pro (1 qt/100) plus AMS (8.5-17 lb/100)**

or

- **CHS Fixate/CHS Wheelhouse Pro (2-3 qt/100)**

or

- **Encloax (2.5-5 gal/100)**

or

- **CHS Hypertonic (1 qt/100) plus AMS (8.5-17 lb/100)**

Timing/Comments

Preharvest Weed Control / Desiccant

- Apply when backside of sunflower heads are yellow and bracts are turning brown. Seed moisture content is less than 35%. Do not apply to sunflower grown for seed.
- Apply up to 7 days PHI.

Poast (sethoxydim)

EPA Reg. #: **7969-58-51036**
Rate/A: 0.5–1.5 pt
Spray Volume: 5–20 gpa
Rainfast: 1 hour
S.O.A.: ACC-ase Inhibitor (Group 1)
P.P.E.: coveralls, l.s. shirt, l. pants, c.r. gloves, c.r. footwear, headgear, eyewear, shoes, socks, apron
R.E.I.: 12 hours
W. Notification: Oral
S. Word: Warning

Adjuvant(s)/ Comments

- **CHS Penetrec* (1 pt/A) plus AMS*** (2.5 lb/A)**

or

- **CHS Aggrestrol** (0.75 pt/A) plus AMS*** (2.5 lb/A)**
- Use **CHS Hypertonic (1 qt/100 gal)** in certain tank mixes.

Target Weeds	0.5 oz	1 oz	1.5 oz
– barnyardgrass	-	8″	-
– crabgrass	-	6″	-
– field sandbur	-	-	3″
– foxtail	-	8″	-
– volunteer cereals	-	-	4″
– volunteer corn	-	20″	-
– wild proso millet	10″	-	-
– wild oat	-	4″	-
– woolly cupgrass	-	8″	-

*Crop Oil @ 2 pt/A or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1.5 pt/A can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply up to 70 day PHI.

Select Max (clethodim)

EPA Reg. #: **59639-132**
Rate/A: 9-16 fl oz
Spray Volume: 5–40 gpa
Rainfast: 1 hour
S.O.A.: ACC-ase Inhibitor (Group 1)
P.P.E.: l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks
R.E.I.: 24 hours
W. Notification: Oral
S. Word: Caution

Adjuvant(s)/ Comments

- **CHS Penetrec* (2 qt/100) plus AMS*** (2–4 lb/A)**

or

- **CHS Aggrestrol** (2 qt/100) plus AMS*** (2–4 lb/A)**
- Use **CHS Hypertonic (1 qt/100 gal)** in certain tank mixes.

Target Weeds	9 oz	12 oz
– barnyardgrass	6″	8″
– crabgrass	2″	6″
– giant foxtail	6″	12″
– green foxtail	6″	8″
– quackgrass	-	4–12″
2nd application may be needed		
– volunteer cereals	6″	8″
– volunteer corn	12″	18″
– wild proso millet	8″	10″
– woolly cupgrass	6″	8″
– yellow foxtail	6″	8″

*Crop Oil @ 1 gal/100 or CHS Endurium @ 1 qt/100 gal can be substituted for CHS Penetrec.
**CHS Emulate @ 1 gal/100 gal can be substituted for CHS Aggrestrol.
***CHS Fixate/CHS Wheelhouse Pro @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply up to 70 day PHI.

Sunflower Herbicide Postemergence Efficacy Chart

		Annual/Perennial Grasses													Annual Broadleaves															Perennial Broadleaves		
Herbicide	Crop Tolerance	Barnyardgrass	Crabgrass	Cheatgrass	Downy Brome	Fall Panicum	Foxtail, Green, Giant	Foxtail, Yellow	Sandbur	Shattercane	Volunteer Cereals	Wild Oat	Woolly Cupgrass	Quackgrass	Field Bindweed	Buffalobur	Canada Thistle	Cocklebur*	Kochia*	Lambsquarters	Lanceleaf Sage	Marshelder	Morning Glory (Annual)	Nightshade, Black*	Pigweed, Redroot*	Prickly Sida	Ragweed, Common	Ragweed, Giant	Russian Thistle*	Canada Thistle	Field Bindweed	Sowthistle
Assure II / Targa	E	E	E	-	E	E	E	G	E	E	E	E	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Beyond* (Clearfield Sunflower Only)	E	G	F	P	F	G	G	F	F	E	G	G	P	P	F	P	F	F	F	F	E	E	E	E	P	F	F	F	G	P	P	P
Eptam	E	E	G	-	-	G	E	E	-	-	G	G	-	F	-	-	N	P	P	F	N	P	G	F	G	-	F	-	P	N	-	-
Express SG (Express Sunflower only)	E	N	N	N	N	N	N	N	N	N	N	N	N	N	P	N	G	F	G	F	N	E	F	F	G	E	N	N	E	G	P	F
Poast	E	E	E	F	F	E	E	E	E	E	G	E	G	F	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Select Max / Volunteer / Arrow	E	E	E	G	G	E	E	E	E	E	E	E	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Weed control table key:

E = Excellent G = Good F = Fair P = Poor N = No Control

*Biotypes of weeds with an asterisk can and have developed resistance to sulfonyl-urea herbicides such as Beyond, and Express SG.

Foliar Sunflower Insecticides

An integrated approach to controlling sunflower insects should be used to effectively manage insect populations. Application of foliar insecticides may help to alleviate insect pressure. However, frequent applications of the same chemical insecticide is not a good economic or long-term strategy for insect control. Alternating classes of insecticide used can delay or even prevent insects becoming resistant to those chemicals.

Insecticide	MOA	Rate Per Acre	Timing PHI	Insects Controlled
Bacillus thuringiensis **Dipel DF** **Dipel ES**	11A	0.5–1 lb 2.5-2.5 pt	None	Sunflower Moth
Beta-cyfluthrin **Baythroid XL***	3A	0.8–2.8 fl oz	30 Days	Banded Sunflower Moth, Cutworm, Grasshoppers, Sunflower Beetle, Sunflower Moth, Sunflower Seed Weevil, Sunflower Stem Weevil
Carbaryl **Sevin XLR Plus**	1A	1–1.5 qt	60 Days for Seed, 30 Days for Grazing Forage	Cutworm, Sunflower Beetle, Sunflower Moth, Sunflower Stem Weevil
Chlorantraniliprole **Coragen** **Prevathon**	28	3.5–5 fl oz 14–20 fl oz	21 Days	Banded Sunflower Moth, Sunflower Moth
Chlorantraniliprole + Lambda-cyhalothrin **Besiege**	28 + 3A	5–10 oz	45 Days	Banded Sunflower Moth, Cutworm, Grasshoppers, Sunflower Beetle, Sunflower Moth, Sunflower Seed Weevil, Sunflower Stem Weevil, Thistle Caterpillar
Cyantraniliprole **Exirel**	28	7–20.5 fl oz	7 Days	Banded Sunflower Moth, Cutworm, Sunflower Moth
Esfenvalerate **Asana XL***	3A	5.8–9.6 fl oz	28 Days	Banded Sunflower Moth, Cutworm, Grasshoppers, Sunflower Beetle, Sunflower Moth, Sunflower Seed Weevil, Sunflower Stem Weevil
Flonicamid **Beleaf 50SG** **Carbine 50 WG**	29	2.8 oz 2.8 oz	0 Days	Lygus Bugs
Lambda-cyhalothrin **Lambda-Cy*** **Lambda Star*** **Lambda-Cyhalothrin EC*** **Silencer VXN*** **Warrior II***	3A	1.92–3.84 fl oz 1.92–3.84 fl oz 1.92–3.84 fl oz 1.92–3.84 fl oz 0.96–1.92 fl oz	45 Days	Banded Sunflower Moth, Cutworm, Grasshoppers, Sunflower Beetle, Sunflower Moth, Sunflower Seed Weevil, Sunflower Stem Weevil, Thistle Caterpillar
Sulfoxaflor **Transform WG**	4C	1.5–2.75 fl oz	14 Days	Lygus Bugs
Zeta-cypermethrin **Mustang Maxx***	3A	Foliar: 1.28–4 fl oz	30 Days	Banded Sunflower Moth, Cutworm, Grasshoppers, Sunflower Beetle, Sunflower Moth, Sunflower Seed Weevil, Sunflower Stem Weevil, Longhorned Beetle, Thistle Caterpillar

* Restricted Use Pesticide

The addition of CHS Endurium @ 0.25% v/v may improve insect control by increasing coverage in dense canopies and preventing evaporation of small spray droplets in hot conditions.

Sunflower Desiccation

Desiccating sunflower gives the grower the ability to harvest sunflower several weeks early resulting in higher yields and lower drying costs. Other benefits of earlier harvest include avoiding potential damaging late season winds, reduced blackbird damage, and reduced diseases pressure such as *Sclerotinia* (White Mold).

Desiccant	Adjuvants	PHI
Buccaneer Plus @ 32 fl oz/A OR **Roundup Powermax @ 21 fl oz/A** OR **Multiple Others @ 0.75 lb ae/A**	CHS Fixate @ 0.5% v/v OR CHS Level Best Pro @ 0.25% v/v + AMS @ 8.5 lbs/100 gal	7 Days – Do Not Apply to Sunflower intended for Seed Production
Gramoxone SL 3.0 @ 0.8 – 1.3 pt/A **Helmquat 3SL @ 0.8 – 1.3 pt/A** **Parazone 3SL**	CHS Fixate @ 0.5% v/v OR CHS Level Best Pro @ 0.25% v/v + AMS @ 8.5 lbs/100 gal	7 Days
Sharpen @ 1–2 fl oz/A	CHS Fixate @ 0.5% v/v + CHS Emulate @ 1 qt/A	7 Days – Do Not Apply to Sunflower intended for Seed Production
Valor @ 2–3 oz/A	CHS Fixate @ 0.5% v/v + CHS Emulate @ 1 qt/A	5 Days

Timing of desiccation is critical as application prior to physiological maturity can lead to decreased quality, seed size, and test weight. Sunflowers are physiologically mature at R-9 or 30 to 45 days after bloom. At this time, seeds have reached maximum size and weight. Visually, this is when the back of the head is yellow, the bracts are brown, and the seed moisture is between 30-35%.

The bract tip turns brown at 40-45% moisture. At this stage, seed moisture is still too high to desiccate. The broadest part of the bract should be turning brown. It is at this stage that the seeds are between 30-35% moisture and desiccation can be performed.



Figure 1. The head has turned yellow and the bracts are green. Continue to monitor.



Figure 2. The bracts have turned yellow and the tips are brown. Seed moisture is at 40-50%. Too soon to spray.



Figure 3. The bracts are brown to the shoulder and seed moisture is between 30-35%. It's time to spray.



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Iron deficiency chlorosis in sorghum is caused by high pH and calcareous soils.

Iron deficiency chlorosis (IDC) in sorghum is a complicated nutrient deficiency to predict. IDC usually occurs in high pH soils that have high carbonate content (calcium carbonate equivalent, CCE) and worsened by increased soluble salts (electrical conductivity, EC). Utilizing calcium carbonate and salinity soil test information is the best way to predict IDC occurrence and severity.

Calcium carbonate reacts with water to produce bicarbonate, which inhibits both the uptake and the translocation of iron throughout the plant. Plants can take up ferrous (Fe(2+)) and ferric (Fe(3+)), but the plant can only utilize ferrous (Fe(2+)) in the chloroplasts to provide the green healthy color required for adequate photosynthesis. Salts make it difficult for the plant to take up nutrients and water from the soil.

An iron test is not a good indicator of IDC because most soils within the "normal" agricultural soil pH range have sufficient available iron to supply the basic plant requirement. Soil pH is only an indicator of where iron availability may be at its lowest and where CaCO3 may be present. Therefore, soil pH should only be used as a diagnostic tool to determine when it is necessary to test for CaCO3 and salinity.

IDC generally occurs at the same geographical location every year. However, the severity of IDC can vary by year based on the climatic conditions. Wet conditions can enhance the production of bicarbonate from CaCO3 and dry conditions can enhance the effects of salts, making IDC worse. Also, extremely cold or hot temperatures can enhance IDC. Therefore, IDC in the same field with the same soil test values may act differently from year to year.

Managing IDC in Sorghum

IDC is best controlled by implementing multiple best management practices. Selecting IDC tolerant hybrids is the first step. Refer to the seed supplier about yield potential of IDC tolerant hybrids. Consider both IDC score and yield potential when selecting a hybrid for soils prone to iron deficiencies.

Generally, soil or foliar-applied iron fertilizers have not been effective in managing iron chlorosis. However, Soygreen containing the ortho-ortho EDDHA chelate keeps ferrous iron (Fe2+) in its soluble state and minimizes iron deficiency chlorosis (IDC). Soygreen brands that contain the high quality and long-lasting ortho-ortho EDDHA chelate are effective at managing IDC when applied to sorghum crops.

Soygreen for IDC

Best results are observed when Soygreen is mixed with water alone. Always conduct a jar test if mixing with any fertilizer or pesticide. Rates range from 2–4 lb/A in-furrow along with 4–10 gal/A water. Post emergence application rates range from 1–3 lb/A with 10–20 gal/A water and a minimum of 5 gal/A water if applied by airplane. Post emergence applications should be split into two applications for best results. Make the first application of a half rate of Soygreen at the first sign of IDC symptoms and follow up with a second application approximately 1–2 weeks later. Rainfall is needed after post emergence applications to incorporate Soygreen into the soil. Application efficiency is enhanced when a water conditioner/acidifier like CHS Fixate at 1–2 qt/100 gal is added.

Soygreen AST For IDC

Best results are observed when Soygreen AST is mixed with water alone. Always conduct a jar test if mixing with any fertilizer or pesticide. Rates range from 2.65–5.34 qt/A in-furrow along with 4–10 gal/A water. Post emergence application rates range from 1.33–2.67 qt/A with 10–20 gal/A water and a minimum of 5 gal/A water if applied by airplane. Post emergence applications should be split into two applications for best results. Make the first application of a half rate of Soygreen AST at the first sign of IDC symptoms and follow up with a second application approximately 1–2 weeks later. Rainfall is needed after post emergence applications to incorporate Soygreen AST into the soil. Application efficiency is enhanced when a water conditioner/acidifier like CHS Fixate at 1 to 2 qt/100 gal is added.

Soygreen Granular for IDC

Soygreen granular is intended for application as a dry product. Recommended application is placement in-furrow or near the root zone. Equipment that can meter dry fertilizer products are best suited to apply Soygreen granular. Use rates of 4 lb/A to 8 lb/A are recommended to minimize the effects of IDC in the sorghum crop. Soygreen granular can be mixed with additional fertilizers as needed or recommended.

Always read and follow label directions.



Healthy Sorghum



IDC in Sorghum

Zinc Fertility for Crop Production

Zinc (Zn) is an essential component of enzymes involved with important crop growth and development processes. Zinc is involved in carbohydrate, protein, and auxin metabolism. In addition, zinc protects plants from biotic and abiotic stresses by maintaining membrane integrity. Zinc is taken up by plants as chelated-Zn and divalent cation and is recognized by the plant as an essential micronutrient. Significant reductions in crop yield will occur if there is an inadequate supply of zinc. University research has identified that field corn, sweet corn, and edible beans are crops that can be relatively sensitive to Zn deficiency and can experience yield losses even if all other nutrients are present in adequate amounts. Soil tests are the best way to predict the need for Zn in a fertilization program. University research data supports the addition of Zn to many cropping systems to increase yield. Crop requirement and uptake for Zn is measured in ounces rather than pounds per acre.

Factors Influencing Zinc Availability

High phosphorus fertility levels influence Zn availability and may be part of the reason why applying Zn with phosphate fertilizers at planting can provide a yield response. In addition, any factor that influences root growth such as cool conditions, disease, or insect damage can also impact Zn uptake. Zinc applied as a starter fertilizer is recommended to target critical need of the nutrient at a critical time of development. There are several sources of Zn for crop production including dry products or chelated liquid Zn formulations. The chelating agent is important regarding both product stability in the soil as well as the mix-ability of the product with other fertilizer sources or water. Zinc uptake by crops still comes down to a basic premise of all plant nutrition, plants do not chew...they drink. In fact, over 70% of Zn required for corn production is through diffusion in the soil solution to plant roots. See the below table for zinc sources.

CHS Agronomy Zinc Sources

	Levesol Zn	Blue Tsunami	Zinc 9	Equation	Tachline Pro	CHS Lumen	Four-Score
Analysis	4-0-0-4.5 Zn	8-0-0-10 Zn	8-0-0-9 Zn	0-10-10-0.5 Zn, Mn, Fe, 0.1 Cu	0-0-0-4 Zn, 3.6 S, 3 Mn, 0.1 B	5-15-3-0.8 Zn	3-0-1-2.25 Zn 1 Mn, 0.5 Fe, Cu
Chelate	EDDHA/EDTA	EDTA/Citric	EDTA	EDTA	Zn Sulfate	EDDHA/EDTA	EDTA
Mixes with 10-34-0	Yes	Yes	Yes	Yes	No	Yes	Yes
Mixes with Ortho-P	Yes	No	Yes	Yes	No	No	Yes
Foliar Utility	Yes	No	Yes	Yes	Yes	Yes	Yes

Always read and follow label directions.

Common Micronutrients

B Boron
- Cell wall formation
- Very important for reproduction and other rapid growth stages

Cu Copper
- Helps with enzyme activation and photosynthesis
- Assists with protein synthesis

Fe Iron
- Associated with chlorophyll production
- Taken up as ferrous (Fe^{2+})

Mn Manganese
- Contributes to photosynthesis, respiration, and N assimilation

Mo Molybdenum
- Component for two enzymes that convert nitrate to nitrite
- Vital for symbiotic N fixation

Zn Zinc
- Associated with growth hormone production
- Most common micro limiting yields today

Micronutrient Products

Micronutrient products from CHS agronomy are designed to help provide crops with balanced plant nutrition. Each product is strategically designed for maximum uptake to satisfy a crop's needs. These micronutrients offer compatibility with phosphate based fertilizers while providing complete and quality chelation at convenient use rates, regardless of crop or utility.

CHS AVENTINE®

CHS Aventine is a starter fertilizer enrichment that will assure the crop achieves its full yield potential.

- Provides 4% Nitrogen, 5% Potash, 3% Sulfur, 4.5% Zinc
- CHS Aventine is compatible with most polyphosphate and orthophosphate fertilizers and is compatible with other fertilizer additives such as CHS Unlocked, Levesol, and Levesol Zn

ZINC 9

Zinc 9 is an EDTA chelated zinc solution designed for use in most soil-applied liquid fertilizers and foliar sprays.

- Provides 8% Nitrogen, 9% Zinc
- Designed for use in wide range of agricultural crops, turf, ornamental, and greenhouse crops
- 100% chelated with EDTA acid
- 1 gal contains 1 lb of elemental zinc and CAN be mixed with UAN, 10-34-0, ATS and orthophosphates
- Can be used soil-applied or foliar-applied

BORON 10

Boron 10 is designed for use in most soil-applied liquid fertilizers and foliar sprays.

- Provides 10% Boron
- Designed for use with a wide range of agricultural crops, turf, ornamental and greenhouse crops
- Can be mixed with UAN, 10-34-0, and ATS
- Can be used soil-applied or foliar-applied

Iron 5

Iron 5 is a chelated iron solution designed for use in most applied liquid fertilizers and foliar sprays.

- Provides 6% Nitrogen, 5% Iron, and 3% Sulfur
- Designed for use with a wide range of agricultural crops, turf, ornamental, and greenhouse crops
- Corrects iron deficiencies in crops while maintaining low input costs
- Can be used soil-applied or foliar-applied

Iron 4.5

Iron 4.5 is an HEDTA chelated iron solution designed for use in most soil-applied liquid fertilizers and foliar sprays.

- Provides 2% Nitrogen, 4.5% Iron
- Designed for use with a wide range of agricultural crops, turf, ornamental, and greenhouse crops
- Can be mixed with UAN, 10-34-0, ATS, and orthophosphates
- Product is 100% chelated with HEDTA acid
- Can be used soil-applied or foliar-applied

Copper 7.5

Copper 7.5 is an EDTA chelated copper solution designed for use in most soil-applied liquid fertilizers and foliar sprays.

- Provides 7% Nitrogen, 7.5% Copper
- Designed for use with a wide range of agricultural crops, turf, ornamental, and greenhouse crops
- Can be mixed with UAN, 10-34-0, ATS, and Orthophosphates
- Product is 100% chelated with EDTA acid
- Can be used soil-applied or foliar-applied

Man 5

Man 5 is a chelated manganese solution designed for use in most applied liquid fertilizers and foliar sprays.

- Provides 6% Nitrogen, 5% Manganese, and 3% Sulfur
- Designed for use with a wide range of agricultural crops, turf, ornamental, and greenhouse crops
- Can be tank mixed with glyphosate
- Can be mixed with 10-34-0, UAN, and ATS
- Can be used soil-applied or foliar-applied

Man 6

Man 6 is an EDTA chelated manganese solution designed for use in most soil-applied liquid fertilizers and foliar sprays.

- Provides 6% Nitrogen, 6% Manganese
- Designed for use with a wide range of agricultural crops, turf, ornamental, and greenhouse crops
- Product is 100% chelated with EDTA acid
- Can be mixed with UAN, 10-34-0, ATS, and orthophosphates
- Can be used soil-applied or foliar-applied

Zinc 15

Zinc 15 is a zinc ammonium chloride solution designed for use in most soil-applied liquid fertilizers.

- Provides 13% Nitrogen, 15% Zinc
- This product is intended for the correction of zinc deficiencies
- NOT intended for use with ORTHO phosphate fertilizers
- Can be used soil-applied

Zinc 10

Zinc 10 is a citric chelated zinc solution designed for use in most soil-applied liquid fertilizers.

- Provides 8% Nitrogen, 10% Zinc
- Can be splash blended with 10-34-0, requires little agitation
- 1 gal contains 1 lb of elemental zinc
- Designed for use with a wide range of agricultural crops
- Can be used soil-applied

Best Management Practices

The First Phosphate Enhancing Fertilizer For Broadcast Applications

Trivar contains three unique modes of action:

- Helps unlock nutrients that exist in your fertilizer and in the soil by utilizing a highly concentrated ortho-ortho EDDHA chelate, Figure 1.
- Utilizing a phosphatase enzyme that readily converts organic phosphorus into a more available form.
- Contains two micronutrients responsible for increased root growth and spring hardiness, zinc and boron.

Trivar mixes readily with many dry fertilizers including:

- 11-52-0 (MAP), 18-46-0 (DAP), 0-45-0 (TSP), MESZ, etc.

Blending Instructions:

- Fill blender with desired amount of phosphate fertilizer **ONLY**.
- Add 3-4 qt/ton of Trivar to the dry phosphate fertilizer while blending.
- Allow adequate time to blend for uniform distribution into phosphate granules.
- Add other forms of dry fertilizer such as urea, potash, AMS, zinc or sulfur.

Trivar is broken down by sunlight. If treated phosphate fertilizer is kept in a bin, the product will be stable for up to two years. However, after Trivar treated phosphate fertilizer has been applied as a broadcast application, it needs to be incorporated within 10 days. Tillage or rainfall can be used for incorporation. If there is heavy crop residue present at time of broadcast application, incorporation window may be extended. Trivar impregnated fertilizer is designed to be applied as a broadcast application. Do not apply fertilizer treated with Trivar as a starter within 2 inches of the seed.

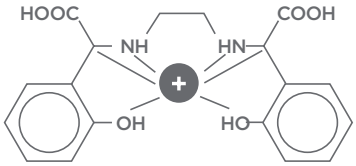


Figure 1: ortho-ortho EDDHA chelate

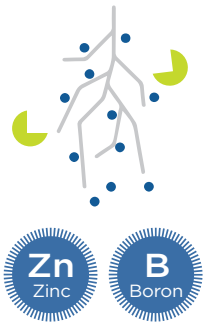


Figure 2: Trivar in a root system

The phosphatase enzyme, shown in Figure 2, converts phosphorus into a readily available form. This, combined with zinc and boron found in Trivar, allows seedlings access to critical nutrients for growth.



11-52-0 Untreated 11-52-0 with TRIVAR®





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42-s Thiram

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**264-929**	**Active Ingredients**	**Type**	**All Crops:**	
Product Type:	Fungicide—Add-on	Thiram (4 lb AI/gal)	Fungicide	seed decay, damping-off and seedling blights caused by many seed-borne and soil-borne organisms	
Application Type:	Commercial	**Crops**			
Density:	10 lb/gal	barley, millet, oats, rye, sorghum, triticale, wheat, beans and peas, vegetables, corn, cotton, grasses, peanuts, rice, sunflower and sugarbeets			
Rate:	Varies by crop				
Standard Rate:	2 fl oz/bu—wheat				
Coverage:	Not stated				
Package Size:	5's, 50's, 200's				
Units Treated:	64 bu/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Adage ST

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**100-1283**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Thiamethoxam (2.06 lb AI/gal)	Insecticide	*Fusarium*, General seed rots, *Phytophthora*, *Pythium, Rhizoctonia*, Seed-borne Phomopsis, Seed-borne *Sclerotinia*	aphids, bean leaf beetle, grape colapis, leafhopper, seed corn maggot, three-cornered alfalfa hopper, thrips, white grub, wireworm
Application Type:	Commercial/On-farm	Mefenoxam (0.31 lb AI/gal)	Fungicide		
Density:	9.6 lb/gal	Fludioxonil (0.10 lb AI/gal)	Fungicide		
Rate:	3.1 fl oz/Cwt	**Crops**			
Standard Rate:	3.1 fl oz/Cwt	soybeans			
Coverage:	4.0 fl oz/Cwt				
Package Size:	15's				
Units Treated:	40 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Allegiance FL

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**264-935**	**Active Ingredients**	**Type**	**Small Grain Diseases:**	**Grain Crops:**
Product Type:	Fungicide—Component	Metalaxyl (2.6 lb AI/gal)	Fungicide	*Pythium, Phytophthora*	*Pythium*
Application Type:	Commercial	**Crops**			**Cotton:**
Density:	9.18 lb/gal	corn (field), wheat, oats, barley, rye, soybeans, edible beans, sunflowers, peanuts, and rice			*Pythium*
Rate:	Varies by crop				
Standard Rate:	0.75 fl oz/Cwt—soybean				
Coverage:	Not stated				
Package Size:	2x2.5, 4x1, 15's, 30's				
Units Treated:	170 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Warning				
Restricted:	No				

*Reduced Rate - Apply ONLY in combination with EPA-registered rates of seed treatment fungicides.

Stand-alone is defined as a fungicide or insecticide designed to be used alone; nothing added.
Component is defined as a fungicide or insecticide designed to be used in conjunction with another.
Auxiliary is defined as a fungicide or insecticide designed to aid in the effectiveness of another.

Apron Maxx RFC

General Information		Agronomic Information		Target Pests
EPA Reg #:	**100-1195**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Stand-alone	Fludioxonil (0.21 lb AI/gal)	Fungicide	*Fusarium*, *Phytophthora*, *Pythium Rhizoctonia*, seed-borne *Phomopsis*, seed-borne *Sclerotinia*
Application Type:	Commercial/On-farm	Mefenoxam (0.31 lb AI/gal)	Fungicide	
Density:	9.01 lb/gal	**Crops**		
Rate:	1.5 fl oz /Cwt	soybeans, legume crops		
Standard Rate:	1.5 fl oz/Cwt			
Coverage:	5 fl oz/Cwt			
Package Size:	15's			
Units Treated:	85.3 Cwt/gal			
Colorant:	Colored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

Apron Maxx RTA

General Information		Agronomic Information		Target Pests
EPA Reg #:	**100-946**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Stand-alone	Fludioxonil (0.064 lb AI/gal)	Fungicide	*Fusarium*, *Phytophthora*, *Pythium Rhizoctonia*, seed-borne *Phomopsis*, seed-borne *Sclerotinia*
Application Type:	Commercial/On-farm	Mefenoxam (0.096 lb AI/gal)	Fungicide	
Density:	8.68 lb/gal	**Crops**		
Rate:	5 fl oz/Cwt	soybeans, legume crops		
Standard Rate:	5 fl oz/Cwt			
Coverage:	5 fl oz/Cwt			
Package Size:	2x2.5			
Units Treated:	25.6 Cwt/gal			
Colorant:	Colored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

Apron XL

General Information		Agronomic Information		Target Pests
EPA Reg #:	**100-799**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Stand-alone	Mefenoxam (3.0 lb AI/gal)	Fungicide	*Fusarium*, *Phytophthora*, *Pythium Rhizoctonia*, seed-borne *Phomopsis*, seed-borne *Sclerotinia*
Application Type:	Commercial	**Crops**		
Density:	9.29 lb/gal	soybeans, legume crops		
Rate:	Varies by crop			
Standard Rate:	0.16 fl oz/Cwt—soybean			
Coverage:	Apply with other fungicides			
Package Size:	4x1, 30's			
Units Treated:	800 units/gal			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Warning			
Restricted:	No			

Stand-alone is defined as a fungicide or insecticide designed to be used alone; nothing added.
Component is defined as a fungicide or insecticide designed to be used in conjunction with another.
Auxiliary is defined as a fungicide or insecticide designed to aid in the effectiveness of another.

AS - 50

General Information		Agronomic Information		Target Pests
EPA Reg #:	**55146-98**	**Active Ingredients**	**Type**	**Soybeans:**
Product Type:	Agricultural Antibiotic	Streptomycin Sulfate	Agricultural Antibiotic	halo blight
Application Type:	Commercial	**Crops**		
Density:	No information	soybeans		
Rate:	0.18–0.91 oz/cwt			
Standard Rate:	0.18 oz/cwt			
Coverage:	No information			
Package Size:	25 lb drum			
Units Treated:	No information			
Colorant:	No			
Seed Tag:	Required—See label			
Signal Word:	Danger			
Restricted:	No			

Aveo EZ

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**59639-220**	**Active Ingredients**	**Type**	**Nematodes Corn:**	**Nematodes Soybeans:**
Product Type:	Nematicide	Bacillus amyloliquefaciens Strain PTA-4838	Nematicide	dagger nematode lance nematode needle nematode pin nematode ring nematode root knot nematode root lesion nematode spiral nematode sting nematode stubby root nematode stunt nematode	reniform nematode root knot nematode soybean cyst nematode
Application Type:	Commercial	**Crops**			
Density:	10.05	soybeans and corn			
Rate:	0.1 fl oz per 80,000-140,000 seeds				
Standard Rate:	Varies by crop				
Coverage:	Provide uniform coverage				
Package Size:	4x1				
Units Treated:	Varies by crop				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Avipel / Avipelshield (Dry)

General Information		Agronomic Information		Target Pests
Product Type:	Bird Repellent	**Active Ingredients**	**Type**	**Birds:**
Application Type:	On-farm	9,10-Anthraquinone	Bird repellant	sandhill cranes, ring-neck pheasants, red-wing blackbirds, crows, blackbirds, grackles, starlings
Rate:	2 oz/25 lb of seed	**Crops**		
Standard Rate:	2 oz/25 lb of seed	seed corn (field and sweet)		
Package Size:	12x16 oz canisters			
Units Treated:	2,400 lb of seed			
Seed Tag:	Required—See label			
Signal Word:	Caution			

Note: Avipel is a Sec. 18.
See specific state label for use.

Stand-alone is defined as a fungicide or insecticide designed to be used alone; nothing added.
Component is defined as a fungicide or insecticide designed to be used in conjunction with another.
Auxiliary is defined as a fungicide or insecticide designed to aid in the effectiveness of another.

Avipel / Avipelshield (Liquid)

General Information		Agronomic Information		Target Pests
Product Type:	Bird Repellent	**Active Ingredients**	**Type**	**Birds:**
Application Type:	Commercial	9,10-Anthraquinone	Bird repellant	sandhill cranes, ring-neck pheasants, red-wing blackbirds, crows, blackbirds, grackles, starlings
Rate:	13.5 fl oz/Cwt	**Crops**		
Standard Rate:	13.5 fl oz/Cwt	seed corn (field and sweet)		
Coverage:	Max. 5 oz H_2O/1-gal Avipel			
Package Size:	2x2.5			
Units Treated:	4,900 lb of seed			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Caution			

Note: Avipel is a Sec. 18.
See specific state label for use.

Avicta Complete Beans 500

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**100-1457**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide/ Nematicide	Abamectin (2.06 lb AI/gal)	Nematicide	*Fusarium*, general seed rots, *Phytophthora*, *Pythium*, *Rhizoctonia*, seed-borne *Phomopsis*, seed-borne *Sclerotinia*	aphids, bean leaf beetle, grape colaspis, leafhopper, seed corn maggot, three-cornered alfalfa hopper, thrips, white grub, wireworm and nematodes
Application Type:	Commercial	Thiamethoxam (1.03 lb AI/gal)	Insecticide		
Density:	9.28 lb/gal	Mefenoxam (0.15 lb AI/gal)	Fungicide		
Rate:	6.2 fl oz/Cwt	Fludioxonil (0.05 lb AI/gal)	Fungicide		
Standard Rate:	6.2 fl oz/Cwt	**Crops**			
Coverage:	Provide uniform coverage	soybeans			
Package Size:	System				
Units Treated:	40 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Danger, Poison				
Restricted:	Yes				

Captan 4L

General Information		Agronomic Information		Target Pests
EPA Reg #:	**42750-253**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Stand-alone	Captan (3.9 lb AI/gal)	Fungicide	seed-borne and soil-borne fungi which cause seed decay and seedling blight
Application Type:	Commercial	**Crops**		
Density:	10.85 lb/gal	legumes, small grains, dry beans, vegetables, soybeans, corn, sugarbeets, sorghum, cotton, and alfalfa		
Rate:	Varies by crop			
Standard Rate:	Varies by crop			
Coverage:	Per equipment needs			
Package Size:	2x2.5, 30's, 110's, 265's			
Units Treated:	32–64 Cwt/gal			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Danger			
Restricted:	No			

Direct application into a planter box is prohibited.

Stand-alone is defined as a fungicide or insecticide designed to be used alone; nothing added.
Component is defined as a fungicide or insecticide designed to be used in conjunction with another.
Auxiliary is defined as a fungicide or insecticide designed to aid in the effectiveness of another.

CHS Apprise

General Information		Agronomic Information		Target Pests
EPA Reg #:	**55146-160**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide	Difenoconazole (0.31 lb AI/gal)	Fungicide	Control of seed rots such as *Penicillium* and *Aspergillus* and seed-borne *Fusarium* Scab and *Septoria*. Control of dwarf bunt, karnal bunt*, stinking smut (common bunt), flag smut, loose smut, covered smut of barley. control of early season barley stripe, *Pythium* damping-off, *Septoria* disease complex, *Rhizoctonia* root rot, common root rot (Cochiliobolus spp.), *Fusarium* foot rot. Early season suppression of powdery mildew, wheat leaf rust, and *Septoria* leaf blotch.
Application Type:	Commercial	Metalaxyl (0.16 lb AI/gal)	Fungicide	
Density:	8.84 lb/gal	Tebuconazole (0.034 lb AI/gal)	Fungicide	
Rate:	5.0–7.5 oz/Cwt	**Crops**		
Standard Rate:	5.0 fl oz/Cwt	barley, oats, and wheat		
Coverage:	10.0–15.0 fl oz/Cwt			
Package Size:	2x2.5, 15-gal, 250			
Units Treated:	25.6 Cwt/gal			
Colorant:	Colored			
Seed Tag:	Required—See Label			
Signal Word:	Caution			
Restricted:	No			

CHS Apprise FI

General Information		Agronomic Information		Target Pests
EPA Reg #:	59639-183	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide/Insecticide	Clothianidin (0.256 lb AI/gal)	Insecticide	covered smut, loose smut, seed decay fungi, *Fusarium* seed scab, *Pythium* seed rot and seedling dieback, early season *Fusarium* seedling dieback, *Rhizoctonia* root rot, common root rot, common bunt, flag smut
Application Type:	Commercial/On-farm	Metalaxyl (0.077 lb AI/gal)	Fungicide	
Density:	8.76 lb/gal	Metconazole (0.038 lb AI/gal)	Fungicide	
Rate:	5.0 oz/Cwt	**Crops**		
Standard Rate:	5.0 fl oz/Cwt	barley, oats, and wheat		
Coverage:	10.0–15.0 fl oz/Cwt			
Package Size:	2x2.5, 15-gal, 250			
Units Treated:	25.6 Cwt/gal			
Colorant:	Colored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

CHS Armis FI

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**59639-205**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Clothianidin (1.91 lb AI/gal)	Insecticide	seed rots including: seed-borne *Phomopsis*, seed-borne *Sclerotinia*, seed-borne *Fusarium*, *Penicillium* and *Aspergillus*, damping-off and seedling blights caused by soil-borne *Pythium*, *Fusarium*, and *Rhizoctonia solani*	aphids, bean leaf beetle, grape colaspis, leafhoppers, pea leaf weevil, seed corn maggot, three-cornered alfalfa hopper, thrips, white grubs, and wireworms
Application Type:	Commercial/On-farm	Ethaboxam (0.282 lb AI/gal)	Fungicide		
Density:	9.51 lb/gal	Ipconazole (0.094 lb AI/gal	Fungicide		
Rate:	3.37 fl oz/Cwt—soybean	Metalaxyl (0.075 lb AI/gal)	Fungicide		
Standard Rate:	3.37 fl oz/Cwt—soybean	**Crops**			
Coverage:	Accurate application	soybeans			
Package Size:	15's				
Units Treated:	37.98 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required				
Signal Word:	Caution				
Restricted:	No				

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Auxiliary is defined as a fungicide or insecticide designed to aid in the effectiveness of another.

CHS Unlocked

General Information	
EPA Reg #:	**90930-2-46661**
Product Type:	Plant Growth Regulator
Application Type:	Commercial/On-Farm
Density:	8.76
Rate:	0.5–5.0 fl oz per Cwt
Standard Rate:	Varies by crop
Coverage:	Provide uniform coverage
Package Size:	2x2.5
Units Treated:	Varies by crop
Colorant:	Uncolored
Seed Tag:	Required—See label
Signal Word:	Caution
Restricted:	No

Agronomic Information	
Active Ingredients	**Type**
Cytokinin, Auxin, Gibberellin	PGR
Crops	
Multiple crops	

Clariva pn

General Information	
EPA Reg #:	**100-1524**
Product Type:	Nematicide
Application Type:	Commercial
Density:	8.7 lb/gal
Rate:	Varies by crop
Standard Rate:	0.9 fl oz/Cwt—soybean
Coverage:	Not stated
Package Size:	2x2.5
Units Treated:	142 Cwt/gal
Colorant:	Uncolored
Seed Tag:	Required—See label
Signal Word:	Caution
Restricted:	No

Agronomic Information		Target Pests
Active Ingredients	**Type**	cyst nematodes
Pasteuria nishizawae Pn1	Nematicide	
Crops		
soybeans, sugarbeet		

Cruiser 5FS

General Information	
EPA Reg #:	**100-941**
Product Type:	Insecticide
Application Type:	Commercial
Density:	10.8 lb/gal
Rate:	Varies by crop
Standard Rate:	1.28 fl oz/Cwt—soybean
Coverage:	Provide uniform coverage
Package Size:	4x1, 15's
Units Treated:	100 Cwt/gal
Colorant:	Uncolored
Seed Tag:	Required—See label
Signal Word:	Caution
Restricted:	Yes

Agronomic Information		Target Pests	
Active Ingredients	**Type**	**Insects Soybeans:**	**Insects Small Grains:**
Thiamethoxam	Insecticide	aphids, bean leaf beetle, grape colaspis, leafhopper, seed corn maggot, three-cornered alfalfa hopper, thrips, white grubs and wireworms	aphids, greenbug, hessian fly, wireworm, grasshopper, stored grain insects
Crops			
barley, buckwheat, millet, oats, rye, triticale, corn, cotton, cucurbit vegetables, legume vegetables, oil seed crops, peanuts, potatoes, rice, sorghum, and soybeans			

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Auxiliary is defined as a fungicide or insecticide designed to aid in the effectiveness of another.

CruiserMaxx Advanced

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**100-1283**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Thiamethoxam (2.06 lb AI/gal)	Insecticide	*Fusarium*, general seed rots, *Phytophthora*, *Pythium*, *Rhizoctonia*, seed-borne *Phomopsis*, seed-borne *Sclerotinia*	aphids, bean leaf beetle, grape colaspis, leafhopper, seed corn maggot, three-cornered alfalfa hopper, thrips, white grub, wireworm
Application Type:	Commercial	Mefenoxam (0.31 lb AI/gal)	Fungicide		
Density:	9.6 lb/gal	Fludioxonil (0.10 lb AI/gal)	Fungicide		
Rate:	3.2 fl oz/Cwt	**Crops**			
Standard Rate:	3.2 fl oz/Cwt	soybeans			
Coverage:	4 fl oz/Cwt				
Package Size:	15's				
Units Treated:	40 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

CruiserMaxx Cereals

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**100-1305**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Thiamethoxam (0.26 lb AI/gal)	Insecticide	general seed rots, seedling blight, root rot, and damping-off by seed- and soil-borne *Fusarium* and soil-borne *Pythium*, *Rhizoctonia* root rot, covered and false loose smut, dwarf bunt, loose smut Suppression of: common root rot, *Fusarium* crown and foot rot, take-all	aphids, wireworm, hessian fly
Application Type:	Commercial	Mefenoxam (0.05 lb AI/gal)	Fungicide		
Density:	9.59 lb/gal	Difenoconazole (0.31 lb AI/gal)	Fungicide		
Rate:	5 fl oz/Cwt	**Crops**			
Standard Rate:	5 fl oz/Cwt	barley, triticale, and wheat			
Coverage:	5 fl oz/Cwt				
Package Size:	2x2.5, 1x15, 1x110				
Units Treated:	25.6 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

CruiserMaxx Potato

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**100-1248**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Thiamethoxam (2.85 lb AI/gal)	Insecticide	*Fusarium* dry rot seed decay, seed-borne *Rhizoctonia*, seed-borne *Helminthosporium solani*	green peach aphids, colorado potato beetles, flea beetles, leafhoppers, leaf miners, psyllids and whiteflies
Application Type:	Commercial	Fludioxonil (0.73 lb AI/gal)	Fungicide		
Density:	9.96 lb/gal	**Crops**			
Rate:	0.19–0.27 fl oz/Cwt	potato			
Standard Rate:	Varies by planting rate				
Coverage:	4 fl oz/Cwt				
Package Size:	4x1				
Units Treated:	Varies by planting rate				
Colorant:	Colored				
Seed Tag:	Not stated				
Signal Word:	Caution				
Restricted:	No				

Stand-alone is defined as a fungicide or insecticide designed to be used alone; nothing added.
Component is defined as a fungicide or insecticide designed to be used in conjunction with another.
Auxiliary is defined as a fungicide or insecticide designed to aid in the effectiveness of another.

CruiserMaxx Vibrance

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**100-1508**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Thiamethoxam (1.99 lb AI/gal)	Insecticide	*Pythium, Phytophthora,* systemic downy mildew, *Fusarium, Rhizoctonia, Sclerotinia*, *Phomopsis,* seed decay, seedling blight, and damping-off caused *Rhizoctonia*	aphids, bean leaf beetle, grape colaspis, leaf miners, leaf hoppers, mexican bean beetle, seed corn maggot, three-cornered alfalfa hopper, thrips, white grubs and wireworm
Application Type:	Commercial	Mefenoxam (0.30 lb AI/gal)	Fungicide		
Density:	9.56 lb/gal	fludioxonil (0.10 lb AI/gal)	Fungicide		
Rate:	3.22 fl oz/Cwt	Sedaxane (0.10 lb AI/gal)	Fungicide		
Standard Rate:	3.22 fl oz/Cwt	**Crops**			
Coverage:	4 fl oz/Cwt	soybeans			
Package Size:	2x2.5				
Units Treated:	39.75 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

CruiserMaxx Vibrance Cereals

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**100-1383**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Thiamethoxam (0.26 lb AI/gal)	Insecticide	general seed rots, seedling blight, root rot, and damping-off by seed- and soil-borne *Fusarium* and soil-borne *Pythium*, seed-borne *Septoria*, *Rhizoctonia* root rot, covered, false, loose and true loose smut, flag smut, common, dwarf, and karnal bunt Suppression of: common root rot, *Fusarium* crown and foot rot, take-all	wireworm, european chafer
Application Type:	Commercial	Mefenoxam (0.079 lb AI/gal)	Fungicide		
Density:	9.21 lb/gal	Difenoconazole (0.31 lb AI/gal)	Fungicide		
Rate:	5–10 fl oz/Cwt	Sedaxane (0.67 lb AI/gal)	Fungicide		
Standard Rate:	5 fl oz/Cwt	**Crops**			
Coverage:	5 fl oz/Cwt	barley, oats, rye, triticale, and wheat			
Package Size:	2x2.5				
Units Treated:	25.6 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Difenoconazole 3L ST

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**42750-256**	**Active Ingredients**	**Type**	**Wheat/Triticale Diseases:**	**Barley:**
Product Type:	Fungicide—Component	Difenoconazole (3.1 lb AI/gal)	Fungicide	common bunt, seed-borne *Septoria*, loose smut, flag smut, general seed rots, *Fusarium* seed scab, common root rot, *Rhizoctonia* root rot 1.0 fl oz - *Fusarium* root rot, *Fusarium* crown rot, and take-all	barley stripe, general seed rots, covered smut, *Pythium* damping-off, common root rot, *Fusarium* seed scab, *Rhizoctonia* root rot 1.0 fl oz - take-all, *Fusarium* root rot, *Fusarium* crown rot
Application Type:	Commercial	**Crops**			
Density:	9.7 lb/gal	small grains, cotton, and sweet corn			
Rate:	0.5–1.0 fl oz/Cwt–wheat				
Standard Rate:	0.05 fl oz/Cwt–wheat				
Coverage:	Uniform coverage				
Package Size:	2.2.5, 15's, 250's				
Units Treated:	128–256 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Stand-alone is defined as a fungicide or insecticide designed to be used alone; nothing added.
Component is defined as a fungicide or insecticide designed to be used in conjunction with another.
Auxiliary is defined as a fungicide or insecticide designed to aid in the effectiveness of another.

