



CHS Agronomy Application Manual





CHS: INVESTED IN YOUR SUCCESS.

Combining crop protection assets with crop nutrients strength makes CHS agronomy a leading supply chain partner. Strong relationships with formulators and producers around the world help us deliver products that provide high value to our members, and our comprehensive agronomy distribution system is aligned with cooperatives and retailers who provide local expertise to farmers.

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 owns or operates more than 50 wholesale distribution centers for crop nutrients, crop protection products and other specialized crop inputs. The crop protection distribution capabilities encompass products from all the major manufacturers as well as innovative specialized adjuvants, seed treatments, plant enhancements and more.

CHS agronomy is a full-service distributor focused on supplying quality crop nutrition and protection solutions for healthy, profitable crops. Through decades of service, farmer-owned CHS has built a world-class agronomy system supported by experts in operations, risk management, marketing and agronomy services. Throughout the entire distribution process, CHS remains focused on safety, stewardship and customer success.



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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.

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

ADVATROL®

High Surfactant Oil Concentrate

Advatrol® 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.

Functions

- High quality concentration of emulsifiers and methylated seed oil in a convenient low use rate
- Increases contact activity and penetration of the spray across a broad range of herbicides.
- Made with highly refined soybean oil for enhanced performance, stability, and mixing

CERIUM® ELITE

Cerium® Elite is our patent pending surfactant that can be used to replace traditional oil adjuvants. This technology is effective at reducing drift and off-target movement, helping you be as effective as possible across a wide variety of applications.

Functions

- Low use rate replacement for oil concentrates at 1 qt/100 gal - a fraction of the use rate of traditional oil adjuvants
- Premier patent pending surfactant that aids in deposition and reduces drift
- Multifunctional adjuvant for herbicides, fungicides, insecticides, defoliants, desiccants, plant growth regulators, and any other crop protection product where an oil concentrate or nonionic surfactant is recommended

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

COGNITIVE 1™

Drift Control, Foliar Retention Agent, Deposition Aid

Cognitive 1™ is a stand-alone drift reduction and deposition aid technology.

Functions

- Drift reduction and deposition aid specifically formulated for use when a DRA is required for dicamba technologies
- Can be used in combination with other adjuvants and non-dicamba spray mixes
- Convenient low use rate

COVREX®

High Surfactant Oil Concentrate

Covrex® is a highly concentrated blend of emulsifiers and highly refined soybean oil.

Functions

- Increases penetration and uniform coverage on leaf surface
- Half the use rate of standard crop oil
- Made with highly refined soybean oil for enhanced performance, storage stability, and mixing

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

Adjuvants

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

ENERPEX®

Nonionic Surfactant, Drift Control Agent, Deposition Aid, Water Conditioner

Enerpex® 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.

Functions

- All-in-one adjuvant
- Unparalleled low use rate
- Ensures on target application, mitigating risk

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

JACKHAMMER®

Nonionic Surfactant, pH Buffer, AMADS Water Conditioner Chemistry

Jackhammer® utilizes AMADS chemistry to improve water quality and herbicide activity at a convenient use rate.

Functions

- Reduces herbicide antagonism from hard water impurities
- Buffers spray solution pH below neutral
- Improves leaf wetting and deposition

JACKHAMMER® ELITE

When drift control may not be required, Jackhammer® Elite works to alleviate antagonism from hard water impurities including iron, calcium, magnesium and other impurities in the spray solution.

Functions

- Includes an unsurpassed water conditioner and utilizes an industry-leading surfactant proven across millions of acres to increase glyphosate herbicide activity and maximize application effectiveness
- Has a convenient low use rate of 2 qt/100 gal to save you time and money when mixing and handling
- Increases herbicide absorption in plants, and slowed droplet drying; improves droplet coverage and canopy penetration

LAST CHANCE®

Nonionic Surfactant, Water Conditioner, Deposition Aid

Last Chance® is a superior deposition aid and significantly improves uniform coverage, adhesion and penetration of the herbicide.

Functions

- 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

Adjuvants

LAST CHANCE·PRO®

Nonionic Surfactant, Water Conditioner, Deposition Aid

Last Chance Pro® improves uptake, translocation, and efficacy of herbicides. This formulation also meets the surfactant level requirements of most active ingredient labels in the industry that require or recommend the use of a nonionic surfactant (NIS).

Functions

- Formulated for increased performance over that of a standard adjuvant program
- Improves uptake, translocation, and efficacy of herbicide applications
- Low use rate and additional defoamer allows for convenient mixing and handling

LINKAGE®

Nonionic Surfactant, Nitrogen, pH Buffer

Linkage® pairs a surfactant with nitrogen and a pH buffer to strengthen application efficacy and crop safety over comparable oil-based adjuvants.