Dividend Extreme

General Information		Agronomic Information		Target Pests
EPA Reg #:	**100-1141**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Stand-alone	Mefenoxam (0.19 lb AI/gal)	Fungicide	barley stripe, common bunt, covered smut, dwarf bunt, flag smut, *Fusarium*, general seed rots, karnal bunt, loose smut, *Pythium*, *Septoria*
Application Type:	Commercial	Difenoconazole (0.77 lb AI/gal)	Fungicide	
Density:	9.93 lb/gal	**Crops**		
Rate:	1–4 fl oz/Cwt	barley, cotton, sweet corn, wheat and triticale		
Standard Rate:	2 fl oz/Cwt			
Coverage:	Provide uniform coverage			
Package Size:	2x2.5, 1x30, 1x110			
Units Treated:	64 Cwt/gal			
Colorant:	Colored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

Dividend XL RTA

General Information		Agronomic Information		Target Pests
EPA Reg #:	**100-826**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Stand-alone	Mefenoxam (0.025 lb AI/gal)	Fungicide	barley stripe, common bunt, covered smut, dwarf bunt, flag smut, *Fusarium*, general seed rots, karnal bunt, loose smut, *Pythium*, *Septoria*
Application Type:	Commercial/On-farm	Difenoconazole (0.31 lb AI/gal)	Fungicide	Suppression of: common root rot, *Fusarium* seed scab and crown rot, *Rhizoctonia* root rot, take-all
Density:	9.15 lb/gal	**Crops**		
Rate:	2.5–10 fl oz/Cwt	barley and wheat		
Standard Rate:	5 fl oz/Cwt			
Coverage:	Provide uniform coverage			
Package Size:	2x2.5, 1x110			
Units Treated:	25.6 Cwt/gal			
Colorant:	Colored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

Dynasty

General Information		Agronomic Information		Target Pests
EPA Reg #:	**100-1159**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Add-on	Azoxystrobin (0.83 lb AI/gal)	Fungicide	seed-borne diseases
Application Type:	Commercial	**Crops**		
Density:	8.6 lb/gal	corn, sunflower, barley, brassica, bulb vegetables, canola, cucurbits, leafy vegetables, legume vegetables, pepper, potatoes, rice, sorghum, soybeans, and tomatoes		
Rate:	Varies by crop			
Standard Rate:	N/A			
Coverage:	Provide uniform coverage			
Package Size:	1x15			
Units Treated:	Varies by crop			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

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Emesto Silver

General Information		Agronomic Information		Target Pests
EPA Reg #:	**264-1123**	**Active Ingredients**	**Type**	**Potatoes:**
Product Type:	Fungicide—Stand-alone	Penflufen (0.83 lb AI/gal)	Fungicide	Provides powerful activity on seed- and soil-borne diseases, including *Rhizoctonia, Fusarium* and *Helminthosporium* silver scurf, resulting in a perfect skin finish and optimum size and shape
Application Type:	Commercial	Prothioconazole (0.15 lb AI/gal)	Fungicide	
Density:	8.92 lb/gal	**Crops**		
Rate:	0.31–2.5 fl oz/Cwt–potato	potato		
Standard Rate:	0.31 fl oz/Cwt–potato			
Coverage:	Complete seed coverage			
Package Size:	2x2.5, 15's			
Units Treated:	412.9 Cwt/gal			
Colorant:	Colored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

EverGol Energy

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**264-1122**	**Active Ingredients**	**Type**	**Cereal Grains:**	**Beans and Peas (Dried):**
Product Type:	Fungicide—Stand-alone	Prothocionazole (0.64 lb AI/gal)	Fungicide	common bunt, covered smut, false loose smut, flag smut, leaf stripe, loose smut, stinking smut, stem smut, true loose smut, seed rot, pre-emergence damping-off and seedling blight caused by soil-borne and seed-borne *Rhizoctonia, Fusarium, Cochliobolus*, *Pythium*, common root rot, foot rot, crown rot, rust, *Septoria*, powdery mildew (early season)	seed rot and sampling-off caused by *Rhizoctonia, Fusarium*, *Pythium,* seed rot, damping-off and seedling blight caused by seed-borne *Botrytis cinerea*, seed decay caused by *Phomopsis*- and *Asochyta*-blight (suppression)
Application Type:	Commercial	Metalaxyl (0.51 lb AI/gal)	Fungicide		
Density:	8.92 lb/gal	Penflufen (0.32 lb AI/gal)	Fungicide		
Rate:	Varies by crop	**Crops**			
Standard Rate:	1 fl oz/Cwt–wheat	alfalfa, beans and peas, cereal grains, field corn, popcorn, sweet corn and rice			
Coverage:	Complete seed coverage				
Package Size:	2x2.5, 15's				
Units Treated:	128 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Fludioxonil 4L ST

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**42750-248**	**Active Ingredients**	**Type**	**Soybeans:**	**Cereal Grains:**
Product Type:	Fungicide—Component	Fludioxonil (4.0 lb AI/gal)	Fungicide	seed-borne and soil-borne fungi which cause decay, damping-off, and seedling blight	seed-borne and soil-borne fungi which cause decay, damping-off, and seedling blight
Application Type:	Commercial	**Crops**			
Density:	8.9 lb/gal	corn, soybeans, cereals, cotton, potatoes, rice, vegetables, legumes, peanuts, and sorghum			
Rate:	0.08–0.16 fl oz/Cwt				
Standard Rate:	0.08 fl oz/Cwt–soybean				
Coverage:	Uniform coverage				
Package Size:	4x1, 15's				
Units Treated:	1,600-3,200 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

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Gaucho 600

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**264-968**	**Active Ingredients**	**Type**	**Soybeans:**	**Small Grains:**
Product Type:	Insecticide	Imidacloprid (5.0 lb AI/gal)	Insecticide	seed corn maggot, wireworm, soybean aphids, and bean leaf beetles	aphids, hessian fly, wireworm
Application Type:	Commercial	**Crops**			
Density:	10.3 lb/gal	oil seed crops, field corn, wheat, barley, oats, rye, triticale, sorghum, millet, cotton, sugarbeets, sweet corn, popcorn, soybeans, and edible beans			
Rate:	Varies by crop				
Standard Rate:	1.6–3.2 fl oz/Cwt–soybean				
Coverage:	Not stated				
Package Size:	2x2.5, 15′s, 260′s				
Units Treated:	80 Cwt /gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Gaucho XT

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**264-971**	**Active Ingredients**	**Type**	**Small Grain Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Imidacloprid (1.16 lb AI/gal)	Insecticide	*Pythium*, stinking smut, flag smut, loose smut, *Septoria, Rhizoctonia* root rot, common root rot, and *Fusarium*	aphids, hessian fly, wireworm
Application Type:	Commercial	Metalaxyl (0.075 lb AI/gal)	Fungicide	Suppression of: powdery mildew, wheat leaf rust and *Fusarium* scab	
Density:	9.4 lb/gal	Tebuconazole (0.056 lb AI/gal)	Fungicide	Additional Barley Diseases: covered smut, barley stripe, *Fusarium* foot rot	
Rate:	3.4–4.5 fl oz/Cwt	**Crops**		Suppression of: barley leaf rust	
Standard Rate:	3.4 fl oz/Cwt	barley, oats, and wheat			
Coverage:	Ensure thorough coverage				
Package Size:	2x2.5, 15′s				
Units Treated:	37.64 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

ILeVO

General Information		Agronomic Information		Target Pests
EPA Reg #:	**564-1167**	**Active Ingredients**	**Type**	**Soybeans:**
Product Type:	Nematicide/Fungicide	Fluopyram (5 lb AI/gal)	Nematicide/ Fungicide	sudden death syndrome (*Fusarium viguliforme*), soil borne nematodes, soybean cyst nematodes (heterodera glycines), root-knot nematodes (meloidogyne incognita), reniform nematodes (rotylenchulus reniformis), root lesion nematodes (pratylenchus spp.), ance nematodes (hoplolaimus spp.)
Application Type:	Commercial	**Crops**		
Density:	10.34 lb/gal	soybeans		
Rate:	1.2–2.36 fl oz/Cwt			
Standard Rate:	1.2 fl oz/Cwt			
Coverage:	Ensure thorough coverage			
Package Size:	2x2.5, 15′s			
Units Treated:	54–106			
Colorant:	No			
Seed Tag:	Required—See label			
Signal Word:	Warning			
Restricted:	No			

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Inovatet

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**59639-176**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide—Stand-alone	Clothianidin (1.34 lb AI/gal)	Insecticide	seed rots including: seed-borne *Phomopsis*, seed-borne *Sclerotinia*, seed-borne *Fusarium*, *Penicillium* and *Aspergillus*, damping-off and seedling blights caused by soil-borne *Pythium*, *Fusarium*, and *Rhizoctonia solani*	aphids, bean leaf beetle, grape colaspis, leafhoppers, pea leaf weevil, seed corn maggot, three-cornered alfalfa hopper, thrips, white grubs, and wireworms
Application Type:	Commercial	Metalaxyl (0.108 lb AI/gal)	Fungicide		
Density:	9.37 lb/gal	Ipconazole (0.0675 lb AI/gal)	Fungicide		
Rate:	4.74 fl oz/Cwt	**Crops**			
Standard Rate:	4.74 fl oz/Cwt	soybeans			
Coverage:	4.74 fl oz/Cwt				
Package Size:	45's				
Units Treated:	27 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Intego Solo*

General Information		Agronomic Information		Target Pests
EPA Reg #:	**59639-186**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Auxiliary	Ethaboxam (3.2 lb AI/gal)	Fungicide	provides protection against the *Oomycete* class of fungi including *Pythium* spp., *Phytophthora* spp. and *Aphanomyces* spp. causing seed decay, seedling dieback, and root rot
Application Type:	Commercial	**Crops**		
Density:	9.36 lb/gal	cereal grains except rice and wild rice, corn (sweet and field), popcorn, sorghum, grain milo, legume vegetables except cowpea and field pea, and canola		
Rate:	Varies by crop			
Standard Rate:	0.3 fl oz/Cwt—soybean			
Coverage:	Accurate application			
Package Size:	3x1			
Units Treated:	426 Cwt/gal			
Colorant:	Uncolored			
Seed Tag:	Required			
Signal Word:	Caution			
Restricted:	No			

*Sold as a system with Inovate Pro

Intego Suite Cereals OF

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**59639-183**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Ethaboxam (0.123 lb)	Insecticide	covered smut, loose smut, seed decay fungi, *Fusarium* seed scab, *Pythium* seed rot and seedling dieback, early season *Fusarium* seedling dieback, *Rhizoctonia* root rot, common root rot, common bunt, flag smut	wireworm
Application Type:	Commercial/On-farm	Clothianidin (0.246 lb)	Fungicide		
Density:	8.76 lb/gal	Metalaxyl (0.074 lb)	Fungicide		
Rate:	5.0–7.5 fl oz/Cwt	Metconazole (0.037 lb)			
Standard Rate:	5.0 fl oz/Cwt	**Crops**			
Coverage:	10.0–15.0 fl oz/Cwt	barley, oats, and wheat			
Package Size:	2x2.5, 1x260				
Units Treated:	25.6 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

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Intego Suite Soybeans

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**59639-205**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Clothianidin (1.91 lb AI/gal)	Insecticide	seed rots including: seed-borne *Phomopsis*, seed-borne *Sclerotinia*, seed-borne *Fusarium*, *Penicillium* and *Aspergillus*, damping-off and seedling blights caused by soil-borne *Pythium*, *Fusarium*, and *Rhizoctonia solani*	aphids, bean leaf beetle, grape colaspis, leafhoppers, pea leaf weevil, seed corn maggot, three-cornered alfalfa hopper, thrips, white grubs, and wireworms
Application Type:	Commercial	Ethaboxam (0.282 lb AI/gal)	Fungicide		
Density:	9.51 lb/gal	Ipconazole (0.094 lb AI/gal	Fungicide		
Rate:	3.37 fl oz/Cwt—soybean	Metalaxyl (0.075 lb AI/gal)	Fungicide		
Standard Rate:	3.37 fl oz/Cwt—soybean	**Crops**			
Coverage:	Accurate application	soybeans			
Package Size:	15's				
Units Treated:	37.98 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required				
Signal Word:	Caution				
Restricted:	No				

Maxim 4FS

General Information		Agronomic Information		Target Pests
EPA Reg #:	**100-758**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Add-on	Fludioxonil (4 lb AI/gal)	Fungicide	seed-borne and soil-borne fungi that cause decay, damping-off, and seedling blight
Application Type:	Commercial	**Crops**		
Density:	9.93 lb/gal	brassica vegetables, bulb vegetables, cereal grains, cucurbit vegetables, flax, cotton, crambe, jajoba, lesquerella, rape, safflower, sunflower, legume vegetables, fruiting vegetables, grass forage, herbs and spices, leafy vegetables, root and tuber vegetables, peanuts, and soybeans		
Rate:	Varies by crop			
Standard Rate:	0.08 fl oz/Cwt—soybean			
Coverage:	Provide uniform coverage			
Package Size:	4x1 qt, 4x1			
Units Treated:	160 Cwt/gal			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

Maxim MZ

General Information		Agronomic Information		Target Pests
EPA Reg #:	**100-1158**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Stand-alone	Fludioxonil (0.005 lb AI/gal)	Fungicide	*Fusarium* dry rot seed decay, seed-borne *Rhizoctonia solani*, seed-borne *Helminthosporium solani*, *Phytophthora* infestans
Application Type:	Commercial	Mancozeb (0.057 lb AI/gal)	Fungicide	
Density:	Dry—pound	**Crops**		
Rate:	0.5 lb/Cwt	potatoes		
Standard Rate:	0.5 lb/Cwt			
Coverage:	Provide uniform coverage			
Package Size:	1x50 lb			
Units Treated:	100 Cwt/bag			
Colorant:	Uncolored			
Seed Tag:	Not stated			
Signal Word:	Caution			
Restricted:	No			

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Maxim PSP

General Information		Agronomic Information		Target Pests
EPA Reg #:	**100-821**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Stand-alone	Fludioxonil (0.005 lb AI/gal)	Fungicide	*Fusarium* dry rot seed decay, seed-borne *Rhizoctonia solani*, seed-borne *Helminthosporium solani*
Application Type:	Commercial	**Crops**		
Density:	Dry—pound	potatoes		
Rate:	0.5 lb/Cwt			
Standard Rate:	0.5 lb/Cwt			
Coverage:	Provide uniform coverage			
Package Size:	1x50 lb			
Units Treated:	100 Cwt/bag			
Colorant:	Uncolored			
Seed Tag:	Not stated			
Signal Word:	Caution			
Restricted:	No			

Metalaxyl 4.0 ST

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**42750-219**	**Active Ingredients**	**Type**	**Soybeans: 0.5–1.0 fl oz/Cwt**	**Cereal Grains:**
Product Type:	Fungicide—Component	Metalaxyl (4.0 lb AI/gal)	Fungicide	*Pythium* damping-off control and early-season *Phytophthora*	Reduced rates in combination with other fungicides
Application Type:	Commercial	**Crops**			**0.07–0.25 fl oz/Cwt**
Density:	9.4 lb/gal	canola, cotton, soybeans, peanuts, sorghum, sunflower, legumes, small grains, and vegetables			Aid in control of seed decay and damping-off caused by *Pythium*
Rate:	Varies by crop				
Standard Rate:	0.5 fl oz/Cwt–soybean				
Coverage:	Not stated				
Package Size:	4x1, 2x2.5, 15's, 250's				
Units Treated:	256 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Metalaxyl 265 ST

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**42750-208**	**Active Ingredients**	**Type**	**Soybeans: 0.75–1.50 fl oz/Cwt**	**Cereal Grains:**
Product Type:	Fungicide—Component	Metalaxyl (2.65 lb AI/gal)	Fungicide	*Pythium* damping-off control and early-season *Phytophthora*	Reduced rates in combination with other fungicides
Application Type:	Commercial	**Crops**			**0.07–0.25 fl oz/Cwt**
Density:	9.0 lb/gal	canola, cotton, soybeans, peanuts, sorghum, sunflower, legumes, small grains, and vegetables			Aid in control of seed decay and damping-off caused by *Pythium*
Rate:	Varies by crop				
Standard Rate:	0.75 fl oz/Cwt–soybean				
Coverage:	Not stated				
Package Size:	4x1, 15's, 250's				
Units Treated:	170 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Warning				
Restricted:	No				

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NipsIt Inside

General Information		Agronomic Information		Target Pests
EPA Reg #:	**59639-151**	**Active Ingredients**	**Type**	**Insects:**
Product Type:	Insecticide	Clothianidin (5 lb AI/gal)	Insecticide	**Cereal Grains:** wireworm, aphids, hessian fly
Application Type:	Commercial	**Crops**		**Canola:** flea beetle, wireworm
Density:	10.43 lb/gal	wheat, barley, buckwheat, millet, oats, rye, tesonite, triticale, corn, popcorn, soybean, sorghum, sugarbeet, and rice		**Corn:** chinch bug, corn flea beetle, corn leaf aphid, cutworm, grape colaspis, seedcorn maggot, southern corn leaf beetle, southern corn rootworm, southern green stinkbug, storage pests, sugarcane beetle, white grub, thrips, wireworm
Rate:	Varies by crop			**Sorghum:** black granulate cutworm, chinch bug, corn leaf aphid, english grain aphid, greenbug, seed corn maggot, white grub, wireworm, yellow sugarcane aphid
Standard Rate:	0.25 fl oz/Cwt—wheat			**Soybeans:** aphids, bean leaf beetle, grape colaspis, leafhopper, pea leaf weevil, seed corn maggot, three-cornered alfalfa hopper, thirps, white grub, wireworm
Coverage:	Not stated			
Package Size:	4x1, 55's			
Units Treated:	512 Cwt/gal			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

Obvius

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**7969-371**	**Active Ingredients**	**Type**	**Dried Shelled Diseases:**	**Additional Rapeseed Diseases:**
Product Type:	Fungicide—Stand-alone	Pyraclostrobin (0.14 lb AI/gal)	Fungicide	*Colletotrichum*, *Fusarium* seed rot, *Fusarium* seedling blight, *Botrytis Cinerea*, *Pythium* damping-off, *Rhizoctonia* root rot	*Leptosphaeria, Alternaria Brassicae*
Application Type:	Commercial/On-farm	Fluxapyroxad (0.14 lb AI/gal)	Fungicide		
Density:	8.84 lb/gal	Metalaxyl (0.11 lb AI/gal)	Fungicide		
Rate:	4.6 fl oz/Cwt	**Crops**			
Standard Rate:	4.6 fl oz/Cwt	dried shelled pea and bean (except soybean), flax seed, and rapeseed			
Coverage:	May dilute w/H_2O				
Package Size:	2x2.5, 1x200				
Units Treated:	27.8 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Warning				
Restricted:	No				

Obvius Plus

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**7969-426**	**Active Ingredients**	**Type**	**For control of:**	**For suppression of:**
Product Type:	Fungicide	Fluxapyroxad (0.417 lb)	Fungicide	• Anthracnose *Colletotrichum spp.*	• Seed rot and seedling blight *Alternaria spp. Aspergillus spp. Cladosporium spp. Penicillium spp. Phomopsis spp.*
Application Type:	Commercial/On-farm	Pyraclostrobin (0.334 lb)		• Root rot, seed rot, and seedling blight *Fusarium spp. Phytophthora spp. Pythium spp. Rhizoctonia solani*	
Density:	9.34	Metalaxyl (1.377 lb)		• Seed rot *Aspergillus spp. Penicillium spp.*	
Rate:	1.53 fl oz/Cwt	Thiophanate-methyl (0.835 lb)		• Seedling blight *Ascochyta spp.*	
Standard Rate:	1.53 fl oz/Cwt	**Crops**		• Seed rot and seedling blight *Botrytis cinerea*	
Coverage:	Provide uniform coverage	soybean, dry bean			
Package Size:	2x2.5, 15-gal, 30-gal				
Units Treated:	836.60				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

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Rancona 3.8 FS

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**400-544**	**Active Ingredients**	**Type**	**Diseases:**	
Product Type:	Fungicide	Ipconazole (3.77 lb AI/gal)	Fungicide	general seed rots, damping-off and seedling blight, loose smut, common bunt, *Rhizoctonia* root rot, common root rot, *Fusarium* crown and foot rot	
Application Type:	Commercial	**Crops**		Additional barley diseases: true loose smut, covered smut, false loose smut, and leaf stripe	
Density:	9.17 lb/gal	barley, oats, rye, triticale, wheat, dried shelled beans, peas, and soybeans		Additional soybean diseases: *Phomompsis*	
Rate:	0.051–0.085 fl oz/Cwt				
Standard Rate:	0.051 fl oz/Cwt				
Coverage:	Apply as H_2O mixture				
Package Size:	2x2.5, 1x15, 1x30				
Units Treated:	2,510 Cwt/gal				
Colorant:	No				
Seed Tag:	Required—See Label				
Signal Word:	Warning				
Restricted:	No				

Rancona Crest

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**400-574**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Imidacloprid (1.3 lb AI/gal)	Insecticide	general seed rots, damping-off and seedling blight, loose smut, common bunt, *Rhizoctonia* root rot, common root rot, *Fusarium* crown and foot rot	aphid, grasshopper, and hessian fly
Application Type:	Commercial/On-farm	Ipconazole (0.04 lb AI/gal)	Fungicide	Additional barley diseases: true loose smut, covered smut, false loose smut, and leaf stripe	Suppression of: wireworm
Density:	8.77 lb/gal	Metalaxyl (0.05 lb AI/gal)	Fungicide		
Rate:	5.0–8.33 fl oz/Cwt	**Crops**			
Standard Rate:	5.0 fl oz/Cwt	barley, oats, rye, triticale, and wheat			
Coverage:	Diluted with H_2O if desired				
Package Size:	2x2.5, 1x50				
Units Treated:	25.6 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See Label				
Signal Word:	Caution				
Restricted:	No				

Rancona Summit

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**400-570**	**Active Ingredients**	**Type**	**Diseases:**	
Product Type:	Fungicide—Stand-alone	Ipconazole (0.08 lb AI/gal)	Fungicide	damping-off, seed rot and seedling blight, *Pythium*, *Rhizoctonia*, seed and soil-borne *Phomopsis* and *Sclerotinia*, general seed rots including *Penicillium* and *Aspergillus*	
Application Type:	Commercial/On-farm	Metalaxyl (0.13 lb AI/gal)	Fungicide		
Density:	8.9 lb/gal	**Crops**			
Rate:	4.0 fl oz/Cwt	soybeans, dried shelled beans and peas			
Standard Rate:	4.0 fl oz/Cwt				
Coverage:	Diluted with H_2O if desired				
Package Size:	2x2.5, 1x50				
Units Treated:	32 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See Label				
Signal Word:	Caution				
Restricted:	No				

Stand-alone is defined as a fungicide or insecticide designed to be used alone; nothing added.
Component is defined as a fungicide or insecticide designed to be used in conjunction with another.
Auxiliary is defined as a fungicide or insecticide designed to aid in the effectiveness of another.

Rancona V 100 Pro FS

General Information		Agronomic Information		Target Pests
EPA Reg #:	**400-596**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide	Ipconazole (0.208 lb AI/gal)	Fungicide	general seed rots, damping-off and seedling blight, loose smut, common bunt, *Rhizoctonia* root rot, common root rot, *Fusarium* crown and foot rot
Application Type:	Commercial	Carboxin (3.34 lb AI/gal)	Fungicide	
Density:	9.39 lb/gal	**Crops**		Additional barley diseases: true loose smut, covered smut, false loose smut, and leaf stripe
Rate:	0.9–1.5 fl oz/Cwt	barley, oats, rye, triticale, and wheat		
Standard Rate:	0.9 fl oz/Cwt			
Coverage:	Apply as H_2O mixture			
Package Size:	2x2.5, 1x50			
Units Treated:	142 Cwt/gal			
Colorant:	No			
Seed Tag:	Required—See Label			
Signal Word:	Warning			
Restricted:	No			

Rancona V RTU FS

General Information		Agronomic Information		Target Pests
EPA Reg #:	**400-595**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Stand-alone	Ipconazole (0.042 lb AI/gal)	Fungicide	general seed rots, damping-off and seedling blight, *Pythium*, loose smut, common bunt, *Rhizoctonia* root rot, common root rot, *Fusarium* crown and foot rot
Application Type:	Commercial/On-farm	Metalaxyl (0.111 lb AI/gal)	Fungicide	
Density:	8.84 lb/gal	Carboxin (1.11 lb AI/gal)	Fungicide	Additional barley diseases: true loose smut, covered smut, false loose smut, and leaf stripe
Rate:	4.6 fl oz/Cwt	**Crops**		
Standard Rate:	4.6 fl oz/Cwt	barley, oats, rye, triticale, and wheat		
Coverage:	Diluted with H_2O if desired			
Package Size:	2x2.5, 1x50			
Units Treated:	28 Cwt/gal			
Colorant:	Colored			
Seed Tag:	Required—See Label			
Signal Word:	Warning			
Restricted:	No			

Raxil Pro MD

General Information		Agronomic Information		Target Pests
EPA Reg #:	**264-1072**	**Active Ingredients**	**Type**	**Small Grain Diseases:**
Product Type:	Fungicide—Stand-alone	Prothioconazole (0.128 lb AI/gal)	Fungicide	stinking smut, flag smut, loose smut, early season *Septoria*, general seed rots, *Pythium* damping-off, *Rhizoctonia* root rot, common root rot, *Fusarium* scab and foot rot
Application Type:	Commercial/On-farm	Metalaxyl (0.052 lb AI/gal)	Fungicide	
Density:	8.67 lb/gal	Tebuconazole (0.025 lb AI/gal)	Fungicide	Suppression of: powdery mildew, rust and barley stripe
Rate:	5.0 fl oz/Cwt	**Crops**		
Standard Rate:	5.0 fl oz/Cwt	wheat and barley		
Coverage:	Ensure thorough coverage			
Package Size:	2x2.5, 15's, 200 gal			
Units Treated:	25.6 Cwt/gal			
Colorant:	Colored			
Seed Tag:	Required—See label			
Signal Word:	Warning			
Restricted:	No			

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Auxiliary is defined as a fungicide or insecticide designed to aid in the effectiveness of another.

Raxil Pro Shield

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**264-1186**	**Active Ingredients**	**Type**	**Small Grain Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Imidacloprid (0.768 lb AI/gal)	Insecticide	stinking smut, flag smut, loose smut, early season *Septoria*, general seed rots, *Pythium* damping-off, *Rhizoctonia* root rot, common root rot, *Fusarium* scab and foot rot Suppression of: powdery mildew, rust and barley stripe	aphids, hessian fly, wireworm
Application Type:	Commercial/On-farm	Prothioconazole (0.128 lb AI/gal)	Fungicide		
Density:	9.0 lb/gal	Metalaxyl (0.51 lb AI/gal)	Fungicide		
Rate:	5.0 fl oz/Cwt	Tebuconazole (0.025 lb AI/gal)	Fungicide		
Standard Rate:	5.0 fl oz/Cwt	**Crops**			
Coverage:	Ensure thorough coverage	barley, triticale, and wheat			
Package Size:	2x2.5, 15's, 200 gal				
Units Treated:	25.6 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Warning				
Restricted:	No				

Redigo 480

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**264-825**	**Active Ingredients**	**Type**	**Diseases Controlled:** **Alfalfa:** Seed rot and damping-off caused by *Rhizoctonia* **Beans and Peas (dried) including Soybean:** Seed rot and damping-off caused by *Rhizoctonia, Fusarium*, Seed decay	**Cereal grains:** common bunt covered smut false loose smut flag smut leaf stripe loose smut stinking smut stem smut true loose smut seed rot, preemergence, damping-off, and seedling blight caused by soil-borne *Rhizoctonia solani, Fusarium, Cochliobolus* seed decay common root rot, foot rot, and crown rot (early season suppression) rust, *Septoria* and powdery mildew (early season suppression)
Product Type:	Fungicide	Prothioconazole (4.00 lb)	Fungicide		
Application Type:	Commercial	**Crops**			
Density:	9.84	Multiple crops			
Rate:	0.16–0.48 fl oz/Cwt				
Standard Rate:	0.16 fl oz/Cwt				
Coverage:	Provide uniform coverage				
Package Size:	2x2.5, 15 gal				
Units Treated:	Varies by crop				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

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Release LC

General Information	
EPA Reg #:	**73049-42**
Product Type:	Plant Growth Regulator
Application Type:	Commercial
Density:	6.84 lb/gal
Rate:	0.5–3 fl oz/Cwt
Standard Rate:	0.5 fl oz/Cwt
Coverage:	8–20 fl oz/Cwt slurry
Package Size:	4x1, 30's
Units Treated:	256 Cwt/gal
Colorant:	Uncolored
Seed Tag:	Not required
Signal Word:	Warning
Restricted:	No

Agronomic Information

Active Ingredients	Type
Gibberellins (0.2736 lb AI/gal)	PGR

Crops

cereal seed, grasses, and field corn

Resonate 600 ST

General Information	
EPA Reg #:	**42750-133**
Product Type:	Insecticide—Component
Application Type:	Commercial
Density:	10.35 lb/gal
Rate:	Varies by crop
Standard Rate:	1.6 fl oz/Cwt–soybean
Coverage:	Thorough coverage
Package Size:	4x1, 2x2.5, 15's, 250's
Units Treated:	80 Cwt/gal
Colorant:	Uncolored
Seed Tag:	Required—See label
Signal Word:	Caution
Restricted:	No

Agronomic Information

Active Ingredients	Type
Imidacloprid (5.0 lb AI/gal)	Insecticide

Crops

canola, cotton, soybeans, sorghum, sunflowers, legumes, small grains, vegetables, and potatoes

Target Pests

Soybeans: 1.6–3.2 fl oz/Cwt

seed corn maggot, soybean aphids, overwintering bean leaf beetles, wireworm thirps

Suppression: white grubs

Cereal Grains: 0.8–2.4 fl oz/Cwt

aphids (bird cherry-oat, English grain, greenbug, and Russian wheat aphid) hessian fly

0.13–0.26 fl oz/Cwt

wireworm (suppression)

1.2–2.4 fl oz/Cwt

grasshopper

Rizolex

General Information	
EPA Reg #:	**59639-178**
Product Type:	Fungicide—Auxiliary
Application Type:	Commercial
Density:	9.98 fl oz/Cwt
Rate:	Varies by crop
Standard Rate:	0.3 fl oz/Cwt—soybean
Coverage:	Accurate application
Package Size:	4x1
Units Treated:	426 Cwt/gal
Colorant:	Uncolored
Seed Tag:	Required—See label
Signal Word:	Caution
Restricted:	No

Agronomic Information

Active Ingredients	Type
Toldofos-methyl (4.17 lb AI/gal)	Fungicide

Crops

soybeans, corn, popcorn, sorghum, sugarbeet, and cotton

Target Pests

Diseases:

protection against *Rhizoctonia* and seed-borne and soil-borne fungal pathogens that cause seed decay, damping-off and seedling blight

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Salient TMI

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**55146-159**	**Active Ingredients**	**Type**	**Diseases Controlled:**	**Insect Control:**
Product Type:	Fungicide/Insecticide	Imidacloprid - Incesticide (0.50 lb) Difenoconazole (0.31 lb) Metalaxyl (0.16 lb) Tebuconazole (0.035 lb)	Fungicide/ Insecticide	Control of seed rots such as *Penicillium* and *Aspergillus* and seed-borne *Fusarium* scab and *Septoria* Control of dwarf bunt, karnal bunt, stinking smut (common bunt), flag smut, loose smut, covered smut of barley Control of early season barley stripe, *Pythium* damping-off, *Septoria* disease complex, *Rhizoctonia* root rot, common root rot (Cochiliobolus spp.), *Fusarium* root rot Early season suppression of powdery mildew, wheat leaf rust, and *Septoria* leaf blotch	Control of light to moderate pressure of wireworms. Controls aphids (including bird cherry-oat, English grain, greenbug and Russian wheat, and hessian fly)
Application Type:	Commercial/On-farm	**Crops**			
Density:	8.93	cereals			
Rate:	5.0–7.5 fl oz/Cwt				
Standard Rate:	5.0 fl oz/Cwt				
Coverage:	Provide uniform coverage				
Package Size:	2x2.5				
Units Treated:	256				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Saltro

General Information		Agronomic Information		Target Pests
EPA Reg #:	**100-1648**	**Active Ingredients**	**Type**	**Disease/Pest Controlled:**
Product Type:	Fungicide/Nematicide	Pydiflumetofen (4.17 lb)	Fungicide/ Nematicide	Control of seed- and air-borne blackleg caused by *Leptosphaeria maculans* Sudden Death Syndrome *(Fusarium virguliforme)* Early-season *Septoria* brown spot *(Septoria glycines)* Plant parasitic nematodes soybean cyst *(Heterodera glycines)* root knot *(Meloidogyne incognita)* reniform *(Rotylenchulus reniformis)* lesion *(Pratylenchus spp.)* lance *(Hoplolaimus spp.)*
Application Type:	Commercial	**Crops**		
Density:	9.76	multiple crops		
Rate:	1.23–1.52 fl oz/Cwt			
Standard Rate:	1.52 fl oz/Cwt			
Coverage:	Provide uniform coverage			
Package Size:	2x2.5, 15 gal			
Units Treated:	Varies by crop			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

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Sativa 309 FS

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**55146-101**	**Active Ingredients**	**Type**	**Wheat/Triticale Diseases:**	
Product Type:	Fungicide—Component	Tebuconazole (2.6 lb AI/gal)	Fungicide	stinking smut, flag smut, loose smut, *Septoria*, *Rhizoctonia* root rot, common root rot, *Fusarium* foot rot	
Application Type:	Commercial	**Crops**		Suppression of: powdery mildew, and wheat leaf rust	
Density:	9.1 lb/gal	barley, corn, oats, triticale and wheat		Additional barley diseases: covered smut, barley stripe (suppression), and barley leaf rust (suppression)	
Rate:	Varies by crop			Additional oats diseases: crown rust (suppression)	
Standard Rate:	0.08–0.10 fl oz/Cwt–wheat				
Coverage:	9–20 fl oz/Cwt				
Package Size:	4x1 qt, 4x1, 30's				
Units Treated:	1,600 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Sativa IM RTU

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**55146-111**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Imidacloprid (0.13 lb AI/gal)	Insecticide	*Pythium* damping-off, stinking smut, flag smut, loose smut, *Septoria, Rhizoctonia* root rot, general seed rots, common root rot, *Fusarium* scab and foot rot	wireworm (suppression)
Application Type:	Commercial/On-farm	Metalaxyl (0.05 lb AI/gal)	Fungicide		
Density:	8.4 lb/gal	Tebuconazole (0.04 lb AI/gal)	Fungicide		
Rate:	5 fl oz/Cwt	**Crops**		Suppression of: powdery mildew and rusts	
Standard Rate:	5 fl oz/Cwt	barley, oat, triticale and wheat			
Coverage:	1 part H_2O/1 Sativa IM RTU				
Package Size:	2x2.5, 30's, 250's				
Units Treated:	25.6 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Sativa IMF Sembolite Max

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**55146-119**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Imidacloprid (1 lb AI/gal)	Insecticide	seed decay caused by *Aspergillus, Penicillium* and other species. *Pythium* damping-off, covered smut (barley), stinking smut, flag smut, loose smut, *Septoria, Rhizoctonia* root rot, general seed rots, common root rot, *Fusarium* scab and foot rot	aphids, wireworm and hessian fly
Application Type:	Commercial/On-farm	Metalaxyl (0.05 lb AI/gal)	Fungicide		
Density:	8.98 lb/gal	Tebuconazole (0.04 lb AI/gal)	Fungicide		
Rate:	3.4–5.0 fl oz/Cwt	Fludioxonil (0.03 lb AI/gal)	Fungicide		
Standard Rate:	3.4 fl oz/Cwt	**Crops**		Suppression of: powdery mildew and rusts	
Coverage:	Thorough coverage	barley and wheat			
Package Size:	2x2.5, 30's, 250's				
Units Treated:	37.6 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Warning				
Restricted:	No				

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Sativa M2F RTU

General Information		Agronomic Information		Target Pests
EPA Reg #:	**55146-152**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Stand-alone	Metalaxyl (0.107 lb AI/gal)	Fungicide	seed decay caused by *Aspergillus, Penicillium* and other species. *Pythium* damping-off, stinking smut, flag smut, loose smut, *Septoria*, *Rhizoctonia* root rot, common root rot, and *Fusarium* foot rot Suppression of: powdery mildew and early season suppression of wheat leaf rust
Application Type:	Commercial/On-farm	Tebuconazole (0.040 lb AI/gal)	Fungicide	
Density:	8.62 lb/gal	Fludioxonil (0.032 lb AI/gal)	Fungicide	
Rate:	3.4–5.0 fl oz/Cwt	**Crops**		
Standard Rate:	3.4 fl oz/Cwt	barley, oats, triticale, and wheat		
Coverage:	Ensure thorough coverage			
Package Size:	2x2.5, 30's, 250's			
Units Treated:	37.65 Cwt/gal			
Colorant:	Colored			
Seed Tag:	Required—See label			
Signal Word:	Warning			
Restricted:	No			

Sebring 318 FS

General Information		Agronomic Information		Target Pests
EPA Reg #:	**55146-107**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Auxiliary	Metalaxyl (2.65 lb AI/gal)	Fungicide	*Pythium*, *Phytophthora*
Application Type:	Commercial/On-farm	**Crops**		
Density:	8.82 lb/gal	brassica leafy vegetables, canola, mustard seed, rapeseed cotton, cucurbit vegetables, forage grasses, forage legumes, fruiting vegetables, grain crops, leafy vegetables, onions, peanuts, rice, root and tuber vegetables (except potato), seed and pod vegetables, sorghum, soybeans, sunflowers, and turf grasses		
Rate:	Varies by crop			
Standard Rate:	0.75–1.50 fl oz/Cwt—soybean			
Coverage:	Apply with other fungicides			
Package Size:	2x2.5, 4x1, 30's, 250's			
Units Treated:	170 Cwt/gal			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

Sebring 480 FS

General Information		Agronomic Information		Target Pests
EPA Reg #:	**55146-106**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Auxiliary	Metalaxyl (4 lb AI/gal)	Fungicide	*Pythium*, *Phytophthora*
Application Type:	Commercial	**Crops**		
Density:	9 lb/gal	brassica leafy vegetables, canola, mustard seed, rapeseed cotton, cucurbit vegetables, forage grasses, forage legumes, fruiting vegetables, grain crops, leafy vegetables, onions, peanuts, rice, root and tuber vegetables (except potato), seed and pod vegetables, sorghum, soybeans, sunflowers, and turf grasses		
Rate:	Varies by crop			
Standard Rate:	0.50–1 fl oz/Cwt—soybean			
Coverage:	Apply with other fungicides			
Package Size:	2x2.5, 4x1, 30's, 250's			
Units Treated:	256 Cwt/gal			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

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Senator 600 FS

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**228-522**	**Active Ingredients**	**Type**	**Soybeans:**	**Small Grains:**
Product Type:	Insecticide	Imidacloprid (5 lb AI/gal)	Insecticide	seed corn maggot, wireworm, soybean aphids and bean leaf beetles	aphids, hessian fly, wireworm and grasshopper
Application Type:	Commercial	**Crops**			
Density:	10.27 lb/gal	oil seed crops, field corn, wheat, barley, oats, rye, triticale, sorghum, cotton, sugarbeets, popcorn, soybean, and edible beans			
Rate:	Varies by crop				
Standard Rate:	1.6 fl oz/Cwt—soybean				
Coverage:	Not stated				
Package Size:	2x2.5, 4x1, 30's, 250's				
Units Treated:	80 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Signet 480 FS

General Information		Agronomic Information		Target Pests
EPA Reg #:	**45728-26-55146**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Component	Thiram (4 lb AI/gal)	Fungicide	seed decay, damping-off and seedling blights caused by many seed-borne and soil-borne organisms, smuts, bunt
Application Type:	Commercial	**Crops**		
Density:	9.09 lb/gal	barley, millet, oats, rye, sorghum, triticale, wheat, bean and peas, beet, Swiss chard, vegetables (see label for type and rate), corn, cotton, flax, grasses, flower seed, peanuts, rice safflower, sunflower, sugarbeet, and tomato		
Rate:	Varies by crop			
Standard Rate:	2 fl oz/bu—small grains			
Coverage:	Applied as a H_2O suspension			
Package Size:	2x2.5, 30's, 266's			
Units Treated:	64 bu/gal			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

Sonoma 20EW AG

General Information		Agronomic Information		Target Pests
EPA Reg #:	**42750-165**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Auxiliary	Myclobutanil (1.67 AI/gal)	Fungicide	*Rhizoctonia* solani, black root rot
Application Type:	Commercial/On-Farm	**Crops**		
Density:	9.6 lb/gal	cotton seed treatment		
Rate:	1.52–4.75 fl oz/Cwt			
Standard Rate:	1.05 fl oz/Cwt–lentil			
Coverage:	8–10 fl oz/Cwt			
Package Size:	4x1			
Units Treated:	27–84 Cwt/gal			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

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Spirato 480 FS

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**55146-116**	**Active Ingredients**	**Type**	**Soybeans:**	**Cereal Grains:**
Product Type:	Fungicide—Component	Fludioxonil (4 lb AI/gal)	Fungicide	seed-borne and soil-borne fungi which cause decay, damping-off, and seedling blight	seed-borne and soil-borne fungi which cause decay, damping-off, and seedling blight
Application Type:	Commercial	**Crops**			
Density:	9.97 lb/gal	corn, soybeans, cereals, cotton, potatoes, rice, vegetables, legumes, peanuts, and sorghum			
Rate:	0.08–0.16 fl oz/Cwt				
Standard Rate:	0.08–0.16 fl oz/Cwt—soybean				
Coverage:	Uniform coverage				
Package Size:	4x1 qt, 4x1, 15's				
Units Treated:	1,600–3,200 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Spirato IMTm 348 FS

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**55146-111**	**Active Ingredients**	**Type**	**Diseases:**	**Insects:**
Product Type:	Fungicide/Insecticide	Imidacloprid (1.98 lb AI/gal)	Insecticide	protection against damping-off and seed rots caused by *Pythium*, *Phytophthora, Fusarium, Rhizoctonia* spp, and *Phytopthora* root rot. Suppresses seed-borne *Sclerotinia* and *Phomopsis* spp.	seed corn maggot, wireworm, soybean aphids, and bean leaf beetles
Application Type:	Commercial/On-farm	Fludioxonil (0.08 lb AI/gal)	Fungicide		
Density:	9.78 lb/gal	Metalaxyl (0.49 lb AI/gal)	Fungicide		
Rate:	4.0 fl oz/Cwt	Thiophanate - Methyl (0.32 lb AI/gal)	Fungicide		
Standard Rate:	4.0 fl oz/Cwt	**Crops**			
Coverage:	Complete seed coverage	soybeans, dry beans, and snap beans			
Units Treated:	32				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Warning				
Restricted:	No				

Spirato M 185 FS

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**55146-118**	**Active Ingredients**	**Type**	**Soybeans/Seed and Pod Vegetables:**	**Cotton:**
Product Type:	Fungicide—Component	Metalaxyl (1.34 lb AI/gal)	Fungicide	protection against damping-off and seed rots caused by *Pythium*, *Phytophthora, Fusarium, Rhizoctonia* spp, and *Phytopthora* root rot. Suppresses seed-borne *Sclerotinia* and *Phomopsis* spp.	protection against seed- and soil-borne fungi such as *Pythium*, *Rhizoctonia,* and *Fusarium* that causes decay, damping-off, and seedling blights
Application Type:	Commercial	Fludioxonil (0.21 lb AI/gal)	Fungicide		
Density:	8.91 lb/gal	**Crops**			
Rate:	1.5–3.0 fl oz/Cwt	soybean, rice, cotton, black-eyed peas, chickpeas, garbanzos, cowpeas, field beans, field peas, garden peas, green beans, kidney beans, lima beans, lupines, navy beans, okra, peas, pole beans, snap beans, string beans, wax beans, and lentils			
Standard Rate:	1.5 fl oz/Cwt—soybean				
Coverage:	Ensure thorough coverage				
Package Size:	2x2.5				
Units Treated:	85.33 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Warning				
Restricted:	No				

Stand-alone is defined as a fungicide or insecticide designed to be used alone; nothing added.
Component is defined as a fungicide or insecticide designed to be used in conjunction with another.
Auxiliary is defined as a fungicide or insecticide designed to aid in the effectiveness of another.

Spirato MTm 285 FS

General Information		Agronomic Information		Target Pests
EPA Reg #:	**55146-154**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide	Fludioxonil (0.21 lb AI/gal)	Fungicide	protection against damping-off and seed rots caused by *Pythium*, *Phytophthora, Fusarium, Rhizoctonia* spp, and *Phytopthora* root rot. Suppresses seed-borne *Sclerotinia* and *Phomopsis* spp.
Application Type:	Commercial	Metalaxyl (1.34 lb AI/gal)	Fungicide	
Density:	9.19 lb/gal	Thiophanate - Methyl (0.833 lb AI/gal)	Fungicide	
Rate:	1.5 fl oz/Cwt	**Crops**		
Standard Rate:	1.5 fl oz/Cwt	soybeans, dry beans, and snap beans		
Coverage:	Complete seed coverage			
Units Treated:	85			
Colorant:	Colored			
Seed Tag:	Required—See label			
Signal Word:	Warning			
Restricted:	No			

ST-Methyl 540 FS

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**55146-127**	**Active Ingredients**	**Type**	**Soybeans:**	**Cereal Grains:**
Product Type:	Fungicide—Auxiliary	Thiophanate-methyl (4.5 lb AI/gal)	Fungicide	seed decay such as *Phomopsis, Fusarium,* seedling blight (soil-borne *Fusarium* and *Rhizoctonia*)	seed decay such as *Phomopsis, Fusarium,* seedling blight (soil-borne *Fusarium* and *Rhizoctonia*)
Application Type:	Commercial	**Crops**		**Dry Beans, Snap Peas:**	
Density:	10 lb/gal	peanuts, soybeans, dry beans, snap beans, and wheat		seed decay such as *Phomopsis, Fusarium,* seedling blight (soil-borne *Fusarium* and *Rhizoctonia*)	
Rate:	0.14–0.28 fl oz/Cwt				
Standard Rate:	0.28 fl oz/Cwt—soybeans 0.14 fl oz/Cwt—wheat				
Coverage:	Complete seed coverage				
Package Size:	4x1, 15's				
Units Treated:	457–914 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Stamina

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**7969-266**	**Active Ingredients**	**Type**	**Wheat:**	**Corn (Field, Pop, Sweet):**
Product Type:	Fungicide—Auxiliary	Pyraclostrobin (1.67 lb AI/gal)	Fungicide	*Rhizoctonia solani* seed-borne fungi causing seed decay, seedling damping-off	*Rhizoctonia solani* seed-borne fungi causing seed decay, seedling damping-off
Application Type:	Commercial/On-farm	**Crops**			
Density:	9.1 lb/gal	alfalfa, barley, corn, dried and succulent shelled peas and beans, edible podded legume vegetables, oats, rye, sorghum, sugarbeet, and wheat		Mixes easily with water and other BASF seed treatments. When mixing with other manufacturers' product, jar test.	
Rate:	Crop dependent				
Standard Rate:	0.4 fl oz/Cwt–C and Sm Gr				
Coverage:	Apply as H_2O mixture				
Package Size:	2x2.5, 1x30				
Units Treated:	320 Cwt/gal at 0.4 fl oz				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

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Stamina F3 Cereals

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**7969-322**	**Active Ingredients**	**Type**	**Small Grain Diseases:**	**Additional Barley Diseases:**
Product Type:	Fungicide—Stand-alone	Pyraclostrobin (0.14 lb AI/gal)	Fungicide	common bunt, flag smut, *Fusarium* seed rot, *Fusarium* seedling blight, loose smut, *Pythium* damping-off, *Rhizoctonia* root rot	dry seed decay, false loose smut, true loose smut
Application Type:	Commercial/On-farm	Triticonazole (0.14 lb AI/gal)	Fungicide		**Additional Oat Diseases:**
Density:	8.94 lb/gal	Metalaxyl (0.08 lb AI/gal)	Fungicide		covered smut
Rate:	4.6 fl oz/Cwt	**Crops**			
Standard Rate:	4.6 fl oz/Cwt	barley, oats, rye, triticale, and wheat			
Coverage:	May dilute w/H_2O				
Package Size:	2x2.5, 1x200				
Units Treated:	27.8 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Stamina F4 Cereals

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**7969-399**	**Active Ingredients**	**Type**	**Small Grain Diseases:**	**Additional Barley Diseases:**
Product Type:	Fungicide stand-alone	Pyraclostrobin (0.14 lb AI/gal)	Fungicide	common bunt, flag smut, *Fusarium* seed rot, *Fusarium* seedling blight, loose smut, *Pythium* damping-off, *Rhizoctonia* root rot	dry seed decay, false loose smut, true loose smut
Application Type:	Commercial/On-farm	Triticonazole (0.14 lb AI/gal)	Fungicide		**Additional Oat Diseases:**
Density:	8.92 lb/gal	Metalaxyl (0.081 lb AI/gal)	Fungicide		covered smut
Rate:	4.6 fl oz/Cwt	Fluxapyroxad (0.071 AI/gal)	Fungicide		
Standard Rate:	4.6 fl oz/Cwt	**Crops**			
Coverage:	May dilute w/ H_2O	barley, oats, rye, triticale, and wheat			
Package Size:	2x2.5, 1x200				
Units Treated:	27.8 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

TebuStar 250 ST

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**42750-130**	**Active Ingredients**	**Type**	**Wheat: 0.10 fl oz/Cwt**	**Oats: 0.10 fl oz/Cwt**
Product Type:	Fungicide—Component	Tebuconazole (2.5 lb AI/gal)	Fungicide	stinking smut, flag smut, loose smut, early season *Septoria*, *Rhizoctonia* root rot, common root rot, *Fusarium* foot rot, powdery mildew, and wheat leaf rust	loose smut, *Pythium* damping-off, early season *Rhizoctonia* root rot, common root rot, *Fusarium* foot rot, powdery mildew, crown rust
Application Type:	Commercial	**Crops**		**Barley: 0.10 fl oz/Cwt**	
Density:	8.9 lb/gal	wheat, barley, and oats		covered smut, loose smut, barley stripe (suppression), early season *Rhizoctonia* root rot, common root rot, *Fusarium* foot rot, suppression of powdery mildew and barley leaf rust	
Rate:	0.1 fl oz/Cwt				
Standard Rate:	0.1 fl oz/Cwt				
Coverage:	Uniform coverage				
Package Size:	4x1, 2x2.5				
Units Treated:	1,280 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

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Thiabendazole 4L ST

General Information		Agronomic Information		Target Pests
EPA Reg #:	**42750-226**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Auxiliary	Thiabendazole (4.0 lb AI/gal)	Fungicide	*Ascochyta* blight
Application Type:	Commercial	**Crops**		
Density:	9.6 lb/gal	wheat, barley, and oats		
Rate:	Varies by crop			
Standard Rate:	1.05 fl oz/Cwt–lentil			
Coverage:	Uniform coverage			
Package Size:	2x2.5			
Units Treated:	122 Cwt/gal			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

Trilex 2000

General Information		Agronomic Information		Target Pests
EPA Reg #:	**264-1068**	**Active Ingredients**	**Type**	**Diseases:**
Product Type:	Fungicide—Stand-alone	Trifloxystrobin (0.64 lb AI/gal)	Fungicide	*Alternaria* spp., *Aspergillus* spp. *Cladosporium* spp., *Penicillium* spp., *Rhizoctonia solani*, *Fusarium* spp., *Pythium* spp.
Application Type:	Commercial	Metalaxyl (0.51 lb AI/gal)	Fungicide	
Density:	9.01 lb/gal	**Crops**		Suppression of: *Phytophthora* seed and root rot
Rate:	Varies by crop	corn, cotton, soybeans, edible and succulent beans, and rice		
Standard Rate:	1.0 fl oz/Cwt—soybean			
Coverage:	Not stated			
Package Size:	2x2.5, 15's			
Units Treated:	128 Cwt/gal			
Colorant:	Colored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

Trilex Advanced

General Information		Agronomic Information		Target Pests
EPA Reg #:	**264-1069**	**Active Ingredients**	**Type**	**Cotton:**
Product Type:	Fungicide—Add-on	Trifloxystrobin (0.83 lb AI/gal)	Fungicide	seed-borne fungi causing seed decay and soil-borne pathogens such as *Fusarium, Rhizoctonia, Pythium*, *Thielaviopsis basicola* (suppression)
Application Type:	Commercial	Metalaxyl (1.25 lb AI/gal)	Fungicide	
Density:	9.76 lb/gal	Triadimenol (0.42 lb AI/gal)	Fungicide	
Rate:	1.6 fl oz/Cwt	**Crops**		
Standard Rate:	1.6 fl oz/Cwt—cotton	cotton		
Coverage:	Uniform coverage			
Package Size:	5x32 oz, 15's			
Units Treated:	80 Cwt/gal			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

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Trunemco

General Information		Agronomic Information		Target Pests
EPA Reg #:	**55146-162**	**Active Ingredients**	**Type**	**Soil Nematodes, such as:**
Product Type:	Nematicide	*Bacillus amyloliquefaciens* strain MBI 600 cis-Jasmone Contains a minimum of 2.0 x 109 colony forming units per mL	Nematicide	dagger nematode lance nematode needle nematode pin nematode ring nematode root knot nematode root lesion nematode spiral nematode sting nematode stubby root nematode stunt nematode columbia lance nematode reniform nematode soybean cyst nematode
Application Type:	Commercial	**Crops**		
Density:	8.73	corn, cotton, and soybeans		
Rate:	0.06–0.31 fl oz per Cwt			
Standard Rate:	0.20 fl oz/Cwt			
Coverage:	Provide uniform coverage			
Package Size:	4x1			
Units Treated:	1280 units per gallon			
Colorant:	Uncolored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			

Vibrance

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**100-1374**	**Active Ingredients**	**Type**	**Small Grain Diseases:**	**Soybean and Canola Diseases:**
Product Type:	Fungicide—Add-on	Sedaxane (4.3 lb AI/gal)	Fungicide	true loose smut caused by *Ustilago nuda*, seed decay, seedling blight and damping-off caused *Rhizoctonia solani*, loose smut caused by *Ustilago triticale*	seed decay, seedling blight and damping-off caused by *Rhizoctonia solani*
Application Type:	Commercial	**Crops**			
Density:	9.76 lb/gal	barley, canola, oat, rye, soybean, triticale, and wheat			
Rate:	0.08–0.16 fl oz/Cwt				
Standard Rate:	0.08 fl oz/Cwt				
Coverage:	Provide uniform coverage				
Package Size:	4x1 qt, 4x1, 1x15				
Units Treated:	160 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

Vibrance Extreme

General Information		Agronomic Information		Target Pests	
EPA Reg #:	**100-1382**	**Active Ingredients**	**Type**	**Diseases:**	**Suppression of:**
Product Type:	Fungicide—Stand-alone	Sedaxane (0.155 lb AI/gal)	Fungicide	general seed rots, seedling blight, root rot, damping-off caused by seed- and soil-borne *Fusarium* spp. or *Rhizoctonia* spp. seedling blight, root rot, damping-off caused by soil-borne *Pythium* spp., seed-borne *Septoria*, covered smut false loose smut, true loose smut, common bunt, dwarf bunt, karnal bunt, flag smut, *Fusarium* seed scab, loose smut, *Pythium* damping-off	common root rot, *Fusarium* crown and foot rot, take-all
Application Type:	Commercial	Mefenoxam (0.138 lb AI/gal)	Fungicide		
Density:	9.31 lb/gal	Difenoconazole (0.552 lb AI/gal)	Fungicide		
Rate:	2.8–5.6 fl oz/Cwt	**Crops**			
Standard Rate:	2.8 fl oz/Cwt	barley, oats, rye, triticale, and wheat			
Coverage:	Provide uniform coverage				
Package Size:	2x2.5, 1x30, 1x110				
Units Treated:	45.7 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

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Product	Temp. (°F)	Density (g/mL)	Weight (lb/gal)
Apron Maxx + Moly 15	NTR	1.17	9.76
Apron Maxx RFC	NTR	1.08	9.01
Apron Maxx RTA	NTR	1.04	8.68
Apron XL	NTR	1.11	9.26
Armis FI	32	1.14	9.51
Artect	32	1.03	8.6
Artect FI	32	1.05	8.76
Aveo EZ	NTR	1.21	10.06
Avipel	32	1.16	9.67
Captan 4L	NTR	1.2	10.01
Centynal	NTR	1.04	8.68
Centynal EC	NTR	1.05	8.76
Charter F2	NTR	1.07	8.93
CHS Unlocked	32	1.06	8.85
Clariva Elite Bean	NTR	1.09	9.09
Cruiser 5FS	NTR	1.3	10.85
CruiserMaxx	NTR	1.14	9.51
CruiserMaxx APX	NTR	1.12	9.35
CruiserMaxx Cereals	NTR	1.16	9.68
CruiserMaxx Potato	NTR	1.19	9.93
CruiserMaxx Potato Extreme	NTR	1.19	9.93
CruiserMaxx Vibrance	NTR	1.15	9.6
CruiserMaxx Vibrance Cereals	NTR	1.11	9.26
CruiserMaxx Vibrance Potatoes	NTR	1.15	9.6
Diacon IGR	NTR	0.85	7.1
Diacon IGR Plus	NTR	1.04	8.68
Difenoconazole 3L ST	NTR	1.1	9.18
Dividend Extreme	NTR	1.19	9.93
Dynasty	NTR	1.03	8.6
Emesto Silver	NTR	1.07	8.93
EverGol Energy	NTR	1.07	8.93
Gaucho 600 FS	32	1.23	10.26
Gaucho XT	32	1.12	9.35
Halifax FnI	32	1.14	9.51
ILeVO	14	1.24	10.35
Intego Fungicide CB	NTR	1.12	9.34
Intego Suite Soybeans	32	1.14	9.51
Lumisena	NTR	1.07	8.92
Macho 600 ST	32	1.18	9.85
Maxim 4FS	NTR	1.19	9.93
Mertect 340F	32	1.16	9.68
NipSit Inside	NTR	1.28	10.68
NipSit Suite Cereals	NTR	1.05	8.76
NipSit SUITE Rice System	NTR	1.28	10.68

Product	Temp. (°F)	Density (g/mL)	Weight (lb/gal)
Obvius Plus	NTR	1.12	9.34
Obvius	NTR	1.06	8.85
Rancona 3.8 FS	32	1.1	9.18
Rancona Crest	32	1.09	9.1
Rancona Crest WR	32	1.05	8.76
Rancona Pinnacle	32	1.06	8.85
Rancona Summit	32	1.06	8.85
Rancona V RTU FS	32	1.06	8.85
Raxil Pro MD	NTR	1.04	8.68
Raxil Pro Sheild	NTR	1.08	9.01
Recover PO4	68	1.04	8.68
Redigo 480	NTR	1.18	9.85
Relenya	NTR	1.15	9.59
Resonate 600 ST	32	1.2	10.01
Rizolex	NTR	1.19	9.92
Salient 372 FS	NTR	1.12	9.35
Salient TMI	NTR	1.07	8.92
Saltro	NTR	1.17	9.76
Sativa 309 FS	NTR	1.09	9.1
Sativa IM RTU	NTR	1.01	8.43
Sativa IMF Max	32	1.07	8.93
Sativa IMF Sembolite Max	32	1.08	9.01
Sativa M RTU	NTR	1.01	8.43
Sativa M2F RTU	32	1.03	8.6
Sebring 318 FS	NTR	1.06	8.85
Sebring 480 FS	NTR	1.09	9.1
Senator 600 FS	32	1.28	10.68
Signet 480 FS	32	1.16	9.68
Spirato 480 FS	32	1.19	9.93
Spirato IMTM 348 FS	NTR	1.173	9.78
Spirato M185 FS	NTR	1.068	8.91
Spirato MTM 285 FS	32	1.1	9.2
Stamina	NTR	1.09	9.1
Stamina F3 Cereals	32	1.07	8.93
Stamina F4 Cereals	NTR	1.07	8.92
Storcide II	NTR	0.99	8.26
Teraxxa	NTR	1.15	9.64
Teraxxa F4	NTR	1.08	9.01
Thiabendazole 4L ST	32	1.14	9.51
Trilex 2000	NTR	1.08	9.01
Trilex Flowable FS	NTR	1.09	9.1
Trunemco	NTR	1.05	8.76
Vibrance	NTR	1.17	9.76
Vibrance Extreme	NTR	1.13	9.43

*This chart is for quick reference only. All other trademarks and registrations listed in this reference chart remain the property of their respected owners.

Soybean Liquid Inoculants

Company	Product	Market	Action	Active Ingredient	Viable Cells/gram	Rate (oz/Cwt)	Package Size	Units Treated (50 lb)	Shelf Life	Survivability: Bare Seed	Survivability: With Seed Treat	Comments
BASF	Vault IP Plus	Retailer	Multiple	*Bradyrhizobium japonicum)* *Bacillus amyloliquefaciens (MBI600) + Bacillus subtilis*	1.0×10^{10}	1.1	2×4x50 4×200	400 800	1-yr	60 days	60 days	3 MOA including rhizobia, growth enhancer and INTERGAL biofungicide. See label for seed treatment compatibility.
BASF	Vault NP	Retailer and On-Farm	Single	*Bradyrhizobium japonicum*	3×10^{9}	4.2	4×50 1×200	200 200	1-yr	30 days	2–30 days	See label for seed treatment compatibility.
Lallemand	BYSI-N	Retailer and On-farm	Single	*Bradyrhizobium japonicum*	4.0×10^{9}	3.4	4x50 1x200	200 200	2-yr	30 days	14–30 days	See label for seed treatment compatibility.
Lallemand	LALFIX PROYIELD	Retailer	Multiple	*Bradyrhizobium elkanii* *Delftia acidovorans*	1.0×10^{10} 1.0×10^{7}	1.5	1×400 4×100	400 400	1-yr	90 days	90 days	All-in-one formulation multi-action inoculant. Plant Growth Promoting Rhizobacteria.
Novozymes BioAG	Optimize FXC DS	Retailer	Multiple	*Bradyrhizobium japonicum* *Lipo-chitooligosaccharide (LCO)*	1×10^{10} $2.66\times10^{-5\%}$	1.5	5×2×40 1×400	400 400	1-yr	120 days	120 days	2-part mix with LCO technology.
Novozymes BioAG	TagTeam LCO XC	Retailer	Multiple	*Bradyrhizobium japonicum* *Penicillium bilaii* *Lipo-chitooligosaccharide (LCO)*	1.0×10^{10} 7.2×10^{8} 1.0×10^{7}	1.5	5×2×40 1×400	400 400	1-yr	120 days	120 days	3-part mix with LCO technology.
Novozymes BioAG	Cell-Tech	Retailer and On-farm	Single	*Bradyrhizobium japonicum*	2.0×10^{9}	2.1	4×50	200	2-yr	4 days	4 hrs–4 days	See label for seed treatment compatibility.
Verdesian	Preside CL	Retailer and On-farm	Multiple	*Bradyrhizobium japonicum* *Glutamate Proline Citric Acid*	2×10^{10}	2.5	4×50 2×200 1×400	200 400 400	1-yr	120 days	120 days	See label for seed treatment compatibility.

Soybean Granular Inoculants

Company	Product	Market	Action	Active Ingredient	Viable Cells/gram	Rate (oz/Cwt)	Package Size	Units Treated (50 lb)	Shelf Life	Survivability: Bare Seed	Survivability: With Seed Treat	Comments
BASF	Rhizo Flo	On-farm	Single	*Bradyrhizobium japonicum*	1×10^{8}	2.5 lb/A (drilled)	1×40 1×520	6 78	1-yr	N/A	N/A	See label for proper row spacing rate.
Lallemand	LALFIX Start Spherical	On-farm	Multiple	*Bradyrhizobium elkanii* *Bacillus velezensis*	1×10^{8} 5.0×10^{7}	0.9 lb/A	27 432	30 480	1-yr	N/A	N/A	See label for proper row spacing rate.
Novozymes BioAG	Tag Team	On-farm	Multiple	*Bradyrhizobium japonicum* *Penicillium bilaii*	1×10^{8} 1.0×10^{5}	1.4 lb/A	36.4	26	1-yr	N/A	N/A	See label for proper row spacing rate.

Soybean Peat Inoculants

Company	Product	Market	Action	Active Ingredient	Viable Cells/gram	Rate (oz/Cwt)	Package Size	Units Treated (50 lb)	Shelf Life	Survivability: Bare Seed	Survivability: With Seed Treat	Comments
BASF	Vault SP	On-farm	Single	*Bradyrhizobium japonicum*	3×10^{9}	2.8	10×20	200	1-yr	24 hrs	24 hrs	
Novozymes BioAG	Cell-Tech NS	On-farm	Single	*Bradyrhizobium japonicum*	2.0×10^{9}	3.0 oz/ 55 lb	4×30	120	1-yr	48 hrs	48 hrs	
Lallemand	LALFIX Peat	On-farm	Single	*Bradyrhizobium elkanii*	4×10^{9}	1.4 oz/ 50 lb	6×42	180	1-yr	48 hrs	24 hrs	

Pea and Lentil Liquid Inoculants

Company	Product	Market	Action	Active Ingredient	Viable Cells/gram	Rate (oz/Cwt)	Package Size	Units Treated (50 lb)	Shelf Life	Survivability: Bare Seed	Survivability: With Seed Treat	Comments
BASF	Nodulator	Retailer and On-farm	Single	*Rhizobium leguminosarum bv. viciae*	7.5×10^8	2.5 oz/ 60 lb	4×1.2 gal	14,600	1-yr	6–8 hrs	0–8 hrs	See label for seed treatment compatibility.
Novozymes BioAG	TagTeam LCO	Retailer and On-farm	Multiple	*Rhizobium leguminosarum* *Penicillium bilaii* *Lipo-chitooligosaccharide (LCO)*	7.2×10^8 7.2×10^8 1×10^7	2.5	4×30 L (sold out) 9.8 L (limited supply)	9,600 (sold out) 7,800 (limited supply)	1-yr	48 hrs	0–24 hrs	See label for seed treatment compatibility.
Novozymes BioAG	Cell-Tech	Retailer and On-farm	Single	*Rhizobium leguminosarum*	2.0×10^9	2.5	1×9.8 L	7,800	1-yr	48 hrs	0–24 hrs	See label for seed treatment compatibility.
Lallemand	LALFIX Liquid	Retailer and On-farm	Single	*Rhizobium leguminosarum bv. viciae*	8×10^8	2.5	416 oz	10,000	1-yr	48 hrs	48 hrs	See label for seed treatment compatibility.

Pea and Lentil Granular Inoculants

Company	Product	Market	Action	Active Ingredient	Viable Cells/gram	Rate (oz/Cwt)	Package Size	Units Treated (50 lb)	Shelf Life	Survivability: Bare Seed	Survivability: With Seed Treat	Comments
BASF	Nodulator Duo SCG	On-farm	Multiple	*Rhizobium leguminosarum bv. Viciae* *Bacillus subtilis*	8.0×10^7 2.0×10^8	3.3 lb/ac	40 520	6.1 80.0	1-yr	N/A	N/A	Rates vary by row spacing. See label for row spacing and corresponding rate/A.
Lallemand	LALFIX Start Spherical	On-farm	Multiple	*Rhizobium leguminosarum bv. Viciae* *Bacillus velezensis*	1.0×10^8 5.0×10^7	2.7	27 432	10 160	1-yr	N/A	N/A	Rates vary by row spacing. See label for row spacing and corresponding rate/A.
Novozymes BioAG	Cell-Tech	On-farm	Single	*Rhizobium leguminosarum*	1.3×10^8	4.0	39.7 1,000.9	9.93 250.23	1-yr	N/A	N/A	Rates vary by row spacing. See label for row spacing and corresponding rate/A.

Pea and Lentil Peat Inoculants

Company	Product	Market	Action	Active Ingredient	Viable Cells/gram	Rate (oz/Cwt)	Package Size	Units Treated (50 lb)	Shelf Life	Survivability: Bare Seed	Survivability: With Seed Treat	Comments
BASF	Nodulator SA	On-farm	Single	*Rhizobium leguminosarum*	1×10^9	1,300 lb/ pack	5×42 oz	6,500	1-yr	24 hrs	0–24 hrs	See label for seed treatment compatibility.
Lallemand	LALFIX Peat	On-farm	Single	*Rhizobium leguminosarum bv. viciae*	1×10^9	1,500 lb/ pack	6×42 oz	9000	1-yr	24 hrs	24 hrs	See label for seed treatment compatibility.
Novozymes BioAG	Cell-Tech NS	On-farm	Single	*Rhizobium leguminosarum*	2.0×10^9	1,500 lb/ pack	4×6.75 lb	6,000	1-yr	48 hrs	6–48 hrs	See label for seed treatment compatibility.
Verdesian	N-Charge Field Pea/ Lentil	On-farm	Single	*Rhizobium leguminosarum bv. viciae*	2.0×10^8	1,500 lb/ pack	6×4.11 lb	9,000	1-yr	24 hrs	N/A	See label for seed treatment compatibility.

Chickpea Granular Inoculants

Company	Product	Market	Action	Active Ingredient	Viable Cells/gram	Rate (oz/Cwt)	Package Size	Units Treated (50 lb)	Shelf Life	Survivability: Bare Seed	Survivability: With Seed Treat	Comments
BASF	Nodulator Clay	On-farm	Single	*Bradyrhizobium sp. (Cicer)*	8×10^7	5.0 lb/ac	1×50	10.0	1-yr	N/A	N/A	Rates vary by row spacing. See label for row spacing and corresponding rate/A.
Lallemand	LALFIX Start Spherical	On-farm	Multiple	*Mesorhizobium cicero* *Bacillus velezensis*	1.0×10^8 5.0×10^7	2.7	27 432	10 160	1-yr	N/A	N/A	Rates vary by row spacing. See label for row spacing and corresponding rate/A.
Novozymes BioAG	TagTeam	On-farm	Multiple	*Mesorhizobium cicero* *Penicillium bilaii*	1.0×10^8	3.6	1×36.4	10.0	1-yr	N/A	N/A	Rates vary by row spacing. See label for row spacing and corresponding rate/A.

Chickpea Peat Inoculants

Company	Product	Market	Action	Active Ingredient	Viable Cells/gram	Rate (oz/Cwt)	Package Size	Units Treated (50 lb)	Shelf Life	Survivability: Bare Seed	Survivability: With Seed Treat	Comments
Novozymes BioAG	TagTeam	On-farm	Multiple	*Mesorhizobium cicero* *Penicillium bilaii*	8×10^7	1.31	7×4.8 lb	21,000	1-yr	6 hrs	4–6 hrs	
Lallemand	LALFIX Peat	On-farm	Single	*Mesorhizobium ciceri*	1×10^9	1.4	6×42 oz	9,000	1-yr	24 hrs	24 hrs	

Dry Bean Peat Inoculants

Company	Product	Market	Action	Active Ingredient	Viable Cells/gram	Rate (oz/Cwt)	Package Size	Units Treated (50 lb)	Shelf Life	Bare Seed	With Seed Treat	Comments
Lallemand	LALFIX Peat	On-farm	Single	*Rhizobium tropici*	1×10^9	1.4	6×42 oz	9,000	1-yr	24 hrs	24 hrs	

Peanut Liquid Inoculants

Company	Product	Market	Action	Active Ingredient	Viable Cells/gram	Rate (oz/Cwt)	Package Size	Units Treated (50 lb)	Shelf Life	Bare Seed	With Seed Treat	Comments
Lallemand	LALFIX Liquid	On-farm	Single	*Bradyrhizobium spp.*	2.0×10^9	15 oz/ac	4 x 1.1 gal	40 ac	1-yr	N/A	N/A	
BASF	Vault Integral	On-farm	Single	*Bradyrhizobium vigna*	2.0×10^9	14 oz/ac	4 x 1.1 gal	40 ac	1-yr	N/A	N/A	

Biologicals

Company	Product	Market	Action	Active Ingredient	Viable Cells/gram	Rate (oz/Cwt)	Package Size	Units Treated (50 lb)	Shelf Life	Bare Seed	With Seed Treat	Comments
Brett Young	*Recover PO4	Commercial	Single	*Penicillium bilaii*	7.2×10^8	*See table	4×100 mL 2 L	*See table	1-yr	15–30 days	15–30 days	Varies by crop.
Lallemand	BioBoost Liquid	Retailer and On-farm	Single	*Delftia acidovorans*	1.0×10^8	8.8 oz. Acre	2.75 gal	40	1-yr	N/A	N/A	Tank mix with herbicide early post and pre.
Novozymes Bio Ag	*JumpStart	Commercial	Single	*Penicillium bilaii*	7.2×10^8	*See table	2.0 oz 14 oz	N/A	1-yr	7–60 days	Varies by crop	See label for specific crops and table.
Novozymes Bio Ag	*JumpStart LCO	Commercial	Multiple	*Penicillium bilaii* *Lipo-chitooligosaccharide (LCO)*	N/A	See label	2×10 oz Btl + 150 fl oz Jug	N/A	1-yr	N/A	N/A	See label for specific crops and table.
Novozymes Bio Ag	Quickroots (PB) Corn	Commercial	Multiple	*Bacillus amyloliquefaciens* *Trichoderma virens*	2.5×10^9 5×10^8	16 g per 80,000 kernels	10×25 units 1×200 units	units = 80,000 kernels	1-yr	N/A	N/A	**PB = Planter Box**
Novozymes Bio Ag	Quickroots (WP) Corn	Commercial	Multiple	*Bacillus amyloliquefaciens* *Trichoderma virens*	2.5×10^9 5×10^8	Varies based on dilution	10×25 units 1×600 units	units = 80,000 kernels	1-yr	N/A	N/A	**WP = Wettable Powder**
Novozymes Bio Ag	Quickroots (PB) Soybeans	Retailer and On-farm	Multiple	*Bacillus amyloliquefaciens* *Trichoderma virens*	5×10^8 5.7×10^7	17.6 g/Cwt	440 g pouch	500	2-yr	N/A	N/A	**PB = Planter Box**
Novozymes Bio Ag	Quickroots (WP) Soybeans	Retailer and On-farm	Multiple	*Bacillus amyloliquefaciens* *Trichoderma virens*	3×10^8 3.0×10^7	8 g/Cwt	200 g spoutpak	500	2-yr	N/A	N/A	**WP = Wettable Powder**
Novozymes Bio Ag	Quickroots (PB) Wheat	Commercial	Multiple	*Bacillus amyloliquefaciens* *Trichoderma virens*	2.5×10^9 5×10^8	5 g/bu	10×100 bu 1×1,000 bu	N/A	1-yr	N/A	N/A	**PB = Planter Box**
Novozymes Bio Ag	Quickroots (PB) Wheat	Commercial	Multiple	*Bacillus amyloliquefaciens* *Trichoderma virens*	2.5×10^9 5×10^8	5 g/bu	10×100 bu 1×1,000 bu	N/A	1-yr	N/A	N/A	**PB = Planter Box**

Recover PO_4

	Crop 400 ml 2L								
Lallemand	Seed Inoculated Approx.			Water Volume	Seed Inoculated Approx.		Water Volume		Planting Window
	Lbs	Kgs	Gallons	Liters	Lbs	Kgs	Gallons	Liters	Days
Alfalfa	875	400	2.0	8	4,375	2,000	10	40	15
Canola	800	360	2.0	8	4,000	1,800	10	40	60
Chickpea	19,000	8,720	6.5	24	95,000	43,600	33	120	15
Corn	60	80,000	5.5	20	300	80,000	28	100	30
Dry bean	13,500	6,125	5.5	20	67,500	30,625	28	100	15
Lentils	13,500	6,125	5.5	20	67,500	30,625	28	100	15
Peas	24,000	10,900	8.5	32	120,000	54,500	43	160	15
Soybean	275	140,000	5.5	20	1,375	140,000	28	100	30
Wheat	13,500	6,125	10.5	40	67,500	30,625	53	200	30

Jumpstart

	Crop 2 oz 14 oz				
Novozymes Bio Ag	Seed Inoculated Approx.			Water Volume	Planting Window
	Lbs	Kgs	Gallons	Liters	Days
Corn	80,000	10	50		
Soybean	2,500	3.5	17,500	26.5	30
Wheat	2,400	7.2	16,800	50.5	30
Canola	140	1.5	980	11.0	60
Chickpea	3,300	4.0	23,100	31.0	30
Dry Bean	2,400	3.5	16,800	26.5	30
Lentil	2,400	3.5	16,800	26.5	30
Pea	4,200	6.0	29,400	41.0	30
Sugarbeet	5	1.0	35	6.5	7
Sunflower	230	2.0	1,610	15.0	30

*Planting window for when Recover PO_4, Jumpstart, or Jumpstart LCO is applied to bare seed

Nematicide

Company	Product*	Active Ingredient	AI Type	Market/ Signal Word	Crop	Rate	Package Size	Units (50#)	Nematode controlled
Albaugh	BIOst Nematicide 100	Heat killed *Burkholderia rinojensis*	Biological	Retailer Caution	Soybean	3.0 fl oz/Cwt	2x2.5 gal	426	Soybean cyst, root-knot, reniform nematodes
BASF	ILeVO	*Fluopyram*	Synthetic	Retailer Caution	Soybean	1.2–3.94 fl oz/Cwt	2x2.5 gal 15 gal	1,066 3,200	Soybean cyst, root-knot, reniform nematodes
BASF	Poncho/VOTiVO	Clothianidin, *Bacillus firmus*	Synthetic, Biological	Retailer Caution	Multiple	1.02–6.13 fl oz/Cwt	2x2.5 gal	1,280	Soybean cyst, root-knot, reniform nematodes
Nufarm	Trunemco	*Bacillus Amyloliquefaciens* Cis-Jasmone	Biological	Retailer Caution	Corn, Soybean, Cotton	0.004–0.059 mg per seed	4x1 gal	4,266	All nematodes
Syngenta	Avicta 500FS	Abamectin	Synthetic	Retailer Caution	Soybean, Cotton	0.10–0.15 mg per seed	15 gal	960	Soybean cyst nematode
Syngenta	Clariva pn	*Pasteuria nishizawae* PN1	Biological	Retailer Caution	Soybean, Sugarbeet	0.034–3.0 fl oz/Cwt	1x2.5 gal	640	Soybean cyst, sugarbeet cyst nematodes
Syngenta	Saltro	Pydiflumetofen	Synthetic	Retailer Caution	Rapeseed, Soybean	1.23–1.52 fl oz/Cwt	2x2.5 gal 15 gal	1,040 3,122	All nematodes
Valent USA	Aveo EZ	*Bacillus amyloliquefaciens*	Biological	Retailer Caution	Corn, Soybean	0.2 fl oz/Cwt	4x1 gal	1,280	Soybean cyst, root-knot, reniform nematodes

*See label for seed treatment compatibility and WPS

This chart is for quick reference only.

A symbiotic relationship exists between soybean and rhizobium bacteria that growers can take advantage of in order to increase nitrogen availability. Rhizobium bacteria invade root hairs of seedlings upon germination and in response, the soybean plant builds nodules on the roots to house the rhizobia. In these nodules, the bacteria fix nitrogen for the soybean crop and in return are provided with nutrients and sugar by the plant. Most soybean crops would become nitrogen deficient without rhizobium bacteria to fix about half of the nitrogen they need throughout the season. Considering that soybeans required about 5 lbs. of nitrogen to produce each bushel of grain, nitrogen fixation by rhizobium bacteria is truly an agronomic and economic gift of nature. Although native rhizobia populations are present in soils, they still undergo selection pressure for survivability and become less vigorous and reliable overtime. Therefore, inoculants should be used to ensure that additional, vigorous rhizobia are present to maximize nitrogen fixation.

Factors to Consider for Inoculation

- **Soybeans were last planted.** Inoculation is highly recommended to maximize yield potential, if it has been several years since soybeans were last grown (i.e. CRP acres or fields that have been in continuous corn for several years). In these instances, it is unlikely that the correct rhizobia will be present in soils or that rhizobia populations have been depleted.
- **Non-optimal pH.** Low soil pH can decrease nodulation, nitrogen fixation, and survivability of rhizobia. Optimal pH is 6.0–7.0 and a pH significantly outside this range (< 5.0 or > 8.0) can decrease the formation of nodules.
- **Flood or Drought.** Flooding results in anaerobic soil conditions that can kill native rhizobia. Therefore, when planting into wet soils, a rhizobial inoculant is recommended for successful nodulation. Sandy soils and droughts in years where soybeans are not being grown can also lower rhizobia populations.



Soybean roots with nitrogen-fixing root nodules (David Herridge)

Benefits of Inoculation

- Average yield increase of 2 bu/A in low-rhizobia soil
- Increases nodulation, nitrogen fixation, and post-crop soil nitrate levels
- Profitable activity
- Virtually eliminates the need for commercial nitrogen fertilizer

Liquid Inoculant Products

Company	Product	Active Ingredient	Rate	Survivability			Comments
				shelf life	bare seed	w/seed treat	
Lallemand	**Lalfix ProYield**	*Bradyrhizobium Elkanii* *Delftia Acidovorans*	1.5 fl oz/Cwt	1-yr	90 days	90 days	All-in-one formulation multi-action inoculant. Plant Growth Promoting Rhizobacteria (PGPR).
Lallemand	**BYSI-N**	*Bradyrhizobium japonicum*	3.4 fl oz/Cwt	1-yr	60 days	60 days	All-in-one formulation multi-action inoculant. Plant Growth Promoting Rhizobacteria (PGPR).
BASF	**Vault HP**	*Bradyrhizobiumjaponicum* *Growth Enhancer* *Integral Biofungicide*	2.0 fl oz/Cwt	1-yr	120 days	2–120 days	3-part mix with rhizobia growth enhancer and INTERGAL biofungicide. See label for seed treatment compatibility.
Novozymes BioAg	**TagTeam LCO XC**	*Bradyrhizobium japonicum* *Penicillium bilaii* *Lipo-chitooligosaccharide*	1.5 fl oz/Cwt	1-yr	120 days	120 days	3-part mix with LCO technology.
Novozymes BioAG	**Optimize FXC DS**	*Bradyrhizobium japonicum* *Lipo-chitooligosaccharide*	1.5 fl oz/Cwt	1-yr	120 days	120 days	2-part mix with LCO technology.

Rhizoctonia Management Strategies

Rhizoctonia infections to sugarbeet can lead to direct losses to grower root yield and quality in addition to losses related to beet storage issues. Managing Rhizoctonia requires an integrated approach involving multiple control strategies including seed treatment, soil and/or POST applied fungicides. Ask your local sugarbeet Ag-Staff for specific recommendations.

Industry Fungicide Strategies and Best Management Practices:

1. Variety selection is the most important Rhizoctonia management strategy.
2. Quadris®, Aframe®, Headline®, Proline®, Priaxor®, Azterknot®, Excalia® and AZteroid® are currently labeled fungicides providing Rhizoctonia control/suppression when used in accordance with the label.
3. T-banded fungicide applications of labeled products have provided good control.
4. In-furrow applications can be effective but may have specific precautions (see below).
5. Both application timings may be desirable when Sugarbeet varieties are susceptible to Rhizoctonia.
6. POST band applications of Quadris®, Priaxor®, Azterknot® or Excalia® fungicides have been effective when applied at or prior to average daily 4″ soil temperatures of 65 F° (approximately 6 to 8-leaf stage).
7. Excalia® is labeled for broadcast applications at 6 to 8-leaf stage Sugarbeets.
8. Sugar cooperative research data suggests that Proline® can provide suppression of Rhizoctonia applied to beets when the soil temperature reaches 65 F° or if applied early season for Cercospora leaf spot control. The use of good adjuvant systems, such as CHS Endurium, Parachute II or CHS Acuvant can increase coverage or deposition of Proline®, increasing its effectiveness.
9. Relatively new seed treatment products are also available to offer control and/or suppression to early Rhizoctonia infections. Seed treatment fungicides do not provide season-long suppression and are not considered to be a stand-alone strategy without an additional application of a POST fungicide and/or use of resistant varieties under heavy Rhizoctonia pressure.

Mixing Concerns and Strategies For Rhizoctonia Fungicide Products:

1. Consult with Beet Sugar Cooperative personnel for specific information and recommendations involving mixing certain fungicides with starter fertilizers for potential compatibility and phytotoxicity issues.
2. Issues relating to fungicide application, mixing, or phytotoxicity are associated with product formulation. SC formulations have greater risk of mixing and compatibility issues.
3. Research indicates that Quadris® alone, applied in-furrow, may impact sugarbeet emergence or may cause seedling injury when applied in-furrow with liquid fertilizer.
4. If mixing a fungicide with CHS Lumen or any other phosphorus-based fertilizers, consider using AZteroid®. AZteroid® is a fertilizer compatible formulation of azoxystrobin.
5. Unload or empty out fungicide and fertilizer tank mixes within ~ 4 hours of mixing. Do not allow tank mix to sit without agitation for extended time periods.
6. Fertilizer starters may fluctuate in quality and analysis which can magnify mixing difficulties.

Always read and follow label directions relating to precautions, rates, premixing instructions, and tank-mixing procedures prior to use.





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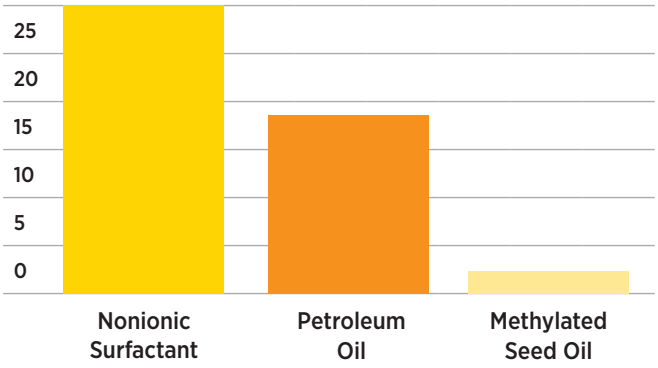
Spring Burndown

In many reduced and no-till fields it is essential to apply herbicides with foliar activity before crop emergence to control existing weeds that have emerged. It is also extremely important to include a soil residual preemerge to prevent early season weeds from emerging. The chart on the following pages includes some of the more common herbicides that are used in spring burndown as well as other important information including rates, adjuvant recommendations and plant back restrictions.

Adjuvants

Using the correct adjuvant in a burndown application is extremely important due to cool and less than optimal growing conditions early in the spring. Since there is no concern for crop response in burndown applications it is a good idea to use the "hottest" adjuvant available. This is especially true for the burndown herbicides that have contact activity like Sharpen, Valor, Spartan and their pre-mix combinations. Adjuvants that include at least 60% of a crop oil concentrate, (CHS Penetrec) or Methylated Seed oil (CHS Aggrestrol) typically increase weed control as compared to non-ionic Surfactants (CHS Hypertonic) in most applications.

Time (hours) taken for various adjuvants to dissolve epicuticular wax of giant foxtail



Glyphosate: Glyphosate is still effective on many annual and perennial broadleaf and grass weeds making it a key component of many burndown programs. The addition of 2,4-D ester greatly improves control of broadleaf weeds like marestail.

2,4-D Ester / Dicamba: 2,4-D and dicamba have similar activity and are effective for controlling many broadleaf weed species. Dicamba is typically slightly better on marestail. 2,4-D or dicamba should be used in combination with other herbicides like glyphosate, gramoxone or Sharpen for complete control of emerged weeds.

Glufosinate: Glufosinate, or Liberty, is a contact herbicide that can be used to control small emerged weeds. glufosinate should be tank mixed with 2,4-D and metribuzin for optimal control.

Metribuzin: Metribuzin is a constituent of many pre-mix herbicides, increasing the burndown activity for these pre-mix herbicide combinations on many annual weeds like horseweed (marestail).

Saflufenacil: Saflufenacil or Sharpen, is a contact and residual herbicide that has activity on annual broadleaf weeds like marestail. Saflufenacil must be applied with another burndown herbicide like glyphosate for optimal control. Saflufenacil must also be applied with an MSO adjuvant like CHS Aggrestrol @ 0.5 % v/v plus 8.5 lb/100 gal AMS or UAN @ 1.25 gal/100. Saflufenacil is a component in Verdict and Zidua Pro herbicides.

Paraquat: Paraquat, or Gramoxone SL, is a contact herbicide that is effective on small annual weeds. Paraquat should be tank mixed with a 2,4-D or a photosystem inhibitor residual herbicide like atrazine or metribuzin. Paraquat should also be applied with a COC adjuvant like CHS Penetrec @ 0.5% v/v for optimal control.

Flumioxazin: Flumioxazin, or Valor EZ, is a contact and residual herbicide that has activity on annual broadleaf weeds like marestail. Flumioxazin must be applied with another burndown herbicide like glyphosate for optimal control. Flumioxazin is a component in many premixes including Valor XLT, Fierce, Fierce XLT, Envive and Panther Pro.

Sulfentrazone: Sulfentrazone, or Spartan/Authority Brands, is a contact and residual herbicide that has activity on annual broadleaves and grasses. Sulfentrazone should be applied with 2,4-D alone or in combination with either glyphosate, Gramoxone, or glufosinate.

Residuals: Residual herbicides should be included in burndown applications for extended control. Many soil residual herbicides also have foliar activity (Atrazine, Authority Brands, Metribuzin, Sharpen brands and Valor brands). There are also many premixes available that contain soil residual and foliar herbicides.

Product		Rate/A[1]	Adjuvant Rec.[4/5]	Cotton	Field Corn	Rice	Soybean	Notes[1]
				Plant-back[1] (Months before planting/d=days)				
Afforia		2.5-3.75 fl oz	CHS Penetrec or CHS Aggrestrol or Tapran @ 0.5% v/v	30d	14d	30d	0	**AI: Flumioxazin + Thifensulfurion-Methyl +Tribenuron-Methyl** For best burndown results include 2,4-D. Plant-back depends on 1" of rainfall between application and replant.
Authority Brands	Assist	6.0–12.0 oz	CHS Penetrec or CHS Aggrestrol or Tapran @ 0.5% v/v	18	4–10	40	0	**AI: Sulfentrazone + Imazethapyr** For complete burndown of emerged weeds include 2,4-D alone or in combination with dicamba, glyphosate, glufosinate, Gramoxone or saflufenacil
	First DF	6.45–8.0 oz		12–18	10–18	10	0	**Sulfentrazone + Cloransulam** For complete burndown of emerged weeds include 2,4-D alone or in combination with dicamba, glyphosate, glufosinate, Gramoxone or saflufenacil
	XL	3.0–9.6 oz		12–18	10–18	10–18	0	**AI: Sulfentrazone + Chlorimuron** For complete burndown of emerged weeds include 2,4-D alone or in combination with dicamba, glyphosate, glufosinate, Gramoxone or saflufenacil. Refer to label for specific Rotation Restrictions.
	MAXX	6.0–9.6 oz		12–18	10–18	10–18	0	
	MTZ[3]	8.0–18 oz		12–18	4–10	10	0	**AI: Suflentrazone + Metribuzin** For complete burndown of emerged weeds include 2,4-D alone or in combination with dicamba, glyphosate, glufosinate, Gramoxone or saflufenacil.
	Supreme	6.0–11.5 oz		12–18	4	10–24	0	**AI: Sulfentrazone + Pyroxasulfone** For complete burndown of emerged weeds include 2,4-D alone or with dicamba, glyphosate, glufosinate, Gramoxone or saflufenacil
Dicamba[2]		8.0 fl oz	See Notes	21d	0	0	1	**AI: Dicamba** Use the adjuvant rec. of the tank mix partner. For complete burndown control dicamba should be tank mixed with glyphosate, Gramoxone or Sharpen.
		16 fl oz	See Notes	21d	0	0	1.5	
Elevore		1 oz	CHS Penetrec or CHS Aggrestrol or Tapran @ 0.5% v/v	1	14 d	14 d	14 d	**AI: Halauxifen** For complete burndown of emerged weeds include 2,4-D, or glyphosate as well as an herbicide for residual control. Visit www.elevoretankmix.com for tank mix restrictions.
Fierce Brands	EZ	6.0–9.0 oz	CHS Penetrec or CHS Aggrestrol or Tapran @ 0.5% v/v	1–2	1	10	0	**AI: Flumioxazin + Pyroxasulfone** For complete burndown control tank mix with glyphosate and 2,4-D up to 7 to 15 days prior to planting. Fierce EZ application must be made within 3 days after planting and prior to soybean emergence.
	MTZ	1.0–1.5 pt		18	1	12	0	**AI: Flumioxazin + Pyroxasulfone + Metribuzin** For complete burndown control tank mix with Glyphosate and 2,4-D. Fierce MTZ application must be made within 3 days after planting and prior to soybean emergence.
	XLT	3.75–5.25 oz		18–30	10	18	0	**AI: Flumioxazin + Pyroxasulfone + Chlorimuron** For complete burndown control tank mix with Glyphosate and 2,4-D. Fierce XLT application must be made within 3 days after planting and prior to soybean emergence.
Glyphosate (All Formulations)		0.75–3.0 lb Ae	CHS Fixate @ 2 qt/100 or CHS Wheelhouse 2 @ 5-6 qt/100	0	0	0	0	**AI: Glyphosate** If tank mix partner requires COC or MSO use CHS Penetrec or CHS Aggrestrol. Under tougher conditions or larger weeds use CHS Level Best Pro @ 1 qt/100 + AMS.
Gramoxone SL 3.0		2.0–4.0 pt	CHS Penetrec or CHS Aggrestrol @ 0.5% v/v or CHS Hypertonic @ 1 qt/100	0	0	0	0	**AI: Paraquat** For complete burndown of emerged weeds and residual control apply with 2,4-D and a photosynthetic inhibitor (atrazine/metribuzin). 15–20 GPA spray volume is recommended.

Plant-back restriction color code for specific crops from shortest to longest (d = days / m = months)

0 | < 14d | < 1m | > 1m

Where multiple rotation ranges are listed, the label lists specific geographic, soil type, or cropping system restrictions;

NCS = Next Cropping Season

[1] Always refer to herbicide label for specific rates or when tank mixing with other herbicides.

[2] Dicamba labels vary on rotation restrictiveness. Consult label for specific cropping restrictions.

[3] Refer to label for specific soybean varieties that should not be planted after Metribuzin applications.

[4] CHS Emulate can be used in place of CHS Aggrestrol at 1.0% v/v/100 gal spray solution.

[5] Crop Oil can be used in place of CHS Penetrec at 1.0% v/v/100 gal spray solution.

Product	Rate/A[1]	Adjuvant Rec.[4/5]	Plant-back[1] (Months before planting/d=days)				Notes[1]
			Cotton	Field Corn	Rice	Soybean	
Kyber Pro	1 pt	CHS Penetrec or CHS Aggrestrol or Tapran @ 0.5% v/v	18	7d to 1 Mo	12	0	**AI: Pyroxasulfone + Flumioxazin + Metribuzin** For complete burndown glyphosate, glufosinate and/or 2,4-D should be added to the tank-mix. Limited amount available for sale in 2025. Adjust adjuvants to match.
Liberty 280 SL	32–43 fl oz	CHS Level Best Pro @ 1 qt/100 + AMS @ 1.5–3 lb/A	0	0	6	0	**AI: Glufosinate** 15–20 GPA Spray volume required. Tank mix with 2,4-D and metribuzin for complete burndown control.
Select Max Volunteer	9–16 oz/A	CHS Penetrec or Tapran @ 0.5% v/v + 2-4 lb AMS/A	0	10 to 16 d	30 d	0	**AI: Clethodim** For control of annual grasses. Refer to label for specific rates on grass species and sizes. Use 2,4-D and residual herbicide in the tank-mix for broadleaf weed control. Tank-mixing broadleaf herbicides can reduce the effectiveness of Clethodim. Contact your local Chemical Rep for exact recommendations.
Lo-Vol 4 Ester Lo-Vol 6 Ester	0.5–1.0 lb ai	CHS Fixate @ 2 qt/100 or CHS Wheelhouse 2 @ 5-6 qt/100	1–3	14d	1	7–15 d	**AI: 2,4-D Ester** For complete burndown of emerged weeds include glyphosate, glufosinate, Gramoxone or saflufenacil as well as an herbicide for residual control.
Metribuzin 75 DF3 (Component in many Premixes)	4–12 oz	See Notes	18	4	12	0	**AI: Metribuzin** Metribuzin help control emerged weeds when applied in combination with other effective burndown herbicides as well as providing residual control. Many premixes including metribuzin are also available. Use Adjuvant rec. of tank mix partner.
Sharpen	1.0 fl oz	CHS Aggrestrol or Tapran @ 1 pt/A + AMS @ 8.5 lb/100 gal or UAN @ 1.25-2.5 gal/100	1.5–9	0	0	0	**AI: Saflufenacil** For complete burndown control of emerged weeds apply in combination with glyphosate or glufosinate. 15–20 GPA spray volume required. Do not use NIS or crop oil as a substitute for MSO.
	2.0 fl oz		1.5–9	0	0	1	
	3.0 fl oz		1.5–9	0	4	2	
Verdict/Corsican	5.0 fl oz	CHS Aggrestrol @ 0.5% v/v + AMS @ 8.5 lb/100 gal or UAN @ 1.25–2.5 gal/100	NCS	0	0	0	**AI: Saflufenacil + Dimethenamid-P** For complete burndown control of emerged weeds apply in combination with glyphosate or glufosinate. 15–20 GPA spray volume required. Do not use NIS or crop oil as a substitute for MSO.
	10–16 fl oz		NCS	0	0	1	
Valor Brands EZ	2.0–3.0 oz	CHS Penetrec or CHS Aggrestrol or Tapran @ 0.5% v/v	1–2	1	1–2	0	**AI: Flumioxazin** For complete burndown control tank mix with Glyphosate and 2,4-D. Valor EZ or Valor SX application must be made within 3 days after planting and prior to soybean emergence.
Valor Brands SX	2.0–3.0 oz		14 d–2	7 d–30 d	1–2	0	
Valor Brands XLT	2.5–5.0 oz		10–30	10–18	9–18	0	**AI: Flumioxazin + Chlorimuron** For complete burndown control tank mix with Glyphosate and 2,4-D. Valor XLT application must be made within 3 days after planting and prior to soybean emergence.
Weedmaster	1.0–2.5 pt	CHS Penetrec or Tapran @ 1 pt/A + AMS @ 2.5 lb/A or UAN @ 2-4 qt/A	1	0	120 d	15–30 d	**AI: 2,4-D + Dicamba** For complete burndown of emerged weeds include glyphosate as well as a herbicide for residual control.
Zidua Pro	4.5–6.0 fl oz	CHS Aggrestrol or Tapran @ 1 pt/A + AMS @8.5 lb/100 gal or UAN @ 1.25-2.5 gal/100	18	18.5	12	0	**AI: Saflufenacil + Pyroxaslufone + Imazethapyr** For complete burndown control of emerged weeds apply in combination with glyphosate. 15–20 GPA Spray volume required. Do not use NIS or crop oil as a substitute for MSO. Use 6.0 fl oz rate in no till or in fields with high weed pressure

Plant-back restriction color code for specific crops from shortest to longest (d = days / m = months)

0 | < 14d | < 1m | > 1m

Where multiple rotation ranges are listed, the label lists specific geographic, soil type, or cropping system restrictions;

NCS = Next Cropping Season

[1] Always refer to herbicide label for specific rates or when tank mixing with other herbicides.

[2] Dicamba labels vary on rotation restrictiveness. Consult label for specific cropping restrictions.

[3] Refer to label for specific soybean varieties that should not be planted after Metribuzin applications.

[4] CHS Emulate can be used in place of CHS Aggrestrol or Tapran at 1.0% v/v/100 gal spray solution.

[5] Crop Oil can be used in place of CHS Penetrec at 1.0% v/v/100 gal spray solution.

Fall Burndown

In reduced and no-till fields, fall is an important time for controlling tough weed species, allowing for a clean start next year. Some winter annuals and perennials are not just harder to control in the spring but can delay planting by keeping fields cooler and wetter, along with creating a planting issue called hair pinning. Hair pinning reduces seed to soil contact when the planter pushes plant material into the furrow and reduces water uptake by the seed reducing germination.

Horseweed/Marestail and Dandelion are difficult to control with only a spring herbicide application because the majority of these emerge in the fall then bolt in early spring. In the fall these seedlings are more susceptible to herbicides, having the ability to use higher rates of growth regulator products resulting in better consistency and efficacy.

Many products contain residual activity and extend weed control into the spring giving a clean start to planting. Residuals should be considered when fall burndowns are sprayed earlier in the fall, especially when applications are being made in September or October.

Fall burndown should be considered as an integral piece of the overall weed control program, keeping in mind the crop rotation when choosing a residual herbicide.

Advantages of Fall Weed Control

- Increased soil temperatures
- Faster planting
- Dryer fields
- Reduced egg laying sites for Black Cutworm and other insect pests
- Easier seedbed preparation – less tillage passes
- Elimination of soybean cyst hosts (Purple deadnettle, Henbit, Field Pennycress, Shepherd's purse, Common chickweed)
- Provides superior control of some tough to control weed species such as Dandelion, Horseweed/Marestail, Poison hemlock and Canada Thistle.

Disadvantages of Fall Weed Control

- If considering cover crops, fall burndown choices maybe limited to glyphosate, glufosinate or paraquat.
- Need to be cautious when making fall burndown applications to HEL (highly erodible land). Leaving erodible land with no cover can increase soil erosion.
- In true no-till situations do not expect to completely replace the need for spring burndowns, weeds such as, Horseweed/ Marestail and Giant ragweed can germinate very early in the growing season.
- As temperature decrease later in the fall, control can be reduced with some herbicides.