Functions

- Increases herbicide solubility and systemic activity
- Reduces crop response
- Buffers spray solution pH above neutral
- Increases leaf wetting and deposition

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

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

Adjuvants

PETRICHOR®

Deposition Aid, Drift Control Agent

Petrichor® is an NPE-free oil emulsion deposition and drift management agent specifically designed to suppress off-target drift and increase contact activity and penetration of spray applications.

Functions

- Industry-leading drift and deposition agent
- Low 3 oz/A use rate
- Made with highly refined soybean oil for enhanced performance, storage stability, and mixing

PRECINCT™ 2

Water Conditioning Agent, Wetting Agent

Precinct™2 contains a combination of ammonium sulfate and an electrolyte-stable surfactant system in a user friendly, convenient liquid form.

Functions

- Recommended for use with all crops and non-crops
- Improves uniform coverage and penetration through waxy cuticles

PREFER™ 90

90% Nonionic Surfactant

Prefer™ 90 is a high-load surfactant with excellent wetting properties for leaf surface coverage.

Functions

- Maintains uniform coverage
- Increases leaf penetration

SAVVY™

Methylated Seed Oil, High-load Surfactant, Concentrated Emulsifiers

Savvy™ uses a high surfactant methylated seed oil concentrate to improve the activity of glyphosate tank mixes at nearly half the use rate of standard crop oil.

Functions

- Increases leaf penetration
- Increases activity of glyphosate and lipophilic herbicides with minimal antagonism
- Improves spray coverage, retention and penetration into the leaf

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

STAKE™

Paraffin Oil, High-load Surfactant, Concentrated Emulsifiers

Stake™ uses a high surfactant crop oil concentrate to improve the activity of glyphosate tank mixes at nearly half the use rate of standard crop oil (COC and MSO).

Functions

- Increases activity of glyphosate and lipophilic herbicides with minimal antagonism
- Improves spray coverage, retention and penetration into the leaf

SURALTA®

VaporGrip[®]Xtra
AGENT

Volatility Reducing Agent

Suralta® VaporGrip® Xtra Agent is a tank mix adjuvant that delivers additional Vaporgrip® Technology to spray tanks for further reduction of potential dicamba volatility. VaporGrip® Technology buffers against significant changes in solution pH and prevents the formation of dicamba acid by scavenging extraneous protons.

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

Adjuvants

UPLAND™ MSO

Methylated Soybean Oil, Surfactant Emulsifier

Upland™ MSO is a low-foam oil formulation designed for use with postemergence herbicides.

Functions

- Humectant properties reduce droplet evaporation
- Penetrates rapidly into leaf cuticles
- Improves herbicide retention on leaf surfaces
- Increases leaf penetration

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

VERACITY® ELITE II

The unique combination of functioning agents improves the performance of glyphosate, dicamba, and 2,4-D and many other herbicides that require or recommend a surfactant, water conditioning, deposition and drift management as well as reducing foam in the spray tank.

Functions

- Veracity® Elite II has been approved for use with XtendiMax, Fexapan, Engenia, and Enlist Duo
- Does not contain ammonium sulfate or acidify the spray solution
- Wind tunnel proven reduction in fine droplet formation
- Principal functioning agents in an all-in-one formulation: water conditioner, quality surfactant, defoamer, and drift reduction agents

VERASURE®

Volatility Reduction Agent, Drift Reduction Agent, Water Conditioner, Surfactant

Verasure® contains nonionic surfactants, water conditioning agents, deposition and drift management aids and defoamer.

Functions

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

VERIUM™

NPE-free Nonionic Surfactant, Drift Reduction Agent

Verium™ is a unique nonionic surfactant (NIS) that can be used to replace crop oil concentrate (COC) adjuvants for most herbicides.

Functions

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

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

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

PARALIGN®

Advanced starter fertilizer that contains key plant nutrients, patent pending chelate, and advanced enzyme.

Paralign® is formulated for use with cropping systems that have shown benefit to a nitrogen or phosphorus starter fertilizer application or have exhibited deficiencies to zinc.

Functions

- Ortho-ortho EDDHA chelate frees phosphorus and other nutrients in the fertilizer and soil
- Advanced hemicellulase enzyme processes organic matter to release nitrogen, phosphorus and water
- The chelate and enzyme create a push-pull mode of action that redefines starter fertilizer efficiency

Levesol® Family

REDLINE®***Liquid ortho-ortho EDDHA chelated starter fertilizer.***

Redline® contains many nutrients that are necessary for plant growth.