Dandelion stunting corn



Corn following a good fall burndown



Corn following NO fall burndown

Fall Herbicide Program	Next Season Crop[3]	Common Chickweed	Mustards, Shepherds purse	Canada Thistle	Horseweed / Marestail	Prickly Lettuce	Deadnettle, henbit	Dandelion	Cressleaf groundsel
2,4-D[1]	C,S	-	9	6	9	9	7	8	9
Autumn Super 51WDG[1]+ glyphosate	C,S	9	9	--	9	9	9	8	9
Basis[1] + 2,4-D	C,S	9	9	6	9	9	8	8	9
Classic[1] + 2,4-D	S	7	9	--	9	9	9	9	9
Canopy EX/Cloak EX[1] + 2,4-D	S	9	9	--	9	9	9	9	9
Dicamba[1] + 2,4-D	C,S	7	9	7	8	9	7	8	9
Express[1] + 2,4-D	C,S	9	9	6	9	9	8	7	9
Glyphosate[1] + Sharpen[4]	C,S	9	9	8	9	9	8	7	9
Glyphosate + 2,4-D	C,S	9	9	8	9	9	9	8	9
Gramoxone[1] + 2,4-D	C,S	9	9	7	9	9	9	7	9
Metribuzin/TriCor[1] + 2,4-D	S	7	9	--	9	9	9	7	9
Simazine/Princep[1] + 2,4-D	C	9	9	--	9	9	8	7	9
Canopy/Cloak[1] + 2,4-D	S	9	9	--	9	9	9	9	9
Panoflex[1] + 2,4-D	C,S	9	9	--	9	9	9	9	9
Authority XL[1] + 2,4-D	S	8	9	--	9	9	9	9	9
Authority Maxx[1] + 2,4-D	S	8	9	--	9	9	9	9	9
Authority MTZ[1,2] + 2,4-D	C,S	8	9	--	9	9	9	8	9
Valor EZ[1] + 2,4-D	S	7	9	-	9	9	9	8	9
Valor XLT[1] + 2,4-D	S	7	9	-	9	9	9	9	9
Envive Herbicide[1] + 2,4-D	S	7	9		9	9	9	9	9
Panther SC[1] + 2,4-D	C,S	7	9	--	9	9	9	8	9
Panther MTZ[1] + 2,4-D	S	7	9	--	9	9	9	8	9
Fierce MTZ/Kyber[1]+ 2,4-D	C,S	7	9	-	9	9	9	8	9
Laudis[4] + 2.4-D	C	8	9	6	9	9	9	8	9

Scale: 9=best 1=worst

[1] Use CHS Aggrestrol, CHS Penetrec, Tapran, CHS Fixate at 0.5% v/v or CHS Emulate or Crop Oil at 1% v/v, or CHS Level Best Pro at 0.25% v/v for maximum weed control.

[2] Four-month rotation to corn when using < 14oz/A.

[3] C=Corn / S=Soybean

[4] MSO's such as CHS Aggrestrol, Tapran or CHS Emulate suggested for greatest weed control.

Read and follow Label Directions for herbicide rates.

Identification And Control

Scientific Name: *Amaranthus Palmeri*

ID: Palmer amaranth is hairless with wide and oval shaped leaves. The petiole is as long as or longer than the leaf blade. Growth patterns resemble a rosette like appearance with leaves arranged for maximum light collection. Seed heads are very long and can reach up to 3 feet in length, with spiny bracts on the female seed heads.

Biology: Palmer amaranth is the most competitive and aggressive pigweed species. When left untreated, 2.5 plants per foot of row can reduce soybean yield up to 79%. It is an annual with prolific seed production of up to 600,000 seeds per plant that can germinate throughout the growing season. Seeds are small and are easily spread through harvest equipment and on feed stocks. It has a high amount of genetic variability, due to separate male and female plants cross pollinating. It also has a relatively fast growth rate and has been reported to grow as much as 2.5 inches per day.

SOA Resistance: Palmer amaranth is resistant to multiple sites of action and can exhibit cross resistance to multiple sites of action at the same time. There are now reported 5-way resistant populations and most recently, confirmation of resistance to the synthetic auxin chemistry.

2 - ALS Inhibitor (chlorimuron, imazethapyr)
3 - Microtubule Inhibitor (pendimethalin, trifluralin)
5 - Photosystem II Inhibitor (atrazine)
9 - EPSPS Synthase Inhibitor (glyphosate)
27 - HPPD Inhibitor (mesotrione, tembotrione)
4 - Synthetic Auxins (2,4-D)
14 - PPO Inhibitors (fomesafen, lactofen)
15 - Long Chain Fatty Acid Inhibitors (metolachlor)



Palmer amaranth leaf and with petiole folded over leaf blade.



Control of Resistant Palmer Amaranth

Burndown: It is very important to provide a clean start with any Palmer amaranth controlled with tillage and/or effective burndown herbicides prior to planting. To ensure a clean start to the growing season many burndown programs contain glyphosate(9) in combination with growth regulator(4), photo system II(5), or PPO(14) herbicides. Non-glyphosate burndown programs may include Liberty (10) or Gramoxone (22). Adding metribuzin (5) to the burndown application can provide additional residual control as well as another site of action to the mix.

Corn: Many herbicides are available for pre-emergence control in corn. Most of these pre-emerge products contain stand alone or premixes that contain PSII (atrazine), long chain fatty acid-inhibitors (Dual, Harness, Zidua, or Outlook), or HPPD (Callisto, Balance). Post-emergent programs should include one or more of these modes of action: PSII, growth regulator (Status, DiFlexx) or HPPD (Callisto, DiFlexx Duo, Impact) in combination with residual herbicides to provide season long control.

Soybeans: Pre-emergent control is even more important for soybeans as the post-emergent options are very limited. Products or programs containing either sulfentrazone (Spartan, Authority) or flumioxazin (Valor) provide the highest levels of pre-emergent control but will start to lose their effectiveness in two to three weeks. Residual herbicides that can be applied post-emergent (Dual, Outlook, Warrant, Warrant Ultra, Zidua) will extend residual control later in the season. Post-emergent products are limited to PPO herbicides (Flexstar and Cobra) and Liberty or Interline (Liberty Link Soybeans only). Xtendimax with VaporGrip Technology, or Engenia provide good Palmer amaranth control but may require multiple applications, weed < 4-6″, and residual herbicides applied post-emergent (dicamba tolerant soybeans only). Tavium Plus VaporGrip Technology (dicamba + s-metolachlor) is one such pre-mix option to provide residual herbicide in a Xtend soybean system.

Resistance Management

Scientific Name: *Ambrosia artemisiifolia*

ID: Erect to branching with thick cotyledons that are oval to spatula-shaped. Adult plants reach 3–6 feet in height possessing leaves up to 4′ across to 6″ long, fernlike, and compound to deeply cut into lobes. Lower leaves may be opposite or alternate while upper leaves become predominantly alternate.

Biology: Summer annual capable of producing up to 60,000 seeds per plant. Seed requires dormancy period before germination can begin. Germination is triggered by combination of light and temperature. Some seed can remain dormant for several years. Emergence occurs early in the season and continues until hot temperatures halt germination processes. Flowering occurs as day lengths begin to shorten.

MOA Resistance: Common ragweed has been shown to demonstrate resistance to the following modes of action including multiple resistance to various combinations of each depending upon state or geography.

2 - ALS Inhibitor
5 - Photosystem II Inhibitor
9 - EPSP Synthase Inhibitor
14 - PPO Inhibitor

Control Strategies: Controlling emerged seedlings prior to planting with tillage and/or a burndown herbicide provides effective control. In addition, the use of a PRE herbicide that possesses common ragweed activity can provide important residual activity but many will also possess a potential to carry over into the following cropping season to certain crops. Check label for local precautions and rotational guidelines.

PRE products with G-E or better control (or generic equivalent)[1]: Acuron, Acuron Flexi, Authority First / Sonic, Balance Flexx[2] Callisto, Corvus[2], Dicamba Products, Lumax EZ, Permit / Sandea, Prequel, Resicore, Sharpen, Verdict.

POST products with G-E or better control (or generic equivalent)[1]: Axial Star, Brox 2EC, Brox M, Curtail, Dicamba Products, Elevore, glyphosate products[3], Gramoxone SL / Parazone 3SL, Halex GT[3], Hornet, Huskie/Complete, Liberty 280 SL[4], Lumax EZ, Marvel, MCPA, Orion, Perfectmatch, Pixxaro, Quelex, Resicore, Starane/flex/NXT/Ultra, Status, Stinger, Supremacy, Talinor, Wolverine Advanced, 2,4-D products. Armezon/Pro, Callisto, Capreno, Impact, and Laudis when applied with Atrazine also provide G-E Control.

Cultural and Mechanical Control: Apply POST HERBICIDES before ragweed plants exceed 4–6 inches tall. Tillage controls seedlings but stimulates germination unless performed at night, which reduces germination by up to 45%. Planting later (mid-May) reduces infestations by allowing emergence and control by tillage prior to planting. Common ragweed does not tolerate mowing.

[1] Atrazine or products possessing atrazine can improve PRE and POST activity of common ragweed in labeled tank mixtures and/or geographies.

[2] Products with this designation may lack registration in specific states or possess prohibitory label statements. Check label for use restrictions.

[3] RR crops only.

[4] LL crops only







Photos courtesy of Steven Gower, Michigan State University Diagnostic Services.

Resistance Management

Scientific Name: *Ambrosia trifida*

ID: Seedlings have large spoon shaped cotyledons with the first true leaves ovate with deep lobes. Leaves are simple, deeply lobed and opposite with stiff hairs that point toward the tip.

Biology: Giant ragweed is one of the first summer annual weeds to emerge in the spring and are extremely competitive in both corn and soybeans growing up to 17 feet tall. Even low populations can cause considerable reductions in yield in both corn and soybean. Due to its ability to germinate from as deep as 4″ and fast growth rate, giant ragweed can be very difficult to control with both PRE- and POST- emergent herbicide programs. Emergence does decline in early summer but can continue into July in some biotypes. Seeds are large and crown-shaped and, if left on the soil surface, can be preyed upon by insects and rodents.

SOA Resistance: Giant ragweed has developed resistance to both group 2 and group 9 with multiple resistance in certain populations.

2 - ALS Inhibitor (Firstrate/Classic)
9 - EPSP Synthase Inhibitors (glyphosate)

Control Strategies: All strategies start with a clean field using tillage. 2,4-D or dicamba tank-mixed with an effective PRE-emergent herbicide pass assuming ALS and glyphosate resistant populations.

Corn: PRE-emergent products like Acuron, Lumax EZ, Surestart II, and Resicore can provide good control of light to moderate populations. Scout for escapes within two to three weeks after PRE-emergent application. Follow up the residual application with an effective POST-emergent application of dicamba or Callisto/Impact/Armezon to provide complete control.

Soybean: PRE-emergent products like Authority First/Sonic, Valor XLT, and Surveil provide limited control to resistant populations. There are limited choices for POST-emergent herbicides with activity on resistant populations. Flexstar and Cobra used in combination with glyphosate performs better than either herbicide without glyphosate, though glyphosate may have limited control by itself. Do no let giant ragweed exceed 4″ in height or control will be difficult. A second POST-emergent application of Cobra after two to three weeks may be necessary to control late emerging or poorly controlled weeds.



Large spoon-shaped cotyledons.



First true leaves on giant ragweed simple but deeply lobed.

Dicamba Tolerant Soybeans: Xtendimax(4), Fexapan(4), Tavium(4,15) or Engenia(4) provide excellent and consistent control. Do not let giant ragweed get too tall as increased selection pressure may select out more tolerant biotypes. Multiple applications may be needed to control later emerging plants. Xtendimax, Tavium and Engenia provide limited and inconsistent residual control. Include CHS Level Best Pro at 1 qt/100 with CHS Traplok at 19.2 fl oz/A to maximize weed control and meet DRA qualifications.

Enlist E3 Soybeans: Enlist Duo(4,9) or Enlist One(4) (2,4-D Choline) provide excellent and consistent control. These E3 traited varieties also have tolerance to Liberty/Interline(10) (glufosinate). Apply alone or in combination with Enlist One for an effective weed control program. Liberty is more sensitive to weed size as compared to Enlist so special attention needs to be placed on weed size and timing. Include CHS Level Best Pro at 1-2 qt/100 to maximize weed control with Enlist One with glyphosate or glufosinate.

Scientific Name: *Conyza canadensis*

Biology: Horseweed (Marestail) emerges at two primary periods throughout the year – late March through June, and from late summer through late fall. Horseweed remains in the rosette stage through March in the southern states to late April in the northern states. This growth stage is followed by stem elongation (bolting) and rapid growth to an eventual height of 3–6 feet. Plants that emerge in the fall will bolt earlier than the spring-emerging plants. Horseweed will mature in the late summer or early fall, and can produce up to 200,000 seeds per plant.

SOA Resistance: Horseweed has developed resistance to the following sites of action including multiple resistance to various combinations of each depending upon state or geography.

2 - ALS Inhibitor-Firstrate, Classic and many others

5/7 - Photosystem II Inhibitor-atrazine, simazine

9 - EPSP Synthase Inhibitor-glyphosate

22 - Photosystem I Electron Diverter-paraquat

Control Strategies

Horseweed is most easily controlled when in the seedling or rosette stage. In no-till or minimum tillage situations fall emerging horseweed is best controlled utilizing a fall burndown program. For all other emergence times horseweed should be controlled using a spring burndown application. Using a burndown application to control horseweed takes pressure off relying on your POST application which is limited in options.

Fall Burndown: For fall burndown applications use 2,4-D along with one of the following tank mixes for optimum control of horseweed.

- glyphosate
- dicamba
- Basis®
- Canopy®/Cloak™ EX or DF (Low Rate)
- Autumn™ Super
- metribuzin

Spring Burndown: Do not plant into existing stands of horseweed. Tillage can be used close to planting to remove emerged horseweed. If tillage is not used close to planting use one of the following preplant herbicide treatments. A residual herbicide should be included for to help with horseweed control until canopy closure.

- 2,4-D ester / dicamba + glyphosate
- 2,4-D ester / dicamba + saflufenacil (Sharpen®/Verdict™) + glyphosate + CHS Aggrestrol or CHS Emulate
- 2,4-D ester + gramoxone + metribuzin
- Liberty + metribuzin
- saflufenacil (Sharpen/Verdict) + CHS Aggrestrol or CHS Emulate + glyphosate/Liberty





Scientific Name: *Kochia Scoparia*

ID: Kochia emerges in spring and has thick, alternately arranged dull green leaves. The young plant forms into a small rosette. Mature kochia reach 2 to 5 feet tall and are usually branched from the base. Kochia roots can extend down up to 15 feet and measure 21 feet in diameter.

Biology: Kochia is a summer annual that germinates early in shallow soils, favoring dry soil conditions. Kochia germination can initiate in cold soil temperatures. Under favorable conditions, kochia seeds germinate within three hours which helps in early establishment of seedlings. Early scouting should be done to identify kochia stands and a burndown herbicide should be applied. Kochia is a day-length sensitive plant with flowering beginning in late July. Kochia uses a "tumble weed" style seed dispersal mechanism during the fall with each plant producing up to 30,000 seeds. This dispersal method is extremely effective and allows Kochia to spread from field to field.

SOA Resistance: Kochia can have both self and cross pollination which leads to high level of genetic variability within and between the populations. Greater genetic diversity helps in rapid evolution of herbicide-resistance. Kochia has developed resistance to four different sites of action (SOA) including:

2 - ALS Inhibitor (Harmony, Pursuit)– First detected in 1980

4 - Plant Growth Regulator (Clarity, Starane) – First detected in 1994

5 - Photosystems II Inhibitor (Atrazine, Metribuzin) – First detected in 1976

9 - EPSPS Synthase Inhibitor (Roundup) – First detected in 2007

(Recently, few identified cases of Kochia population resistance to group 14 have been documented)

Control Strategies:

Burndown: Consider spring and fall burndown herbicide applications in fields with dense resistant kochia populations. Residual herbicides should be applied in late fall or early spring to get activated before kochia starts to germinate. It is very important to start cleaning in early spring because later in the season dense populations of kochia plants are difficult to control. Authority and Valor based residual products provide good control of Kochia into the growing season. Sharpen and OpTill with MSO also provide good control of Kochia. When Authority or Valor is used in conjunction with Sharpen or OpTill, there should be a 30-day period between herbicide application and planting of soybeans.







Pre-Applied: Acetochlor® (suppression), Anthem/ATZ, Atrazine, Balance Flexx®, Boundary, Callisto, Capreno, dicamba, Fierce®, Lumax®, metribuzin, Nortron, Prefix, Prowl® (suppression), Sharpen®, Verdict®, Accuron, Resicore, Authority brands, Valor EZ®.

Post-Applied: Target < 3" tall Kochia. Aim®, atrazine, Buctril®, dicamba, Flextar/Reflex®, Huskie Complete®, Impact+Atrazine, Laudis+Atrazine, Liberty®, Lumax, Paraquat, Starane®, and Status®, early postemergence application of Engenia®, Xtendimax®, and FeXapan® on Dicamba resistance soybean.

Integrated Control Measures: It is imperative to control kochia in early spring with several pre-emergence residual herbicides which can reduce the over-reliance on post-emergence herbicides. There are less kochia herbicides available for broadleaf crops as compared to grass crops, especially for postemergence control. Crop rotation is an effective measure to diversify integrated control strategy. Other strategies include planting one planter width of corn or sunflower around the field boundary to prevent kochia rolling into the non-infested field. Ninety-five % of kochia seeds die within one year of being dispersed; therefore, stewardship that reduces seed production for two or three years can greatly reduce kochia populations. To reduce further herbicide resistance, use cultivation and crop rotation. To maximize herbicide performance, apply post-emergence herbicides with the recommended CHS adjuvants, tank-mix partners, spray volumes, and application guidelines before kochia plants reach 3-4 inches tall. Fortunately, kochia's seed longevity is less than three years, by implementing strong integrated control measures seed banks can easily be depleted by applying all above mentioned tools. Always act quick on kochia because kochia knows no border.

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Resistance Management

Scientific Name: *Salsola tragus*

ID: Seedling cotyledons are linear, 2 cm long, cylindrical, succulent, and alternate. Stems are erect and can reach 1.5 m tall, spiny, well branched, forming a rounded plant at maturity and turning a reddish color. Stems may also have purple stripes. Flowers are small and inconspicuous, developing in the upper leaf axils, each flower forms a pair of spiny bracts. Seeds are coiled, round, 1.5–2 mm long, are greenish to black in color. Roots are fibrous from a branched taproot, reach 2 m deep and 2 m surrounding the plant.

Biology: Summer annual capable of producing up to 40,000–60,000 seeds per plant. Large adult plants may produce as many as 200,000 seeds. Seed dormancy is very short after maturity in the fall, and decreases over the winter. Flowering increases greatly after small grain harvest. Russian thistle is indeterminate therefore, will continue flowering and producing seed as long as there is not a killing frost of 25°F or less. Seeds can germinate within 12 hours after brief or limited precipitation. Optimal germination temperatures range from 45°F to 95°F. Seeds located greater than 1 inch below the surface reduce chances of germination. Ninety percent or greater of seeds either germinate or decay in the soil the first year. Seeds are very drought tolerant and are dispersed when the mature plant breaks off at the ground level and tumbles with the wind.

SOA Resistance: Russian thistle has demonstrated resistance to the following sites of action.

2 - ALS Inhibitors
9 - EPSP Synthase Inhibitors
*Potential Group 9





Photos courtesy of University of California, Davis.

Control Strategies: Several pre-emergent and post-emergent products are capable of providing weed control and resistance management. Control weeds within four weeks of emergence. The use of pre-harvest and post-harvest herbicide applications are effective. Check label for local geographic precautions, restrictions, and rotational guidelines.

PRE products with G-E control (Includes generic equivalents)[1]: Acuron, Acuron Flexi, Atrazine, Authority Assist, Authority Elite/BroadAxe XL, Authority First/Sonic, Authority MTZ, Boundary, Fierce, Gangster, Lumax EZ, Metribuzin, Sharpen, Sonalan, Spartan, Spartan Charge, Surveil, Verdict, Zidua Pro, Surestart II.

POST products with G-E control (Includes generic equivalents)[1]:
Affinity Broadspec/Audit 1:1, Affinity Tank mix/Audit 4:1, Ally XP, Audit 75WDG, Armezon, Armezon Pro, Atrazine, Beyond, Brox M, Buctril/Brox 2EC, Bromoxynil/+MCPA, Callisto Extra, Capreno, Cleansweep D/M, ClearMax, Express, Extreme[2], Goal/Collide, GoldSky, Harmony, Huskie, Huskie Complete, Impact, Laudis, Liberty[3], Lumax EZ, Paraquat, Starane NXT, Status, Supremacy, Talinor, Wolverine Advanced.

Cultural and Mechanical Control: Tillage that buries seed greater than one inch. Crop rotation, i.e. planting winter wheat in place of spring wheat. Planting early. Seeding crop shallow if conditions allow to promote early emergence. Fertilizer placement close to developing seedling to enhance growth and vigor. Narrower crop row spacing to increase crop competition.

[1] Atrazine products or those possessing atrazine can improve PRE and POST control of Russian Thistle in areas where use is allowed.

[2] RR crops only.

[3] LL crops only.

Scientific Name: *Amaranthus tuberculatus / Amaranthus rudis*

ID: Waterhemp is taxonomically related to other pigweed species from Amaranthus genus and therefore can be difficult to correctly differentiate between them unless made aware of specific plant growth features. Seedlings are smooth, hairless, with pointed leaves sometimes having a slight notch at the tip. The branches may be brightly colored, varying from deep red or pink to green. The leaves of waterhemp are typically glossy and often more elongated, or lanceolate, compared to redroot or smooth pigweed. Waterhemp petiole is always shorter than the leaf blade, whereas Palmer amaranth petiole is often longer than leaf blade. Inflorescence or seed heads are characterized as open with minimal branching and both the male and female seedheads are smooth or without the spiny bracts on other species such as Palmer amaranth.

Biology: Waterhemp is a summer annual, that can produce 250,000 seeds per plant. Some plants can produce up to one million seeds under noncompetitive favorable environment. Emergence occurs later in the growing season and it has a long emergence period which produces new weed flushes all summer long. Seeds are very small and well suited to germinate under reduced tillage systems and can easily spread through harvest equipment and on feed stocks. It has a high amount of genetic variability, due to cross breeding between separate male and female plants (dioecious). This outcrossing allows plants to rapidly evolve resistance to multiple modes of action (MOA).

SOA Resistance: Waterhemp has evolved resistance to seven herbicide sites of action and can exhibit cross resistance to multiple sites of action at the same time. Recent investigations also indicate the case of "enhanced herbicide metabolism" which is very difficult to manage as compared to target site resistance.

- 2 - ALS Inhibitor (chlorimuron, imazethapyr)
- 5 - Photosystem II Inhibitor (atrazine)
- 27 - HPPD Inhibitor (mesotrione, tembotrione)
- 14 - PPO Inhibitor (fomesafen, lactofen)
- 9 - EPSP Synthase Inhibitor (glyphosate)
- 4 - Synthetic Auxins (2,4-D)
- 15 - Long Chain Fatty Acid herbicides (metolachlor)



Waterhemp and Palmer Amaranth petiole folded over leaf blade
Pic. Courtesy: University of Illinois, KSU

Control Of Resistant WATERHEMP

Burndown: To ensure a clean start to the growing season many burndown programs contain glyphosate in combination with growth regulator, photosystem II, or PPO herbicides. Non-glyphosate programs may include glufosinate (Liberty, Interline) or paraquat (Gramoxone, Parazone) tank-mixed with metribuzin.

Corn: Many herbicides are available for pre-emergence control in corn. Most of these pre-emerge products contain stand alone or premixes that contain PSII (atrazine), long chain fatty acid-inhibitors (Dual, Harness, Zidua, or Outlook), or HPPD (Callisto, Balance). Post-emergent programs should include one or more of these modes of action: PS II, growth regulator (dicamba, Status, Diflexx) or HPPD (Callisto, Impact, DiFlexx Duo) in combination with post-emergent residual herbicides to provide season long control.

Soybeans: Pre-emergent control is even more important for soybeans as effective post-emergent options are very limited. Products or programs containing either sulfentrazone (Spartan, Authority) or flumioxazin (Valor, Encompass) provide the highest levels of pre-emergent control but will start to lose their effectiveness in two to three weeks. Residual herbicides that can be applied post-emergent (Dual, Outlook, Warrant, Warrant Ultra, Zidua and Anthem Max as well as Tavium for use only on dicamba tolerant soybeans) will extend residual control later in the season. Other post-emergent products are PPO herbicides (Flexstar, Cobra, Ultra Blazer), glutamine synthetase inhibitors (Liberty, Interline on Liberty Link soybeans only) and growth regulator herbicides (Enlist One/Enlist Duo on E3 soybeans only and Engenia, Xtendimax, or Tavium on dicamba tolerant soybeans only).

Resistance Management

Scientific Name: *Sorghum halepense*

ID: Seedling: Leaf sheaths and leaves glabrous, ligule fringed, membranous.

Mature: Fibrous roots, thick rhizomes. Leaves glabrous, sheaths open, prominent membrane with fringe of trichomes.

Biology: Summer perennial, warm-season grass forming large stands from rhizomes. Producing up to 60′ a year from each plant. These large, dense stands produce plants commonly 5′-6′ tall, topped with an open panicle that can be up to 1′ long with a clump of Johnsongrass producing up to 30,000 seeds per plant. Rhizomes begin new growth when soil temperatures reach 60°F and seeds germinate when soil temperatures reach 70°F. Those arising from seed can produce rhizomes in 3-4 weeks.

SOA Resistance: Johnsongrass has developed resistance to the following sites of action including multiple resistance in certain geographies and areas.

1 - ACCase Inhibitor
2 - ALS Inhibitor
3 - Microtubule Inhibitor
9 - EPSP Synthase Inhibitor

Control Strategies: Johnsongrass present, at plant, should be controlled with a burndown application. If the population is glyphosate susceptible, then it should be included in the application. A soil-applied residual, such as Prowl (pendimethalin) or Treflan (trifluralin) can provide some control of plants emerging from seed. Most Johnsongrass will need to be controlled by an effective postemergence herbicide, glyphosate being the most effective if the plants are susceptible.

Soybean:
PRE Products: Treflan, Prowl, Pendimax, Authority Elite/ Broadaxe XC, Prefix

POST Products: Assure II, Fusilade DX/Fusion, Poast Plus, Select (Clethodim), Pursuit, Glyphosate, Glufosinate

Cotton:
Preplant: Preplant: Treflan or Prowl, Treflan + Cotoran/Meturon, Brake X

POST (Over-the-top): Assure II, Fusilade DX, Poast Plus, Select, Glyphosate (+Envoke or + Staple), glufosinate

POST (Directed): Suprend, Caparol + MSMA, Karmex + MSMA, Cotoran + MSMA, Valor (layby) + MSMA, DSMA, MSMA





Glyphosate Resistant Volunteer Crop Control

		Canola					Corn			Soybean	
Herbicide*	Rate/A	PRE	3 Leaf	6 Leaf	Bolt Initiation	Flower Initiation	10"–18"	18"–24"	24"–40"	V2–V3	V4–V6
Aim/Cadet	0.56/0.9 fl oz	-	P	N	N	N	N	N	N	P	P
Armezon/Impact + Atrazine	0.5 fl oz + 0.38 lb ai	E	E	E	F	P	N	N	N	P	P
Armezon Pro	14–18 fl oz	G	E	E	G	F	N	N	N	G	F
Assure II/Fusilade DX	3–5 fl oz	N	N	N	N	N	E	E	G-E	N	N
Atrazine	0.5 lb ai	E	G-E	G	P	P	N	N	N	E	F
Banvel	4–6 fl oz	F	P	P	P	P	N	N	N	E	E
Bronate / Maestro Advanced	0.8 pt	-	E	G	-	-	N	N	N	E	E
Callisto + Atrazine	3 fl oz + 0.38 lb ai	E	E	E	E	E	N	N	N	P	P
Capreno + Atrazine	3 fl oz + 0.38 lb ai	-	E	G-E	-	-	N	N	N	G	G
Cobra	6 fl oz	-	F	P	N	N	-	-	-	N	N
Curtail	0.25–0.5 pt	-	E	F-G	-	-	N	N	N	F-G	P-F
Engenia (non-DT Soybean)	12.8 fl oz	F	P	P	P	P	N	N	N	E	E
Enlist Duo (non-Enlist Soybean)	3.5 pt/A 4.75 pt/A	N N	E E	E E	E E	P P	- -	N N	N N	G E	F G
Express SG	0.25 oz	-	E	G-E	F-G	F	P	P	P	P	P
Extreme	1.5 pt	E	E	G-E	P	P	F-G	F	P	N	N
Fexapan (non-DT Soybean)	22 fl oz	F	P	P	P	P	N	N	N	E	E
FirstRate/Sonic	0.2–0.3 oz	E	E	F-E	P-F	F	-	-	-	N	N
Flexstar	0.38–0.75 pt	-	E	E	E	E	N	N	N	N	N
Harmony	0.33 oz DF 0.5 fl oz SG	- -	E E	G-E G-E	P P	P P	N N	N N	N N	N N	N N
Hornet	1–2 oz	P-F	G-E	F-E	-	-	N	N	N	E	F
Huskie	11-15 fl oz	-	E	E	E	E	N	N	N	G	G
Huskie Complete	13.7 fl oz	-	E	E	E	E	N	N	N	G	G
Ignite, Cheetah, Liberty	32-43 fl oz	N	E	G-E	P-F	P	N	N	N	G	F-G
Laudis + Atrazine	3 fl oz + 0.38 lb ai	-	E	E	E	F	N	N	N	G	G
Marvel	6–7.25 fl oz	-	E	E	E	E	N	N	N	N	N
MCPA	1 pt	P	E	E	G-E	G	N	N	N	G	F
Permit	1.5 oz	E	E	E	-	-	N	N	N	E	G
Pursuit	2 fl oz	G-E	E	G-E	P	P	G	F	P	N	N
Raptor/ Beyond Xtra	4 fl oz	-	E	E	G	F	G-E	F	P	N	N
Select Max	6–9 fl oz	N	N	N	N	N	G-E	P-F	P	N	N
Sencor	0.25 lb	E	G	F	-	-	N	N	N	P	P
Sharpen	1 fl oz	E	E	E	F	G	N	N	N	P	P
Status	4 oz	N	G	F	P	P	N	N	N	E	E
Steadfast	0.75 oz	-	E	E	-	-	N	N	N	P	P
Stinger	3–4 fl oz	N	N	N	N	N	N	N	N	E	G-E
Talinor	13.7–18.2 fl oz	E	E	E	E	-	-	-	-	E	G
Ultra Blazer	1 pt	-	E	G	F	F	-	-	-	N	N
WideMatch	0.13–0.25 pt	-	P	P	N	N	N	N	N	E	G
Varisto	11-16 fl oz 21 fl oz	- -	E E	E E	G E	F E	P-F G-E	P F	N-P P	N N	N N
Wolverine Advanced	1.7 pt	-	E	E	E	E	E	E	E	G	G
Xtendimax (non-DT Soybean)	22 fl oz	F	P	P	P	P	N	N	N	E	E
2,4-D	1 pt	N	E	E	G-E	P	N	P	P	-	-

*Refer to product label for crop rotations, weed size, and adjuvant recommendations.

E = Excellent, G = Good, F = Fair, P = Poor, N = No Control

Herbicide Applications In Cold Weather

Optimum temperatures for most herbicide applications are between 65°F and 85°F. Herbicides affect the growing crop and target weeds much differently under cool conditions. Cool conditions slow crop growth and development which can slow the rate at which crops metabolize certain herbicides. Slowing the metabolism of herbicides can result in greater potential for crop injury from certain herbicides. Additionally, cool/cold conditions cause many weeds to slow growth and/or harden off cell walls, which can hinder the uptake and translocation of many herbicides, and lead to slower and reduced weed control.

Corn growth and development is slowed by cool conditions. Cool temperatures hinder the ability of corn to grow, therefore it is common for corn plants to exhibit symptoms such as a yellow and/or purple discoloration in the spring. Fields may differ in symptoms as hybrids, starter fertilizer, and presence of insects impact the ability of corn to tolerate cool weather. Postemergence herbicides should not be applied to corn plants that have turned yellow or purple due to cool weather.

Soybean growth will not be impacted as greatly as corn but can be slowed somewhat by cool weather. The extent will depend on whether there is another stress involved such as wet conditions, root rot, or a soil applied herbicide.

Small grains grow quite well in cool conditions. Some herbicides which are commonly used in small grains are much more active in cool weather. Others may not provide adequate weed control, always refer to label for climatic restrictions.

General Rule of Thumb

The best recommendation to avoid either crop injury or reduced weed control is to make applications to healthy plants after daytime temperatures exceed 60°F. If the herbicide application is "absolutely necessary" under cool or cold conditions, check your herbicide label for any warnings or precautions.

Group 1, ACC-ASE Inhibitors

Assure II, Poast, Select Max, Volunteer provide better weed control in warm rather than cool conditions, a decrease in weed control is possible in cool conditions.

Parity is much more active in cool conditions and may be more effective on certain weeds during cold temperatures.

Discover NG performs very similarly across a wide array of environmental conditions. However, the Discover label does warn of potential for crop injury when applied within 48 hours of temperatures below 40°F.

Axial XL provides consistent performance across various temperature ranges. However, reduced weed control and slight crop response is possible when temperatures are cool and cold (less than 50°F) for a prolonged period of time (days).

Group 2, ALS Enzyme Inhibitors

SU and Imi herbicides like: Accent Q, Affinity products, Basis Blend, Everest 2.0, Sierra, FirstRate, Sonic, GoldSky, Harmony SG, Olympus, Orion, PowerFlex HL, Pursuit, Raptor, Rimfire Max and Varro are metabolized by the crop and therefore can cause injury during periods of poor plant growth such as when conditions become cool. Damage can manifest itself in many ways, the picture below shows damage on soybean leaves. Some products especially wheat herbicides can work very slowly taking up to a month to achieve weed control.

Group 4, Growth Regulators

Phenoxy herbicides such as 2,4-D, Enlist One, Enlist Duo, Curtail, Dicamba (Banvel, Clarity, Detonate, DiFlexx, Xtendimax, Engenia), Hornet, MCPA, Stinger and WideMatch usually do not increase crop injury in cool conditions although usually not reduced. It may take longer to see effects on weed control under cool conditions. Picture below shows poor Marestail control with 2,4-D ester due to cool weather.



Photo: omafra, ALS damage on soybean leaves



Poor Marestail control with 2,4-D ester

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Group 5, Photosystem II Inhibitors, Site A
Metribuzin and atrazine can increase crop injury when rainfall moves them into the root zone, allowing for root uptake during periods of slow growth related to a cool environment. Picture to the right shows metribuzin damage on the lower leaves of soybeans.

Group 6, Photosystem II Inhibitors, Site B
Buctril in corn and small grains, and Wolfpack Advanced in small grains both contain bromoxynil which can result in increased cosmetic leaf burn when applications are made in cool weather. This cosmetic injury rarely results in yield loss.

Group 9, ESPS Inhibitors
Glyphosate symptoms can be slow to show when applied during or after cool temperatures with overall weed control being reduced. Many perennial weeds such as dandelion, canada thistle and quackgrass are tough to control in the spring at best, due to reduced plant growth, resulting in lower herbicide translocation during cool, cloudy conditions.

Group 10, Glutamine Synthase Inhibitors
Group 14, PPO Inhibitors
Group 22, Photosystem I Inhibitors
Group 27, HPPD Inhibitors
Contact herbicides such as Cobra, Flexstar, and Ultra Blazer (Group 14), Gramoxone (Group 22), Liberty, Cheetah, Autonomy, Interline (Group 10), Marvel (Group 14), and Callisto (Group 27) usually do not have any increased risk of crop injury but may result in reduced weed control when conditions are cool/cold following application of these herbicides due to hardening off of weeds in cold temperatures.

Aim (Group 14) performs consistently across varying temperatures and is more sensitive to sunlight. Aim should provide very good burndown activity, even in cool conditions, provided it receives adequate sunlight for activation.

Huskie (Group 6, 27) contains both bromoxynil and pyrasulfotole. As noted earlier, bromoxynil can result in increased cosmetic injury when applications are made during or just prior to cool/cold weather. However, Huskie contains a safener (mefenpyr-diethyl) and less bromoxynil than other bromoxynil formulations, so injury potential is much less than traditional bromoxynil formulations (Buctril, Wolfpack Advance, etc.). Weed control from Huskie is relatively consistent across temperatures, but in extreme cool conditions, weed control can be reduced due to weeds hardening off.



Photo: Purdue University, Metribuzin damage on the lower leaves of soybeans



Photo: Iowa State University, Poor control of Giant Ragweed due to cool weather

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Effect of Cold, Frost, or Hail on Various Crops

Corn

Germination: Cold soil temperatures (sub 50°F) can trigger imbibitional chilling injury or cold temperature injury. These phenomena occur when either seed kernels imbibe water that is colder than what is considered ideal resulting in ruptured tissue during cell expansion or from damage to the mesocotyl during cell elongation. Plant death is possible but more commonly observed are corkscrewed mesocotyls that are responsible for arrested development or delayed emergence.

Emergence to V5: Very little effect, even if crops are completely defoliated, as the growing point is still about one-half inch below the soil surface. New growth should be visible the day after frost as long as the temperature rises above 65°F. Stands can be evaluated after a few days to determine whether certain plants will survive.

V6 or later: Growing point is now above ground. Lodged plants can recover and continue to grow, but plants snapped off at the base are dead. Plants that were borderline 5-6 leaf should be monitored for three or four days to see if regrowth occurs. Stem bruising can be a problem that manifests later in the season. Young stalks will be able to stand with bruising, if significant damage occurs, plants in later stages may not be able to support their own weight and will be more prone to lodging.

V6 to V8: Leaf loss at this stage has a little impact on final yield provided there is no damage to the growing point. Corn can sustain up to 50% leaf loss with almost no yield reduction and 75% leaf loss relates to only about 5% yield reduction. In fact, even when all leaves have been stripped, one can expect only about 10% yield reduction to occur as long as the growing point is undamaged.

9-11 leaf stage: A 50% leaf loss will result in an approximately 5% yield reduction, and 75% leaf loss will result in an approximately 10% yield reduction. Complete (100%) leaf loss will result in an approximately 15% yield reduction.

12-14 leaf stage: A 50% leaf loss will result in an approximately 5% yield reduction, and 75% leaf loss will result in an approximately 20% yield reduction. Complete leaf loss will result in an approximately 35% yield reduction.

15+ leaf stage: A 50% leaf loss will result in an approximately 10% yield reduction, and 75% leaf loss will result in an approximately 40% yield reduction. Complete leaf loss will result in an approximately 60% yield reduction.

Tasseling: A 50% leaf loss will result in an approximately 20% yield reduction, and 75% leaf loss will result in an approximately 65% yield reduction. Complete leaf loss will result in a total yield loss.

Late Milk: A 50% leaf loss will result in an approximately 10% yield reduction, and 75% leaf loss will result in an approximately 35% yield reduction. Complete leaf loss results in an approximately 50% yield reduction.

Buggywhipping: Corn that has been subjected to hail at any stage is susceptible to a phenomenon known as "buggywhipping" where leaves become tightly wound in the whorl and the tassel has difficulty emerging. There is no surefire way to determine when or if these leaves will unfurl, and agronomists should not count these as viable plants when taking stand counts.

Stand Loss at any stage: University research suggests that a 25% stand loss will result in a 10% total yield loss, a 50% stand loss will result in a 25% yield loss, and a 75% stand loss will result in a 45% yield loss.

Soybeans And Dry Beans

Seed Germination: Soybean will readily germinate at soil temperatures near 50° F. However, the concern relating to soybean that germinate in cold soils is that the germination processes are dramatically repressed thus maintaining the seedling at a susceptible stage for a longer period of time for injury to occur from seedling rot pathogens. Dry bean are not as tolerant to cold or frost as soybean and generally require planting at or near the last frost free date for a given geography.

Cotyledon: Soybeans can survive freezing temperatures down to 27°F for several hours.

Unifoliate to Trifoliate Stages: Soybean at these stages are more sensitive to frost than when in the cotyledon stage. However, plants can compensate readily for frost or hail damage even when the terminal bud is destroyed because soybean are capable of growing from axillary buds. However, if the plant is cut off below the cotyledons of the plant, the plant will not regrow and, like corn, soybean stem bruising from hail can cause plants to be more prone to lodging at later stages.

Always wait a few days after injury before assessing bean stands for replant decisions. Soybean plants may take up to 4 to 7 days after injury before regrowth becomes evident. The general rule of thumb is that if four plants per foot of row remain, the crop can still produce appreciable yields.

Small Grains

Prior to or at 5 leaf stage: Very little effect, even if crops are completely defoliated, as the growing point is still below the soil surface. Small grains may exhibit leaf injury symptomology, but the growing point is well protected and plants can often withstand temperatures in low 20s without experiencing yield losses.

Jointing: Damage to the growing point will cause that tiller or main stem to be nonproductive. However, if the growing point is injured prior to flag leaf, additional tillering may occur. Defoliation after jointing will reduce yield even if the growing point is not damaged due to the loss of photosynthetic activity.

Boot: Hail damage during boot and later stages will have a significant impact on yield due to both loss of leaves and damage to the growing point.

Heading: Stems bent from hail will result in a dramatic yield reduction. Bent wheat stems will lose about 66% of their production, and bent barley stems about 33%. For example, if 50% of wheat plants in a field have bent stems, the grower can expect a 33% loss of yield (50% x 0.66 = 33%).

Hard Dough Stage: Yield loss is solely due to shattering and lodging.

Sunflower

Frost or hail damage to sunflower has the largest impact when in seedling or budding stage. Sunflower in the bud stage can withstand temperatures down to approximately 26°F. Sunflowers in the 2-6 leaf stage are not as tolerant to cold temperatures and significant losses can occur if the growing point is injured. Stand reduction and growing point loss will result in significant yield reduction. Defoliation and injured tissue can also lead to yield reductions due to loss of photosynthetic activity and disease infestation of stems. Fifty percent stand reduction will result in an approximately 12% yield reduction during vegetative stages and a 20% (R1) - 45% (R6) yield reduction during reproductive stages. Seventy-five percent stand reduction will result in yield reductions of approximately 25% when in vegetative stages and 35% (R1) - 60% (R6) when in reproductive stages. Leaf defoliation of 75% or greater during the bud stage can result in yield reduction of approximately 50%.

Sugarbeet

Sugarbeet are relatively hardy to early planting and cold temperatures. However, extended temperatures below freezing can kill the growing point. Plants that survive frost or hail damage in the early season have minimal yield loss as long as they are able to recover and regrow within a few days. Sugarbeet replant decisions are both population and timing dependent. Consult your local cooperative Ag-Staff for specific geographic and calendar date recommendations. Mature Sugarbeet can tolerate cold temperatures down to approximately 25°F. However, tonnage losses are exacerbated when defoliation due to hail occurs during the midseason months (June or July) than if defoliation occurs later in season (August or September). Weather conditions prior to a frost can impact the effect of the cold temperatures on the plant. As with many crops, cool or cold conditions prior to frost can "harden off" the mature crop and it is able to better withstand cold temperatures. It is best to wait a few days before evaluating the impact of frost or hail on the crop. Pesticide applications after a frost or hail event should be delayed until new growth is observed.

Canola

Canola can compensate very well for hail damage as long as the growing point survives. Plants in early growth stages that lose the growing point from being cut off below the cotyledons will die. However, even when stands are reduced from an average of 12 plants per square foot to four plants per square foot, yield is only reduced about 10%. Plants that are farther along in their vegetative growth typically experience yield loss relative to the amount of leaf loss. Generally, yield loss is equal to about 25% of the loss of leaf area due to the reduction in photosynthetic potential. For example, a 50% loss of leaf area from a hail event will likely result in a 12.5% loss in seed yield. Plants losing flowers or buds due to hail will rapidly compensate by developing flowers that would have otherwise been aborted since the plants do not typically support all of the flowers they have the potential to produce. Additionally, crops can also form branches lower on the plant which are capable of producing additional flowers and buds. Final yield loss is dependent on the crops' ability to compensate for lost branches, flowers, or buds, and this can be variety dependent. Finally, hail that occurs during pod fill will result in direct seed yield losses based on the amount of branches, pods, and seeds that are removed from the plant. Any flowers that are generated after a portion of the plant is lost due to a hail event during pod fill will likely not contribute to yield because it will be too late in the season for those flowers to produce pods and seeds.

Field Pea, Lentil, and Chickpea

These legumes are not real tolerant to hail damage. Losses depend on extent of damage, growth stage, varietal variability, and environmental conditions after a hail event. Damage during vegetative stages prior to flowering can be compensated for depending on the ability of the plant to regrow from lower nodes. Disease problems can be more prevalent due to the bruising on the plant, so fungicide programs should become more aggressive than originally planned. If the top node is cut off, plants will likely stop growing vertically and have increased growth from lower nodes, resulting in a shorter, bushier plant. Yield losses from hail damage that occurs during flowering, pod development, or pod fill are hard to estimate until plants reach full maturity. Losses can only be compared to healthy plants as pod fill is dependent on environmental conditions during vegetative stages. If hail damage results in pods being set lower than normal, pods may not fill as large as if they had been set higher. Growers and insurance agents usually need to wait until full maturity in order to get a true assessment of yield loss. Hail damage during pod fill can lead to actual seed loss as well as quality loss, making some seed be unacceptable for commercial grade.

Based on work done in the Pacific Northwest, stems that are broken or cutoff during vegetative stages will generally result in yield losses that are approximately 50% of the percentage of the cutoff stems. Additionally, stems that are cutoff during flowering stages will generally result in yield losses of about 75% of percentage of cutoffs. However, these numbers are for use in making estimates only as they are only arbitrary numbers.

Mite infestations are common in dry regions of the western U.S. or when dry conditions persist. The Banks grass mite (BGM) and two-spotted spider mite (TSM) are most commonly identified as species of concern although other species are capable of threshold level feeding. Feeding and symptoms begin near the bottom of the canopy and move upward so early detection should begin with lower leaf examination. Infestations typically first appear near field edges or stressed areas; however, spot treatments are ineffective because mites spread well before visual symptoms detection.

Miticides / Insecticides Recommended for Mite Management in Corn

Mite feeding causes loss of photosynthetic (Ps) leaf surface area. Therefore, an insecticide management strategy should focus on preventing leaf damage prior to it reaching the ear-leaf.

Insecticide/Miticide	Mite Rate/A	Grain PHI	Other important insects controlled
Brigade 2EC* or Fanfare 2EC*	5.12–6.4 fl oz	30 d	Aphids, Armyworms, Corn Borer, Cutworms, Flea Beetles, Grasshopper, Stink/Plant bugs, and Adult Corn Rootworm, Cucumber Beetle, Japanese Beetle.
Comite* II	36–54 fl oz	30 d	The active ingredient in Comite II is specific for mite species.
Dimethoate 4E	0.66–1.0 pt	28 d	Aphids, Bean Beetle, Grasshopper, and Adult Corn Rootworm.
Zeal SC	2–6 fl oz		Zeal SC is a miticide specific for control of BGM, TSM, and other mite species including Carmine, Pacific, and Strawberry spider mite.
Oberon 4 SC	2.85–8.0 fl oz	30 d	Oberon is a miticide specific for control of BGM and TSM.
Onager EC	12–24 fl oz	30 d	Onager EC is a miticide specific for control of BGM, TSM, and other mite species including Pacific and Strawberry spider mite sp.
Zeal WDG	1.0–3.0 oz	21 d	Zeal WDG is a miticide specific for control of BGM, TSM, and other mite species including Carmine, Pacific, and Strawberry spider mite.
Elevest*	7.7 to 9.6 oz	30 d	3 apps total/crop year. See label for additional use restrictions. Broad spectrum.

Insecticides Recommended for Mite Management in Soybean

Mite feeding in soybean reduces Ps leaf area and accentuates drought stress resulting in reduced pod set as well as diminished seed number and size.

Insecticide/Miticide	Mite Rate/A	Grain PHI	Other important insects controlled
Brigade 2EC* or Fanfare 2EC*	5.12 to 6.4 fl oz	18 d	Aphids, Armyworms, Bean Leaf Beetle, Blister Beetle, Corn Borer, Cutworms, Flea Beetles, Grasshopper, Loopers, Stink/Plant bugs, Bud, Clover, Ear, & Hornworms, Spittlebugs, Adult Corn Rootworm, Cucumber Beetle, Japanese Beetle.
Dimethoate 4E	1.0 pt	21 d	Aphids, Bean Leaf Beetle, Leafhoppers, and Mexican Bean Beetle, Mites.
Agri-Mek SC 0.7	1.75 to 3.5 fl oz	28 d	Agri-Mek SC 0.7 is a miticide specific for control of BGM, TSM, and other mite species including Carmine, Pacific, and Strawberry spider mite.
Hero*	10.3 fl oz	21 d	Broad Spectrum
Elevest*	7.7- 9.6 fl oz	18 d	Broad Spectrum
Ridgeback*	11.0 - 13.8 fl oz	18 d	Broad Spectrum
Zeal Pro	11.5 – 34.6 fl oz		Zeal Pro is predominately an ovicide/ larvicide and should be used early in the life cycle of mites. Apply prior to R5
Zeal SC	2 – 6 fl oz		Zeal SC is predominately an ovicide/ larvicide and should be used early in the life cycle of mites. Apply prior to R5

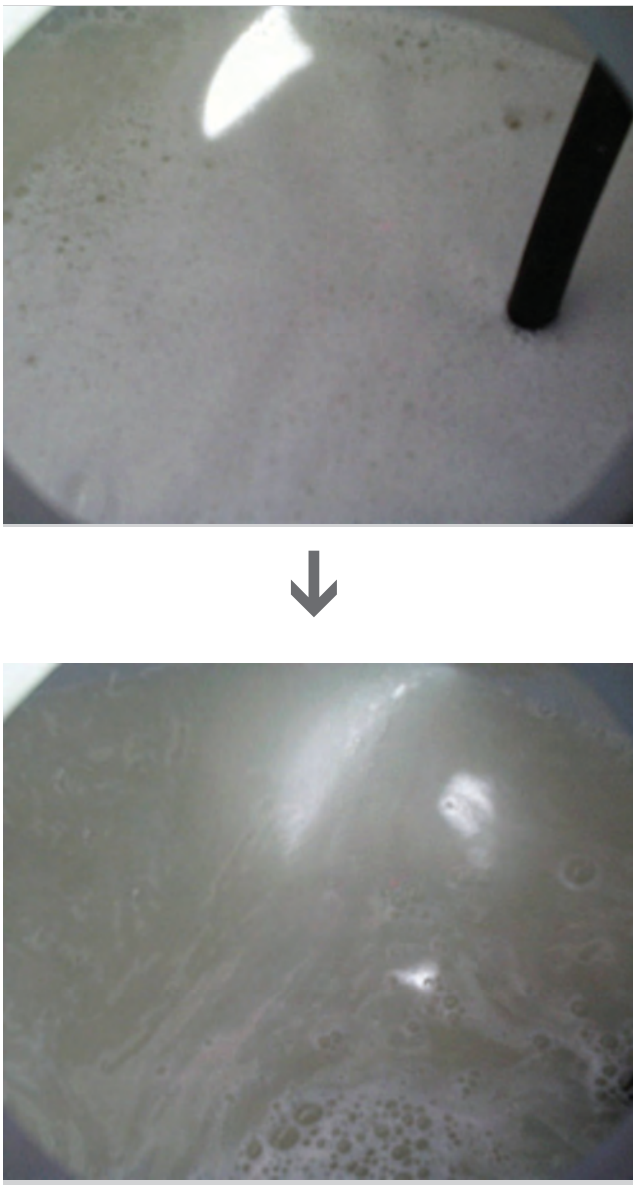
* Restricted use Pesticide.