Functions

- Complete package of macro and micronutrients for the most complete liquid fertilizer package
- High concentration formula offering an unparalleled low use rate
- Low salt content is safe on seeds, preventing injury and crop loss

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

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

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

Plant Nutrition

MICRO PAK

4% Nitrogen, 5% Potassium, 3% Sulfur, 0.5% Boron, 1% Manganese, 4.5% Zinc

Micro Pak is a heavily chelated nutrient blend formulated for use with most soil applied liquid fertilizers and foliar solutions.

Functions

- Micronutrient blend of key nutrients chelated with EDTA to broaden its compatibility with starter fertilizers and pesticides
- The addition of Micro Pak can alleviate key micronutrient deficiencies

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 of potassium
- Excellent herbicide compatibility

RAPID UP™

Rapid Up™ 10-52-10

Rapid Up™ 20-10-20

Rapid Up™ 20-20-20

Rapid Up™ Bean Mix

Rapid Up™ Corn Mix

Don't let a lack of key micronutrients limit your crops' yield or quality. Formulated with high quality ingredients, our micronutrient fertilizer products help crops overcome challenging soils and growing conditions.

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

XLR-RATE®

XLR-rate 2-17-17

XLR-rate 2-17-17 with Micro-Nutrient Pack

XLR-rate 7-23-5

XLR-rate 7-23-5 with Micro-Nutrient Pack

Exclusively from CHS, our XLR-rate® liquid starter and foliar fertilizers are low-salt, high-orthophosphate NPK blends that provide critical plant nutrition for early growth and harvest.

Nitrogen Management

N·EDGE®

Nitrogen Stabilizer

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.

Functions

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

N·EDGE® 2

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

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.

Functions

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

N·EDGE® PRO

NBPT & DCD Nitrogen Stabilizer

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.

Functions

- 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® SOIL 2

High-load DCD Nitrogen Stabilizer

N-Edge® Soil 2 is a high-load DCD (dicyandiamide) nitrogen stabilizer that provides protection against leaching and denitrification with below ground applications.

Functions

- 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

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 early season 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

Crop Enhancement

CYGIN™

Naturally Derived PGR

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

Functions

- Naturally derived plant growth regulator designed to increase plant performance
- Increased activity compared to that of synthetically derived plant growth regulators
- Increases internal plant functions and drives increased nutrient movement allowing for better plant performance

CYGIN™·PRO

Naturally Derived PGR

Cygin™ Pro contains a unique combination of three naturally derived plant growth regulators Homobrassinolide, Auxin, and Gibberellin designed to increase plant performance.

Functions

- Unique combination of three naturally derived plant hormones
- New generation Homobrassinolide plant hormone initiates stem elongation, root development, floral initiation, and other plant processes
- Increased growth and development help mitigate effects of pest and abiotic stresses

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

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.

LIQUID AMS

Water Conditioner

Functions

- Convenient 3.4 lb/gal liquid formulation of ammonium sulfate
- Designed for use with glyphosate, glufosinate and other pesticide formulations that require ammonium sulfate

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.





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
				Last Chance Pro	Verium	Covrex** COC based	Advatrol** MSO based	Tapran		Encloax / Precinct 2	Jackhammer	Enerpex	Linkage
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.

** Covrex may be substituted with Crop Oil at 2x rate. Advatrol may be substituted with Upland MSO at 2x rate.

*** In most situations, Encloax, Precinct 2, Jackhammer or Enerpex 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
				Last Chance Pro	Verium	Covrex** COC based	Advatrol** MSO based	Tapran		Encloax / Precinct 2	Jackhammer	Energex	Linkage
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	

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.

** Covrex may be substituted with Crop Oil at 2x rate. Advatrol may be substituted with Upland MSO at 2x rate.

*** In most situations, Encloax, Precinct 2, Jackhammer or Energex 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
				Last Chance Pro	Verium	Covrex** COC based	Advatrol** MSO based	Tapran		Encloax / Precinct 2	Jackhammer	Energex	Linkage
DiFlex 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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** Covrex may be substituted with Crop Oil at 2x rate. Advatrol may be substituted with Upland MSO at 2x rate.

*** In most situations, Encloax, Precinct 2, Jackhammer or Energex can be used as AMS replacement.

Postemergence Herbicide Adjuvant Chart

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				Last Chance Pro	Verium	Covrex** COC based	Advatrol** MSO based	Tapran		Encloax / Precinct 2	Jackhammer	Energex	Linkage
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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				Last Chance Pro	Verium	Covrex** COC based	Advatrol** MSO based	Tapran		Encloax / Precinct 2	Jackhammer	Energex	Linkage
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		

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.

** Covrex may be substituted with Crop Oil at 2x rate. Advatrol may be substituted with Upland MSO at 2x rate.

*** In most situations, Encloax, Precinct 2, Jackhammer or Energex 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
				Last Chance Pro	Verium	Covrex** COC based	Advatrol** MSO based	Tapran		Encloax / Precinct 2	Jackhammer	Enerpex	Linkage
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							

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.