CHS Endurium at 1 qt/100 or CHS Acuvant at 3 fl oz/A will provide drift reduction and droplet retention.

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Reducing Foam From Mixing Glyphosate Herbicides

Glyphosate formulations vary by product and year regarding the amount of foam produced when preparing spray mixtures for weed control applications. Additional surfactants, water conditioners, and deposition management aids will help maximize glyphosate activity, but these also contain highly active surfactants that can cause excessive foam formation. Some adjuvants include a defoamer in their formulation to try to minimize foam, but even with this addition, excessive foam can still result with certain products or tank mixtures.



Use the following steps to minimize foam formation:

1. Begin filling spray tank with water.
2. When the spray tank is approximately half full and while continuing to fill with water, begin moderate agitation and add a water conditioning agent or AMS adjuvant in its entirety at the necessary volume.
3. After the addition of water conditioner, add defoamer at 1–2 oz/100 gal to assist with preventing potential foam formation in the spray load. The required defoamer use rate will vary based on water source and glyphosate product used. Adding defoamer prior to adding the glyphosate product is important in the reduction of foam formation and will also lessen the need to "knock down" foam that has already formed, which tends to be more difficult and time consuming.
4. After defoamer is added, add the glyphosate herbicide with moderate agitation.
5. Once the sprayer is completely loaded with all products being used, continue agitation.
6. Additional defoamer should not be necessary, but if foam does occur after agitation is started, add additional defoamer as needed.

Note: If additional tank mix partners are used:

a. Add wettable powders and dry flowables to the water and moderately agitate until mixed. Add the water conditioner and continue agitation.

b. Add EC and soluble liquid pesticides.

c. Add defoamer

d. Add the glyphosate herbicide.

e. Add micronutrient products after the glyphosate herbicide.

f. Add drift control and/or deposition management products last.

Always read and follow label directions.

The USDA estimates that insect damage in stored corn and wheat inventories approach hundreds of millions of dollars per year. Losses of this magnitude are never tolerated in the field but insect damage in the bin goes largely unseen and therefore seldom acted upon.

The best way to prevent insect or mold damage to stored grain is to make use of an Intergraded Pest Management (IPM) plan. IPM in stored grain utilizes a combination of preventive measures to keep grain in good condition. The following IPM steps are recommended for stored grain:

- **Sanitation** – Clean the bin of old grain and debris both inside and outside the bin. Make sure to get under the aeration floors. Remove any vegetation around the bin.
- **Repair** – Fill any cracks and crevices that would allow insects entry into the bin.
- **Spray bin and surrounding area** with a residual insecticide that is labeled for such use.
- **Remove fines** – Clean grain is less attractive to insects and it allows protectant products and aeration methods to work more effectively.
- **Apply a protective product** if the grain is going to be stored for periods greater than six months or during the summer when insect activity is at its highest levels.
- **Aeration** – Properly aerated grain helps keep mold and insects out of the grain.
- **Monitor** grain every two weeks for moisture, temperature, and possible insect activity.
- **Fumigate when necessary** – If an infestation happens, fumigation is your only reliable method of control. Due to tighter restriction on the use of fumigant products, this option of control is becoming more expensive and limited.

CHS agronomy recommended products for grain storage

Bin Spray:

1. **Tempo® SC Ultra** – Easy to use, controls a wide range of pests, and has good residual properties.
2. **Malathion 5EC** – For residual wall, floor and machinery spray and other grain storage.

Grain Applied:

3. **Centynal™ EC** – Single mode of action, suppresses a wide range of stored grain pests.
4. **Diacon® IGR Plus** – Two modes of action, controls a wide range of stored grain pests and has good residual properties. Controls Lesser Grain Borer.
5. **Diacon® IGR** – Single mode of action, long lasting, and controls many insects.
6. **Diacon-D® IGR** – Easy to apply dust product.
7. **Dusta-Cide® 6** – Economical product for short-term storage.
8. **Sensat** – An effective, reduced risk insecticide for the protection of stored grain.
9. **Storcide® II** – Two modes of action, controls a wide range of stored grain pests, and has good residual properties.
10. **Suspend® EC** – Single mode of action, suppresses a wide range of stored grain pests.

Contact your CHS agronomy representative for more stored grain information and services offered by CHS Inc.

Always read and follow label instructions for product use.

Tempo, Storcide, Sensat, and Suspend are registered trademarks of Bayer. Centynal is a trademark, Diacon IGR, and Diacon-D IGR are registered trademarks of Central Life Science.

Discussion Points to have with the Grower

Crop:

1. *What crop is being stored?* As a rule of thumb, certain crops such as small grains or sunflowers seem to be more susceptible to infestation over other crops such as soybeans.
2. *Is there any old crop that would be mixed with the new crop?* Old crop can harbor insects and be the source of infestation for the new crop.
3. *Does the end user have less tolerance for insect infested grain than the USDA standards?*
   a. Example - Popcorn
   b. Example - Sunflower
4. *History –*
   a. Has the grower had insect problems before?
   b. Was the insect identified?
   c. Certain insect species will dictate what control options are best

Storage:

1. *Storage Type -*
   a. Bin – ideal type of storage for grain protectant use
      • Bin condition and maintenance is very important for helping control insects.
   b. Flat storage – difficult to treat grain and prevent infestation
2. *Length of storage -*
   a. Choice of protectant may be dictated by the length of storage time assumed for that crop.

Insecticide Types:

1. *Bin Sprays* – Used on and around the storage structure to control existing insect populations and deter future access to the grain. These products may or may not be labeled for use on grain.
2. *Protective* – Insecticides that help prevent infestations from insects that are entering the grain. Protective products cannot be used as a Rescue option.
3. *Rescue* – Insecticides that eradicate an established infestation. Rescue products do not protect the grain from future infestations.

Formulation Types:

1. *Dust* – From a handling perspective they are the easiest to use but the least accurate in application. They do not cover the grain mass as well as liquids or gas and leave openings for infestations to happen. Excellent control is hard to obtain with dust formulations and therefore expectations need to be moderated on their use.
2. *Liquid* – More difficult to work with than dusts but provide better coverage and grain dust suppression.
3. *Gas* – Gas formulations are the best for penetrating through the whole grain mass and even through the grain coat. However, these formulations are mostly Restricted Use and need to be applied by qualified and certified personnel.

Application Methods:

1. Admixture –

- All grain in the bin is treated
- Recommended application for maximum protection

2. Layered –

- Grain on the bottom and the top of the bin is treated (3-6 ft. in depth)
- Failure to treat enough of the grain layer could lead to infestation
- Economical choice for protecting grain from insects entering the bin
- Good choice for short-term storage options

3. Top-Dress –

- Minimum protection from insects entering the bin from above
- Only protective option available after grain has been binned

Always read and follow label instructions for product use.

Category	Product	Active Ingredient	Formula	Mode of Action	Use	Rate	Signal Word	Labeled Insects	Comments
Bin Spray	**Tempo SC Ultra**	Beta-Cyfluthrin	Liquid	Nerve poison	granaries	8–16 ml/gal water	Caution	Exposed adults and immature stages: weevils, flour beetles, Indian meal moth, and many other grain insects.	Applications to building foundations up to a maximum height of 3 feet, all outdoor applications to impervious surfaces are limited to spot and crack and crevice applications only.
Bin Spray	**Malathion 5EC**	Malathion	Liquid	Nerve poison	storage building for barley, corn, oats, rye, wheat	0.96 pt per 1,000 sq ft Mix in 2-3 gal of water	Warning	Cereal leaf beetles, confused flour beetles, flat grain beetles, granary weevils, Indian meal moth, khapra beetle, lesser grain borer, maize weevils, red flour beetles, rice weevils, rusty grain beetles, saw-toothed grain beetles.	Well documented eveidence that many stored grain insect pests, including Indian Meal Moth, are resistant or highly tolerant to Malathion. Liquid is not labeled on grain. **NOTE: not all Malathion % labels carry Bin Spray as an application method.**
Grain Applied	**Centynal EC**	Deltamethrin	Emulsifiable concentrate	Nerve poison	barley, corn, oats, popcorn, rice, rye, sorghum (milo), and wheat	0.34 fl oz/ton	Warning	Adults and accessible stages of lesser grain borer, Indian meal moth, saw-toothed grain beetle, merchant grain beetle, red flour beetle, confused flour beetle, and other insect pests that are affected by IGRs. Suppresses weevils, flour beetles, and other grain insects.	
Grain Applied	**Diacon IGR**	(S)-Methoprene	Liquid	Insect growth regulator (IGR)	All stored products	varies with crop and storage time	Caution	Almond moth, Indian meal moth, cigarette beetle, lesser grain borer, flour beetle.	IGRs are not an adulticide. Control is achieved by breaking the insect life cycle.
Grain Applied	**Diacon IGR Plus**	Deltamethrin (S)-Methoprene	Liquid	Nerve poison Insect growth regulator (IGR)	barley, corn, oats, popcorn, rice, rye, sorghum (milo), and wheat	0.34 fl oz/ton with 13-21 oz of diluent	Warning	Adult and accessible larval stages of: lesser grain borer, larger grain borer, Angoumois grain moth, Indian meal moth, tobacco moth, dermestids, bean weevils, granary weevils, rice weevil, maize weevil, saw-toothed grain beetles, red flour beetles, and confused flour beetles.	Two active ingredients with different modes of action. CODEX approved for cereal grains.
Grain Applied	**Diacon-D IGR**	(S)-Methoprene	Dust	Insect growth regulator (IGR)	All stored products	8–10 lb/ 1,000 bu	Caution	Insect pests, such as: almond moth, Indian meal moth, lesser grain borer, saw-thoothed grain beetle, merchant grain beetle, red and confused flour beetle, and other insect pests that are affected by Insect Growth Regulators (IGRs).	IGRs are not an adulticide. Control is achieved by breaking the insect life cycle.
Grain Applied	**Max Kill Dusta-Cide 6**	Malathion	Dust	Nerve poison	barley, corn, oats, rye, and wheat	10 lb/1,000 bu	Caution	Rice weevil, granary weevil, lesser grain borer, saw-toothed grain beetle, cadelle black carpet beetle, flat grain beetle, rusty grain beetle, red flour beetle, confused flour beetle, Mediterranean flour mouth, Indian meal moth, Angoumois grain moth.	Malathion has well documented evidence of resistance in many stored grain insects.
Grain Applied	**Sensat**	Spinosad	Liquid	Nerve poison	barley, birdseed, corn, millet, oats, sorghum, triticale, and wheat	5.9–10.5 fl oz/1,000 rates vary by crop	Caution	Grain Commodities against injury from insect pests including, lesser grain borer, Indian meal moth, and Angoumois grain moth, rice moth, almond moth, confused flour beetle, and flat grain beetle. Additional pests such as rice weevil, granary weevil, maize weevil, red flour beetle, saw-toothed grain beetle, and rusty grain beetle are suppressed to low levels. Protection is achieved by breaking the pest life cycle through control of adults and/or immature life stages.	Treated grain is available to be used immediately for feed, food, and oil. **STORED SEED USED FOR PLANTING:** This use is restricted to those crops listed on this label, but includes all non-food crop seeds including, flower seed, ornamental seed, and grass seed. Sensat may also be used in conjunction with registered fungicides or other insecticide seed protectants. Seed treated with Sensat alone, is considered food-quality grain. Seed treated with other seed protectant products may be required to be colored and tagged. Requirements for coloring and tagging can be found on the product labels.
Grain Applied	**Storcide II**	Chlorpyrifos-methyl Deltamethrin	Liquid	Nerve poison	barley, oats, rice, sorghum and wheat	Crop Specific 6.6–12.4 fl oz/1,000 bu	Danger	Adults and accessible stages of lesser grain borer, Indian meal moth, weevils, flour beetles, and other grain insects.	Two active ingredients with different modes of action. Applying direct to grain or stored seed must use automated admixture system that transfer grain or seed directly into stationary storage facilities.
Grain Applied	**Suspend SC**	Deltamethrin	Liquid	Nerve poison	barley, corn, oats, popcorn, rice, rye, sorghum (milo), and wheat	4.88–9.14 fl oz/1,000 bu rates vary by crop	Caution	Adults and accessible stages of lesser grain borer, Indian meal moth, weevils, flour beetles, and other grain insects.	

Always read and follow label instructions

Centynal EC

General Directions for Treatment of Grain Being Stored: Dilute Centynal with water or approved dust controlling oils, mineral or soybean oils and apply to the moving grain stream as a coarse spray to give a deposit of 0.5–1.0 ppm of deltamethrin on the grain. The final spray volume with water solutions is 3–5 gallons of liquid per 1,000 bu. of grain.

Centynal EC Per 1,000 Bushels (Synthetic)

Grain	fl oz	ml	Gal of dilute solution
Barley	7.75	229	3–5
Corn	9.0	266	3–5
Oats	5.15	152	3–5
Popcorn	9.0	266	3–5
Rice	7.20	212	3–5
Rye	9.0	266	3–5
Sorghum (milo)	8.0	236	3–5
Wheat	9.6	283	3–5

Diacon-D

General Directions for Treatment of Grain Being Stored: DIACON-D is a ready to use dust formulation for use in stored commodities. Apply dust as uniformly as possible to the commodity stream to assure even coverage.

Diacon-D Per 1,000 Bushels (Biological)

Grain	lb	bu
All Grain types	8-10	1,000

Diacon IGR

General Directions for Treatment of Grain Being Stored: Dilute DIACON IGR with water of FDA approved food grade mineral or soybean oil and apply to the moving grain stream as a coarse spray. Final water or oil dilution volume is 5 gallons of liquid per 1,000 bu. of grain.

Diacon IGR Per 1,000 Bushels (Biological)

Grain	fl oz	ml	fl oz	ml	fl oz	ml	Gal of dilute solution
Wheat	7	210	3.5	105	1.75	52	5
Corn	7	210	3.5	105	1.75	52	5
Sorghum (milo)	7	210	3.5	105	1.75	52	5
Barley	6	180	3.0	90	1.50	45	5
Rice	6	180	3.0	90	1.50	45	5
Oats	4	120	2.0	60	1.00	30	5
Sunflower	4	120	2.0	60	1.00	30	5

Diacon IGR Plus

General Directions for Treatment of Grain Being Stored: Dilute Diacon IGR Plus with water or approved dust-controlling oils, mineral or soybean oils and apply to the moving grain stream as a coarse spray to provide a concentration of 0.5–1.0 ppm of deltamethrin and 1.25–2.5 ppm of S-methoprene on the grain. The final spray volume with water solutions is 3–5 gallons of liquid per 1,000 bu. of grain.

Diacon IGR Plus Per 1,000 Bushels (Synthetic)

Grain	fl oz	ml	Gal of dilute solution
Barley	7.75	229	3–5
Corn	9.0	266	3–5
Oats	5.15	152	3–5
Popcorn	9.0	266	3–5
Rice	7.2	212	3–5
Rye	9.0	266	3–5
Sorghum (milo)	8.0	236	3–5
Wheat	9.6	283	3–5

Max Kill Dusta-Cide 6

General Directions for Treatment of Grain Being Stored: Dusta-Cide 6 is a ready to use dust formulation for use in certain stored commodities. Apply dust as uniformly as possible to the commodity stream to ensure even coverage.

Max Kill Dusta-Cide 6 (Synthetic)

Grain	lb	bu
Corn	10	1,000
Oats	10	1,000
Barley	10	1,000
Rye	10	1,000

Sensat

General Directions for Treatment of Grain Being Stored: Dilute Sensat with water, mix thoroughly and occasionally agitate. Apply as a coarse spray to the moving grain stream. Apply 5 gallons spray mixture per 1,000 bushels of grain for all grains listed.

Sensat Per 1,000 Bushels

Grain	lb	bu
Barley	8.2	242
Bird seed	See rate/ton	See rate/ton
Corn (field, sweet, pop, grown for seed)	9.8	290
Millet, foxtail	8.7	257
Millet, pearl	5.9	174
Millet, proso	9.8	290
Oats	5.9	174
Sorghum (Milo)	9.8	290
Triticale	10.3	305
Wheat	10.5	310

Storcide II

General Directions for Treatment of Grain Being Stored: Dilute Storcide II with water or FDA approved food grade mineral or soybean oil and apply to the moving grain stream as a coarse spray to give a deposit of 3 ppm of chlorpyrifos-methyl and 0.5 ppm of deltamethrin on the grain. The final spray volume with water solutions is 5 gallons of liquid per 1,000 bu. of grain.

Storcide II Per 1,000 Bushels (Synthetic)

Grain	fl oz	ml	Gal of dilute solution
Wheat	12.4	356.7	5
Barley	9.9	292.7	5
Oats	6.6	195.2	5
Rice	9.3	275.0	5
Sorghum (milo)	11.6	343.0	5

Suspend SC

General Directions for Treatment of Grain Being Stored: Dilute Suspend SC with water or FDA approved food grade mineral or soybean oil and apply to the moving grain stream as a coarse spray to give a deposit of 0.5 ppm of deltamethrin on the grain. The final spray volume with water solutions is 5 gallons of liquid per 1,000 bu. of grain.

Suspend SC Per 1,000 Bushels (Synthetic)

Grain	fl oz	ml	Gal of dilute solution
Barley	7.31	216	5
Corn	8.53	252	5
Oats	4.88	144	5
Popcorn	8.53	252	5
Rice	6.86	202	5
Rye	8.53	252	5
Sorghum (milo)	8.53	252	5
Wheat	9.14	270	5

All information provided in this document is for general reference only. Always read and follow label instructions for product use.

Product	Area or Use	Rates	Adjuvant Recommendation	Notes	Grazing Restrictions
Plateau	New and established grasses Winter annual grass control	New 2.0–4.0 oz/A Est. 4.0–8.0 oz/A	**CHS Hypertonic** @ 0.25% v/v or **Tapran** @ 0.25 – 0.5% v/v **CHS Acuvant** 3 oz/A for drift control	Imazapic 2 lb/gal	None
2,4-D Amine	Grass seedlings	16.0–32.0 oz/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	Multiple forms	Lactating: 7 days Others: 3–7 days
2,4-D Ester 2,4-D Ester (LV)	Grass seedlings, Annual, Biennial, and Perennial broadleaf weeds in RandP	Grass Seedling 16 oz/A Annual/Biennial up to 32 oz/A Perennial up to 32 oz/A		Multiple forms	
Gramoxone SL	Sod Seeding Dormant alfalfa, clover and other legumes	2.0 pt/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	Paraquat dichloride 2 lb/gal Restricted use pesticide	0 days for seeding 30–60 days for dormant alfalfa, clover and other legumes
Glyphosate (Loaded)	Sod Seeding	16.0–32.0 oz/A	**CHS Hypertonic** @ 0.125% v/v + AMS 1-3 lbs/A or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	Multiple glyphosate salts	7 days spot treatment 56 days renovation
Amber	Annual and Biennial broadleaf weeds in RandP	0.28–0.56 oz/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	Triasulfuron 75 WD	None
Clarity Detonate Banvel Dicamba	Annual, Biennial, and Perennial broadleaf weeds in RandP	8.0–16.0 oz/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	DGA Dicamba 4 lb/gal DMA Dicamba 4 lb/gal	Lactating: 7 days: < 1 pt/A 21 days: 1–2 pt/A 40 days: 2–4 pt/A Others: 0 days
Chaparral RandP	Annual, Biennial, and Perennial broadleaf weeds in RandP	1.5–3.3 oz/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	Aminopyralid 0.62 lb ai/lb Metsulfuron 0.095 lb ai/lb Hay/Manure restrictions, see label	0 days
Cimarron Plus	Annual, Biennial, and Perennial broadleaf weeds in RandP	0.125–1.25 oz/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	Metsulfuron 48% Chlorsulfuron 15%	None
Cimarron Max		See label for rates		Metsulfuron 60 WP Dicamba 1 lb/gal / 2,4-D 2.87 lb/gal	Lactating: 7 days Others: 0 days
Cimarron Xtra		0.5–2.0 oz/A		Metsulfuron 30% Chlorsulfuron 37.5%	None
Curtail	Annual, Biennial, and Perennial broadleaf weeds in RandP	Annual/Biennial 2.0–4.0 pt/A Perennial 4.0–6.0 pt/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	2,4-D 2.0 lb/gal / Clopyralid 0.38 lb/gal	Lactating: 14 days Others: 0 days
ForeFront HL	Annual, Biennial, and Perennial broadleaf weeds in RandP	1.2–2.1 pt/A	**CHS Hypertonic** @ 0.25 – 0.50% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	Aminopyralid 0.41 lb/gal / 2,4-D 3.33 lb/gal Hay/Manure restrictions, see label	7 days harvested 0 days grazed
Grazon P+D	Annual, Biennial, and Perennial broadleaf weeds in RandP	Annual/Biennial 2.0–4.0 pt/A Perennial 3.0 pt–6.0 pt/A	**CHS Hypertonic** @ 0.25 – 0.50% v/v or **Tapran** 0.5% v/v	2,4-D 2 lb/gal Picloram 0.54 lb/gal	Lactating: 7 days Others: 0 days

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**Use low rate for sparse weed infestations and when shorter soil residual is required.

Product	Area or Use	Rates	Adjuvant Recommendation	Notes	Grazing Restrictions
Grazon Next HL (Broadcast)	Annual, Biennial, and Perennial broadleaf weeds in RandP	1.5–2.6 pt/A	**CHS Hypertonic** @ 0.25 – 0.50% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	Aminopyralid 0.41 lb/gal 2,4-D 3.33 lb/gal Hay/Manure restrictions, see label	7 days harvested 0 days grazed
Grazon Next HL (On Liquid or Dry Fertilizer)	Annual, Biennial, and Perennial broadleaf weeds in RandP	2–2.5 pt/A	**Soiltrate** 1-3 pt/A	Aminopyralid 0.41 lb/gal 2,4-D 3.33 lb/gal Hay/Manure restrictions, see label	7 days harvested 0 days grazed
Milestone	Annual, Biennial, and Perennial broadleaf weeds in RandP	3.0–7.0 oz/A	**CHS Hypertonic** @ 0.25 – 0.50% v/v **CHS Acuvant** 3 oz/A for drift control	Aminopyrlid 2 lb/gal Hay/Manure restrictions, see label	0 days
Overdrive	Annual, Biennial, and Perennial broadleaf weeds in RandP	4.0–8.0 oz/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	Dicamba 0.50 lb Diflufenzopyr 0.20 lb	None
Plotter	Annual and Biennial broadleaf weeds in RandP	0.1–0.4 oz/A	**CHS Hypertonic** @ 0.125 – 0.25% v/v **CHS Acuvant** 3 oz/A for drift control	Metsulfuron 60 WP	0 days
Pastora	Annual and Biennial broadleaf weeds in bermudagrass pastures and hay meadows, and in non-crop areas	1.0–1.5 oz/A	**CHS Hypertonic** @ 0.25 – 0.50% v/v **CHS Acuvant** 3 oz/A for drift control	Nicosulfuron 56.2% Metsulfuron 15.0%	0 days
Pasture Gard HL	Annual and Biennial broadleaf weeds in RandP. Perennial and woody control in RandP including basal, bark and cut stump treatment	1.0–4.0 pt/A See label for spot treatments	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	Triclopyr 3 lb/gal Fluoxypyr 1 lb/gal	0 days grazing 14 days for hay harvest 3 days slaughter
Facet or QuinStar	Many broadleaf and grass weeds in bermudagrass pasture, hay, and non-crop areas. Use in rotation with Pastora. Use on small weeds.	Facet 22–32 oz/A Quinstar L 15–4 oz/A	**Tapran** 2-3 qt/100 **CHS Acuvant** 3 oz/A for drift control	Quinchlorac 4 lb/gal	7 days harvested 0 days grazed
Remedy Ultra	Woody plant control	1.5 qt/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	4 lb/gal Triclopyr	Next growing season for lactating 0 days other
Duracor	Annual, Biennial, and Perennial broadleaf weeds in RandP. Fluid spray or impregnate on dry fertilizer.	12–20 oz/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control None needed if applied with fertilizers.	Aminopyralid 8.95 lb/gal Florpyrauxifen 0.76 lb/gal Hay/Manure restrictions, see label	14 haying days to grazing see label
Invora	Annual and Biennial broadleaf weeds in RandP. Perennial and woody control in RandP including basal, bark and cut stump treatment	12–48 oz/A	**CHS Level Best Pro** 1-2 qt/100 on Herbaceous weeds **CHS Acuvant** 3 oz/A for drift control	Aminocyclopyrachlor 0.67 lb/gal Trichlopyr 1.33 lb/gal	2 years hay harvest 3 days grazing and see label
Mezaveu (cactus)	Annual, Biennial, and Perennial broadleaf weeds, and brush in RandP	12–32 oz/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	Aminopyralid 0.49 lb/gal Picloram 0.97 lb/gal Fluoxypyr 1.2 lb/gal	See label restrictions for grazing and haying

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Product	Area or Use	Rates	Adjuvant Recommendation	Notes	Grazing Restrictions
Surmount	Annual, Biennial, and Perennial broadleaf weeds in RandP. Cedars and Woody Plant and Control	Annual/Biennial 1.5–2.0 pt/A Perennial 2.0–4.0 pt/A Woody Plant 3.0–6.0 pt/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	1.19 lb/gal Picloram 0.96 lb/gal Fluroxpyr	14 days lactating 0 days other
Tordon 22K	Annual, Biennial, and Perennial broadleaf weeds in RandP	Annual/Biennial 0.5–2.0 pt/A Perennial 2.0–4.0 pt/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	2 lb/gal Picloram	14 days lactating
Transline	Annual and Biennial broadleaf weeds in RandP	0.25–1.3 pt/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	3 lb/gal Clopyralid	None
RangeStar/ Weedmaster	Annual, Biennial, and Perennial broadleaf weeds in RandP	0.5–4.0 pt/A	**Tapran** @ 2-4 Qts/100 or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	1 lb/gal Dicamba/ 2.87 lb/gal 2,4-D	7 days lactating 0 days other 7 days hay/silage harvest
Sendero	Annual and Biennial broadleaf weeds in RandP. Perennial and woody control in RandP	0.5–1.75 pt/A	**CHS Hypertonic** @ 0.125% v/v or **CHS Level Best Pro** 1-2 qt/100 **CHS Acuvant** 3 oz/A for drift control	2.3 lb/gal Clopyralid/ 0.5 lb/gal Aminopyralid	14 days harvest See label for additional restrictions
Spike 20P	Woody plant control	0.20–0.41 oz/100 sq ft	None	Use caution close to desirable trees	See Label
Velpar L	Annual and Biennial broadleaf weeds in RandP. Perennial and woody plant control	2.75–4.5 pt/A See label for woody plants.	**Soiltrate** 1-3 pt/A	2 lb/gal Hexazinone	38 days harvested 0 days grazed
Crossbow	Annual and Biennial broadleaf weeds in RandP	1–2 qt/A	May be mixed with liquid nitrogen fertilizer.	2 lb/gal 2,4-D/ 1 lb/gal Triclopyr	Next growing season for lactating 0 days other
Rejuvra	Pre-emerge Annual and Biennial broadleaf weeds in RandP see label	3.5** to 5 oz/A	Use **Soiltrate** 1-3 pt/A, with Rejuvra alone and specified adjuvants with post-emerg tank mixes.	1.67 lbs/gal Indaziflam	40 Day PHI hay. 0 days grazing
Rezilon	Pre-emerge for annual grass weeds	3 oz spring and 3 oz fall	**Soiltrate** 1-3 pt/A	Indaziflam	Very good on annual rye and sand burrs
NovaGraz AR, OK, MO, LA, GA, see map	Annual, Biennial, & Perennial broadleaf weeds in R&P that's easy on clovers	24-48 oz/a Rain fast in 2 hours	**Tapran** 1% v/v **CHS Emulate** 1% v/v NO Organo-silicone adjuvants	0.045 lbs Florpyrauxifen 2.67 lbs 2,4D acid	3 days grazing 14 days for hay harvest 3 days slaughter See plant back issues

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**Use low rate for sparse weed infestations and when shorter soil residual is required.

Cover crops are planted specifically to benefit soil and water which, in turn, could lead to higher crop yields. They provide biomass which stays in the field and may be incorporated into the soil. Additional benefits that cover crops provide are improving overall soil health, preventing soil erosion, retaining nutrients, suppressing weeds, and promoting biodiversity.

Many Factors Affect Herbicide Degradation

A primary concern when planting a cover crop is the residual herbicide used earlier in the growing season and its impact on the establishment and development of the intended cover crop. Many labels don't address specific rotation intervals for cover crops. The table below classifies rotational intervals of common herbicides based on relative tolerance/susceptibility. This can be used as a guide when considering cover crop choices following prior residual herbicide use however many factors need to be considered. One of the most influential factors in herbicide degradation prior to planting cover crops is rainfall (timing and amount). Other factors include rate of herbicide, soil texture, temperature, pH, and organic matter. Since these factors will vary from field to field, definitive time intervals of residual herbicide activity can be difficult to predict. A field bioassay may be advisable to more accurately predict individual field situations and evaluate potential risk to cover crops prior to seeding an entire field.

Guide To Relative Sensitivity Of Common Cover Crops To Various Herbicides

Herbicide	Common Name	Crimson Clover	Austrian winter pea	Hairy Vetch	Radish	Annual Rye-grass	Oats	Cereal Rye	Winter Wheat
2,4-D amine	2,4-D								
atrazine	Atrazine								
chlorimuron	Classic								
cloransulam	FirstRate								
dicamba	Clarity								
flumioxazin	Valor								
fomesafen	Flexstar								
imazethapyr	Pursuit								
isoxaflutole	Balance Flexx								
lactofen	Cobra								
mesotrione	Callisto								
metribuzin	Sencor, Tricor								
pyroxasulfone	Zidua								
s-metolachlor	Dual/Brawl								
s-metolachlor + fomesafen	Prefix, Ledger								
sulfentrazone	Spartan								

More tolerant range when planted 90 days after application dependent on other variable factors.

Less tolerant range so > 90 days after application dependent on other variable factors.

Least tolerant range so > 120 days after application dependent on other variable factors.

* This information is for cover crops used for soil and water conservation benefits and not for potential forage harvest. Forage harvest situations introduce the legal herbicide rotational intervals.

Overall, residual herbicides that have grass activity can interfere with grass cover crop establishment and herbicides that have broadleaf residual activity can interfere with establishment of broadleaf cover crops.

The general order of sensitivity of cover crops to herbicide carryover, from greatest to least sensitive*: *tillage radish > Austrian winter pea > crimson clover = annual ryegrass > winter wheat = winter oats > hairy vetch = cereal rye.*

Soybean herbicides that are most injurious to cover crops*: fomesafen (Flexstar,Prefix), pyroxasulfone (Zidua, Anthem Maxx, etc), aceotochlor (Warrant).

Corn herbicides that are most injurious to cover crops*: topramezone (Impact, Armezon), mesotrione (Callisto, Halex GT, Resicore, etc.), clopyralid (Stinger, SureStart, Resicore, etc), isoxaflutole (Balance Flexx), pyroxasulfone (Zidua, Anthem Maxx, etc.).

* Information provided from Dr. Kevin Bradley, University of Missouri

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Soil Applied Herbicide

Herbicide	Rate	Stage	Comments
Acumen / Prowl / Prowl H20 / Satellite HydroCap	1.8–3.6 pt/A	Pre, Post up to 24″	Rate based on soil type. Plant at least 1.5″ deep.
Acuron	2.5–3.0 qt/A	Preplant, Preemergence	Rate based on soil type.
Acuron Flexi	2.0–2.25 qt/A	Preplant, Preemergence	Rate based on soil type.
Anthem Flex	2.75–7.28 fl oz/A	Pre, Post: emerge–V4	Rate based on soil type and timing.
Anthem Maxx	2.0–6.5 fl oz/A	Early Pre-Plant, PPI, Pre, Post: emerge–V4	Rate based on soil type.
Armezon Pro	14–24 fl oz/A	Pre – Post up to 12″ tall	Rate based on soil type.
Atrazine	1–4 pt/A	Preplant, Preemergence, Post 12″ tall	Rate based on soil type.
Bicep Lite II Magnum	0.9–1.5 qt/A	Pre or Post up to 12″ tall	Rate based on soil type.
Bicep II Magnum, Brawl ATZ	1.3–2.14 qt/A	Pre or Post up to 12″ tall	Rate based on soil type.
Callisto/Explorer	3.0–7.7 fl oz	Pre or Post	Use low rate (3.0 fl oz) for post application.
Degree Xtra	2.9–3.7 qt/A	Early Pre-Plant, PPI, Pre, Post up to 11″	Rate based on soil type.
Dual II Magnum / Brawl II	1–2 pt/A	Pre or Post	Rate based on soil type.
Harness, Volley NXT	1.5–3.75 pt/A	Pre Only	Rate based on soil type.
Harness Xtra, Volley ATZ Lite NXT	1.8–2.2 qt/A	Pre Only	Rate based on soil type.
Harness Xtra 5.6L, Volley ATZ NXT	1.7–3.0 qt/A	Pre Only	Rate based on soil type.
Lexar EZ	3–3.5 qt/A	Pre Only	Rate based on OM.
Lumax EZ	2.7–3.25 qt/A	Pre Only	Rate based on OM.
Outlook	16–21 oz/A	PPI, Pre, Post up to 12″	Rate based on soil type.
Sharpen	2.0 fl oz/A	Preplant, PPI, and Pre	Processing varieties Only.
Simazine 4F	1.0–2.0 qt/A	Preplant, Pre-emerge	45 day PHI.
TriCor 75 DF	1.6–5.3 oz/A	Pre Only	MN, SD and WI Only.
Verdict	10 fl oz/A	Preplant, PPI, and Pre	Processing varieties Only.
Palace	2–2.4 qt/A	Pre Only	Rate based on OM.
Zidua SC	1.75–6.5 fl oz/A	Pre, Post up to V-4	Certain sweet corn genetics may be more sensitive than others.

Post-Applied Herbicide

Herbicide	Rate	Stage	Comments
2,4-D Amine /Lo-Vol[1]	0.5–1.0 pt/A	Up to 8″ corn	Risk of injury
Accent Q[1]	0.9 oz/A	Up to 12″ (V5), Drop nozzles 12-18″ (V6) corn	**CHS Penetrec** (2 qt/100 gal) **CHS Endurium** (1 qt/100 gal) + **AMS** 2 lb/A
Aim	0.5 oz/A	Anytime	**CHS Hypertonic** (1 qt/100 gal) + **AMS** 2 lb/A
Basagran/ Broadloom[1]	1–2 pt/A	Anytime	**CHS Penetrec** or **CHS Aggrestrol** (2 qt/100 gal) **CHS Endurium** (1 qt/100 gal) + **AMS** 2 lb/A
Cadet	0.6–0.9 fl oz/A	Preplant to 48″ corn, 40 day PHI	**CHS Hypertonic** (1 qt/100 gal) **CHS Penetrec** (2 qt/100 gal)
Callisto / Explorer[1]	3 fl oz/A	Up to 30″ corn or V-8	**CHS Hypertonic** (1 qt/100 gal) **CHS Penetrec** (2 qt/100 gal) **CHS Endurium** (1 qt/100 gal)
Callisto Xtra[1]	20–24 fl oz/A	Emergence up to 12″ corn	**CHS Hypertonic** (1 qt/100 gal) **CHS Penetrec** (2 qt/100 gal) **CHS Endurium** (1 qt/100 gal)
Impact / Armezon	0.5–1.0 fl oz/A	Up to V8, 45 day PHI	**CHS Penetrec** or **CHS Aggrestrol** (2 qt/100 gal) + **AMS** 8.5 to 17 lb/100 gal
Impact Z	8.0–10.7 fl oz/A	Up to 12″	**CHS Aggrestrol** (2 qt/100 gal)
Laudis[1]	3 oz/A	Emergence up to V7 corn	**CHS Aggrestrol** (2 qt/100 gal) + **AMS** 1.5 lb/A
Permit/Sandea[1]	2/3 oz/A	Broadcast or drop nozzle applications from spike thru lay-by	**CHS Hypertonic** (1 qt/100 gal)
Primero	0.75 oz/A	Up to 12″ (V5), Drop nozzles 12-18″ (V6) corn	**CHS Penetrec** (2 qt/100 gal) **CHS Endurium** (1 qt/100 gal) + **AMS** 2 lb/A
Revulin Q[1]	3.4–4.0 oz/A	Up to 12″ tall or 5 collar 12″ to 18″ tall or six collar with drop nozzles	**CHS Hypertonic** (1 qt/100 gal)
Stinger	0.33–0.66 pt/A	Emergence up to 18″ corn	
Starane Ultra[1]	0.4 pt/A	PRE or POST up to 4 collars	

[1]Sweet corn hybrid sensitivity is highly variable and not all hybrids have been tested for crop tolerance. Injury may occur to sensitive hybrids.

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Soil Nitrogen Stabilizer Products

Products capable of delaying naturally occurring soil Nitrogen (N) transformation processes can lengthen the time that fertilizer N sources are available for plant uptake and improve Nitrogen Use Efficiency (NUE).

Product Name[1]	Common Name (% Active Ingredient)	Nitrogen Process Involved	Use Specifics
AGROTAIN ADVANCED 1.0	NBPT (30%)	Urease Inhibitor	UAN: 1 qt/ton Urea: 2 qt/ton
AGROTAIN DRI-MAXX	NBPT (60%)	Urease Inhibitor	UAN: 1.25 lb/ton Urea: 2.5 lb/ton
AGROTAIN PLUS SC for UAN	NBPT (unknown) + DCD (unknown)	Urease + Nitrification Inhibitor	UAN: 3 gal/ton Manure: 0.5 gal/A Poultry Litter: 0.5 gal/A
AGROTAIN ULTRA	NBPT (26.7%)	Urease Inhibitor	UAN: 1.5 qt/ton Urea: 3.0 qt/ton Increase rate by 1 qt/ton for conditions favor volatility
ANVOL	NBPT (16%) + Duromide (27%)	Urease Inhibitor	Urea: 1.5 qt/ton Nitrification Inhibitor UAN: 0.75 qt/ton (mix thoroughly)
CENTURO	Pronitridine (14%)	Nitrification Inhibitor	Anhydrous Ammonia: 5 gal/ton (clear dye) UAN: 2.5 gal/ton Liquid Urea Solutions: 1.5 gal/ton
CHS N-EDGE	NBPT (26.7%)	Urease Inhibitor	Urea: 2 to 4 qt/ton Nitrification Inhibitor UAN: 1.5 qt/ton as a tank mix
CHS N-EDGE 2	NBPT (40%)	Urease Inhibitor	Urea: 2 qt/ton sprayed as urea goes into blender UAN: 1 qt/ton (mix thoroughly)
CHS N-EDGE PRO	NBPT (17%) + DCD (23%)	Urease + Nitrification Inhibitor	Urea: 3 qt/ton UAN: 1.5 qt/ton Manure: 8–32 oz/A
CHS N-EDGE SOIL 2	DCD (30%)	Nitrification Inhibitor	Urea: 3 qt/ton UAN: 2 qt/ton Anhydrous Ammonia: 5-7 qt/ton or 10-32 oz/A with Toolbar (clear dye) Manure: 1–2 pt/A
CONTAIN	NBPT + Ca copolymers and alcohols (unknown)	Urease Inhibitor + Nitrogen Management Aid	Urea: 2 to 3 qt/ton UAN: 1.5 qt/ton (use soon after mixing for best results) Liquid Manures: 13.5–18 fl oz/A
CONTAIN MAX	NBPT + Ca copolymers and alcohols (unknown)	Urease Inhibitor + Nitrogen Management Aid	Urea: 2 to 3 qt/ton UAN: 1.5 qt/ton (use soon after mixing for best result Liquid Manures: 13.5–18 fl oz/A

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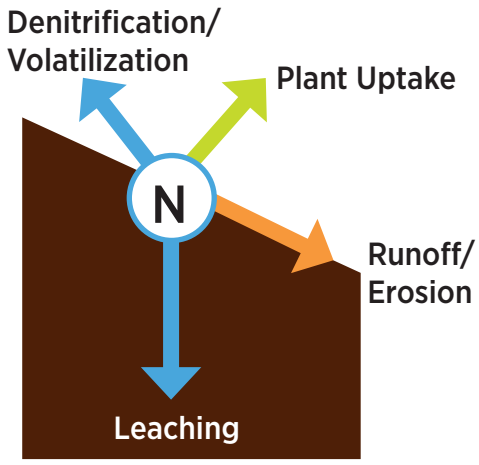
Always read and follow label directions.

Product Name[1]	Common Name (% Active Ingredient)	Nitrogen Process Involved	Use Specifics
CONTAIN ADVANCED	NBPT (unknown)	Urease Inhibitor	Urea: 2 to 3 qt/ton UAN: 1.5 qt/ton (use soon after mixing for best result Liquid Manures: 13.5 fl. oz/A
INSTINCT II	Nitrapyrin (16.95%)	Nitrification Inhibitor	Pre-plant, PRE, at-plant, or injection: 37 fl oz/A Side-dress prior to V6 corn: 19–7 fl oz/A Liquid manure: 37 fl oz/A (spring), 37–74 fl oz/A (fall) Do not apply more than 74 fl oz/A per year on corn.
INSTINCT NXTGEN	Nitrapyrin (25.97%)	Nitrification Inhibitor	Pre-plant, PRE, at-plant, or injection: 24 fl oz/A Side-dress prior to V6 corn: 12–24 fl oz/A Liquid manure: 24 fl oz/A (spring), 24–48 fl oz/A (fall) Do not apply more than 48 fl oz/A per year on corn.
LIMUS	NBPT (16.88%) + NPPT (5.63%)	Urease Inhibitor	UAN: 1–1.5 qt/ton Urea: 2–3 qt/ton
LIMUS for UAN	NBPT (16.88%) + NPPT (5.63%)	Urease Inhibitor	UAN: 1–1.5 qt/ton Urea: 2–3 qt/ton
N-SERVE 24	Nitrapyrin (22.2%)	Nitrification Inhibitor	Pre-plant, at-plant, or band injection: 1 qt/A Side-dress up to 30 days post plant at 0.5–1.0 qt/A
N-ZONE GL	Ca co-polymers and alcohols (unknown)	Nitrogen Management Aid	Anhydrous Ammonia: 6 oz/ 50 units of Nitrogen UAN: 2 qt/ton Liquid Manures: 24–32 fl oz/A
N-ZONE MAX	Ca co-polymers and alcohols (unknown)	Nitrogen Management Aid	Urea: 2–3 qt/ton UAN: 1.5 qt/ton Liquid Manures: 13.5–18 fl oz/A

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Urease inhibitors generally reduce N loss from ammonia volatilization when urea is placed on the soil surface whereas nitrification inhibitors reduce nitrate loss to leaching or denitrification by keeping N in the ammonium form. Since dramatic increases in N demand generally occur several weeks after application, the use of soil nitrogen stabilizers to control these naturally occurring N transformation processes can minimize N losses, increase NUE, and result in increased yield.



Cutworm Control – Foliar Insecticide Options and Rate by Crop (fl oz/A unless otherwise stated)

Insecticide	Alfalfa	Canola	Corn (Field)	Cotton	Dry Bean/ Dry Pea	Range/ Pasture	Small Grains	Potato	Soybean	Sugarbeet	Sunflower	IRAC Code
Asana XL* S-Fenvalostar*			5.8–9.6	5.8–9.6	5.8–9.6			5.8–9.6	5.8–9.6	5.8–9.6	5.8–9.6	3A
Baythroid XL*	0.8–1.6		0.8–1.6	0.8–1.6	0.8–1.6	1.6–1.9	1.0–1.8	0.8–1.6	0.8–1.6		0.8–1.6	3A
Besiege*	5–8	5–10	5–10	5–6	5–8	5–8	5–8	5–8	5–8		5–8	3A+28
Brigade 2EC*		2.1–2.6	2.1–6.4	2.6–6.4	2.1–6.4	6.4	1.0–1.8		2.1–6.4			3A
Capture LFR*			2.8–8.5		2.8–8.5			2.8–8.5	2.8–8.5			3A
Endigo ZC*							3.5–4	3.5–4.5	3.5–4.5			3A+4A
Ethos XB*			2.8–8.5		2.8–8.5				2.8–8.5			3A
Fastac CS*	2.2–3.8		2.8	1.3–1.9	1.3–3.8		1.3–3.8	1.3–3.8	2.8	2.2–3.8		3A
Fanfare EC*			2.1–6.4	2.6–6.4	2.1–6.4				2.1–6.4			3A
Hero*		2.6–5.5	4.0–10.3	5.2–10-3	4.0–10.3			2.6–6.1	2.6–6.1			3A
LambdaStar* Silencer*	1.92–3.2	1.92–3.84	1.92–3.2	1.92–2.56	1.92–3.2	1.92–3.2	1.92–3.2	1.92–3.2	1.92–3.2		1.92–3.2	3A
LambdaStar Plus* Warrior II* Province II*	0.96–1.6	0.96–1.92	0.96–1.6	0.96–1.28	0.96–1.6	0.96–1.6	0.96–1.6	0.96–1.6	0.96–1.6		0.96–1.6	3A
Lannate LV*	0.75–3 pt		1.5 pt		1.5 pt			1.5 pt		1.5 pt		1A
Leverage 360*				2.8–3.2	2.4–2.8			2.8	2.8			3A+4A
Mustang Maxx*	2.24–4	4	1.28–2.8	1.28–1.92	1.28–4	2.24–4	1.28–4	1.28–4	1.28–4	2.24–4	1.28–4	3A
Permethrin 3.2 EC*	2-8		4–6					4–8	2–4			3A
Ridgeback*		4.5–5.5	4.5–13.8		5.5–13.8				4.5–13.8			4C + 3A
Renestra*									6.8			3A + 9D

THIS CHART IS ONLY INTENDED TO BE A GENERAL GUIDE. ALWAYS READ AND FOLLOW LABEL DIRECTIONS PRIOR TO USING ANY PRODUCT.
*Restricted Use Pesticide **Blanks indicate that a crop is not labeled.
Use higher rates when cutworms are large or for extra residual. Rates are for foliar application. Some products can be used at-plant in corn.
IRAC MoA Classification: 1A=Carbamates, 3A=Synthetic Pyrethroid, 4A=Neonicotinoids, 4C=Sulfoximines, 28=Diamides

THRESHOLDS
Alfalfa – Treat when 2 or more larvae per square foot are present.
Canola – Treat when 1 or more larvae per 3 feet of row are present.
Corn (field) – Treat when 3 - 6% of plants have damage and larvae are < 3/4 inch long.
Cotton – Treat when plant stands are reduced to 3 or fewer plants per foot of row.
Dry Bean – Treat when 1 cutworm per 3 feet of row is present.
Pea (Dry) – Treat when 2 to 3 cutworms per square yard are present.
Pasture/Rangeland – Treat when 4-5 cutworms per square foot are present.
Small Grains – Treat when 4 or more cutworms per square foot are present
Potato – Treat when 4 or more cutworms per square foot are present.Soybeans – Treat when 1 cutworm per 3 feet of row is present or 20% of the plants show damage.
Sugarbeet – Treat when 4% of seedlings have damage or 3 to 5 cutworm per square foot are present.
Sunflowers – Treat when 1 cutworm per square foot is present or 25% to 30% stand reduction occurs.

For more information or aid in identifying cutworms, refer to:
http://extension.cropsciences.illinois.edu/fieldcrops/insects/black_cutworm/
https://extensionpublications.unl.edu/assets/html/g1153/build/g1153.htm#target4

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Thresholds

Alfalfa – Treat when 2 or more larvae per square foot are present.

Canola – Treat when 1 or more larvae per 3 feet of row are present.

Corn (field) – Treat when 3% to 6% of plants have damage and the larvae are less than 3/4 inch long.

Cotton – Treat when plant stands are reduced to 3 or fewer plants per foot of row.

Dry Bean – Treat when 1 cutworm per 3 feet of row is present.

Pea (Dry) – Treat when 2–3 cutworms per square yard are present.

Potato – Treat when 4 or more cutworms per square foot are present.

Pasture/Rangeland – Treat when 4–5 cutworms per square foot are present.

Small Grains – Treat when 4 or more cutworms per square foot are present.

Soybeans – Treat when 1 cutworm per 3 feet of row is present or 20% of the plants show damage.

Sugarbeets – Treat when 4% of seedlings have damage or 3–5 cutworm per square foot are present.

Sunflowers – Treat when 1 cutworm per square foot is present or 25% to 30% stand reduction occurs.

For more information or aid in identifying cutworms, refer to: http://extension.cropsciences.illinois.edu/fieldcrops/insects/black_cutworm/



Cutworm larvae (from top): Sandhill cutworm, variegated cutworm, black cutworm, dingy cutworm, claybacked cutworm.