** Covrex may be substituted with Crop Oil at 2x rate. Advatrol may be substituted with Upland MSO at 2x rate.

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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
				Last Chance Pro	Verium	Covrex** COC based	Advatrol** MSO based	Tapran		Encloax / Precinct 2	Jackhammer	Energex	Linkage
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			

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.

** Covrex may be substituted with Crop Oil at 2x rate. Advatrol may be substituted with Upland MSO at 2x rate.

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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 Prefer 90 at 1 qt/100 or Covrex 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 trifoliolate 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 ₂ O	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 trifoliolates.
Pursuit /Thunder	3-6 oz/A	2 trifoliolates	Apply prior to 3" alfalfa growth for weed coverage	30 days	Use Linkage @ 1% v/v to maximize weed control and provide crop safety. Covrex or Advatrol ³ at 2 qt/100 or Verium 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 Advatrol 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 trifoliolate 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 Covrex or Advatrol at 1 pt/A, or 1 qt/100 Verium + 2 qt/100 Jackhammer.
Clethodim Products	6-16 fl oz/A	Labeled	Labeled	15 days	Add Covrex or Advatrol at 1 pt/A, or 1 qt/100 Verium + 2 qt/100 Jackhammer.
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 Prefer 90 at 1 qt/100 gal, Jackhammer or Covrex 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 trifoliolate 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 trifoliolate leaves. Following application, plants may be temporarily stunted. Apply to seedling alfalfa when at 3 to 4 trifoliolate 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 Covrex can be substituted by Crop Oil at 2X rate.

³ Advatrol can be substituted by Upland MSO 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 Prefer 90 (1 qt/100 gal)		
Rainfast: 6 hours	or		
S.O.A.: PPO Inhibitor (Group 14)	• Covrex (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:	Apply to seedling alfalfa only possessing at least 2–4 trifoliate leaves in order to avoid unacceptable crop injury.
Maestro 2EC 71368-29		– wild buckwheat	
Brox 2EC 42750-48		– common sunflower	
Maestro 4EC 71368-78		– kochia	
Rate/A: 1–1.5 pt (2EC)		– Russian thistle	
Spray Volume: min 5 gpa		– common lambsquarters	
Rainfast: 1 hour		– pennycress	
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. #:	• Prefer 90 (1 qt/100 gal)	Many broadleaf weeds 1"–3" in height including:	Spray on 2+ trifoliate alfalfa.
Butyrac 42750-38	Risk of injury—See label	– common ragweed	
Rate/A: 2–4 pt		– common lambsquarters	
Spray Volume: 10–20 gpa		– wild mustard	
Rainfast: 4 hours		– pennycress	
S.O.A.: Growth Regulator (Group 4)		– pigweed	
P.P.E.: l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks		– yellow rocket	
R.E.I.: 48 hrs			
W. Notification: Oral			
S. Word: Danger			

Clethodim Products

		Surfactant/Comments	Target Weeds	6 fl oz	8 fl oz
Brand Name:	EPA Reg. #:	• Covrex* (2 qt/100 gal) plus AMS*** (2.5-4 lb/A)	- barnyardgrass - crabgrass - giant foxtail - green foxtail - quackgrass	6"	8"
Volunteer	59639-3-55467			2"	6"
Shadow 3 EC	66330-414	or		6"	12"
Rate/A:	6-8 fl oz	• Advatrol** (2 qt/100 gal) plus AMS*** (2.5-4 lb/A)	- volunteer cereals - volunteer corn - wild proso millet - woolly cupgrass - yellow foxtail	6"	8"
Spray Volume:	5-40 gpa			or	12"
Rainfast:	1 hour	• Verium (1 qt/100 gal)		8"	10"
S.O.A.:	ACC-ase Inhibitor (Group 1)			6"	8"
P.P.E.:	I.s. shirt, I. pants, c.r. gloves, p. eyewear, shoes, socks			6"	8"
R.E.I.:	24 hours			6"	8"
W. Notification:	Oral				
S. Word:	Warning				

*Crop Oil (1 gal/100 gal) or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO (1 gal/100 gal) can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 can be substituted for AMS.

Timing/Comments

15 Day PHI

Glyphosate

		# A.E.	=0.75 AE	Surfactant/Comments
Brand Name:	EPA Reg. #:			• Last Chance Pro (1 qt/100) plus AMS (8.5-17 lb/100)
Buccaneer Plus	55467-9	3.00	32.0	
Gly Star Original	42750-60	3.00	32.0	or
Gly Star Plus	42750-61	3.00	32.0	• Jackhammer/Jackhammer Elite (2-3 qt/100)
Durango DMA	62719-556	4.00	24.0	
Buccaneer 5 Extra	55467-15	4.00	24.0	or
Gly Star 5 Extra	42750-59	4.00	24.0	• Encloax (2.5-5 gal/100)
Gly Star K-Plus	42750-122	4.50	21.3	
Buccaneer K	42750-122-55467	4.50	21.3	or
Roundup RT 3	524-544	4.50	21.3	• Prefer 90 (1 qt/100) plus AMS (8.5-17 lb/100)
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.:	I.s. shirt, I. pants, shoes, socks			
R.E.I.:	12 hours			
W. Notification:	Oral			
S. Word:	Caution			

Paraquat

<p>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.: I.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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Last Chance Pro (1 qt/100) or • Prefer 90 (1 qt/100) or • Jackhammer (2 qt/100) or • Covrex/Advatrol (2 qt/100) or • Encloax (2.5 gal/100) 	<p>Timing/Comments</p> <p>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.</p>
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Pursuit / Thunder (imazethapyr)

<p>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.: I.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)</p>	<p>Surfactant/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100 gal) or • Covrex* (3 qt/100 gal) or • Advatrol** (2 qt/100 gal) plus AMS*** 	<p>Target Weeds</p> <ul style="list-style-type: none"> – foxtail species – wild buckwheat – chickweed – kochia – common mallow – wild mustard – pennycress – pigweed – common ragweed – giant ragweed – shepherd’s purse – smartweed – velvetleaf 	<table border="0"> <tr> <td style="text-align: center;">3 fl oz</td> <td style="text-align: center;">4 fl oz</td> </tr> <tr> <td style="text-align: center;">-</td> <td style="text-align: center;">3–6"</td> </tr> <tr> <td style="text-align: center;">-</td> <td style="text-align: center;">3"</td> </tr> <tr> <td style="text-align: center;">3"</td> <td style="text-align: center;">3"</td> </tr> <tr> <td style="text-align: center;">4"</td> <td style="text-align: center;">6"</td> </tr> <tr> <td style="text-align: center;">-</td> <td style="text-align: center;">2"</td> </tr> <tr> <td style="text-align: center;">-</td> <td style="text-align: center;">3"</td> </tr> <tr> <td style="text-align: center;">3"</td> <td style="text-align: center;">3"</td> </tr> <tr> <td style="text-align: center;">-</td> <td style="text-align: center;">3"</td> </tr> </table>	3 fl oz	4 fl oz	-	3–6"	-	3"	-	3"	-	3"	-	3"	3"	3"	4"	6"	-	2"	-	3"	3"	3"	-	3"
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Timing/ Comments

Alfalfa must have at least 2 trifoliate.

*Crop Oil @ (5 qt/100 gal) or Verium @ (1 qt/100 gal) can be substituted for Covrex.

**Upland MSO @ (1 gal/100 gal) can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 can be substituted for AMS.

Raptor / Vulture (imazamox)

	Surfactant/Comments	Target Weeds	4 fl oz	5 fl oz	6 fl oz
Brand Name: EPA Reg. #:	• Linkage (1 gal/100 gal)	- barnyardgrass	-	3"	-
Raptor 241-379	or	- volunteer corn	4"	5"	8"
Vulture 42750-305	• Covrex* (3 qt/100 gal)	- large crabgrass	-	3"	3"
Rate/A: 4-6 fl oz	plus	- foxtail species	3"	3"	4"
Spray Volume: min 10 gpa	AMS*** (12-15 lb/100)	- bedstraw	-	3"	3"
Rainfast: 1 hour	or	- wild buckwheat	-	3"	3"
S.O.A.: ALS Enzyme Inhibitor (Group 2)	• Advatrol** (2 qt/100 gal)	- volunteer canola	3"	3"	3"
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks	plus	- kochia	-	3"	3"
R.E.I.: 4 hours	AMS*** (12-15 lb/100)	- lambsquarters	-	3"	3"
W. Notification: Oral	Alfalfa must have at least 2 trifoliates.	- common mallow	3"	3"	3"
S. Word: Caution		- 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 Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 can be substituted for AMS.