How to scout for cutworms:

1. Examine plants in the morning while damage is fresh. Cutworms tend to be active overnight. Freshly chewed stems will be easier to scout for in the morning hours. Cutworms also tend to work down a row feeding on consecutive plants.
2. Look for plants that are cut off at the base. Most cutworm species feed from the ground where they mow down plants by chewing the stems. Sometimes they will attack the roots and cut down the plant below the soil level. Check for toppled plants that have been cut off at or near the base.
3. Check for plants with wilted tops. If a cutworm doesn't manage to chew all the way through the bottom of the plant, it may still wither and die. If you notice a wilted plant, check at the base for cuts or notches.
4. When damage is found, dig two or more inches down around the cut off plant and search for larvae. When disturbed, cutworms curl up into a C-shape.
5. Determine treatment feasibility using above thresholds based on crop, defoliation and stage of growth.

Grasshopper Species of Concern in Field Crops and Control Options

Grasshoppers have three life stages: egg, nymph and adult. Females can lay 8-25 egg pods containing up to 100 eggs. These pods are typically laid in the soil, often in pasture or other non-tilled areas. Egg pods are susceptible to fungal diseases favored by wet soil, so egg survival is best during dry seasons. Nymphs will start to feed within one day of hatching and can feed for an extended period before being noticed. Most years, natural conditions keep the populations in check and out breaks are normally related to lengthy dry periods. When grasshopper populations reach very high levels, migration can take place as adult grasshoppers are winged and can take flight devouring most all plant material in their path.

Grasshoppers have several natural enemies that help control populations. These include blister beetles, ground beetles, several parasitic flies, and numerous birds and mammals. For producers, easiest control is achieved when insects are small and confined to limited acres. Seed treatments and foliar applications can also be effective in controlling grasshoppers. The chart below gives some economic treatment thresholds for grasshoppers. An early scouting program during extended dry conditions will assist in making insecticide application decisions.

Creating buffer zones, catch crops, and baits can provide concentration areas for many grasshopper species. These concentration areas can then be treated with conventional insecticides and/or baits infused with insecticide. Mechanical disking of field areas can reduce suitable habitat for grasshopper egg development and or development. Controlling curtain weed species in and around fields can interfere with grasshopper nymph development.



American GH spp.



Carolina GH spp.



Migratory



Differential



Red-Legged



Two-Striped

Crop	Nymph Threshold	Adult Threshold
Alfalfa, Barley, Canola, Corn, Dry Bean, Field Pea, Oat, Pasture, Potato, Soybean, Sugarbeet, Sunflower, Wheat	Field Borders - 50/sq yd, Field - 25/sq yd	Field Borders - 20/sq yd, Field - 8/sq yd
Flax	Field Borders - 25/sq yd, Field - 15/sq yd	Field Borders - 10/sq yd, Field - 4/sq yd
Lentil	2/sq yd	2/sq yd

Crop defoliation by grasshopper species mainly consists of damage to leaf tissue, but grasshoppers will also feed on stems, blossoms, ripening seeds and fruit. When heavy populations are present in perennial crops, the feeding can damage the crown of the plant and cause premature plant death. Maximum control takes place when the insects are small and locally confined. Grasshoppers can also be a contamination issue in certain processed foods.

Insecticide	IRAC Code	General Use Rate	Crops Labeled
Asana XL*, esfenvalerate	3A	3.9–9.6 oz	Corn (all), Dry Bean, Field Pea, Lentil, Potato, Soybean, Sugarbeet, Sunflower
Baythroid XL*	3A	1.8–2.8 oz	Alfalfa, Barley, Corn (all), Dry Bean, Field Pea, Lentil, Oat, Potato, Wheat, Soybean, Sunflower
Besiege	28/3A	5–10 oz	Alfalfa, Canola, Cereal grains, Grain Sorghum, Corn (all), Range and Pasture, Peas and Beans, Peanuts, Soybean
Bifender™ FC	3A	1.8–7.5 oz	Beans and Peas, Canola, Corn (all), Peanut, Sod Farm, Soybean
Brigade 2EC*	3A	2.1–6.4 oz	Alfalfa grown for seed, Canola, Corn (all), Dry Bean, Field Pea, Lentil, Soybean
Coragen	28	2–5 oz	Alfalfa, Beans and Peas, Canola, Cereal grains, Corn (all), Cotton, Pasture and Range, Peanut, Sunflower, multiple specialty crops
Dimethoate 4E / EC	1B	0.5–1.0 pt	Alfalfa, Dry Bean, Field Corn, Pea, Potato, Soybean, Wheat
Endigo ZC*	3A/4A	3.5–4.5 oz	Barley, Potato, Soybean
Fanfare*	3A	1.6–6.4 oz	Canola, Corn (all), Dry Bean, Field Pea, Lentil, Soybean
Fastac EC / CS	3A	2.7–3.9 oz	Alfalfa, Beans and Peas, Corn (all), Cotton, Grain Sorghum, Millet, Rice, Soybean, Sugarbeet, Wheat
Hero*	3A	2.6–6.1 oz	Corn (all), Dry Bean, Field Pea, Lentil, Soybean
Leverage 360*	3A/4A	2.4–3.8 oz	Dry Bean, Field Pea, Lentil, Potato, Soybean
Lorsban 4E*, Lorsban Advanced*, Hatchet*, Chlorpyrifos 4E*, Govern 4E*	1B		Control + Click mouse pad for updates. Frequently Asked Questions about the Current Status of Chlorpyrifos and Anticipated Path Forward | US EPA
Malathion	1B	1–2 pt	Alfalfa, Barley, Corn (field, sweet), Dry Bean, Flax, Pasture**, Peas, Potato, Oat, Wheat
Mustang Maxx*	3A	2.24–4.0 oz	Alfalfa, Canola, Corn (all), Dry Bean, Field Pea, Flax, Lentil, Pasture**, Soybean, Sugarbeet, Sunflower, Wheat
Prevathon, Vantacore	28	8–20 oz 1.2–2.5 oz	Alfalfa, Cereal grains, Canola, Corn (field, pop, seed), Cotton, Bean and Peas, Peanut, Range and Pasture, Soybean, Sunflower
Sevin XLR Plus	1A	1 qt	Alfalfa, Corn (field, sweet), Dry Bean, Field Pea, Flax, Lentil, Pasture**, Sugarbeet, Sunflower, Wheat
Stallion*	1B/3A	5–11.75 oz	**SEE LORSBAN INFO ABOVE**
Warrior*, LambdaStar*, Province*, Silencer*	3A	1.92–3.84 oz	Alfalfa, Barley, Canola, Corn (all), Dry Bean, Field Pea, Lentil, Oat, Potato, Soybean, Sunflower, Wheat
Warrior II*, LambdaStar Plus*, Lambda Cy*	3A	0.96–1.92 oz	Alfalfa, Barley, Canola, Corn (all), Dry Bean, Field Pea, Lentil, Oat, Potato, Soybean, Sunflower, Wheat

The addition of CHS Endurium @ 0.25% v/v or Tapran @ 0.25% v/v may improve grasshopper control by increasing coverage in dense canopies and preventing evaporation of small spray droplets in hot conditions.

* Restricted Use Pesticide

** No grazing or haying restriction of Pasture for Malathion, Mustang Max, or Sevin XLR Plus.

IRAC MoA Classification: 3A=Pyrethroid, 1B=Organophosphate, 1A=Carbamate, 28=Diamides, 22=Oxadiazines, 4A=Neonicotinoids

See labels for grazing/haying restrictions of various insecticides on alfalfa as they vary by product and rate.

Use higher rates for larger adult and/or large populations. Some crops may require higher rates than others due to coverage issues.

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An integrated approach to controlling potato insects should be used to effectively manage insect populations. Application of foliar insecticides are one of many tools to control damaging populations. A proactive approach to rotation of modes of action can allow a class of insecticides to have a longer effective life cycle. Alternating classes of insecticide used can delay or even prevent insects becoming resistant to those chemicals. The charts in this Agronomy Update provide IRAC MOA group numbers and the common active ingredient to assist with rotation.

IRAC MOA	Active Ingredient	Brand(s)	Rate per Acre	PHI	Insects Controlled	Pollinator Restriction
6	Abamectin	ABAMEX* AVERLAND FC* Agri-Mek SC*	8–16 fl oz 1.75–3.5 fl oz 1.75–3.5 fl oz	14 Days	Colorado Potato Beetle, Potato Psyllid	Yes
4A	Acetamiprid	Assail 30SG*	1.5–4 fl oz	7 Days	Aphids, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper	
9D	Afidopyropen	Sefina Inscalis	3–6 fl oz	7 Days	Aphids	
3A	Alpha-Cypermethrin	Fastac CS* Fastac EC*	1.3–3.8 fl oz	1 Day	Cabbage Looper, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Variegated Cutworm	
6 + 3A	Avermectin + Bifenthrin	Athena*	7–17 fl oz	21 Days	Aphids, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Cabbage Looper, Potato Psyllid, Variegated Cutworm	Yes
11	Bacillus Thuringiensis	Dipel DF	0.5–1 lb	0 Days	Cabbage Looper, Variegated Cutworm (Control of 1st and 2nd instar larvae only)	
3A	Beta-Cyfluthrin	Baythroid XL*	0.8–2.8 fl oz	14 Days	Cabbage Looper, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Potato Psyllid, Variegated Cutworm	
4A + 3A	Beta-Cyfluthrin + Imidacloprid	Leverage 360*	2.8 fl oz	7 Days	Aphids, Cabbage Looper, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Potato Psyllid	Yes
3A	Bifenthrin	Brigade 2EC* Bifender FC*	2.1–6.4 fl oz 2.4–7.4 fl oz	21 Days	Flea Beetle	
3A + 28	Bifenthrin + Chlorantaniliprole	Elevest	3.9 - 9.6 fl oz	21 Days	Aphids, Cabbage Looper, Colorado Potato Beetles, Flea Beetles, Variegated Cutworm	
3A + 4A	Bifenthrin + Imidacloprid	Brigadier* Skyraider*	3.8–6.14 fl oz 2.1–6 fl oz	21 Days	Aphids, Cabbage Looper, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Potato Psyllid	Yes
3A + 4C	Bifenthrin + Sulfoxaflor	Hero*	2.6–10.3 fl oz	21 Days	Aphids, Colorado Potato Beetle, Flea Beetles, Potato Leafhopper, Variegated Cutworm	
1A	Carbaryl	Sevin XLR Plus	0.5–2 qt	7 Days	Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Variegated Cutworm	
28	Chlorantraniliprole	Coragen	3.5–5 fl oz	14 Days	Cabbage Looper, Colorado Potato Beetle	
28 + 3A	Chlorantraniliprole + lambda-cyhalothrin	Besiege* Voliam Xpress*	5–9 fl oz	14 Days	Cabbage Looper, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Potato Psyllid, Variegated Cutworm	Yes
28 + 4A	Chlorantraniliprole + Thiamethoxam	Voliam Flexi	4 fl oz	14 Days	Aphids, Cabbage Looper, Colorado Potato Beetle, Flea Beetles, Potato Leafhopper	Yes
4A	Clothianidin	Belay	2–3 fl oz	14 Days	Aphids, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper	Yes
28	Cyantraniliprole	Exirel	5–20.5 fl oz	7 Days	Cabbage Looper, Colorado Potato Beetle, Potato Psyllid, Variegated Cutworm	
28 + 6	Cyantraniliprole + Abamectin	Minecto Pro*	5.5–10 fl oz	14 Days	Aphids, Colorado Potato Beetle, Potato Psyllid	Yes
1B	Dimethoate	Dimethoate 4E	0.5 - 1.0 pt	0-2 Days	Aphid, Potato Leafhopper	

*Restricted Use Pesticide

IRAC MOA	Active Ingredient	Brand(s)	Rate per Acre	PHI	Insects Controlled	Pollinator Restriction
4A	Dinotefuran	Venom	1–1.5 oz	14 Days	Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Potato Psyllid	Yes
3A	Esfenvalerate	Asana XL*	2.9–9.6 fl oz	7 Days	Aphids, Cabbage Looper, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Potato Psyllid, Variegated Cutworm	
9C	Flonicamid	Beleaf 50SG	2–2.8 fl oz	7 Days	Aphids	
4D	Flupyradifurone	Sivanto Prime	7–14 fl oz	7 Days	Aphids, Colorado Potato Beetle, Potato Leafhopper, Potato Psyllid	
4A	Imidacloprid	Admire Pro Nuprid 2SC Nuprid 4F Max Malice 75WSP	1.3 fl oz 3 fl oz 1.5 fl oz 1 fl oz	0 Days 7 Days 7 Days 7 Days	Aphids, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Potato Psyllid	Yes
22A	Indoxacarb	Avaunt	2.5–6 fl oz	7 Days	Cabbage Looper, Colorado Potato Beetle	Yes
3A	Lambda-Cyhalothrin	LambdaStar* Province* Silencer* Warrior II* Province II*	1.92–3.84 fl oz 1.92–3.84 fl oz 1.92–3.84 fl oz 0.96–1.92 fl oz 0.96–1.92 fl oz	7 Days	Aphids, Cabbage Looper, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Potato Psyllid, Variegated Cutworm	
3A + 4A	Lambda-Cyhalothrin + thiamethoxam	Endigo ZC*	3.5–4.5 fl oz	14 Days	Aphids, Cabbage Looper, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Potato Psyllid, Variegated Cutworm	Yes
35	Ledprona	Calantha	16 fl oz	0 Days	Colorado Potato Beetle	No
1B	Malathion	Malathion 57%	1 pt	0 Days	Aphids, Potato Leafhopper	
1A	Methomyl	Lannate LV* Lannate SP*	1.5–3 pt 0.5–1.0 lb	6 Days	Aphids, Cabbage Looper, Flea Beetle, Potato Leafhopper, Variegated Cutworm	
15	Novaluron	Rimon 0.83EC	6–12 fl oz	14 Days	Cabbage Looper, Colorado Potato Beetle	
1A	Oxamyl	Vydate C-LV* Vydate L*	8.5–34 fl oz 1–4 pt	7 Days	Aphids, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper,	
3A	Permethrin	Perm-UP 3.2EC*	4–8 fl oz	14 Days	Aphids, Cabbage Looper, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Potato Psyllid, Variegated Cutworm	
1B	Phosmet	Imidan 70W	1.33 lb	7 Days	Colorado Potato Beetle, Flea Beetle, Potato Leafhopper	
9B	Pymetrozine	Fulfill	2.75–5.5 fl oz	14 Days	Aphids	
5	Spinetoram	Radiant SC	4.5–8 fl oz	7 Days	Cabbage Looper, Colorado Potato Beetle	3 hr restriction
5	Spinosad	Blackhawk Entrust (organic)	1.7–3.5 oz 1–3 oz	7 Days	Cabbage Looper, Colorado Potato Beetle	3 hr restriction
23	Spiromesifen	Oberon 2SC Oberon 4 SC	8–16 fl oz 4–8 fl oz	7 Days	Potato Psyllid, Two-Spotted Spider Mite	
23	Spirotetramat	Movento Movento HL	4–5 fl oz 2–2.5 fl oz	7 Days	Aphids, Potato Psyllid	Honeybee larvae
4C	Sulfoxaflor	Transform WG	0.75–2.75 fl oz	7 Days	Aphids, Potato Leafhopper, Potato Psyllid	Yes
4A	Thiamethoxam	Actara	1.5–3 fl oz	14 Days	Aphids, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper	Yes
21A	Tolfenpyrad	Torac	14–21 fl oz	14 Days	Aphids, Colorado Potato Beetle, Potato Leafhopper, Potato Psyllid	Yes
3A	Zeta-Cypermethrin	Mustang Maxx*	1.28–4 fl oz	1 Day	Cabbage Looper, Colorado Potato Beetle, Flea Beetle, Potato Leafhopper, Variegated Cutworm	

*Restricted Use Pesticide

Insecticide resistance develops when exposed survivor of a given insect species are able to reproduce even after the insecticide application. Survivors after the application have an opportunity to pass on their offspring the genetic traits responsible for their survival. The best strategy to combat insecticide resistance is to not let it happen in the first place. These are three important strategies to address the insecticide resistance issue:

1. Rotation of insecticide classes help to delay or prevent insects becoming resistance to chemicals. Over-reliance on single insecticide often leads to faster rate of resistance development. For example: Be careful when same class of insecticide is used first as seed treatment (imidacloprid and thiamethoxam) followed by in-season foliar application. Excessive dependence on one group of insecticide could lead to insecticide resistance. Always pay attention to upper right corner of the product label to find the group number which indicates the chemical class of the given product, and its site of action (SOA).
2. Take Economic Thresholds Limit (ETL) into consideration before application: Insecticides application should be used, only if significant number of insects/pests are present that are capable to cause economic losses which exceed the cost of insecticide plus application cost.
3. Integrated control strategies: Incorporate a diverse range of control strategies such as, biological insecticides, beneficial insects, genetically modified plants with transgenic insect resistance traits, crop rotation, chemical attractant or deterrents. It is also very important to follow product label for application rate and timings. It is very important to follow the product label and spray interval to avoid the undesirable impact of insecticide on beneficial insects.

Nerve and Muscle Targets

	Group	Chemical Family	Active Ingredient	Brand	Restricted	Signal Word	Formulation
Acetylcholinesterase (AChE) inhibitors	1A	**Carbamates**	Carbaryl	Sevin XLR Plus	Yes	Caution	Liquid
			Methomyl	Lannate LV	Yes	Danger/Poison	Liquid
			Methomyl	Nudrin LV	Yes	Danger/Poison	Liquid
			Oxamyl	Vydate C-LV	Yes	Danger	Liquid
	1B	**Organophosphates**	Acephate	Orthene 97	No	Caution	Dry
			Acephate	Orthene Turf, Tree and Ornamental WSP	No	Caution	Dry
			Acephate	Acephate 97UP	No	Caution	Dry
			Chlorethoxyfos	Fortress 5G Granular	Yes	Danger/Poison	Dry
			Diazinon	Diazinon 50 W	Yes	Caution	Dry
			Diazinon	Diazinon AG 500	Yes	Caution	Liquid
			Dichlorvos	Insect Shield	No	Caution	Dry
			Dichlorvos	Insect Shield Max	No	Warning	Dry
			Dicrotophos	Bidrin 8	Yes	Danger/Poison	Liquid
			Ethoprop	Mocap EC	Yes	Danger	Liquid
			Ethoprop	Mocap 15G	Yes	Danger/Poison	Dry
			Malathion	Malathion 5 EC	No	Warning	Liquid
			Malathion	Max Kill Dusta-Cide 6	No	Caution	Dry
			Naled	Dibrom 8 Emulsive	Yes	Danger	Liquid
			Phorate	Thimet 20-G Lock 'n Load	Yes	Danger/Poison	Dry
			Phorate	Thimet 20-G SmartBox	Yes	Danger/Poison	Dry
			Phosmet	Imidan 70-W	No	Warning	Dry
			Terbufos	Counter 15G Lock 'n Load	Yes	Danger	Dry
			Terbufos	Counter 15G SmartBox	Yes	Danger	Dry
			Terbufos	Counter 20G Lock 'n Load	Yes	Danger	Dry
			Terbufos	Counter 20G SmartBox	Yes	Danger	Dry

Nerve and Muscle Targets

	Group	Chemical Family	Active Ingredient	Brand	Restricted	Signal Word	Formulation
GABA-gated chloride channel antagonists	**2A**	**Cyclodiene Organochlorines**	Endosulfan	Thionex 3EC	Yes	Danger/Poison	Liquid
	2B	**Phenylpyrazoles**	Fipronil	Regent® 4SC Insecticide	Yes	Warning	Liquid
Sodium channel modulators	**3A**	**Pyrethroids/Pyrethrins**	alpha-Cypermethrin	Fastac™ EC Insecticide	Yes	Danger	Liquid
			B-cyfluthrin	Tempo SC Ultra	No	Caution	Liquid
			Beta-Cyfluthrin	Baythroid XL	Yes	Warning	Liquid
			Beta-Cyfluthrin	Leverage 360	Yes	Caution	Liquid
			Bifenthrin	Annex LFR	Yes	Warning	Liquid
			Bifenthrin	Brigade 2EC	Yes	Warning	Liquid
			Bifenthrin	Brigade WSB	Yes	Warning	Dry
			Bifenthrin	Capture LFR	Yes	Warning	Liquid
			Bifenthrin	Ethos XB	Yes	Caution	Liquid
			Bifenthrin	Fanfare 2EC	Yes	Warning	Liquid
			Bifenthrin	Fanfare ES	Yes	Warning	Liquid
			Bifenthrin	Talstar Pro	No	Caution	Liquid
			Cypermethrin	Demon Max	No	Warning	Liquid
			Deltamethrin	Centynal	No	Caution	Liquid
			Deltamethrin	Suspend SC	No	Caution	Liquid
			Esfenvalerate	Asana XL	Yes	Warning	Liquid
			Esfenvalerate	S-FenvaloStar	Yes	Warning	Liquid
			Fenpropathrin	Danitol 2.4 EC	Yes	Warning	Liquid
			Lambda-cyhalothrin	Lambda-Cy	Yes	Warning	Liquid
			Lambda-cyhalothrin	LambdaStar	Yes	Danger	Liquid
			Lambda-cyhalothrin	LambdaStar 1 CS	Yes	Warning	Liquid
			Lambda-cyhalothrin	LambdaStar Plus	Yes	Warning	Liquid
			Lambda-cyhalothrin	Ballista LFC	Yes	Warning	Liquid
			Lambda-cyhalothrin	Province	Yes	Warning	Liquid
			Lambda-cyhalothrin	Silencer	Yes	Warning	Liquid
			Lambda-cyhalothrin	Warrior II with Zeon Technology	Yes	Warning	Liquid
			Lambda-cyhalothrin	Warrior with Zeon Technology	Yes	Warning	Liquid
			Permethrin	Astro	No	Caution	Liquid
			Permethrin	Permethrin 3.2EC	Yes	Caution	Liquid
			Permethrin	Perm-UP 3.2 EC	Yes	Caution	Liquid
			Permethrin	Pounce 1.5G Insecticide	Yes	Caution	Dry
			Resmethrin	Scourge	Yes	Caution	Liquid
			Tefluthrin	Force 3G	Yes	Caution	Dry
			Tefluthrin	Force 3G Smart Box	Yes	Caution	Dry
			Tefluthrin	Force CS	Yes	Warning	Liquid
			Zeta-cypermethrin	Mustang Maxx	Yes	Warning	Liquid

Nerve and Muscle Targets

	Group	Chemical Family	Active Ingredient	Brand	Restricted	Signal Word	Formulation
Nicotinic acetylcholine receptor (nAChR) agonists	**4A**	**Neonicotinoids**	Acetamiprid	Assail 30SG	No	Caution	Dry
			Clothianidin	Belay® Insecticide	No	Caution	Liquid
			Clothianidin	NipsIt INSIDE® Insecticide	No	Caution	Liquid
			Dimethoate	Dimethoate 267	No	Warning	Liquid
			Dinotefuran	Scorpion 35SL	No	Caution	Liquid
			Imidacloprid	Admire Pro Systemic Protectant	No	Caution	Liquid
			Imidacloprid	Resonate	No	Caution	Liquid
			Imidacloprid	Merit 0.5 G	No	Caution	Dry
			Imidacloprid	Nuprid 4.6 Pro	No	Caution	Liquid
			Imidacloprid	Nuprid 4F Max	No	Caution	Liquid
			Imidacloprid	Nuprid 1.6F	No	Caution	Liquid
			Imidacloprid	Provado 1.6 Flowable Insecticide	No	Caution	Liquid
			Imidacloprid	Senator 600 FS	No	Caution	Liquid
			Imidacloprid	Trimax Insecticide	No	Caution	Liquid
			Thiamethoxam	Actara	No	Caution	Dry
			Thiamethoxam	Platinum	No	Caution	Liquid
			Thiamethoxam	Platinum 75 SG	No	Caution	Dry
	4C	**Sulfoxaflor**	Sulfoxaflor	Closer SC	No	Caution	Liquid
			Sulfoxaflor	Transform WG	No	Danger	Dry
	4D	**Butenolides**	Flupyradifurone	Sivanto 200 SL	No	Caution	Liquid
Nicotinic acetycholine receptorallosteric activators	**5**	**Spinosyns**	Spinetoram	Radiant SC	No	Caution	Liquid
			Spinetoram	Delegate WG	No	Caution	Dry
			Spinosad	Blackhawk	Yes	Caution	Dry
			Spinosad	Entrust SC	No		Liquid
Chloride channel activators	**6**	**Avermectins**	Abamectin	Agri-Mek SC	Yes	Warning	Liquid
			Abamectin	Epi-Mek 0.15 EC	Yes	Warning	Liquid
			Abamectin	Nufarm Abamectin 0.15 EC	Yes	Warning	Liquid
Modulators of chordotonal organs	**9B**	**Pymetrozine**	Pymetrozine	Fulfill	No	Caution	Dry
	9C	**Flonicamid**	Flonicamid	Beleaf 50 SG	No	Caution	Dry
Voltage dependent sodium channel blockers	**22A**	**Indoxacarb**	Indoxacarb	Avaunt	No	Caution	Dry
			Indoxacarb	Steward EC	No	Caution	Liquid
Ryanodine receptor modulators	**28**	**Diamides**	Chlorantraniliprole	Coragen	No	Caution	Liquid
			Cyantraniliprole	Exirel	No	Caution	Liquid
			Flubendiamide	Belt SC	No	Caution	Liquid

Growth and Development Targets

	Group	Chemical Family	Active Ingredient	Brand	Restricted	Signal Word	Formulation
Juvenile hormone mimics	**7A**	**Juvenile hormone mimics**	Methoprene Methoprene Methoprene	Diacon-D Diacon-IGR EC Diacon-IGR	No No No	Caution Warning Caution	Dry Liquid Liquid
Mite growth inhibitors	**10A**	**Hexythiazox**	Hexythiazox	Onager	No	Caution	Liquid
	10B	**Etoxazole**	Etoxazole	Zeal® Miticide(1)	No	Caution	Dry
Inhibitors of chitin	**15**	**Benzoylureas**	Novaluron	Rimon 0.83EC (019/021114)	No	Warning	Liquid
Ecdysone receptor agonists	**18**	**Diacylhydrazines**	Methoxyfenozid Tebufenozide	Intrepid 2F Confirm 2F	No No	Caution Caution	Liquid Liquid

Energy Metabolism

	Group	Chemical Family	Active Ingredient	Brand	Restricted	Signal Word	Formulation
Inhibitors of mitochondrial ATP synthesis	**12C**	**Propargite**	Propargite	Comite	Yes	Danger	Liquid
Mitochondrial complex III electron transport inhibitors	**20B**	**Acequinocyl**	Acequinocyl	Kanemite 15 SC	No	Caution	Liquid
Mitochondrial complex I electron transport inhibitors	**21A**	**METI**	Tolfenpyrad	Torac	No	Warning	Liquid
Inhibitors of acetyl CoA caroxylase	**23**	**Tetronic/Tetramic acid**	Spirotetramat Spiromesifen Spirotetramat	Movento Oberon 4 SC Insecticide/Miticide Ultor	No No No	Caution Caution Caution	Liquid Liquid Liquid

UN - Unknown or Uncertain MoA

	Group	Chemical Family	Active Ingredient	Brand	Restricted	Signal Word	Formulation
UN - Unknown or Uncertain MoA	UN	Propargite	Azadirachtin	Aza-Direct	No	Caution	Liquid

Insecticide SOA Multiple Products

Product	Manufacturer	AI	Chemical Family	Group	Restricted	Signal	Type
Athena	FMC Corporation	Bifenthrin Avermectin	Pyrethroids Avemectins	3A 6	Yes	Caution	Liquid
Aztec 2.1G	Amvac Chemical Corporation	Tebupirimphos Cyfluthrin	Organophosphates Pyrethroids	1B 3A	Yes	Warning	Dry
AZTEC 4.67% G	Amvac Chemical Corporation	Tebupirimphos Cyfluthrin	Organophosphates Pyrethroids	1B 3A	Yes	Warning	Dry
Besiege	Syngenta Crop Protection	Chlorantraniliprole Lambda-cyhlothrin	Diamides Pyrethroids	28 3A	Yes	Warning	Liquid
Brigadier	FMC Corporation	Bifenthrin Imidacloprid	Pyrethroids Neonicotinoids	3A 4A	Yes	Warning	Dry
Cobalt	Dow AgroSciences	Chlorpyrifos Gamma-cyhlothrin	Organophosphates Pyrethroids	1B 3A	Yes	Danger	Liquid
Cobalt Advanced	Dow AgroSciences	Chlorpyrifos Lambda-cyhlothrin	Organophosphates Pyrethroids	1B 3A	Yes	Warning	Liquid
Endigo ZC	Syngenta Crop Protection	Lambda-cyhalothrin Thiamethoxam	Pyrethroids Neonicotinoids	3A 4A	Yes	Warning	Liquid
Hero	FMC Corporation	Bifenthrin Zeta-cypermethrin	Pyrethroids Pyrethroids	3A 3A	Yes	Caution	Liquid
Intrepid Edge	Dow AgroSciences	Spinetoram Methoxyfenozide	Spinosyns Diacylhydrazines	5 18	No	Caution	Liquid
Leverage 360 Insecticide	Bayer CropScience	Beta-Cyfluthrin Imidacloprid	Pyrethroids Neonicotinoids	3A 4A	Yes	Caution	Liquid
Seeker	Dow AgroSciences	Lambda-cyhalothrin Sulfoxaflor	Pyrethroids Sulfoxaflor	3A 4C	Yes	Warning	Liquid
SkyRaider	Makhteshim-Agan of North America, Inc.	Bifenthrin Imidacloprid	Pyrethroids Neonicotinoids	3A 4A	Yes	Warning	Liquid
SmartChoice 5G Lock 'N Load	Amvac Chemical Corporation	Chlorethoxyfos Bifenthrin	Organophosphates Pyrethroids	1B 3A	Yes	Danger/Poison	Dry
SmartChoice 5G SmartBox	Amvac Chemical Corporation	Chlorethoxyfos Bifenthrin	Organophosphates Pyrethroids	1B 3A	Yes	Danger/Poison	Dry
Stallion	FMC Corporation	Chlorpyrifos Zeta-cypermethrin	Organophosphates Pyrethroids	1B 3A	Yes	Warning	Liquid
Storcide II Grain	Bayer CropScience	Deltamethrin Chlorpyrifos-methyl	Organophosphates Pyrethroids	1B 3A	No	Danger	Liquid
Talstar XTRA	FMC Corporation	Bifenthrin Zeta-cypermethrin	Pyrethroids Pyrethroids	3A 3A	No	Caution	Dry
Voliam Express	Syngenta Crop Protection	Chlorantraniliprole Lambda-cyhlothrin	Diamides Pyrethroids	28 3A	Yes	Warning	Liquid

Fall armyworm is native to the tropical regions of the Western Hemisphere, but it can overwinter in southern states (Texas and Florida). Multiple migrations of adult moths occur each summer and can be found in the Midwest between June–August. Each generation takes about 30 days to complete. Egg masses of 100-200 are laid on light-colored surfaces and hatch within four days. The larvae (caterpillars) go through six instars before pupation. Fall armyworm can be distinguished from other armyworm species by the white, inverted "Y" on the face.



Photo: J. Obermeyer

Foliar Insecticide Options for Fall Armyworm Larvae

Rates are bolded and listed as fl oz/A unless otherwise stated. Pre-Harvest Interval (PHI) and restrictions listed below rates.

Insecticide	IRAC Code	Alfalfa	Corn (Field)	Cotton	Range/ Pasture	Small Grains[1]	Sorghum	Soybean
Baythroid XL* (Beta Cyfluthrin)	3A	**1.6–2.8** 7 days	**2.8** 21 days grain 0 days forage	**3.2** 0 days no graze	**2.6–2.8** 0 days	**1.8–2.4**	**1.3–2.8** 14 days	**1.6–2.8** 21 days grain 15 days forage
Besiege* (Chlorantraniliprol, Lambda-cyhalothrin)	28, 3A	**6–10**[3] 1 forage 7 hay	**5–10**[3] 21 days	**6.5–6** 21 days	**6–10** 0 graze 7 hay	**6–10** 30 days	**6–10**[3] 30 days	**8–10**[3] 30 days
BlackHawk (Spinosad)	5		**1.67–3.3** 28 days grain 7 days forage	**2.4–3.2** 28 days	**1.1–2.2** 0 days forage 3 days hay	**1.7–3.3** 21 grain 3 forage	**1.7–3.3** 21 grain 3 forage	**1.7–2.2** 28 days no forage
Coragen (Chlorantraniliprole)	28	**3.5–7.5** 0 days	**3.5–7.5** 14 days	**3.5–7.5** 14 days	**3.5–7.5** 0 days	**3.5–7.5** 1 day	**3.5–7.5** 1 day	**3.5–7.5** 1 day
Fastac CS/EC* (alpha-Cypermethrin)	3A	**2.8–3.8** 3 days	**3.2–3.8** 30 days grain 60 forage	**2.6–3.6** 14 days no graze		**Wheat and Triticale only 3.2–3.8** 14 days	**1.8–3.8** 14 days grain 45 forage	**3.2–3.8** 21 days grain no graze
Hero* (Zeta-cypermethrin, Bifenthrin)	3A		**4–10.3**[2] 30 days grain 60 days forage 30 days graze	**5.2–10.3**[2] 14 days no graze				**4–10.3**[2] no graze or forage
Intrepid 2F (Methoxyfenozide)	18	**4–8** 3 days hay 0 days graze		**4–10**[2,3,4] 14 days	**4–8** 0 days graze 7 days harvest		**4–12** 21 days grain 3 days forage	**4–8** 14 days grain 7 days forage
Lambda-Cyhalothrin 1 EC*, Lambda-Cy EC*, LambdaStar* Province*, Silencer*, Silencer VXN* (Lambda-cyhalothrin)	3A	**2.56–3.84**[3] 1 day forage 7 days hay	**1.92–3.84**[3] 21 days 1 day graze	**3.2–5.12** 21 days no graze	**2.56–3.84** 0 days graze 7 days hay	**2.56–3.84** 30 days grain 7 days graze	**2.56–3.84**[3] 30 days	**3.2–3.84**[3] 30 days

CHS Acuvant is APE/NPE free and can be used at 3 fl oz/A for all application timings for drift control and deposition. CHS Endurium is recommended at 1 qt/100 gal (Ground) and 4-6 fl oz/A (Aerial) for increased insecticide efficacy and drift control/deposition.

*Restricted Use Pesticide.

[1]Small cereal grains include barley, buckwheat, oats, rye, triticale, and wheat.

[2]Coverage is essential for control of this pest. Under heavy outbreak conditions, tank mixing with another product that is labeled for this pest is recommended for control.

[3]For large larvae use higher rate range and ensure thorough coverage.

[4]Expect suppression under heavy pest pressure or for large worms.

IRAC MoA Classification: 1A=Carbamates, 3A=Synthetic Pyrethroid, 4C=Sulfoximines, 5=Spinosyns, 18=Amitraz, 28=Diamides

Blanks indicate that a crop is not labeled.

THIS CHART IS ONLY INTENDED TO BE A GENERAL GUIDE. ALWAYS READ AND FOLLOW LABEL DIRECTIONS PRIOR TO USING ANY PRODUCT.

Insecticide	IRAC Code	Alfalfa	Corn (Field)	Cotton	Range/ Pasture	Small Grains[1]	Sorghum	Soybean
LambdaStar Plus* **Warrior II w/Zeon*** **Province II*** (Lambda-cyhalothrin)	3A	**1.28–1.92[3]** 1 day forage 7 days hay	**1.28–1.92[3]** 21 days	**1.6–2.56** 21 days No graze	**1.28–1.92** 0 days graze 7 days hay	**1.28–1.92** 30 days grain 7 days graze	**1.28–1.92[3]** 30 days	**1.6–1.92[3]** 30 days
Lannate LV* (Methomyl Larvin Thiodicarb)	1A	**1.5–3 pt** 7 days	**0.75–1.5 pt** 21 days grain 3 days forage	**1.5–2.25 pt** do not graze or feed	**Bermuda-grass pasture only 0.75–3** 7 days graze and forage 3 days hay		**0.75–1.5 pt** 14 days forage and hay	**0.75–1** 14 days grain 3 days forage 12 days hay
Mustang Max* (Zeta-cypermethrin)	3A	**2.8–4** 3 days	**3.2–4** 7 days	**2.64–3.6** 14 days no graze	**2.8–4** 7 days straw 0 days forage and hay	**3.2–4** 14 days	**1.76–4** 14 days grain 45 days forage	**3.2–4** 21 days no graze
Perm-Up 3.2 EC (Permethrin)	3A	**2–8** 0 days if 4 oz or less, 14 days if > 4 oz	**4–6** 30 days					
Prevathon (Chlorantraniliprole)	28		**14–20** 14 days grain, 1 day forage	**14–27** 21 days	**14–20** 0 days	**14–20** 1 day		**14–20** 1 day
Radiant SC (Spinetoram)	5		**3–6** 28 days grain 3 days forage			**3–6** 21 days grain 3 days forage		**2–4** 28 days
Ridgeback (Sulfoxaflor + Bifenthrin)	4C 3A		**4.5–13.8** 30 days no graze					**4.5–13.8** 18 days
Sevin XLR Plus (Carbaryl)	1A	**1–1.5 qt** 7 days	**1–2 qt** 48 days grain 14 days forage and graze		**1–1.5 qt** 14 days		**1–2 qt** 21 days grain 14 days forage	**1–1.5** 21 days grain 14 days forage
Vantacor (Chlorantraniliprole)	28	**1.2–2.5** 0 day	**1.2–2.5** 14 day	**1.2–2.5** 21 day	**1.2–2.5** 0 day	**1.2–2.5** 1 day	**1.2–2.5** 1 day	**1.2–2.5** 1 day

CHS Acuvant is APE/NPE free and can be used at 3 fl oz/A for all application timings for drift control and deposition. CHS Endurium is recommended at 1 qt/100 gal (Ground) and 4-6 fl oz/A (Aerial) for increased insecticide efficacy and drift control/deposition.

*Restricted Use Pesticide.

[1]Small cereal grains include barley, buckwheat, oats, rye, triticale, and wheat.

[2]Coverage is essential for control of this pest. Under heavy outbreak conditions, tank mixing with another product that is labeled for this pest is recommended for control.

[3]For large larvae use higher rate range and ensure thorough coverage.

[4]Expect suppression under heavy pest pressure or for large worms.

IRAC MoA Classification: 1A=Carbamates, 3A=Synthetic Pyrethroid, 4C=Sulfoximines, 5=Spinosyns, 18=Amitraz, 28=Diamides

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Seedcorn maggot (Delta platura) can be a pest in many crops including corn, soybeans and even wheat. With planting dates being pushed earlier, attempting to maximize yield potentials, the seedcorn maggot needs to be on the watchlist for early season scouting.

The seedcorn maggot is an early season pest that thrives in cool, wet environments with a lifecycle that is completed within 3 to 4 weeks. The adult stage of the seedcorn maggot is a fly and it is attracted to fields that have high levels of decaying organic matter.

Fields at risk include those that have been heavily manured, have heavy plant residue, such as winter cover crops, that has been lightly incorporated into the soil. Eggs are deposited in the soil and the larvae hatch several days later. Once emerged, the maggots feed on the organic residue and seeds of many different plants. Feeding damage can severely affect germination and seedling vigor. Feeding may last for several days prior to the maggots pupating. Seedcorn maggot can produce 3+ generations per year, with the first generation normally resulting in crop damage. Moving into fall the pupae overwinter when soil temperatures drop below 39°F.

Rescue treatments are not available for seedcorn maggot infestations. Therefore, damage may be avoided by either delaying planting until the maggots of the first generation move into the pupae stage or using a labeled insecticide for a timelier planting window. Seed treatment neo-nicotinoid insecticides, such as Senator 600 from Nufarm, is recommended at a rate of 2.4 fl. oz/Cwt.

Careful evaluation of how to best manage a possible seedcorn maggot outbreak is necessary to minimize additional yield loss in a replant situation.







Pictures provided by the Department of Entomology, University of Nebraska

With weeds across the U.S. exhibiting resistance to several of our herbicide families used in burndown or post-emerge applications, many are turning to glufosinate products like Liberty, Cheetah, Noventa, or Interline to fill in the voids. A conscious effort to increase glufosinate activity/Best Management Practices (BMPs), in addition to prudent resistance management practices, will be required to maintain this technology. Below are some examples of specific issues relating to glufosinate efficacy and corresponding BMPs which have the potential to maximize glufosinate activity.

What volume of spray solution should be used and what type of nozzles should I have?

BMP: With glufosinate applications needing good coverage higher volumes of water are desired at application, with 15 to 20 gal/acre being the suggested volume.

What type of spray nozzles should be used?

BMP: Nozzles should produce a medium droplet at the desired nozzle pressure ensuring spray coverage and deposition on the targeted plants. Nozzles that provide coarse droplets, such as nozzles recommended for dicamba applications tend to NOT provide the coverage desired for glufosinate applications.

Should I use any spray additives?

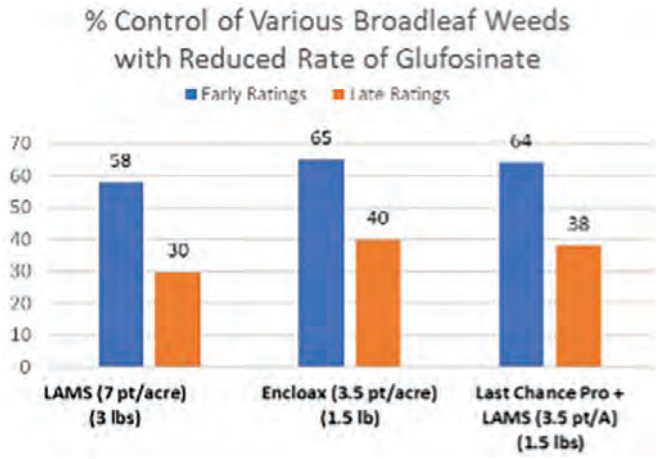
BMP: With any glufosinate application it is highly recommended to use an AMS targeting between 1.5 to 3 lbs/acre, rates may vary depending on your geography. Adjuvant systems vary considerably between Glufosinate formulations, with some containing higher loads of adjuvant than others. CHS agronomy provides good choices for not only straight AMS, but adjuvants like CHS Level Best Pro added to the AMS and adjuvant/AMS premixes such as, Encloax or CHS Wheelhouse 2, have shown improved weed control over straight AMS. This bump in weed control is seen with CHS Level Best Pro + AMS and Encloax in the research data, where low rates of herbicides were used with different adjuvants to measure the adjuvants contribution to herbicide efficacy.

Should we worry about weed resistance to glufosinate?

BMP: Arkansas has confirmed resistance to glufosinate in Palmer Amaranth. Good resistance management plans should be implemented with glufosinate just like with glyphosate, with multiple modes of action always being incorporated in weed management programs. Target applications to weeds < 4" tall and ALWAYS follow the label regarding the rate for a given weed species. Cutting herbicide rates can lead to increased selection pressure on potential resistant biotypes.

How does the time-of-day influence efficacy of applying glufosinate?

BMP: Glufosinate is a non-selective, contact herbicide with limited ability to translocate in the plant, needing good coverage of target weeds for successful control. Glufosinate performs best when applied under higher light intensity situations due its need for sunlight to activate. It is recommended to make glufosinate applications on warm, sunny days.





Prior to Liberty application



After Liberty + CHS Level Best Pro + AMS

Glyphosate resistant weeds have become common across many agricultural areas in the United States. A conscious effort to increase glyphosate activity/Best Management Practices (BMPs), in addition to prudent resistance management practices, will be required to maintain this technology. Below are some examples of specific issues relating to glyphosate efficacy and corresponding BMPs which have the potential to maximize glyphosate activity.

What can be done with tough-to-control weed species, biotypes, or weed sizes as they relate to effective weed control with glyphosate and the development of resistance?

BMP: Target applications to weeds that are < 4" tall or about the size of your index finger. This will provide the most consistent level of weed control and decrease weed competition for the herbicide, providing a better opportunity to kill tough-to-control weeds and decrease the potential to select herbicide resistant biotypes.

What can be done about the influence of hard water on glyphosate antagonism and obtaining adequate spray uptake relating to efficacy?

BMP: Choose only water conditioners and spray surfactants possessing legitimate supporting data from university research and reliable weed scientists, such as CHS Deppex, Encloax, CHS Fixate, CHS Wheelhouse 2 or Adium.

What rate of glyphosate should be applied to provide consistent weed control?

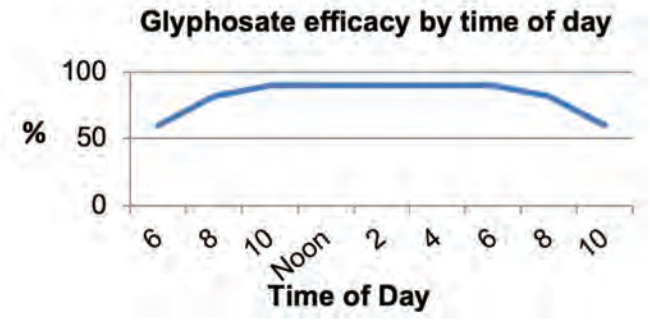
BMP: Target applications to weeds < 4" tall and ALWAYS follow the label regarding the rate for a given weed species. Cutting herbicide rates can lead to increased selection pressure on potential resistant biotypes.

What spray volume provides adequate coverage to ensure excellent weed control?

BMP: For best results apply glyphosate in a minimum of 10 GPA. Applications at this water volume generally ensure adequate coverage of target weeds. For heavier or denser weed infestations increase spray volumes to a minimum of 12-15 GPA.

What influence do environmental conditions have on glyphosate efficacy?

BMP: Glyphosate uptake and translocation can be inhibited by conditions that are unfavorable for plant growth, resulting in poor weed control. Use maximum label rates to overcome unexpected adverse growing conditions or consider postponing an application for more favorable growing conditions.



How do we overcome the influence the time of day has on efficacy while making an application of glyphosate?

BMP: Potential reduced activity from morning or evening applications can be overcome by increasing glyphosate rate or including effective adjuvants, like CHS Level Best Pro.

How do we deal with the influence of dust and tire tracks?

BMP: Target small weeds and apply the maximum label rate.

How does rainfall or dew influence glyphosate activity?

BMP: Rainfall soon after application can wash glyphosate off the weed leaf. In addition, a heavy dew can also impact the amount of glyphosate that is absorbed by the weed. Spray small weeds and apply full labeled rates to maximize rain-free periods and minimize the influence of dew. Rainfastness is also influenced by the formulation of glyphosate, with different rainfast periods for different formulations. Always read and follow label directions. Any apparent influence on herbicide efficacy attributed to dew likely relates to weather-related factors involved during dew formation.

Cercospora Leafspot (CLS) management is vital for profitable sugarbeet production. Research and database information have consistently indicated that greatest sugarbeet revenue is achieved by making three or more applications in a season. However, with multiple applications comes a responsibility for prudent use of fungicide resistance management strategies including rotating MOA. Further, the use of an effective deposition/penetration aid such as CHS Endurium (when permitted by product label) in addition to proper spray volume are also important to assure adequate leaf coverage and canopy penetration to obtain maximum efficacy. Most sugarbeet cooperatives develop their own specific fungicide use strategies for CLS and fungicide resistance management. All sugarbeet cooperatives recommend alternating and tank-mixing different active ingredients in every application as judicious FRAC management. For specific sequence and tank mix recommendations in your geography, contact your local sugarbeet cooperative agronomist.

Fungicide	CR[1]	Rate/A	Spray Interval[2]	PHI Days	Tank Mixes	Comments[3,4]
Triazole Chemistry Family (Tank-Mix with other AI's)						
Delaro	F	11 fl oz	14	21	May be tank-mixed with grass herbicides and insecticides.	When tank-mixing with grass herbicide use CHS Endurium at 0.25% v/v.
Eminent VP or Minerva	F	13 fl oz	14 days	14		
Inspire XT	F	7 fl oz	10–14 days	21		
Proline 480 SC	F	5.0–5.7 fl oz (5.0 oz common rate)	14 days	7		
Provysol	F	5 fl oz	14	21		
Topguard	F	10–14 fl oz	14	21		
Strobilurin Chemistry Family (Tank-Mix with other AI's)						
Aframe / AzoxyStar	N-G	9.0–15.5 fl oz	7–14 days	0	May be tank-mixed with grass herbicides and insecticides.	When tank-mixing with grass herbicide use CHS Endurium at 0.25% v/v.
Azteroid FC 3.3	N-G	5.8–9.7 fl oz	7–14 days	0		
Flint Extra	N-G	3.0–3.6 fl oz	7–14 days	21		
Headline SC	N-G	9–12 fl oz (9 oz under normal disease conditions)	14 days	7		**DO NOT USE ORGANOSILICONES** When tank-mixing with grass herbicide use CHS Endurium at 0.25% v/v.
TriPhenyl Tin Hydroxide Chemistry Family						
Minerva Duo[5]	VG	16 fl oz	Do not exceed two applications per Season	14 (ND,MN,MI)	Do not tank-mix with any insecticide, herbicide.[6]	**Restricted Use Product** Do not exceed 0.75 lb/A in a growing season. TPTH + Triazole
Agri Tin Flowable[5]	VG	4–8 fl oz	10–14 days	21		**Restricted Use Product** Do not apply more than 24 oz per season.
Super Tin 4L[5]	VG	4–8 fl oz	10–14 days	7		**Restricted Use Product** Do not apply more than 24 oz per season.

[1] CR - Cercospora Rating (assuming resistance is managed) VG=Very Good, G=Good, F=Fair, N=No control due to resistance

[2] Spray intervals can be weather- or region-specific and may be shortened if Cercospora levels are high or if heavy rainfall washes product off leaves.

[3] CHS Endurium or CHS Acuvant are excellent choices for increased deposition & canopy penetration when a fungicide is applied without a tank mix partner except when prohibited by fungicide label.

[4] Grass herbicides labeled for sugarbeet include - Volunteer, Clethodim 2E, Dakota, Shadow, Select Max, Assure II, Targa, Fusilade DX, Poast.