SelectMax (clethodim)

	Surfactant/Comments	Target Weeds	9 fl oz	12 fl oz
Brand Name: EPA Reg. #:	• Covrex* (1.5 pt/A)	- barnyardgrass	6"	8"
SelectMax 59639	plus	- crabgrass	2"	6"
Rate/A: 6-12 fl oz	AMS*** (2.5-4 lb/A)	- giant foxtail	6"	12"
Spray Volume: 5-40 gpa	or	- green foxtail	6"	8"
Rainfast: 1 hour	• Advatrol** (1.5 pt/A)	- quackgrass	-	4-12"
S.O.A.: ACC-ase Inhibitor (Group 1)	plus			
P.P.E.: l.s. shirt, l. pants, c.r. gloves p. eyewear, shoes, socks	AMS*** (2.5-4 lb/A)	<i>2nd application may be needed</i>		
R.E.I.: 24 hours		- volunteer cereals	6"	8"
W. Notification: Oral		- volunteer corn	12"	18"
S. Word: Caution		- wild proso millet	8"	10"
		- woolly cupgrass	6"	8"
		- yellow foxtail	6"	8"

*Crop Oil @ (1 qt/A) or Verium @ (1 qt/100 gal) can be substituted for Covrex.

**Upland MSO @ (1 qt/A) can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 can be substituted for AMS.

Thunder Master (glyphosate + imazethapyr)

	Surfactant/Comments	Timing/Comments
Brand Name: EPA Reg. #:	• Prefer 90 (1 pt/100 gal)	Roundup Ready Alfalfa Only
Thunder Master 42750-147	plus	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.
Rate/A: 2.2-4.4 pt*	AMS (8.5-17 lb/100 gal)	*Do not apply more than 3.0 pt/A in N.D. and north of Highway 210 in Minn.
Spray Volume: 10-20 gpa	or	
Rainfast: 1 hour	• Jackhammer/Jackhammer Elite (2 qt/100 gal)	
S.O.A.: ALS Inhibitor EPSP Inhibitor	or	
P.P.E.: l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks	• Linkage (1 gal/100 gal)	
R.E.I.: 48 hours	or	
W. Notification: Oral	• Covrex (2 qt/100 gal)	
S. Word: Warning	or	
	• Advatrol (2 qt/100 gal)	

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 Verium or Petrichor 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
Approach	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	fluxapyroxad + 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 Verium at 1 qt/100 gal or Petrichor at 3 fl oz/A can increase canopy penetration, coverage, and droplet retention.

Alfalfa Herbicide Efficacy Chart

Herbicide	Annual Grasses														Perennial Grasses			Broadleaves																									
	Timing: S = Seeding 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	Vernice 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	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	E	P	G	-	-	-	-	P	-	P	-	P	P	-	-	-	-	-	P	P	-	-		
Chateau	E	F	N	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	E	G	E	G	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	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	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	F	P	F	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	G	P	F	P	F	P	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	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	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.

Alfalfa // Insecticide Options

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 Verium @ 0.25% v/v or Covrex @ 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 Verium @ 0.25% v/v or Covrex @ 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 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 bunched growth.

Mn 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 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 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 ₂ O ₅	K ₂ O	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

PARALIGN®

Paralign 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%). Paralign 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	31
Postemergence Herbicides	32



Trifluralin Products

<p>Brand Name: EPA Reg. #: Treflan 4D 68156-4 Triflurex HFP 66222-46</p> <p>Multiple Brands Rate/A: 1-2 pt of EC 5-10 lb of 10G</p> <p>Spray Volume: 5-40 gpa Rainfast: NA S.O.A.: Mitotic Inhibitor (Group 3) P.P.E.: I.s. shirt, I. 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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Canola, rapeseed <p>Comments</p> <ul style="list-style-type: none"> • 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. 	<p>Target Weeds</p> <p>- Trifluralin applied according to directions will selectively control annual weeds in canola.</p> <p>Annual Grasses</p> <ul style="list-style-type: none"> - barnyardgrass - foxtail - bromegrass - ryegrass, Italian <p>Annual Broadleaf</p> <ul style="list-style-type: none"> - common lambsquarters - kochia - Russian thistle - pigweed
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Sonalan (ethalfluralin)

<p>EPA Reg. #: 10163-355 Rate/A: 1.5-2.5 pt EC 5.5-9.5 lb 10G</p> <p>Application: PPI Timing:</p> <p>Spray Volume: min 5 gpa Rainfast: NA S.O.A.: Mitotic Inhibitor (Group 3) P.P.E.: I.s. shirt, I. pants, eyewear, gloves, shoes, socks R.E.I.: 24 hours W. Notification: Oral S. Word: Danger</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Canola, rapeseed <p>Comments</p> <ul style="list-style-type: none"> • Adjust rate for soil type. • Poor wild oat and no wild mustard control. • Do not apply as broadcast post-emerge application. 	<p>Annual Grasses</p> <ul style="list-style-type: none"> - barnyardgrass - foxtail - crabgrass - ryegrass, Italian <p>Annual Broadleaf</p> <ul style="list-style-type: none"> - wild buckwheat - kochia - Russian thistle - lambsquarters
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Clethodim Products

		Labeled Crops	Target Weeds	5.33 oz	6 oz	8 oz
Brand Name:	EPA Reg. #:	• Canola, rapeseed	- barnyardgrass	8"	6"	8"
Arrow	66222-60		- crabgrass	6"	2"	6"
Clethodim 2E	42750-72	Adjuvant(s)/Comments	- giant foxtail	12"	6"	12"
Shadow 3 EC	66330-414	• Covrex* (1 pt/A)	- green foxtail	8"	6"	8"
Volunteer	59639-3-55467	plus	- quackgrass	4-12"	-	4-12"
		AMS*** (2.5-4 lb/A)	<i>2nd application may be needed</i>			
Rate/Acre:	4-6 fl oz	or	- volunteer cereals	8"	6"	8"
	4-6 fl oz	• Advatrol** (1 pt/A)	- volunteer corn	18"	12"	18"
	2.67-5.33 fl oz	plus	- wild proso millet	10"	8"	10"
	4-6 fl oz	AMS*** (2.5-4 lb/A)	- woolly cupgrass	8"	6"	8"
Spray Volume:	5-40 gpa		- yellow foxtail	8"	6"	8"
Rainfast:	1 hour		- cheat	6"	6"	6"
S.O.A.:	ACC-ase Inhibitor		- downy brome	6"	6"	6"
P.P.E.:	I.s. shirt, I. pants, c.r. gloves, p. eyewear, shoes, socks					
R.E.I.:	24 hours					
W. Notification:	Oral		Timing/Comments			
S. Word:	Caution		Apply up to 70 day PHI.			

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

**Upland MSO @ 1 qt/A or Verium @ 1qt/100 gal.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Draft (thifensulfuron-methyl + tribenuron-methyl)

		Labeled Crops	Target Weeds
EPA Reg. #:	83100-24-83979	• SU Tolerant Canola	- wild buckwheat
Rate/A:	0.3 fl oz		- curly dock
Spray Volume:	min 5 gpa	Adjuvant(s)/Comments	- field pennycress
Rainfast:	4 hour	• Prefer 90 (2 qt/100 gal)	- kochia
S.O.A.:	ALS Enzyme Inhibitors (Group 2)		- prickley lettuce
P.P.E.:	I.s. shirt, I. pants, shoes, socks, c.r. gloves		- Russian thistle
R.E.I.:	12 hours		- common lambsquarters
W. Notification:	Oral		- wild mustard
S. Word:	Caution		- shepherd's purse
			- redroot pigweed
			Timing/Comments
			Apply from 2 to 5 leaf stage.

Glufosinate

		Adjuvant(s)/Comments	Target Weeds	<u>32 fl oz</u>
Brand Name:	EPA Reg. #:	• Last Chance Pro plus AMS (1.5-3.0 lb/A)	- wild buckwheat	6"
Liberty 280 SL	264-829		- cocklebur	6"
Autonomy	7969-448-55467	or	- kochia	4"
Cheetah	71368-112	• Jackhammer (3 qt/100)	- morning glory	6"
Noventa	7696-448		- wild mustard	4"
Interline	70506-310	or	- nightshade	6"
Spray Volume:	15-20 gpa	• Encloax (3.5 pt/A)	- pigweed species	3"
Rainfast:	4 hours		- ragweed species	6"
M.O.A.:	Glutamine Synthase Inhibitor		- velvetleaf	6"
P.P.E.:	I.s. shirt, l. pants, shoes, socks		- waterhemp	3"
R.E.I.:	12 hours		- barnyardgrass	4"
W. Notification:	Oral		- foxtail species	3"
S. Word:	Warning		- wild oat	3"
			- volunteer corn	6"
			- crabgrass	3"

Glufosinate - High Load

		Adjuvant(s)/Comments	Target Weeds	<u>16.3 fl oz</u>
Brand Name:	EPA Reg. #:	• Last Chance Pro plus AMS (1.5-3.0 lb/A)	- wild buckwheat	6"
Surmise 5	42750-401		- cocklebur	6"
Spray Volume:	15-20 gpa	or	- kochia	4"
Rainfast:	4 hours	• Jackhammer (3 qt/100)	- morning glory	6"
M.O.A.:	Glutamine Synthase Inhibitor		- wild mustard	4"
P.P.E.:	I.s. shirt, l. pants, shoes, socks	or	- nightshade	6"
R.E.I.:	12 hours	• Encloax (3.5 pt/A)	- pigweed species	3"
W. Notification:	Oral		- ragweed species	6"
S. Word:	Warning		- velvetleaf	6"
			- waterhemp	3"
			- barnyardgrass	4"
			- foxtail species	3"
			- wild oat	3"
			- volunteer corn	6"
			- crabgrass	3"