[5] Restricted Use Pesticides (RUP).

[6] Consult local Agronomist for adjuvant recommendations.

Fungicide	CR[1]	Rate/A	Spray Interval[2]	PHI Days	Tank Mixes	Comments[3,4]
EBDC Chemistry Family						
Dithane F-45 Rainshield or Manzate Max	F	1.2–1.6 qt	10–14 days when used in tank mix	14	Proper mixing order and thorough agitation when tank-mixing required.	Not recommended as standalone product. Rates are representative of use in tank mix only. Can be tank mixed with TPTH.
Manzate Prostick or Penncozeb 75 DF or Koverall	F	1.5–2 lb	7–14 days when used in tank mix	14		
Benzimidizole Chemistry Family						
T-Methyl 4.5F or T-Methyl 70WSP	G	10–20 fl oz or 0.75–1 lb	14 days	21	Consult local Agronomist.	Rates representative as tank mix partner only. T-Methyl or Topsin should only be used once during a season. Can be tank-mixed with TPTH.
Copper						
Badge SC	F	1.4 pt	10–14 days	0	Do not tank-mix with spray solutions with 6.5 pH or lower, ex. with glyphosate.	Recommended for tank-mix with other products registered for control of CLS.
Badge X2	F	1.4 lb				
Champ WG	F	2–2.5 lb				
Champ Formula 2 Flowable	F	1.33–3.33 pt				
Kocide 3000	F	0.75–2.0 lb				

[1] CR - Cercospora Rating (assuming resistance is managed) VG=Very Good, G=Good, F=Fair, N=No control due to resistance

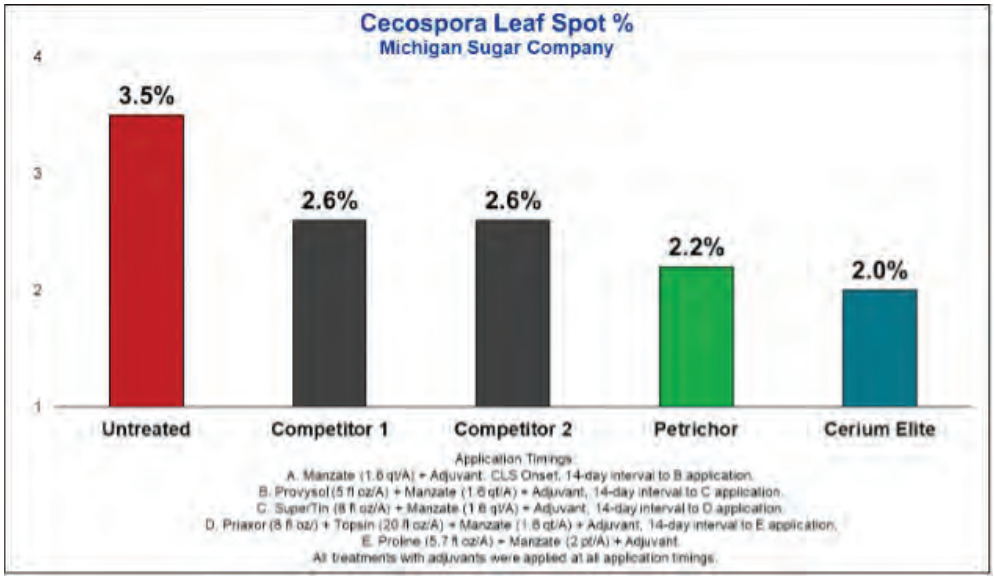
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[5] Restricted Use Pesticides (RUP).

[6] Consult local Agronomist for adjuvant recommendations.



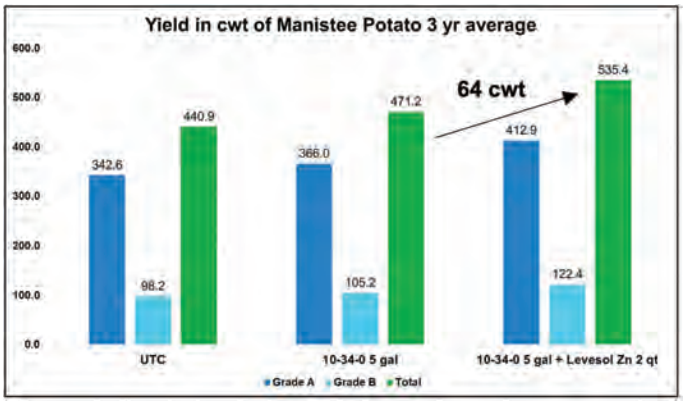
The challenge with any In-furrow fertilizer is placing important nutrients next to the seed without causing seedling damage. Another concern that goes relatively unrecognized is the reality that high Phosphorus (P) concentrations in banded zones can create complexes with other important nutrients making them insoluble and unavailable to plant roots. What if there was a product that could protect both the nutrients in your fertilizer as well as those that you have built up in your soil?

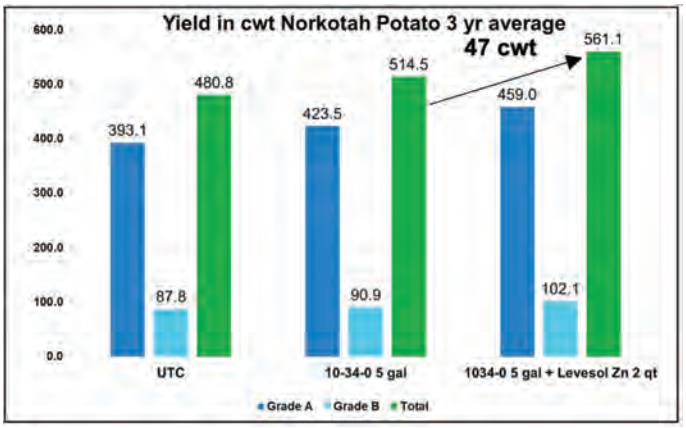
Levesol, is a highly effective nutrient efficiency amendment for your fertilizer program that prevents nutrients from becoming tied up and unavailable in your soil. Levesol protects important micronutrients like Zinc, Manganese, and Copper making them more available to your crop, which increases P availability by preventing P fixation with these cationic nutrients.

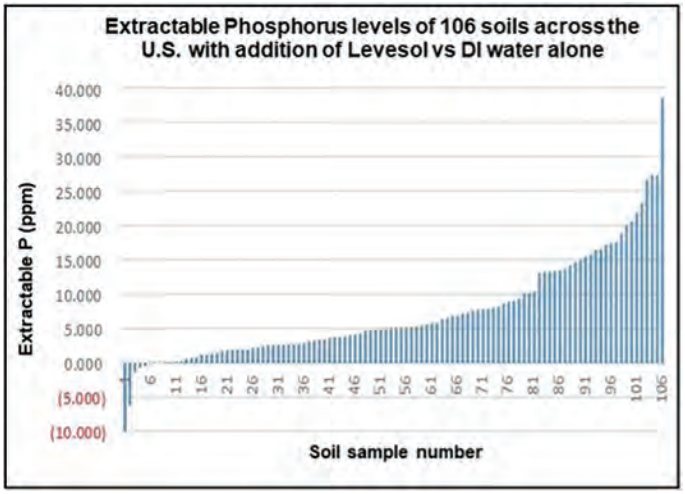
Levesol has shown to be effective on many crops including potatoes, the figures below provide insight into the yield increases that can be expected when using Levesol ZN as an in-furrow fertilizer additive on potatoes. Three years of studies with Levesol ZN in Michigan exhibited a yield increase on chipper potato varieties of 64 cwt average (left), and a yield increase on russet potato varieties of 47 cwt average (right).

The patented ortho, ortho isomer of the EDDHA chelate found in Levesol has been scientifically proven to possess stronger soil stability than any other chelate which makes it the most potent soil fertilizer efficiency product on the market. In fact, of 106 samples taken across the United States, Levesol increased extractable phosphorus 95% of the time with an average increase of 7.2 ppm when mixed with deionized water versus soil and water alone (Figure at right).

LEVESOL®·ZN







Although many sugarbeet acres receive in-furrow fertilizer applications, CHS Lumen is a superior liquid fertilizer providing proven yield benefits in sugarbeet production. In-furrow fertilizer helps the sugarbeets quickly get out of the ground and reach the 6-leaf stage. This rapid growth is vital to allow the crop to maximize solar radiation during early plant development. In-furrow fertilizer further benefits the crop with increased early season vigor, improved stress tolerance, and optimal use of applied phosphorus, allowing for higher recoverable sugar per acre.

- CHS Lumen contains a balance of key macro and micronutrients necessary for plant growth.
- CHS Lumen uses the Levesol chelate technology (ortho, ortho EDDHA) to keep nutrients within the fertilizer and soil more soluble for plant uptake and translocation. This patented technology works by chelating the cations (+) (micronutrients) in the fertilizer and soil. In doing so, the phosphorous is prevented from being tied up with these cations and is more available to the plant.
- CHS Lumen also includes a Hemicellulase enzyme that enhances the plant's natural nutrient uptake process. The Hemicellulase enzyme acts as a non-temperature catalyst to kickstart microbial activity, releasing simple sugars, nitrogen, phosphorous and micronutrients from the soil. (Fig. 1)

In-Furrow Application Directions

- Apply 2-3 gal/A alone or 1-2 gal/A with liquid fertilizer. Add water as needed to bring total volume to a minimum of 5 gal/A. Higher volumes ensure consistent and uniform distribution of the product in-furrow.

Package Size

- Bulk and 250 gal totes

Product Weight Per Gallon

- 10.32 lb/gal

Minimum Storage Temperature

- CHS Lumen will freeze at 10° F, but has no minimum storage temperature.

CHS LUMEN®

Guaranteed Analysis

Total Nitrogen (N)	5.0%
Phosphorus (P)	15.0%
Potassium (K)	3.0%
Zinc (Zn)	0.8%
Hemicellulase Enzyme	0.002 U/mL

Derived from urea, anhydrous ammonia, monoammonium phosphate, diammonium phosphate, monopotassium phosphate, dipotassium phosphate, Zinc EDTA & Zinc EDDHA.



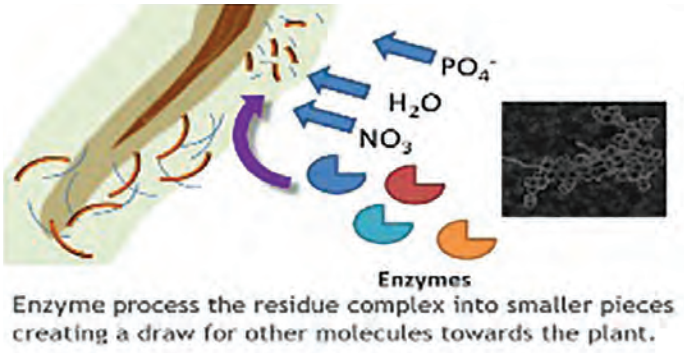


Figure 1

Potassium 19

An In-Furrow and Foliar Potassium + Sulfur Fertilizer for All Crop Uses

Potassium 19 is a proven in-furrow potassium fertilizer developed for cotton, soybeans, corn and many other crops. It has good crop safety. Most of Potassium-19, is available in the acetate form, so when applied to soil and or foliage, plants will benefit throughout the growing season. The acetate form of K is the most plant available form. See graph below.

Potassium 19 contains potassium (19%) which is needed by soybeans, cotton, and other crops in large amounts early in the season and during grain and fruit production. Potassium 19 also contains 6% thiosulfate which is needed throughout the growing season along with nitrogen and potassium in order to convert amino acids to plant proteins. Potassium 19 can be added to many starter fertilizers for in-furrow placement and is an excellent source of essential potassium and sulfur for foliar applications.

Principal Functioning Agents

Total Nitrogen (N)	0%
Total Potassium (K_2O)	19.0%
Total Sulfur (S)	6.0%

Derived from Potassium thiosulfate & potassium acetate.

Key Features

- Good crop safety and performance.
- Versatile product that provides available potassium & sulfate sulfur at all stages of the crop.
- Excellent plant safety for both in-furrow and foliar applications
- Provides crops with a safe product to correct potassium & sulfur nutrient needs all season long.

Application Directions

- For use with many in-furrow starter fertilizers, combine 2-4 qt/A of Potassium 19 with 1-2 gal/A water and the desired volume of started fertilizer. This solution ensures consistent and uniform application of the product.
- Apply to crop foliage at 2-4 qt/A to prevent or correct potassium and sulfur deficiencies.
- For best results, follow local agronomic practices and use soil test results to create a balanced fertility plan.
- Always conduct a jar test to confirm compatibility.

Package Size

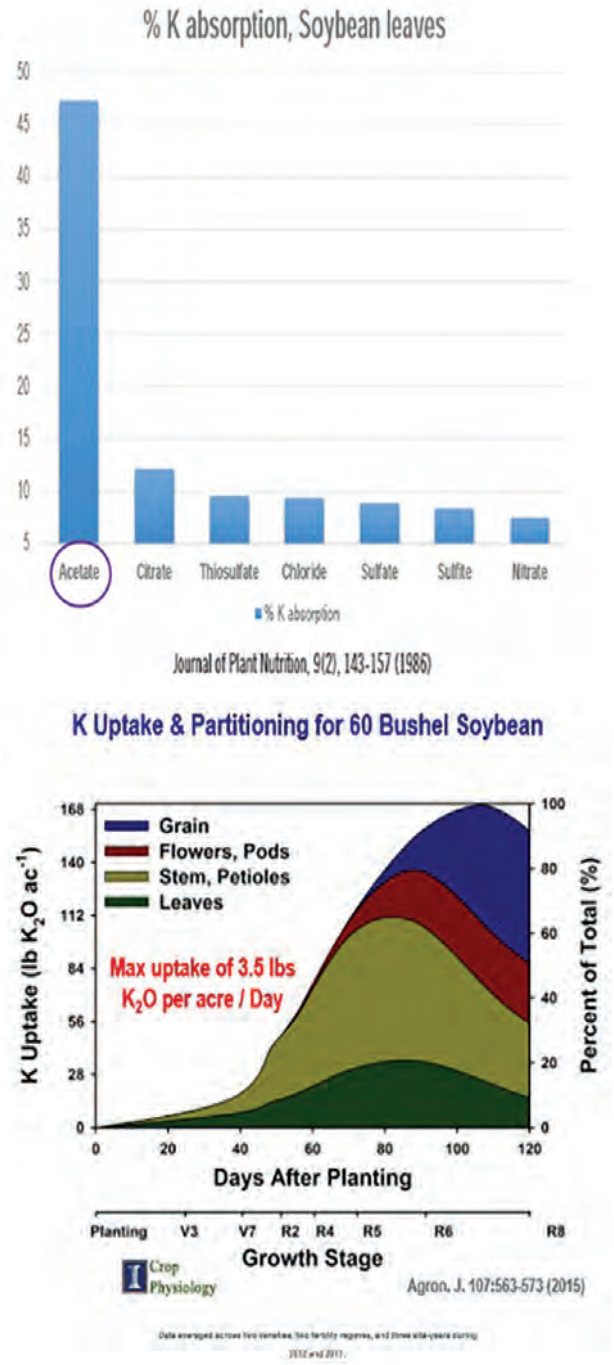
- Mini-bulk 275 gal
- Totes 250 gal
- Bulk

Product Weight Per Gallon

- 10.59 lb/gal

Minimum Storage Temperature

- Potassium 19 will freeze below -22° F. If frozen, thaw completely prior to use.



Graphs showing Potassium 19's relative K absorption, as potassium acetate form, relative to other forms of K.

SOYGREEN®

Grain sorghum and other similar grass crops such as corn have a different iron uptake mechanism compared to broadleaf crops like soybeans. Therefore, grasses are generally considered more tolerant to Iron Deficiency Chlorosis (IDC) than broadleaf crops. Grain sorghum can be more sensitive to IDC than most other grass crops. Further, there can be considerable differences between grain sorghum hybrids when it comes to IDC tolerance. Research conducted with Kansas State in Western Kansas has demonstrated this hybrid variability and provides an indication of the increased yield potential from an application of Soygreen to alleviate IDC symptoms.

Application Methods

In-furrow:

- Soygreen Granule at 1-1.5 lbs/A applied in 5 to 7 gallons of water.
- Soygreen AST Liquid at 2.7 to 5.3 qts/A applied in 4 to 7 gallons of water.
- Soygreen Granular at 4 to 8 pounds/A applied in furrow as a dry granular prill.

A single application made in-furrow or close to the seed furrow has shown to be the most consistent application in reducing IDC symptoms in grain sorghum.

Post Emerge:

- Soygreen Granule at 1.5 to 2 pounds/A applied in 10 to 20 gallons of water plus adjuvant.
- Soygreen AST Liquid at 2.7 to 5.3 qts/A applied in 10 to 20 gallons of water plus adjuvant.

Multiple applications should be made to grain sorghum. First application to be made at the 2 to 3 leaf stage if IDC is evident. A second application should be made 2 to 4 weeks following the first application. In extremely difficult conditions a third application may be necessary. Additionally, increased product performance can be expected from use of adjuvants. ***Uptake and deposition enhancing adjuvant offerings, from CHS agronomy, designed for Soygreen technology include: CHS Endurium or CHS Fixate.**

Pivot Irrigation:

- Soygreen Granule at 1.5 to 2 pounds/A applied in an irrigation event to saturate root zone.
- Soygreen AST Liquid at 2.7 to 5.3 qts/A applied in an irrigation event to saturate root zone.

Pivot injection applications should utilize standard fertilizer injection equipment and involve multiple applications. Apply the first application at 2 to 3 leaf stage sorghum when IDC becomes evident. A second application should be made 2 to 3 weeks following the first application. In extremely difficult conditions a third application may be necessary. Mix Soygreen AST with water at a volume that will work best with injection equipment. Calibrate equipment for this volume and apply in an irrigation event that allows the product to reach the root zone of the crop.

*Research performed by NDSU, Fargo, N.D. using labeled adjuvant rates.





IDC



Soygreen

General Information

Tank Cleaner and Tank Cleaner Elite from CHS will clean and emulsify pesticide and adjuvant residues and bond them to the rinse solution to allow for complete rinsing and system purging with ordinary water. Tank Cleaner and Tank Cleaner Elite contain corrosion inhibitors which are hard water tolerant and work well on metal, fiberglass, and plastic spray systems, while being safe on most painted surfaces. These products will remove light rust and at the same time leave a protective film that helps prevent corrosion.

Triple Rinse Procedure

1. Flush tank hoses, boom, and nozzles with clean water.
2. Clean all strainers, screens, and filters.
3. Prepare solution of Tank Cleaner or Tank Cleaner Elite according to the label instructions.
4. Wash all parts of the tank and start agitation of cleaning solution for at least 15 minutes.
5. Flush hoses, spray lines, and nozzles with Tank Cleaner solution.
6. Dispose of rinsate from the previous steps, and repeat steps 3 through 5.
7. Remove nozzles, screens, and strainers to clean separately in cleaning solution after completing the above steps.
8. Drain the sump, filter, and lines.
9. Rinse the complete system with clean water.
10. Dispose of rinsate according to local, state, and federal requirements, laws, and regulations.

Tank Cleaner

Principal Functioning Agents

Anionic cleaning agents, ammonia and other sequestering agents	100%
Total	100%

Tank Cleaner is a concentrated liquid tank cleaner that is effective with most pesticides including glyphosate and glufosinate. The active ingredients are particularly effective on difficult to clean out pesticides such as ALS Inhibitors (Affinity, Harmony, Pursuit, Raptor, etc.) and ACCASE Inhibitors (Assure II, Select Max, Volunteer, etc.)

Tank Cleaner Elite

Principal Functioning Agents

A proprietary blend of sodium hydroxide and sequestering agents	100%
Total	100%

Tank Cleaner Elite is a concentrated liquid tank cleaner that is effective with most pesticides including glyphosate and glufosinate as well as the auxin herbicides for Xtend and Enlist systems. The active ingredients are particularly effective on especially difficult to clean out pesticides such as Synthetic Auxin herbicides (2,4-D, dicamba, Stinger, etc.), Triazine herbicides (Atrazine, Sencor, etc.), HPPD Inhibitors (Laudis, Callisto, Impact, etc.) and PPO inhibitors (Flexstar, Valor, Sharpen, etc.).

Application Directions

Tank Cleaner
– 1 qt/100 gal of wash water*

Tank Cleaner Elite
– 1 qt/100 gal of wash water*

*Rates may vary based upon specific crops, products equipment or conditions

Package Sizes

Tank Cleaner and Tank Cleaner Elite are available in the following package sizes:
– 4x1 gal
– 12x1 qt

TRIVAR® · EZ

Micronutrients like Cu, Fe, Mn & Zn are important for producing high-yielding crops. While crops require smaller amounts of micronutrients compared to macronutrients (NPK), they still limit yield when not kept at adequate levels. A challenge with micronutrients is many of them are positively charged which causes them to bond with negatively charged phosphorus. When this reaction happens both the micronutrient and phosphorus are tied up and unable to be taken up by the plant. Trivar EZ is an enhanced micronutrient granular blend to help prevent tie up and maximize nutrient availability. Below is information on Trivar EZ and how to utilize it.

Levesol

Every granule of Trivar EZ is infused with the patented O-O EDDHA chelate (Levesol). Levesol increases nutrient availability by chelating positively charged micronutrients in the fertilizer and soil, preventing them from tying up with negatively charged phosphorus. The result is increased availability of applied fertilizer along with nutrients found in the soil.

Application Directions

Use Rate: The most common use rates are 5-10 lb/A blended with other dry fertilizers. (Higher rates can be used if needed). Trivar EZ is effective in both fall and spring broadcast fertilizer applications, as well as in-furrow, 2x2 or strip-till applications.

Compatibility: Trivar EZ is a low dust formulation and can be easily blended with other dry fertilizers including but not limited to; MAP, DAP, Potash, and Urea.

Density: 76 lb/Cu ft

Package Size: Bulk & 2000 lb Bag

Micronutrients (lb/A) supplied per rate of Trivar EZ						
	5 lb/A	10 lb/A	15 lb/A	20 lb/A	25 lb/A	30 lb/A
Zinc	0.4	0.8	1.2	1.6	2.0	2.4
Sulfur	0.3	0.6	0.9	1.2	1.5	1.8
Calcium	0.2	0.4	0.6	0.8	1.0	1.2
Manganese	0.2	0.4	0.6	0.8	1.0	1.2

PRINCIPAL FUNCTIONING AGENTS

Calcium (Ca)	4.0%
Sulfur (S)	6.0%
Manganese (Mn)	4.0%
Molybdenum (Mo)	0.005%
Zinc (Zn)	8.0%

Derived from Calcium Sulfate, Manganese Oxide, Manganese Sulfate, Molybdic Oxide, Zinc Oxide, Zinc Sulfate, and Zinc EDDHA.





Ca Calcium
- -Critical for membrane integrity
- -Regulates other nutrients uptake
- -Cell elongation/division – root
- -Needed for environmental response

Mn Manganese
- -Essential for Chlorophyll production
- -Enzyme activator
- -Part of PSII, & vital for water photolysis
- -Regulates carbohydrates

S Sulfur
- -Essential Amino Acids (Cys, Met)
- -Nitrogen Assimilation (Fe-S proteins)
- -Plant Structure - Cell wall, Wax Layer
- - Soil Reserves are being depleted

Mo Molybdenum
- - Part of two enzymes that convert nitrate to nitrite
- -Part of nitrogenase enzyme in N-fixation bacteria
- -Vital for plant N metabolism

Zn Zinc
- -Part of CO_2 assimilation enzymes (Carbonic anhydrase) and hydrogenases.
- -Vital for protein structure
- -Plant hormone production





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Tank Mixing Order

Tank mix partners properly mixed in the correct sequence can greatly reduce the chance of something going wrong in the spray tank. Improper mixing can cause many problems, including precipitation fallout, screen or nozzle plugging, and sludge. Additionally, these problems impact uniform coverage which leads to reduced efficacy. Remember to always read and follow all label directions and exercise proper handling and safety requirements of each product. Below are general tank mixing guidelines to help determine which products to put in the tank first. If in doubt about product compatibility or proper mixing order, conduct a jar test. Adequate (but not excessive) agitation is also critical for proper tank mixing.

Water Carrier

1. **Fill tank half-full with water**
2. **Begin agitation**
   a. Continue throughout mixing process
3. **Water-Soluble Packets (WSP)**
   a. Pre-slurry in water prior to the addition tank
4. **Wettable Powders (WP), Dry Flowables (WG), and Soluble Granules (SG)**
   a. Recommended: Pre-slurry in water prior to the addition to tank
5. **Polymer Based Drift Reduction Agents (DRA)**
   a. CHS Trapline Pro 2, Mediate and Cognitive 1
6. **Water Conditioners**
   a. Dry AMS
   b. CHS Liquid AMS Solutions (Precint2, Encloax, etc.)
7. **Compatibility Agent and Defoamer (If needed)**
8. **Dispersed Liquid Formulations**
   a. Capsule Suspension (CS, ZC)
   b. Suspension Concentrates (SC)
   c. Liqiuid Flowables (F)
   d. Suspo-emulsions (SE)
9. **Emulsifiable Concentrates (EC)**
10. **Soluble Liquids (SL)**
11. **Adjuvants**
    a. Water Conditioners (CHS Fixate, CHS Deppex)
    b. Crop Oil Concentrates (CHS Penetrec)
    c. Methylated Seed Oils (CHS Aggrestrol)
    d. Nonionic Surfactants (CHS Level Best Pro)
    e. Drift and Deposition (CHS Acuvant/Parachute II)
12. **Micronutrients**
    a. Tachline, etc.
13. **Top off with water carrier**

UAN Carrier

1. **Fill tank half-full with UAN**
2. **Begin agitation**
   a. Continue throughout mixing process
3. **Water-Soluble Packets (WSP)**
   a. Pre-Slurry in water prior to the addition to tank
4. **Wettable Powders (WP), Dry Flowables (WG), and Soluble Granules (SG)**
   a. Pre-slurry in water prior to the addition to tank
5. **Compatibility Agent and Defoamer (If needed)**
6. **Nitrogen Stabilizer**
   a. N-Edge Brands
7. **Dispersed Liquid Formulations**
   Recommended: Pre-Slurry in water prior to the addition to the tank
   a. Capsule Suspension (CS, ZC)
   b. Suspension Concentrates (SC)
   c. Liqiuid Flowables (F)
   d. Suspo-emulsions (SE)
8. **Emulsifiable Concentrates (EC)**
9. **Soluble Liquids (SL)**
10. **Adjuvants**
    a. Crop Oil Concentrates (CHS Penetrec)
    b. Methylated Seed Oils (CHS Aggrestrol)
    c. Nonionic Surfactants (CHS Level Best Pro)
    d. Drift and Deposition (CHS Acuvant/Parachute II)
11. **Ammonium Thiosulfate (ATS)**
12. **Top off with UAN carrier**



Minimum Storage Temperature for Liquid Products and Average Product Weight Per Gallon

NOTE: Average product weights are provided for reference only. Product weight will vary among batches. Refer to bill of lading or manufacturer for exact product weight.

Product	Temp[1] (°F)	Weight[2] (lb/gal)
Abivium	32	NA
Adium	NTR	9.75
Allocate BCMZ	NTR	15.60
Allocate ZN	NTR	15.00
Blue Tsunami	NTR	10.00
Bollbuilder	35	9.85
Boron 10	NTR	11.00
Calantha	NTR	8.34
CHS Acuvant	NTR	7.44
CHS Aggrestrol	NTR	7.72
CHS Aventine	0	10.82
CHS Aventine Complete	NTR	10.20
CHS Axon	0	9.69
CHS Deppex	32	8.93
CHS Emulate	NTR	7.46
CHS Endurium	32	8.42
CHS Fixate	NTR	9.56-10.60
CHS Hypertonic	NTR	8.43-10.36
CHS Level Best Pro	NTR	9.00
CHS Liquid AMS	NTR	10.00
CHS Lumen	NTR	10.32
CHS Sitka	NTR	7.56
CHS Trapline Pro 2, 2x2.5	NTR	9.47
CHS Trapline Pro 2, Bulk/Tote	32	9.47
CHS Traplok	NTR	10.85
CHS Unlocked	NTR	8.88
CHS Unlocked Pro	NTR	8.93
CHS Wheelhouse Pro	NTR	9.59
CHS Wheelhouse 2	NTR	10.13
CHS Woodside	NTR	7.89
Citri-Amp	NTR	8.55
Cognitive 1	NTR	8.93
Compatibility Agent	NTR	8.97
Copper 7.5	NTR	10.40
CHS Penetrec	NTR	8.09
Crop Oil	NTR	7.26
Defoamer	40	8.27
EB Mix	NTR	10.81
Encloax	NTR	10.14
Equation	NTR	10.95
Foam Marker	NTR	N/A
Forge	NTR	8.25
Four-Score	NTR	9.60
H-45	NTR	7.96
H-Pro 20	NTR	9.60
H-Pro 7	NTR	9.60
Impel Boron	50	11.09
Impel Copper	50	9.75
Impel Zinc	50	10.51
Iron 4.5	NTR	11.40
Iron 5	NTR	10.60
K-Tone	NTR	8.51
Laser KB	50	10.92
Laser KS	50	11.42
Laser P	50	11.17
Last Chance	NTR	9.05
Levesol	NTR	8.75
Levesol Defoamer	40	7.82
Levesol DFC Zn	12	9.78
Levesol Zn	NTR	9.69
Man 5	NTR	10.40
Man 6	NTR	11.00
Mediate	32	9.93
Mediate Plus	NTR	9.95
Modulate	32	8.34
Moxon B	50	10.68
Moxon Cu	15	9.06
Moxon Mn	32	10.51
N-Edge	-10	9.26
N-Edge 2	32	9.26
N-Edge Pro	14	9.67
N-Edge Soil 2	14	9.76
N-Ertia 26	20	9.96
N-Ertia B	10	10.04
Parachute II	25	7.76
Potassium 19	NTR	10.59
ProFyl	NTR	10.95
ReLeaf Canola	50	10.67
ReLeaf Cereal	50	10.42
ReLeaf OS	50	11.01
ReLeaf Pulse	50	9.58
ReLeaf Soybean	50	11.33
Soiltrate	NTR	7.26
Soygreen AST	32	9.85
Soygreen Pro	NTR	10.22
Soyshot	32	10.32
Suralta	NTR	10.60
Tachline	20	10.60
Tachline Pro	NTR	11.20
Tank Cleaner	NTR	8.38
Tank Cleaner Elite	NTR	12.73
Tapran	NTR	7.87
Trivar	12	9.39
Veracity	NTR	9.83
White Water 90	NTR	10.19
White Water NIS	NTR	9.00
Zinc 10	NTR	9.77
Zinc 15	NTR	10.20
Zinc 9	NTR	11.00
4 lb Amine	NTR	9.62
Abamex	NTR	8.60
Abundit Edge	-40	11.31
Acumen	40	8.86
Acuron	NTR	9.15
Acuron Flexi	-10	9.07
Acuron GT	-10	10.14
Adastrio	NTR	9.51
Admire Pro	NTR	10.74
Affiance	NTR	9.10
A-Frame	NTR	9.26
A-Frame Plus	NTR	8.79
Agri-Mek SC	NTR	8.75
Agri-Tin	14	13.10
Aim EC	NTR	9.01
Alite 27	NTR	10.01
Alion	32	8.70
Alphanex	NTR	8.18
Alto 100SL	NTR	9.52

[1] NTR = No Temperature Restriction

[2] Check bulk bill of lading for exact weights

Product	Temp[1] (°F)	Weight[2] (lb/gal)
Anthem Flex	NTR	10.06
Anthem Maxx	NTR	10.02
Aproach	NTR	9.27
Aproach Prima	NTR	9.30
Armezon	25	9.43
Armezon Pro	NTR	9.40
Asana XL	NTR	7.76
Assure II	NTR	8.51
Asulox	20	9.85
Atrazine 4L	NTR	9.15
Autonomy	NTR	9.60
Authority Assist	NTR	10.01
Authority Edge	NTR	10.23
Authority Elite	NTR	9.24
Authority Supreme	NTR	10.10
Averland FC	NTR	8.68
Axial Star	NTR	8.45
Axial XL	NTR	8.25
AzoxyStar	NTR	9.10
Azterknot	NTR	9.43
Azteroid 3.3FC	NTR	9.50
Balance Flexx	32	10.00
Basagran 5L	41	10.25
Battle Star	35	9.10
Baythroid XL	NTR	8.50
Belay	32	9.26
Belt SC	NTR	10.26
Besiege	32	8.96
Beyond	32	8.75
Bicep II Magnum	NTR	9.28
Bicep II Magnum FC	NTR	9.31
Bicep Lite II Magnum	NTR	9.31
Bidrin 8	NTR	9.90
Bifender FC	NTR	9.01
Bifenture EC	40	7.99
Blanket 4F	NTR	10.00
Blocker	NTR	10.50
Boomer	10	8.70
Boundary 6.5EC	NTR	9.01
Bravo WeatherStick	NTR	11.17
Bravo Zn	NTR	10.69
Brawl	-30	9.13
Brawl II	-30	9.26
Brawl II ATZ	-30	9.26
Brigade 2EC	40	7.90
Broadaxe XC	32	9.21
Brox 2EC	3	8.72
Brox AT	3	9.26
Brox M Ultra	25	9.71
Brox-M	25	9.47
Buccaneer	NTR	9.66
Buccaneer 5	NTR	10.01
Buccaneer Plus	NTR	9.77
Bumper 41.8 EC	NTR	8.97
Bumper ES	NTR	8.86
Butyrac 200	NTR	9.05
Cadet	32	8.84
Calibra	-10	9.11
Callisto	-20	10.00
Callisto Xtra	-20	9.28
Caparol 4L	NTR	9.05
Capreno	14	10.18
Capture LFR	NTR	8.75
Capture 3Rive 3D	NTR	9.05
Caramba	36	8.72
Centuro	-9	10.50
Champ Formula 2	NTR	11.93
Cheetah	NTR	9.12
Chiptox	NTR	9.10
Cinch ATZ	NTR	9.29
Cinch ATZ Lite	NTR	9.32
Clarity	NTR	10.26
Cleansweep M	10	9.47
CleanWave	NTR	8.28
Cleaver 6B	NTR	9.46
Cobra	NTR	8.31
Comet	10	8.30
Command 3ME	-4	9.60
Concord	NTR	9.85
ContaiN	32	8.50
ContaiN Advanced	NTR	9.10
Coragen	32	9.12
Corvus	NTR	9.83
Crossbow	10	8.45
Curtail	40	9.62
Curtail M	10	8.44
Defol 5	NTR	11.77
Defol 750	NTR	13.77
Degree Xtra	NTR	9.28
Delaro 325	32	9.18
Delaro Complete	32	9.86
Detonate	NTR	10.26
Devrinol 2EC	NTR	9.91
Diflexx	32	9.29
Diflexx DUO	32	9.41
Dimethoate	32	9.10
Dimethoate 400 EC	45	9.26
Discover NG	NTR	7.87
Dithane F-45 Rainshield	NTR	11.27
Domark	32	9.34
Dual II Magnum	-30	9.28
Dual II Magnum SI	-30	8.95
Dual Magnum	-30	9.13
DuraCor	NTR	8.82
Durango DMA	NTR	10.11
Durus	35	9.24
Echo 720	NTR	11.18
Echo Zn	NTR	10.83
Elevest	32	9.33
Eminent	32	9.00
Endigo ZCX	32	9.42
Enlist Duo	NTR	9.77
Enlist One	NTR	9.96
Enversa	NTR	9.11
Eptam 7E	-50	7.93
Ethephon	NTR	9.23
Ethos 3D	NTR	9.03
Ethos Elite LFR	NTR	9.68
Ethos XB	NTR	9.60
Everest 3.0	45	8.51
EverpreX	-30	9.14
Evito	NTR	9.92
Excalia	NTR	9.10
Facet L	NTR	9.44
Fargo EC	32	8.63
Fastac CS	32	8.43
Fierce EZ	NTR	9.57
Fierce MTZ	NTR	9.35
Five Star	35	8.90
Flexstar	32	9.08

[1] NTR = No Temperature Restriction

[2] Check bulk bill of lading for exact weights

Product	Temp[1] (°F)	Weight[2] (lb/gal)
Flexstar GT 3.5	10	10.08
Forum	NTR	9.67
Fulfill	40	7.96
Fultime NXT	NTR	9.25
Fusilade DX	NTR	8.14
Galigan	32	9.01
Gly Star 5 Extra	NTR	9.65
Gly Star Plus	NTR	9.85
Goal	32	8.99
Goaltender	32	9.84
GoldSky	15	8.76
Gramoxone 3.0	NTR	9.49
Grazon P + D	NTR	9.59
GrazonNext HL	NTR	9.74
Halex GT	-10	10.15
Hamper	-30	9.21
Harness Max	NTR	8.97
Harness Xtra	NTR	9.23
Harness Xtra 5.6L	NTR	9.25
Headline AMP	NTR	8.85
Headline SC	NTR	8.93
Helmet Maxx	NTR	8.93
Hero	32	8.26
Huskie	NTR	9.44
Huskie Complete	32	9.26
Impact	NTR	9.43
Impact Core	NTR	9.25
ImpactZ	NTR	9.35
Incognito 4.5 F	NTR	10.09
Index	40	9.35
Inspire XT	NTR	9.26
Instinct II	NTR	9.36
Instinct NxtGen	-40	9.93
Interline	NTR	9.60
InterMoc	NTR	9.13
Intrepid 2F	32	9.17
Intrepid Edge	32	8.96
IronGate	NTR	9.45
Katagon	NTR	8.54
Keystone NXT	NTR	9.27
Keystone LA NXT	NTR	9.24
Kyber Pro	NTR	9.35
Kyro	NTR	9.20
LamdaStar 1CS	NTR	8.51
LamdaStar Plus	NTR	8.59
Lannate LV	32	8.52
Laudis	NTR	10.16
Ledger	NTR	9.01
Leverage 360	32	9.68
Lexar EZ	NTR	9.15
Liberty 280 SL	32	9.60
Liberty Ultra	32	9.42
Lifeline	NTR	9.60
Linex	NTR	9.80
Lucento	NTR	9.09
Lumax EZ	-10	9.12
Luna Experience	32	9.47
Luna Sensation	32	9.73
Luna Tranquility	32	9.26
Macho 4.0	32	9.85
Maestro 2EC	32	8.58
Maestro D	32	9.68
Maestro MA	3	9.48
Malathion	40	8.84
Manzate Max	NTR	10.21
Marvel	32	9.63
Maverick	NTR	9.30
Meteor	NTR	9.77
MiCrop	35	8.84
Milestone	NTR	9.51
Minerva	NTR	9.01
Miravis Ace	NTR	9.16
Miravis Neo	NTR	8.88
Miravis Prime	NTR	9.76
Miravis Top	NTR	9.05
Mocap EC	NTR	8.59
Moccasin MTZ	NTR	8.60
Mustang Max	20	8.72
Newpath	32	9.35
Nexicor	NTR	8.92
Nortron SC	40	9.41
N-Serve 24	18	8.12
Nu-Cop 3L	32	12.94
Nuprid 2F	NTR	9.35
Nuprid 4F Max	NTR	10.06
Oberon 4SC	32	9.00
Omega 500F	NTR	10.34
Omega Top	NTR	10.34
Onager	NTR	8.74
Open Sky	NTR	8.37
Optero	35	8.83
Orion	NTR	8.08
Outlook	NTR	9.41
Palace	NTR	9.14
Palisade Max	32	8.31
Panther Pro	NTR	9.43
Panther SC	NTR	9.66
Parallel	NTR	9.25
Parity	32	8.66
Pentia	32	8.65
PerfectMatch	NTR	8.74
Perm-Up 3.2 EC	40	8.65
Perpetuo	NTR	9.30
Pin-Dee 3.3EC	40	8.81
Pixxaro EC	NTR	8.65
Poast	32	7.77
Pramitol 25E	32	7.80
Preemptor SC	NTR	9.44
Prefix	NTR	9.32
Presidio	32	10.11
Prevathon	32	8.64
Preview 2.1SL	NTR	9.56
Priaxor	32	9.68
Princep 4L	NTR	9.54
Priority GT	35	8.99
Priority MA	35	8.99
Proline 480SC	32	9.83
Propulse	32	9.60
Prosaro	32	9.51
Prosaro Pro	32	9.60
Province II	NTR	9.15
Provysol	32	9.60
Prowl H20	NTR	9.81
Prozio BWP	35	9.50
Pursuit	32	9.20
Quadris Flowable	NTR	9.27

[1] NTR = No Temperature Restriction

[2] Check bulk bill of lading for exact weights

Product	Temp[1] (°F)	Weight[2] (lb/gal)
Quilt Xcel	NTR	8.79
Range Star	35	9.75
Raptor	32	8.75
Reflex	32	9.22
Regent 4SC	3	10.34
Reglone	32	10.09
Rely 280	32	9.60
Renestra	14	8.85
Resicore	NTR	9.06
Resicore REV	NTR	9.35
Resicore XL	NTR	9.35
Resource	NTR	8.51
Reviton	NTR	9.44
Revus	NTR	8.95
Revus Top	NTR	9.55
Revylok	NTR	9.60
Revytek	32	9.51
Ridgeback	NTR	8.38
Ridomil Gold Bravo	NTR	10.10
Ridomil Gold SL	NTR	8.84
Rimon	NTR	9.01
Ringside	NTR	9.22
Roundup PowerMax	NTR	11.32
Roundup PowerMax II	NTR	11.35
Roundup PowerMax 3	NTR	11.46
Roundup RT3	NTR	11.26
Roundup WeatherMax	NTR	11.28
Scala SC	32	9.18
Scoparia	32	10.01
Sefina	14	8.51
Select Max	NTR	7.69
Sendero	NTR	9.82
Sentrallas	NTR	8.27
Sequence	NTR	10.20
Sevin XLR Plus	NTR	9.17
S-fenvaloStar	NTR	7.76
Shadow	NTR	8.00
Shadow 3EC	NTR	8.18
Sharpen	NTR	9.57
Silencer	NTR	7.76
Silencer VXN	32	7.84
Sim-trol 4L	NTR	9.51
Sinate	NTR	9.40
Sivanto Prime	14	9.76
Sonalan HFP	40	8.50
Sonic Boom	NTR	9.56
Spartan 4F	NTR	10.06
Spartan Charge	32	10.01
Sphaerex	10	8.71
Spitfire	32	9.10
Stadium	NTR	9.56
Starane Flex	NTR	8.32
Starane NXT	14	9.12
Starane Ultra	10	8.76
Staunch II	NTR	9.10
Stinger	28	9.69
Stinger HL	28	10.25
Storen	14	9.12
Stratego YLD	32	9.66
Super Tin 4L	0	10.00
SuperBoll	NTR	10.82
SureStart II	NTR	9.10
Surmise 5	35	10.06
Surpass NXT	NTR	9.18
Surtain	32	9.18
Talinor	NTR	9.14
Targa	NTR	8.51
TebuStar 3.6L	NTR	9.00
Tempo SC Ultra	20	8.84
Tendovo	32	9.01
Thionex 3EC	20	8.82
Thistrol	32	9.30
Thunder	32	9.20
Thunder Master	NTR	9.14
Tilt	NTR	8.59
T-Methyl	NTR	10.08
Toledo	NTR	9.12
Tolvera	NTR	8.85
TopGuard	NTR	8.85
TopGuard EQ	NTR	9.84
Topsin	NTR	9.97
Torac	32	8.60
Tordon 22K	NTR	9.71
Tordon RTU	NTR	9.10
Torment	NTR	9.26
Trifluralin 4EC	40	8.97
Trimec 992	32	9.56
Trimec Classic	32	9.32
TripleFLEX II	NTR	9.10
Trivapro	NTR	8.74
Trivolt	32	9.96
Truslate Pro	10	8.88
Ultra-Blazer	32	9.82
Valor EZ	32	9.77
Vantacor	32	10.53
Varisto	32	9.93
Varro	32	8.35
Velpar L	NTR	8.15
Veltyma	32	9.51
Verdict	NTR	9.10
Viatude	NTR	9.17
Volley ATZ Lite NXT	NTR	9.24
Volley ATZ NXT	NTR	9.27
Volley NXT	NTR	9.18
Volunteer	NTR	7.90
Vydate L	32	8.18
Warrant	32	9.20
Warrant Ultra	32	9.28
Warrior II	32	9.11
Weedmaster	NTR	9.67
Weedone 638	NTR	8.80
Weedone 650	NTR	9.26
Weedone LV 4EC	NTR	8.55
Weedone LV 6EC	NTR	9.34
WideMatch	20	8.75
WideARMatch	NTR	8.85
Witness	20	8.75
Xpendient Plus V	40	8.26
Xyway LFR	NTR	9.19
Xyway 3D	NTR	9.46
Zalo	NTR	9.39
Zeal MVP	NTR	8.39
Zeal Pro	NTR	8.39
Zeal SC	NTR	9.10
Zidua Pro	23	9.93
Zidua SC	23	10.03
Zolera FX	NTR	9.37

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Herbicide Premixes

Acuron								
Rate/Acre		Dual II Magnum		Atrazine 4L		Callisto		Bicyclopyrone
2.5 qt	=	22.4 oz	+	20.1 oz	+	4.8 oz	+	0.6 oz
3.0 qt	=	26.9 oz	+	24.0 oz	+	5.75 oz	+	0.72 oz

Acuron GT								
Rate/Acre		Dual Magnum		Callisto		Bicyclopyrone		Glyphosate 4.5 lb ae
3.75 pt	=	1.0 pt	+	3.0 oz	+	0.7 oz	+	26.7 oz

Acuron Flexi						
Rate/Acre		Dual II Magnum		Callisto		Bicyclopyrone
2.0 qt	=	24.0 oz	+	5.1 oz	+	0.64 oz
2.25 qt	=	26.9 oz	+	5.75 oz	+	0.72 oz

Affinity Broadspec				
Rate/Acre		Harmony SG		Express
1.0 oz	=	0.5 oz	+	0.5 oz

Affinity TankMix				
Rate/Acre		Harmony SG		Express
0.6 oz	=	0.48 oz	+	0.12 oz
1.0 oz	=	0.8 oz	+	0.2 oz

Afforia						
Rate/Acre		Harmony SG		Express		Valor
2.5 oz	=	0.25 oz	+	0.25 oz	+	2.0 oz

Agility SG								
Rate/Acre		Banvel		Harmony SG		Express SG		Ally XP
1.6 oz	=	2.0 oz	+	0.15 oz	+	0.08 oz	+	0.05 oz
2.4 oz	=	3.0 oz	+	0.23 oz	+	0.11 oz	+	0.08 oz
3.2 oz	=	4.0 oz	+	0.3 oz	+	0.15 oz	+	0.1 oz

Ally Extra SG						
Rate/Acre		Ally XP		Harmony SG		Express
0.2 oz	=	0.036 oz	+	0.109 oz	+	0.054 oz
0.4 oz	=	0.072 oz	+	0.218 oz	+	0.108 oz

Anthem Flex				
Rate/Acre		Zidua		Aim
1.8 oz	=	0.98 oz	+	0.24 oz
2.7 oz	=	1.5 oz	+	0.36 oz
3.8 oz	=	2.09 oz	+	0.5 oz

Anthem Maxx				
Rate/Acre		Zidua		Cadet
2.0 oz	=	1.23 oz	+	0.277 oz
4.0 oz	=	2.46 oz	+	0.554 oz
6.0 oz	=	3.68 oz	+	0.831 oz

Armezon Pro				
Rate/Acre		Armezon		Outlook
16.0 oz	=	0.57 oz	+	14.0 oz
20.0 oz	=	0.715 oz	+	17.5 oz
24.0 oz	=	0.857 oz	+	21.0 oz

Audit 1:1				
Rate/Acre		Harmony GT XP		Express
0.4 oz	=	0.13 oz	+	0.2 oz
0.7 oz	=	0.23 oz	+	0.35 oz
1.0 oz	=	0.33 oz	+	0.5 oz

Audit 4:1				
Rate/Acre		Harmony GT XP		Express
0.6 oz	=	0.32 oz	+	0.12 oz
0.8 oz	=	0.43 oz	+	0.16 oz
1.0 oz	=	0.53 oz	+	0.2 oz

Audit 9:1				
Rate/Acre		Harmony GT XP		Express
0.4 oz	=	0.028 oz	+	0.35 oz
0.5 oz	=	0.034 oz	+	0.45 oz
0.55 oz	=	0.036 oz	+	0.48 oz

Authority Assist				
Rate/Acre		Spartan 4F		Pursuit
4.0 oz	=	3.3 oz	+	1.34 oz
5.0 oz	=	4.2 oz	+	1.67 oz
6.0 oz	=	5.0 oz	+	2.0 oz

Authority Edge				
Rate/Acre		Spartan 4F		Zidua SC
9.0 oz	=	6.1 oz	+	3.25 oz

Authority Elite				
Rate/Acre		Spartan 4F		Dual Magnum
17.0 oz	=	2.975 oz	+	14.055 oz
19.0 oz	=	3.325 oz	+	15.71 oz
26.0 oz	=	4.55 oz	+	21.5 oz

Authority First/Sonic				
Rate/Acre		Spartan 4F		First Rate
3.225 oz	=	4.0 oz	+	0.3 oz
6.45 oz	=	8.0 oz	+	0.6 oz
8.0 oz	=	10.0 oz	+	0.75 oz

Authority Supreme				
Rate/Acre		Spartan 4F		Zidua
6.0 oz	=	3.12 oz	+	1.84 oz
7.5 oz	=	3.90 oz	+	2.29 oz
9.0 oz	=	4.68 oz	+	2.75 oz

Authority XL				
Rate/Acre		Spartan 4L		Classic
5.0 oz	=	6.1 fl oz	+	1.6 oz
7.0 oz	=	8.68 fl oz	+	2.244 oz
9.6 oz	=	11.90 fl oz	+	3.077 oz

Autumn Super				
Rate/Acre		Autumn		Thiencarbazone
0.5 oz	=	0.3 oz	+	0.225 oz ai

Axial Star				
Rate/Acre		Axial XL		Starane Ultra
16.4 oz	=	16.4 oz	+	4.28 oz

Axiom 68DF				
Rate/Acre		Define 60DF		Sencor 4L
12.0 oz	=	10.88 oz	+	3.26 fl oz
16.0 oz	=	14.5 oz	+	4.35 fl oz
20.0 oz	=	18.13 oz	+	5.44 fl oz

Basis Blend				
Rate/Acre		Harmony SG		Resolve SG
0.825 oz	=	0.165 oz	+	0.66 oz
1.5 oz	=	0.30 oz	+	1.20 oz

Bicep II Magnum/Brawl II ATZ				
Rate/Acre		Dual II Magnum		Atrazine 4L
1.3 qt	=	0.82 pt	+	1.0 qt
1.6 qt	=	1.01 pt	+	1.24 qt
2.1 qt	=	1.32 pt	+	1.63 qt

Bicep Lite II Magnum				
Rate/Acre		Dual II Magnum		Atrazine 4L
1.1 qt	=	0.96 pt	+	0.73 qt
1.5 qt	=	1.31 pt	+	1.0 qt
1.9 qt	=	1.66 pt	+	1.27 qt

Boundary 6.5EC/Ledger				
Rate/Acre		Dual Magnum		Sencor 4L
1.5 pt	=	1.03 pt	+	7.5 oz
2.0 pt	=	1.37 pt	+	10.0 oz
2.25 pt	=	1.54 pt	+	11.25 oz

BroadAxe XC				
Rate/Acre		Spartan 4F		Dual Magnum
19.0 oz	=	3.33 oz	+	15.71 oz
23.0 oz	=	4.03 oz	+	19.01 oz
26.0 oz	=	4.55 oz	+	21.5 oz

Calibra				
Rate/Acre		Dual II Magnum		Callisto
1.4 qt	=	1.08 pt	+	3.14 oz
1.9 qt	=	1.14 pt	+	4.26 oz
2.4 qt	=	1.78 pt	+	5.38 oz
2.8 qt	=	2.07	+	6.27 oz

Callisto Xtra				
Rate/Acre		Callisto		Atrazine 4L
20.0 oz	=	2.5 oz	+	16.0 oz
24.0 oz	=	3.0 oz	+	19.2 oz

Capreno				
Rate/Acre		Laudis		Thiencarbazone-Methyl
2.0 oz	=	1.65 oz	+	0.009 lb ai
2.5 oz	=	2.05 oz	+	0.011 lb ai
3.0 oz	=	2.47 oz	+	0.013 lb ai

Chaparral				
Rate/Acre		Milestone		Ally
2.0 oz	=	4.2 oz	+	0.31 oz
2.5 oz		5.25 oz		0.39 oz
3.0 oz	=	6.3 oz	+	0.47 oz

Cleansweep M						
Rate/Acre		Buctril 2E		Starane Ultra		MCPA Ester 4
1 pt	=	0.84 pt	+	3.7 oz	+	0.45 pt
1.5 pt	=	1.25 pt	+	5.9 oz	+	0.68 pt

Cloak				
Rate/Acre		Classic 25DF		Sencor 4L
4.0 oz	=	1.71 oz	+	5.14 fl oz
5.0 oz	=	2.14 oz	+	6.43 fl oz
6.0 oz	=	2.57 oz	+	7.72 fl oz

Corvus				
Rate/Acre		Balance Flexx		Thiencarbazone-Methyl
3.5 oz	=	3.29 oz	+	0.021 lb ai
5.60 oz	=	5.26 oz	+	0.033 lb ai

Crossbow				
Rate/Acre		Garlon 4		2,4-D 4 lb Ester
1.0 qt	=	0.5 pt	+	1.05 pt
2.0 qt	=	1.0 pt	+	2.1 pt

Curtail M				
Rate/Acre		Stinger		MCPA Ester
1.75 pt	=	0.25 pt	+	1.03 pt
2.0 pt	=	0.28 pt	+	1.18 pt
2.33 pt	=	0.33 pt	+	1.37 pt

Degree Xtra/Fultime NXT				
Rate/Acre		Harness		Atrazine 4L
2.0 qt	=	1.54 pt	+	0.66 qt
3.0 qt	=	2.31 pt	+	1.0 qt
3.5 qt	=	2.7 pt	+	1.2 qt

Diflexx DUO				
Rate/Acre		DiFlexx		Laudis
24.0 oz	=	7.5 oz	+	1.85 oz
32.0 oz	=	10.0 oz	+	2.47 oz
40.0 oz	=	12.5 oz	+	3.09 oz

Distinct 70WG				
Rate/Acre		Diflufenzopyr		Banvel
4.0 oz	=	0.8 oz	+	4.0 oz
5.0 oz	=	1.0 oz	+	5.0 oz
6.0 oz	=	1.2 oz	+	6.0 oz

Enlist Duo				
Rate/Acre		Durango DMA		Enlist One
4.75 pt	+	2.0 pt	+	2 pt

Enlite						
Rate/Acre		Classic		Valor		Harmony SG
2.8 oz	=	0.32 oz	+	2.0 oz	+	0.49 oz
3.5 oz	=	0.40 oz	+	2.5 oz	+	0.60 oz
4.25 oz	=	0.50 oz	+	3.0 oz	+	0.74 oz

Envive						
Rate/Acre		Classic		Valor		Harmony SG
2.5 oz	=	0.92 oz	+	1.43 oz	+	0.14 oz
4.0 oz	=	1.47 oz	+	2.29 oz	+	0.23 oz
5.3 oz	=	1.95 oz	+	3.03 oz	+	0.3 oz

Fierce EZ				
Rate/Acre		Valor		Zidua SC
6.0 oz	=	2.0 oz	+	2.46 oz
8.0 oz	=	2.68 oz	+	3.26 oz
9.0 oz	=	3.0 oz	+	3.68 oz

Fierce MTZ/Kyber Pro						
Rate/Acre		Valor		Zidua SC		Metribuzin 75DF
16.0 oz	=	2.0 oz	+	2.46 oz	+	4.0 oz
20.0 oz	=	2.5 oz	+	3.07 oz	+	5.0 oz
24.0 oz	=	3.0 oz	+	3.68 oz	+	6.0 oz

Fierce XLT						
Rate/Acre		Valor SX		Zidua		Classic 25WDG
4.0 oz	=	2.0 oz	+	1.5 oz	+	1.07 oz
4.5 oz	=	2.2 oz	+	1.65 oz	+	1.92 oz
5.25 oz	=	2.6 oz	+	1.92 oz	+	1.4 oz

Finesse C&F				
Rate/Acre		Glean XP		Ally XP
0.2 oz	=	0.167 oz	+	0.042 oz
0.5 oz	=	0.42 oz	+	0.104 oz

First Shot SG				
Rate/Acre		Harmony SG		Express 70 WDG
0.5 oz	=	0.25 oz	+	0.25 oz
0.6 oz	=	0.3 oz	+	0.3 oz

Flexstar GT 3.5				
Rate/Acre		Glyphosate 4.5 lb ae		Flexstar
2.7 pt	=	21.7 oz	+	0.8 pt
3.5 pt	=	28.1 oz	+	1.04 pt
4.5 pt	=	36.1 oz	+	1.34 pt

GoldSky						
Rate/Acre		PowerFlex		Starane Ultra		Florasulam
1.0 pt	=	1.7 oz	+	4.06 oz	+	0.69 oz

Grazon Next HL				
Rate/Acre		Milestone		2,4-D 4 lb Amine
1.5 pt	=	5.0 oz	+	21.0 oz

Grazon P + D				
Rate/Acre		Tordon 22K		2,4-D 4 lb Amine
1.0 pt	=	4.32 oz	+	0.5 pt
2.0 pt	=	8.64 oz	+	1.0 pt
3.0 pt	=	12.96 oz	+	1.5 pt

Halex GT						
Rate/Acre		Dual Magnum		Glyphosate 4.5 lb ai		Callisto
3.6 pt	=	1.0 pt	+	26.8 oz	+	3.0 oz

Harmony Extra SG with TotalSol				
Rate/Acre		Harmony SG		Express
0.45 oz	=	0.3 oz	+	0.15 oz
0.6 oz	=	0.4 oz	+	0.2 oz
0.9 oz	=	0.6 oz	+	0.3 oz

Harness Max				
Rate/Acre		Harness		Callisto
50.0 oz	=	1.57 pt	+	4.13 oz
60.0 oz	=	1.89 pt	+	4.95 oz

Harness Xtra 5.6/Keystone NXT/Volley ATZ NXT				
Rate/Acre		Harness/Surpass NXT		Atrazine 4L
2.3 qt	=	2.04 pt	+	1.44 qt
2.6 qt	=	2.3 pt	+	1.63 qt
3.0 qt	=	2.66 pt	+	1.88 qt

Harness Xtra (6.0)/Keystone LA NXT/Volley ATZ Lite NXT				
Rate/Acre		Harness		Atrazine 4L
1.8 qt	=	2.21 pt	+	0.77 qt
2.0 qt	=	2.46 pt	+	0.86 qt
2.3 qt	=	2.83 pt	+	0.98 qt

Huskie Complete				
Rate/Acre		Huskie		Varro
13.7 oz	=	11.43 oz	+	6.93 oz

Impact Core				
Rate/Acre		Impact		Harness
24 oz	=	0.61 oz	+	1.51 pt
30 oz	=	0.76 oz	+	1.9 pt
32 oz	=	0.81 oz	+	2.0 pt

Impact Z				
Rate/Acre		Impact		Atrazine 4L
8.0 oz	=	0.75 oz	+	0.50 pt
10.7 oz	=	1.0 oz	+	0.66 pt
21.40 oz	=	2.0 oz	+	1.32 pt

Kyro						
Rate/Acre		Surpass NXT		Stinger		Armezon
35 oz	=	0.87 pt	+	2.91 oz	+	0.59 oz
45 oz	=	1.12 pt	+	3.74 oz	+	0.76 oz
60 oz	=	1.48 pt	+	4.98 oz	+	1.01 oz

Lexar EZ						
Rate/Acre		Callisto		Dual II Magnum		Atrazine 4L
1.5 qt	=	2.69 oz	+	0.68 pt	+	0.65 qt
3.0 qt	=	5.38 oz	+	1.36 pt	+	1.3 qt
3.5 qt	=	6.27 oz	+	1.59 pt	+	1.5 qt

Lumax EZ						
Rate/Acre		Callisto		Dual II Magnum		Atrazine 4L
3.0 qt	=	5.98 oz	+	1.96 pt	+	1.40 pt

Maestro D				
Rate/Acre		Buctril 2E		2,4-D Ester
0.75 pt	=	0.75 pt	+	0.39 pt
1.0 pt	=	1.0 pt	+	0.51 pt
1.5 pt	=	1.5 pt	+	0.77 pt

Maestro MA				
Rate/Acre		Brox 2E		MCPA Ester 4
1.0 pt	=	1.0 pt	+	0.50 pt
1.5 pt	=	1.5 pt	+	0.75 pt
2.0 pt	=	2.0 pt	+	1.0 pt

Maverick						
Rate/Acre		Stinger		Callisto		Zidua SC
14.0 oz	=	2.4 oz	+	2.9 oz	+	2.3 oz
18.0 oz	=	3.1 oz	+	3.7 oz	+	3.0 oz
24.0 oz	=	4.2 oz	+	5.0 oz	+	4.0 oz

Moccasin MTZ				
Rate/Acre		Dual Magnum		Sencor/Tricor DF
1.75 pt	=	0.7 pt	+	7.8 oz
3 pt	=	1.3 pt	+	13.4 oz

Opensky				
Rate/Acre		Powerflex HL		Starane Ultra
1.0 pt	=	1.65 oz	+	5.43 oz
1.25 pt	=	2.06 oz	+	6.79 oz

Orion				
Rate/Acre		Defender		MCPA
17.0 oz	=	1.34 oz	+	10.7 oz

Panoflex Totalsol				
Rate/Acre		Harmony SG		Express
0.3 oz	=	0.06 oz	+	0.24 oz
0.6 oz	=	0.12 oz	+	0.48 oz

Panther MTZ				
Rate/Acre		Valor EZ		Sencor/Tricor 75DF
12 oz	=	2.0 oz	+	6.0 oz
15 oz	=	2.5 oz	+	7.5 oz

PerfectMatch						
Rate/Acre		Powerflex HL		Starane Ultra		Stinger
1.0 pt	=	1.7 oz	+	4.3 oz	+	4.0 oz

Perpetuo				
Rate/Acre		Resource		Zidua SC
6 oz	=	4.1 oz	+	2.5 oz
8 oz	=	5.4 oz	+	3.3 oz
10 oz	=	6.9 oz	+	4.1 oz

Pixxaro EC				
Rate/Acre		Starane Ultra		Elevore
6.0 oz	=	5.0 oz	+	1.0 oz

Prefix				
Rate/Acre		Flexstar		Dual Magnun
2.0 pt	=	1.01 pt	+	1.14 pt
2.5 pt	=	1.26 pt	+	1.42 pt
3.0 pt	=	1.52 pt	+	1.71 pt

Priority MA						
Rate/Acre		Priority 8E		Atrazine 4L		Callisto
3.0 qt	=	21.4 oz	+	39.8 oz	+	5.2 oz
3.5 qt	=	24.9 oz	+	46.5 oz	+	6.1 oz

Quelex				
Rate/Acre		Florasulam		Elevore
0.55 oz	=	1.05 oz	+	0.76 oz
0.75 oz	=	1.43 oz	+	1.04 oz

Range Star				
Rate/Acre		Dicamba		2,4-D 4 lb Amine
1.0 pt	=	4.0 oz	+	0.75 pt
2.0 pt	=	8.0 oz	+	1.5 pt

Rave				
Rate/Acre		Milestone		2,4-D 4 lb Ester
2.0 oz	=	0.23 oz	+	2.0 oz
3.5 oz	=	0.41 oz	+	3.5 oz
4.0 oz	=	0.47 oz	+	4.0 oz

Realm Q				
Rate/Acre		Callisto		Resolve DF
4.0 oz	=	2.5 oz	+	1.2 oz

Resicore						
Rate/Acre		Surpass NXT		Callisto		Stinger
2.25 qt	=	0.9 qt	+	5.4 oz	+	4.56 oz
2.5 qt	=	1.0 qt	+	6.0 oz	+	5.07 oz
3.0 qt	=	1.2 qt	+	7.2 oz	+	6.1 oz

Resicore REV						
Rate/Acre		Surpass NXT		Callisto		Stinger
2.25 qt	=	0.9 qt	+	4.8 oz	+	4.6 oz
2.5 qt	=	1.0 qt	+	5.3 oz	+	5.1 oz
3.0 qt	=	1.2 qt	+	6.4 oz	+	6.1 oz

Resolve Q				
Rate/Acre		Resolve DF		Harmony SG
1.25 oz	=	0.9 oz	+	0.1 oz

Revulin Q				
Rate/Acre		Accent Q		Callisto
3.4 oz	=	0.9 oz	+	2.50 fl oz
4.0 oz	=	1.06 oz	+	2.94 fl oz

Rezuvant						
Rate/Acre		Axial XL		Starane Ultra		Elevore
16.40 oz	=	16.40 oz	+	5.21 oz	+	1.0 oz

RimFire Max				
Rate/Acre		Silverado		Olympus
3.0 oz	=	2.87 oz	+	0.2 oz

Sequence				
Rate/Acre		Dual Magnum		Glyphosate 4.5 lb ai
3.5 pt	=	1.38 pt	+	28.00 fl oz

Sinate				
Rate/Acre		Impact		Liberty
21 oz	=	0.75 oz	+	22.2 oz
24 oz	=	0.86 oz	+	25.3 oz
28 oz	=	1.0 oz	+	29.6 oz

Sonic Boom/Preview				
Rate/Acre		Tricor DF		Spartan
11.0 oz	=	4.0 oz	+	3.0 oz
16.0 oz	=	6.0 oz	+	4.0 oz
21.0 oz	=	8.0 oz	+	6.0 oz

Spartan Charge				
Rate/Acre		Spartan 4F		Aim EC
3.75 oz	=	3.0 oz	+	0.65 oz
4.5 oz	=	3.5 oz	+	0.75 oz
5.75 oz	=	4.5 oz	+	1.0 oz

Spitfire				
Rate/Acre		2,4-D 4 lb Ester		Banvel
1.0 pt	=	0.8 pt	+	2.0 oz
2.0 pt	=	1.6 pt	+	4.0 oz
4.0 pt	=	3.2 pt	+	8.0 oz

Starane Flex				
Rate/Acre		Starane Ultra		Florasulam
13.5 oz	=	4.02 oz	+	1.35 oz

Starane NXT				
Rate/Acre		Starane Ultra		Buctril
14.0 oz	=	2.92 oz	+	1.0 pt
21.0 oz	=	4.37oz	+	1.5 pt

Status				
Rate/Acre		Clarity		Diflufenzopyr
5.0 oz	=	4.0 oz	+	0.8 oz a.i.

Steadfast Q				
Rate/Acre		Accent Q		Resolve SG
1.5 oz	=	0.69 oz	+	0.75 oz

Storm				
Rate/Acre		Basagran		Blazer
1.5 pt	=	1.0 pt	+	1.0 pt
2.0 pt	=	1.33 pt	+	1.33 pt
2.5 pt	=	1.5 pt	+	1.5 pt

Storen								
Rate/Acre		Bicyclopyrone		Callisto		Dual II Magnum		Pyroxasulfone SC
2.1 qt	=	0.6 oz	+	5.2 fl oz	+	1.5 pt	+	2.4 fl oz
2.4 qt	=	0.7 oz	+	6.0 fl oz	+	1.7 pt	+	2.8 fl oz

SureStart II/Tripleflex II						
Rate/Acre		Python 80WDG		Stinger		Surpass NXT/Harness
1.5 pt	=	0.45 oz	+	2.3 oz	+	0.8 pt
1.75 pt	=	0.52 oz	+	2.7 oz	+	0.94 pt

Surveil				
Rate/Acre		Valor SX		First Rate
3.5 oz	=	2.4 oz	+	0.5 oz

Sustain				
Rate/Acre		Sharpen		Zidua SC
14 oz	=	3.08 oz	+	3.36 oz

Synchrony XP				
Rate/Acre		Classic		Harmony SG
0.375 oz	=	0.32 oz	+	0.05 oz
1.0 oz/acre	=	0.86 oz	+	0.14 oz

Talinor				
Rate/Acre		Buctril 2EC		Bicyclopyrone
13.70 oz	=	0.63 pt	+	1.76 oz ai

Tarzec				
Rate/Acre		Elevore		PowerFlex HL
1.0 oz	=	0.94 oz	+	1.92 oz

Tendovo						
Rate/Acre		Dual Magnum		Metribuzin 75DF		Firstrate
1.5 qt	=	1.4 pt	+	5.1 oz	+	0.46 oz
1.75 qt	=	1.6 pt	+	6.0 oz	+	0.53 oz
2.1 qt	=	1.9 pt	+	7.2 oz	+	0.65 oz

ThunderMaster				
Rate/Acre		Pursuit		Glyphosate 4.5 lb ae
2.25 pt	=	3.0 oz	+	12.0 oz
3.0 pt	=	4.0 oz	+	16.0 oz

Torment				
Rate/Acre		Flexstar		Pursuit
0.75 pt	=	12.75 oz	+	3.0 oz
1.0 pt	=	17.0 oz	+	4.0 oz

Trivence						
Rate/Acre		Classic		Valor SX		Metribuzin DF
6.0 oz	=	0.94 oz	+	1.5 oz	+	3.5 oz
7.2 oz	=	1.1 oz	+	1.8 oz	+	4.2 oz
10.0 oz	=	1.6 oz	+	2.5 oz	+	5.8 oz

TriVolt						
Rate/Acre		Balance Flexx		Thiencarbazone-methyl		Flufenacet
10.0 oz	=	3.14 oz	+	+0.0175 lb ai	+	+ 0.2 lb ai
12.0 oz	=	3.5 oz	+	+0.021 lb ai	+	+0.268 lb ai
20.0 oz	=	6.28 oz	+	+0.035 lb ai	+	+0.4 lb ai

Valor XLT				
Rate/Acre		Valor		Classic
3.0 oz	=	1.76 oz	+	1.2 oz
4.0 oz	=	2.35 oz	+	1.65 oz
5.0 oz	=	2.94 oz	+	2.06 oz

Varisto				
Rate/Acre		Raptor		Basagran 4L
11.0 oz	=	2.0 oz	+	11.0 oz
16.0 oz	=	3.0 oz	+	16.0 oz
21.0 oz	=	3.9 oz	+	21.0 oz

Verdict				
Rate/Acre		Sharpen		Outlook
10.0 oz	=	2.0 oz	+	8.3 oz
13.0 oz	=	2.6 oz	+	10.8 oz
16.0 oz	=	3.2 oz	+	13.3 oz

Volta Extra				
Rate/Acre		Harmony		Express
0.3 oz	=	0.15 oz	+	0.075 oz
0.6 oz	=	0.3oz	+	0.15 oz

Warrant Ultra				
Rate/Acre		Warrant		Fomesafen
48.0 oz	=	1.41 qt	+	0.96 pt
60.0 oz	=	1.76 qt	+	1.2 pt
70.0 oz	=	2.06 qt	+	1.36 pt

Weedmaster				
Rate/Acre		Banvel		2,4-D 4 lb Amine
1.0 pt	=	4.0 oz	+	0.75 pt
2.0 pt	=	8.0 oz	+	1.5 pt

WideARmatch						
Rate/Acre		Stinger		Starane Ultra		Elevore
14.0 oz	=	3.83 oz	+	5.10 oz	+	0.98 oz
19.6 oz	=	5.36 oz	+	7.14 oz	+	1.37 oz

WideMatch				
Rate/Acre		Stinger		Starane Ultra
16 oz	=	4.0 oz	+	4.29 oz

Yukon				
Rate/Acre		Permit		Banvel
4.0 oz	=	0.67 oz	+	4.0 oz
8.0 oz	=	1.33 oz	+	8.0 oz

Zalo				
Rate/Acre		Assure II		Liberty
32 oz	=	8.40 oz	+	31.4 oz
43 oz	=	11.20 oz	+	42.10 oz

Zidua Pro						
Rate/Acre		Sharpen		Pursuit		Zidua SC
4.5 oz	=	0.75 oz	+	3.0 oz	+	2.5 oz
6.0 oz	=	1.0 oz	+	4.0 oz	+	3.25 oz

Insecticide Premixes

Besiege				
Rate/Acre		Warrior II w/Zeon		Prevathon
9.0 oz	=	1.8 oz	+	1.1 pt

Elevest				
Rate/Acre		Prevathon		Brigade 2EC
7.0 oz	=	14.45 oz	+	4.7 oz

Endigo ZC				
Rate/Acre		Actara		Warrior II w/Zeon
3.5 oz	=	2.07 oz	+	1.48 oz
4.5 oz	=	2.66 oz	+	1.90 fl oz

Endigo ZCX				
Rate/Acre		Actara		Warrior II w/Zeon
3.5 oz	=	3.15 oz	+	1.51 fl oz
4.5 oz	=	4.05 oz	+	1.95 fl oz

Hero				
Rate/Acre		Capture 2 EC		Mustang Max
6.0 oz	=	2.8 oz	+	2.35 oz

Leverage 360				
Rate/Acre		Admire Pro		Baythroid XL
2.8 oz	=	1.22 oz	+	2.8 oz

Ridgeback				
Rate/Acre		Transform		Brigade 2EC
6.9 oz	=	0.54 oz	+	3.21 oz
10.3 oz	=	0.80 oz	+	4.79 oz
13.8 oz	=	1.07 oz	+	6.42 oz



Fungicide Premixes

Adastrio						
Rate/Acre		Topguard		Quadris		Fluindapyr
7.0 oz	=	9.8 oz	+	4.9 oz	+	0.055 lb ai
8.0 oz	=	11.4 oz	+	5.7 oz	+	0.063 lb ai
9.0 oz	=	13.0 oz	+	6.5 oz	+	0.07 lb ai

Affiance				
Rate/Acre		Quadris		Domark
10.0 oz	=	4.0 oz	+	3.5 oz

Aproach Prima				
Rate/Acre		Approach		Alto 100 SL
5.0 oz	=	4.0 oz	+	4.04 oz

Delaro 325 SC				
Rate/Acre		Proline		Gem 500 SC
8.0 oz	=	2.98 oz	+	2.51 oz
10.0 oz	=	3.73 oz	+	3.14 oz
12.0 oz	=	4.48 oz	+	3.74 oz

Delaro Complete						
Rate/Acre		Proline 480SC		Gem 500 SC		Velum
8.0 oz	=	2.98 oz	+	2.51 oz	+	2.06 oz
10.0 oz	=	3.73 oz	+	3.14 oz	+	2.57 oz

Headline Amp				
Rate/Acre		Headline		Caramba
10.0 oz	=	5.84 oz	+	6.13 oz

Lucento				
Rate/Acre		Topguard		Bixafen
5.0 oz	=	12.4 oz	+	0.06 lb a.i.

Miravis Ace				
Rate/Acre		Tilt		Adepidyn
13.7 oz	=	4.0 oz	+	10.4 oz

Miravis Neo						
Rate/Acre		Miravis		Tilt		Quadris
13.7 oz	=	5.17 oz	+	3.96 oz	+	5.47 oz
20.8 oz	=	7.85 oz	+	6.01 oz	+	8.30 oz

Miravis Top				
Rate/Acre		Adepidyn		Inspire
13.7 oz	=	5.2 oz	+	6.8 oz

Nexicor						
Rate/Acre		Headline		Sercadis		Propiconazole
7.0 oz	=	5.6 oz	+	0.7 oz	+	2.0 oz
9.0 oz	=	7.2 oz	+	0.9 oz	+	2.6 oz
11.0 oz	=	8.8 oz	+	1.1 oz	+	3.2 oz

Preemptor SC				
Rate/Acre		Evito 480 SC		Topguard
5.0 oz	=	1.76 oz	+	8.75 oz

Priaxor				
Rate/Acre		Headline		Sercadis
4.0 oz	=	5.3 oz	+	2.7 oz

Prosaro				
Rate/Acre		Proline		Folicur
6.5 oz	=	2.86 oz	+	3.18 oz
8.0 oz	=	3.52 oz	+	3.91 oz

Prosaro PRO 400 SC						
Rate/Acre		Proline 480 SC		Gem 500 SC		Velum
10.3 oz	=	4.3 oz	+	2.14 oz	+	2.08 oz
12.0 oz	=	5.01 oz	+	2.49 oz	+	2.42 oz

Quilt Xcel/MiCrop				
Rate/Acre		Quadris		Tilt
10.5 oz	=	6.0 oz	+	3.0 oz

Revylok				
Rate/Acre		Provysol		Sercadis
5.5 oz	=	4.14 oz	+	1.84 oz

Revytek						
Rate/Acre		Headline		Provysol		Sercadis
5.7 oz	=	5.7 oz	+	2.7 oz	+	2.4 oz

Sphaerex				
Rate/Acre		Caramba		Proline
5.0 oz	=	6.26 oz	+	1.95 oz
7.3 oz	=	9.15 oz	+	2.85 oz

Stratego Yld				
Rate/Acre		Proline		Gem 500 SC
5.0 oz	=	1.3 oz	+	3.75 oz

Topguard EQ				
Rate/Acre		Topguard		Quadris
5.0 oz	=	8.8 oz	+	5.92 oz
6.0 oz	=	10.5 oz	+	7.10 oz
7.0 oz	=	12.25 oz	+	8.30 oz

Trivapro						
Rate/Acre		Quadris		Tilt		Solatenol
9.4 oz	=	4.16 oz	+	2.7 oz	+	2.8 oz
13.7 oz	=	6.0 oz	+	4.0 oz	+	4.2 oz
20.7 oz	=	9.17 oz	+	6.0 oz	+	6.2 oz

Veltyma				
Rate/Acre		Headline		Provysol
7.0 oz	=	5.6 oz	+	3.5 oz

Viatude				
Rate/Acre		Aproach		Proline
8 oz	=	6 oz	+	1 oz
10 oz	=	7.5 oz	+	1.7 oz
16 oz	=	12 oz	+	2.1 oz

Zolera				
Rate/Acre		Evito 480SC		Domark
4.4 oz	=	1.85 oz	+	3.9 oz
5.6 oz	=	2.35 oz	+	4.8 oz
6.8 oz	=	2.85 oz	+	6.0 oz

Estimates of yield potential are just that, estimates, and not a guarantee of final yield. However, estimating yield of growing crops can help farmers make late season input and marketing decisions. Corn and wheat yields can be estimated accurately, however, soybean and dry bean yield estimates are generally much more variable. Later estimates give more accurate results.

Estimating Corn Yield

Step	Corn should be in the R3 (milk) stage or later	Comments
1.	Measure 1/1000 of an acre See chart at right indicating distance to measure per row to equal 1/1000 of an acre	6″ row spacing - 87′ 1″ 7″ row spacing - 74′ 8″ 15″ row spacing - 34′ 10″ 20″ row spacing - 26′ 2″ 30″ row spacing - 17′ 5″ 36″ row spacing - 14′ 6″
2.	Count the number of harvestable ears per 1/1000 of an acre	
3.	Count the number of kernel rows per ear on every fifth ear then calculate the average kernel rows/ear	The number of rows/ear is always an even number
4.	Count the number of kernels per row on each ear, then calculate the average kernels per row	Do not count kernels on either, end of the ear that are less than ½ of the size of other seeds
5.	Yield (bu/A) = $\frac{\text{(Step 2) x (Step 3) x (Step 4)}}{90}$	

Estimating Wheat Yield

Step	Wheat should be in the late boot stage or later	Comments
1.	Count the number of heads per three feet of row	Do not count small heads with only a couple of kernels
2.	Calculate the average # of spikelets per head	Best to average 5 or more heads
3.	Calculate the average # of kernels per spikelet	This number will most likely be in the 2.1–2.3 kernels/spikelet range
4.	Determine row spacing	6 - 7″ is most common
5.	Bu/A = $\frac{\text{(Step 1) x (Step 2) x (Step 3) x 0.142}}{\text{Step 4}}$	

Estimating Soybean Yield

Step	Soybean should be in the R6 stage or later	Comments
1.	Measure 1/1000 of an acre	See dry bean chart below
2.	Count the number of plants per 1/1000 of an acre Multiply this number times 1000	This gives plant population/Acre
3.	Average the pods/plant on 5 to 10 random plants The key word is random	A common mistake is to choose the largest plants
4.	Multiply pod average times plant/A (from step 2)	This gives pods/Acre
5.	Multiply pods/A times 2.5 seeds per pod	This gives seeds/Acre
6.	Divide seeds/A by 3000 seeds/lb. or, if known use the # of seeds/lb for the specific variety	This gives pounds/Acre
7.	Divide pounds/A by 60 pounds per bushel	This gives bushels/Acre

Estimating Dry Bean Yield

Step	Dry Beans should be in R6 stage or later	Comments
1.	Measure 1/1000 of an acre See chart at right indicating distance to measure per row to equal 1/1000 of an acre	6″ row spacing - 87′ 1″ 7″ row spacing - 74′ 8″ 15″ row spacing - 34′ 10″ 20″ row spacing - 26′ 2″ 30″ row spacing - 17′ 5″ 36″ row spacing - 14′ 6″
2.	Randomly sample 10 plants throughout the field	The best way to do this is without looking, reach down and grab a plant, then count down three plants in either direction, using the plant as a sample
3.	Count the total number of beans (not pods) on these 10 plants	
4.	Divide total beans (from step 3) by 10, which gives average beans per plant	
5.	Multiply plant population (step 1) by average beans per plant (step 4)	
6.	Divide this number (step 5) by the average number of seeds per pound of the variety grown. This will give you the estimated pounds per acre yield.	

Bushel Weights of Common Commodities

Commodity	lb
Alfalfa Seed	60
Apples, Green	47
Apples, Dried	24
Barley	48
Beans, Green or String	24
Beans, Soy	60
Beans, Wax	24
Beans, White	60
Beets	60
Blue Grass Seed	14
Bran	20
Buckwheat	52
Carrots	50
Charcoal	20
Clover Seed	60
Corn Seed, Broom	48
Corn Meal, Unbolted	48

Commodity	lb
Corn, in the ear	70
Corn, Kaffir	56
Corn, Shelled	56
Cotton Seed	32
Cranberries	33
Cucumbers	48
Emmer	40
Flax Seed	56
Gooseberries	40
Hemp Seed	44
Hickory Nuts	50
Hungarian Grass Seed	50
Lime	80
Malt	34
Millet	50
Millet, Japanese Barnyard	35
Oats	32

Commodity	lb
Onions	57
Onion Sets, Top	30
Onion Sets, Bottom	32
Orchard Grass Seed	14
Osage Orange Seed	33
Parsnips	50
Peaches, Dried	33
Peanuts, Green	22
Pears	58
Peas, Dried	60
Peas, Green in pod	32
Popcorn, in the ear	70
Popcorn, shelled	56
Potatoes, Irish	60
Potatoes, Sweet	50
Quinces	48
Rape Seed	50

Commodity	lb
Red Top Seed	14
Rough Rice	45
Rutabagas	50
Rye Meal	50
Rye	56
Shorts	20
Sorghum Seed	50
Spelt	40
Spinach	12
Sweet Clover Seed Unhulled	33
Timothy Seed	45
Tomatoes	56
Turnips	55
Walnuts	50
Wheat	60

Volume Dilution: Fluid Ounces of a Liquid Needed

	Gallons of Final Spray Solution						
Dilution Desired	100	50	25	10	5	2.5	1
1 to 100	128	64	32	12.8	6.4	3.2	1.28
1 to 200	64	32	16	6.4	3.2	1.6	0.64
1 to 400	32	16	8	3.2	1.6	0.8	0.32
1 to 600	24	10.6	5.3	2.1	1.1	0.5	0.21
1 to 800	16	8	4	1.6	0.8	0.4	0.16
1 to 1,000	12.8	6.4	3.2	1.3	0.7	0.32	0.13
1 to 1,200	10.6	5.3	2.6	1.1	0.6	0.26	0.11
1 to 1,600	8	4	2	0.8	0.4	0.2	0.08

Example: To dilute a product to a final dilution ratio of 1 to 100 in 2.5 gallons of liquid, simply add 3.2 fluid ounces of product to the liquid.

Areas and Volume Calculations



Area of a circle is radius squared x 3.1416; or diameter squared x 0.7854



Area of a rectangle or square is length x width



Area of a triangle is (base x height)/2



Volume of a cube or rectangular box is length x width x height



Volume of a cylinder is radius squared x 3.1416 x height of cylinder



Volume of a cone is radius squared x 1.0472 x height

Acre inches	x	9.7286	= Megaliters	Cubic inches	x	0.03613	= Pounds of water
Acres	x	43,560	= Square feet	Cubic inches	x	0.0346	= Pints (liquid)
Acres	x	4,840	= Square yards	Cubic inches	x	0.02976	= Pints (dry)
Acres	x	4,407	= Square meters	Cubic inches	x	0.0173	= Quarts (liquid)
Acres	x	160	= Square rods	Cubic inches	x	0.0164	= Liters
Acres	x	0.405	= Hectares	Cubic inches	x	0.0149	= Quarts (dry)
Acres	x	0.0015625	= Square miles	Cubic inches	x	0.00186	= Pecks
Bu/A (56 lb test)	x	62.74089	= Kilograms/hectare	Cubic inches (dry)	x	0.00372	= Gallons
Bu/A (60 lb test)	x	67.2224	= Kilograms/hectare	Cubic inches (liquid)	x	0.00433	= Gallons
Bushels	x	2,150.42	= Cubic inches	Cubic meters	x	1,000,000	= Cubic centimeters
Bushels	x	64	= Pints	Cubic meters	x	61,023	= Cubic inches
Bushels	x	35.24	= Liters	Cubic meters	x	2,113	= Pints (liquid)
Bushels	x	32	= Quarts	Cubic meters	x	1,057	= Quarts (liquid)
Bushels	x	4	= Pecks	Cubic meters	x	1,000	= Liters
Bushels	x	1.2472	= Cubic feet	Cubic meters	x	1,000	= Megaliters
Bushels	x	0.3524	= Hectoliters	Cubic meters	x	264.2	= Gallons
Bushels	x	0.04606	= Cubic yards	Cubic meters	x	35.31	= Cubic feet
Bushels (corn)	x	0.0254	= Metric tons	Cubic meters	x	1.308	= Cubic yards
Bushels (soybean)	x	0.0272	= Metric tons	Cubic yards	x	46,656	= Cubic inches
$CaCO_3$	x	0.84	= $MgCO_3$	Cubic yards	x	1,616	= Pints (liquid)
$CaCO_3$	x	0.4	= Calcium (Ca)	Cubic yards	x	807.9	= Quarts (liquid)
Calcium (Ca)	x	2.5	= $CaCO_3$	Cubic yards	x	202	= Gallons
Centimeters	x	10	= Millimeters	Cubic yards	x	27	= Cubic feet
Centimeters	x	0.3937	= Inches	Cubic yards	x	21.71	= Bushels
Centimeters	x	0.0328	= Feet	Cubic yards	x	0.7646	= Cubic meters
Centimeters	x	0.01	= Meters	Cups	x	236.5	= Milliliters
Cord feet (4′x4′x1′)	x	16	= Cubic feet	Cups	x	48	= Teaspoons
Cord feet (4′x4′x1′)	x	0.125	= Cords (4′x4′x8′)	Cups	x	16	= Tablespoons
Cords (4′x4′x8′)	x	8	= Cord feet (4′x4′x1′)	Cups	x	8	= Ounces (fluid)
Cubic centimeters	÷	3,785	= Gallons	Cups	x	0.5	= Pints
Cubic centimeters	x	0.061	= Cubic inches	Cups	x	0.25	= Quarts
Cubic centimeters	x	0.0338	= Ounces (fluid)	Degrees Celsius (+17.98)	x	1.8	= Degrees Fahrenheit
Cubic centimeters	x	0.001	= Liters	Degrees Fahrenheit (-32)	x	0.5555	= Degrees Celsius
Cubic centimeters	x	0.000001	= Cubic meters	Drams	x	0.0625	= Ounces (fluid)
Cubic feet	x	1,724.137	= Cubic inches	Fathoms	x	6	= Feet
Cubic feet	x	62.422	= Pounds of water	Feet	÷	6,086	= Knots
Cubic feet	x	59.84	= Pints (liquid)	Feet	÷	5,280	= Miles
Cubic feet	x	29.92	= Quarts (liquid)	Feet	÷	3,281	= Kilometers
Cubic feet	x	28.32	= Liters	Feet	x	30.48	= Centimeters
Cubic feet	x	25.71	= Quarts (dry)	Feet	÷	16.5	= Rods
Cubic feet	x	7.4805	= Gallons	Feet	x	12	= Inches
Cubic feet	x	0.80176	= Bushels	Feet	x	0.33333	= Yards
Cubic feet	x	0.0625	= Cord feet (4′x4′x1′)	Feet	x	0.3048	= Meters
Cubic feet	x	0.03704	= Cubic yards	Feet	x	0.1667	= Fathoms
Cubic feet	x	0.0283	= Cubic meters	Feet/minute	x	0.01667	= Feet/second
Cubic inches	÷	61,023	= Cubic meters	Feet/minute	x	0.01136	= Miles/hours
Cubic inches	÷	46,656	= Cubic yards	Feet/second	÷	88	= Miles/minute
Cubic inches	÷	2,150.42	= Bushels	Feet/second	x	60	= Feet/minute
Cubic inches	÷	1,724.137	= Cubic feet	Feet/second	÷	1.467	= Miles/hour
Cubic inches	x	16.39	= Cubic centimeters	Furlongs	x	40	= Rods
Cubic inches	x	0.554	= Ounces (fluid)				

Gallons	x	3,785	= Cubic centimeters	Liters	x	0.2642	= Gallons
Gallons	x	269	= Cubic inches (dry)	Liters	x	0.0353	= Cubic feet
Gallons	x	231	= Cubic inches (liquid)	Liters	x	0.02838	= Bushels
Gallons	÷	202	= Cubic yards	Liters	x	0.001	= Cubic meters
Gallons	x	128	= Ounces (fluid)	Magnesium (Mg)	x	3.48	= MgCO3
Gallons	x	8	= Pints (liquid)	Megaliters	x	0.1028	= Acres inches
Gallons	x	4	= Quarts (liquid)	Meters	x	1,000	= Millimeters
Gallons	x	3.785	= Liters	Meters	x	100	= Centimeters
Gallons	x	0.1337	= Cubic feet	Meters	x	39.37	= Inches
Gallons	x	0.003785	= Cubic meters	Meters	x	3.281	= Feet
Gallons of water	x	8.3453	= Pounds of water	Meters	x	1.094	= Yards
Gallons of water/A	÷	27,154.28	= inches of water/A	Meters	x	0.001	= Kilometers
Grains	÷	7,000	= Pounds	Metric tons	x	2,204.62	= Pounds
Grains	x	0.0648	= Grams	Metric tons	x	39.3683	= Bushels (corn)
Grains	x	0.00229	= Ounces (dry)	Metric tons	x	36.7437	= Bushels (soybeans)
Grains/gallon	x	17.1233	= Parts/million	Metric tons	x	1.1023	= Short tons
Grams	x	1,000	= Milligrams	MgCO3	x	1.18	= CaCO3
Grams	x	15.43	= Grains	MgCO3	x	0.29	= Magnesium (Mg)
Grams	x	0.0353	= Ounces	Miles	x	5,280	= Feet
Grams	x	0.0022	= Pounds	Miles	x	1,760	= Yards
Grams	x	0.001	= Kilograms	Miles	x	320	= Rods
Grams/liter	x	1,000	= Parts/million	Miles	x	1.6093	= Kilometers
Hectares	x	10,000	= Square meters	Miles/hour	x	88	= Feet/minute
Hectares	x	2.471	= Acres	Miles/hour	÷	60	= Miles/minute
Hectoliters	x	2.8377	= Bushels	Miles/hour	x	1.467	= Feet/second
Hundred wt. (Cwt)	x	100	= Pounds	Miles/minute	x	88	= Feet/second
Inches	x	2.54	= Centimeters	Miles/minute	x	60	= Miles/hour
Inches	x	0.08333	= Feet	Milligrams	x	0.001	= Grams
Inches	x	0.02778	= Yards	Milligrams/kilogram	x	1	= Parts/million
Inches	x	0.0254	= Meters	Milligrams/liter	x	1	= Parts/million
Inches of water/A	x	27,154.28	= Gallons of water/A	Millimeters	x	0.1	= Centimeters
Inches/A	x	3.94	= Megaliters/hectare	Millimeters	x	0.001	= Meters
K2O	x	0.83	= Potassium (elemental)	Milliliters	÷	946	= Quarts
Kilograms	x	1,000	= Grams	Milliliters	÷	473	= Pints (liquid)
Kilograms	x	2.205	= Pounds	Milliliters	÷	15	= Tablespoons
Kilograms	x	0.01594	= Tons	Milliliters	x	0.2	= Teaspoons
Kilograms/hectare	x	0.8929	= Pounds/acre	Milliliters	x	0.1	= Centimeters
Kilograms/hectare	x	0.015939	= Bu./A (56 lb. test)	Milliliters	x	0.034	= Ounces (fluid)
Kilograms/hectare	x	0.014876	= Bu./A (60 lb. test)	Milliliters	x	0.001	= Liters
Kilometers	x	3,281	= Feet	Milliliters	x	0.0004228	= Cups
Kilometers	x	1,094	= Yards	Ounces	÷	32,000	= Tons
Kilometers	x	1,000	= Meters	Ounces (dry)	x	437.5	= Grains
Kilometers	x	0.6214	= Miles	Ounces (dry)	x	28.3495	= Grams
Knots	x	6,086	= Feet	Ounces (dry)	x	0.0625	= Pounds
Liters	x	1,000	= Cubic centimeters	Ounces (fluid)	x	29.573	= Cubic centimeters
Liters	x	1,000	= Milliliters	Ounces (fluid)	x	29.57	= Milliliters
Liters	x	61.02	= Cubic inches	Ounces (fluid)	x	16	= Drams
Liters	x	2.113	= Pints (liquid)	Ounces (fluid)	x	6	= Teaspoons
Liters	x	1.057	= Quarts (liquid)	Ounces (fluid)	x	2	= Tablespoons
Liters	x	0.908	= Quarts (dry)	Ounces (fluid)	x	1.805	= Cubic inches

Ounces (fluid)	x	0.125	=	Cups	Quarts (dry)	x	0.038895	=	Cubic feet
Ounces (fluid)	x	0.0625	=	Pints (liquid)	Quarts (dry)	x	0.03125	=	Bushels
Ounces (fluid)	x	0.03125	=	Quarts (liquid)	Quarts (liquid)	÷	1,057	=	Cubic meters
Ounces (fluid)	x	0.0078125	=	Gallons	Quarts (liquid)	x	946	=	Milliliters
P205	x	0.44	=	Phosphorous (elemental)	Quarts (liquid)	x	57.75	=	Cubic inches
Parts/million	x	2	=	Pounds/acre	Quarts (liquid)	x	32	=	Ounces (fluid)
Parts/million	x	1	=	Milligrams/kilogram	Quarts (liquid)	x	2	=	Pints (liquid)
Parts/million	x	1	=	Milligrams/liter	Quarts (liquid)	x	0.9463	=	Liters
Parts/million	x	0.0584	=	Grains/gallon	Quarts (liquid)	x	0.25	=	Gallons
Parts/million	x	0.001	=	Grams/liter	Quarts (liquid)	x	0.03342	=	Cubic feet
Parts/million	x	0.0001	=	Percent	Quarts (liquid)	x	0.001238	=	Cubic yards
Pecks	x	537.605	=	Cubic inches	Rods	x	16.5	=	Feet
Pecks	x	16	=	Pints (dry)	Rods	x	0.025	=	Furlongs
Pecks	x	8	=	Quarts (dry)	Rods	x	0.003125	=	Miles
Pecks	x	0.25	=	Bushels	Short tons	x	907	=	Kilograms
Percent	x	10,000	=	Parts/million	Short tons	x	0.9072	=	Metric tons
Phosphorus (elemental)	x	2.292	=	P205	Square feet	÷	27,878,400	=	Square miles
Pints	x	2	=	Cups	Square feet	x	144	=	Square inches
Pints (dry)	x	33.6003	=	Cubic inches	Square feet	x	0.11111	=	Square yards
Pints (dry)	x	0.5	=	Quarts (dry)	Square feet	x	0.00002296	=	Acres
Pints (dry)	x	0.0625	=	Pecks	Square inches	÷	1,296	=	Square yards
Pints (dry)	x	0.015625	=	Bushels	Square inches	x	0.00694	=	Square feet
Pints (liquid)	÷	2,113	=	Cubic meters	Square meters	x	0.0001	=	Hectares
Pints (liquid)	÷	1,616	=	Cubic yards	Square miles	x	27,878,400	=	Square feet
Pints (liquid)	x	473	=	Milliliters	Square miles	x	3,097,600	=	Square yards
Pints (liquid)	x	32	=	Tablespoons	Square miles	x	640	=	Acres
Pints (liquid)	x	28.875	=	Cubic inches	Square rods	x	0.00625	=	Acres
Pints (liquid)	x	16	=	Ounces (fluid)	Square yards	÷	3,097,600	=	Square miles
Pints (liquid)	x	2	=	Cups	Square yards	x	1,296	=	Square inches
Pints (liquid)	x	0.5	=	Quarts (liquid	Square yards	x	9	=	Square feet
Pints (liquid)	x	0.4732	=	Liters	Square yards	x	0.0002066	=	Acres
Pints (liquid)	x	0.125	=	Gallons	Tablespoons	x	15	=	Milliliters
Pints (liquid)	x	0.0167	=	Cubic feet	Tablespoons	x	3	=	Teaspoons
Potassium (elemental)	x	1.2	=	K2O	Tablespoons	x	0.5	=	Ounces (fluid)
Pounds	x	453.5924	=	Grams	Tablespoons	x	0.0625	=	Cups
Pounds	x	16	=	Ounces	Tablespoons	x	0.03125	=	Pints (liquid)
Pounds	x	7	=	Grains	Teaspoons	x	5	=	Milliliters
Pounds	x	0.45359	=	Kilograms	Teaspoons	x	0.333	=	Tablespoons
Pounds	x	0.01	=	Hundred wt. (Cwt)	Teaspoons	x	0.17	=	Ounces (fluid)
Pounds	x	0.0005	=	Tons	Teaspoons	x	0.02083	=	Cups
Pounds of water	x	27.68	=	Cubic inches	Tons	x	32,000	=	Ounces
Pounds of water	x	0.1198	=	Gallons	Tons	x	907.1849	=	Kilograms
Pounds of water	x	0.01602	=	Cubic feet	Tons (long)	x	2,240	=	Pounds
Pounds/A	x	1.12	=	Kilograms/hectare	Tons (short)	x	2,000	=	Pounds
Pounds/A	x	0.5	=	Parts/million	Yards	÷	1,094	=	Kilometers
Quarts	x	4	=	Cups	Yards	x	36	=	Inches
Quarts (dry)	x	67.2	=	Cubic inches	Yards	x	3	=	Feet
Quarts (dry)	x	2	=	Pints (dry)	Yards	x	0.9144	=	Meters
Quarts (dry)	x	1.101	=	Liters	Yards	x	0.000568	=	Miles
Quarts (dry)	x	0.125	=	Pecks					

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CASE IH

5500 Cenex Drive
Inver Grove Heights, MN 55077
651-355-6000
chsinc.com

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