Glyphosate

		# A.E.	=0.75 AE	Surfactant/Comments
Brand Name:	EPA Reg. #:			• Last Chance Pro (1 qt/100) plus AMS (8.5-17 lb/100)
Buccaneer Plus	55467-9	3.00	32.0	
Gly Star Original	42750-60	3.00	32.0	or
Gly Star Plus	42750-61	3.00	32.0	• Jackhammer/Jackhammer Elite (2-3 qt/100)
Durango DMA	62719-556	4.00	24.0	
Buccaneer 5 Extra	55467-15	4.00	24.0	or
Gly Star 5 Extra	42750-59	4.00	24.0	• Encloax (2.5-5 gal/100)
Gly Star K-Plus	42750-122	4.50	21.3	
Buccaneer K	42750-122-55467	4.50	21.3	or
Roundup RT 3	524-544	4.50	21.3	• Prefer 90 (1 qt/100) plus AMS (8.5-17 lb/100)
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.:	I.s. shirt, l. pants, shoes, socks			
R.E.I.:	12 hours			
W. Notification:	Oral			
S. Word:	Caution			

Poast (sethoxydim)

	Labeled Crops	Target Weeds	0.5 pt	1 pt	1.5 pt
EPA Reg. #: 7969-58-51036	• Canola, rapeseed	- barnyardgrass		8"	
Rate/Acre: 1.0-2.5 pt		- crabgrass		6"	
Spray Volume: min 5 gpa (air)		- field sandbur			3"
	Adjuvant(s)/Comments	- foxtails		8"	
Rainfast: 1 hour	• Advatrol** (0.75-1 pt/A)	- volunteer cereals			4"
S.O.A.: ACC-ase Inhibitor	plus	- volunteer corn		20"	
P.P.E.: coveralls, l.s. shirt, l. pants, c.r. gloves, c.r. footwear, head gear, eyewear, shoes, socks, apron	AMS*** (2.5 lb/A)	- wild proso millet	10"		
R.E.I.: 12 hours	or	- wild oat		4"	
W. Notification: Oral	• Covrex* (1 pt/A)	- woolly cupgrass		8"	
S. Word: Warning	plus				
	AMS*** (2.5 lb/A)				
	Use the surfactant required by the broadleaf herbicide.				
		Timing/Comments			
		Apply up to 60 day PHI.			

*Crop Oil @ 1 qt/A or Verium @ 1 qt/100 gal.
 **Upland MSO @ 1 qt/A or Verium @ 1qt/100 gal.
 ***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Select Max (clethodim)

	Labeled Crops	Target Weeds	9 oz	12 oz
EPA Reg. #: 59639-132	• Canola, rapeseed	- barnyardgrass	-6"	8"
Rate/Acre: 9-12 fl oz		- crabgrass	2"	6"
Spray Volume: 5-40 gpa		- giant foxtail	6"	12"
Rainfast: 1 hour	Adjuvant(s)/Comments	- green foxtail	6"	8"
S.O.A.: ACC-ase Inhibitor	• Prefer 90* (1 qt/100 gal)	- quackgrass	-	4-12"
P.P.E.: l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks	plus	<i>2nd application may be needed</i>		
R.E.I.: 24 hours	AMS** (2.5-4 lb/A)	- volunteer cereals	6"	8"
W. Notification: Oral		- volunteer corn	12"	18"
S. Word: Caution		- wild proso millet	8"	10"
		- woolly cupgrass	6"	8"
		- yellow foxtail	6"	8"
		Timing/Comments		
		Apply 70 day PHI.		

*Verium @ 1 qt/100 gal can be substituted for Prefer 90.
 **Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Stinger (clopyralid)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Canola, rapeseed <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90 (2 pt/100 gal) or • Jackhammer/Jackhammer Elite (1-2 qt/100 gal) <p>Adjuvants are not usually necessary. They may increase effectiveness on weeds, but may reduce selectivity to the crop.</p>	<p>Target Weeds</p> <ul style="list-style-type: none"> - common/giant ragweed 5 leaf - Canada thistle 5 leaf - cocklebur 5 leaf - sunflower 5 leaf - wild buckwheat 1-3 leaf - prickly lettuce 5 leaf <p>Timing/Comments</p> <p>Apply in the 2-6 leaf stage of crop growth. Do not apply within 50 days of harvest.</p>
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Targa (quizalofop P-ethyl)

	Labeled Crops	Target Weeds	<u>4 oz</u>	<u>6 oz</u>	<u>8 oz</u>
<p>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</p>	<p>• Canola, rapeseed</p> <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Covrex* (2 qt/100 gal) plus AMS*** (2-4 lb/A) or • Advatrol** (2 qt/100 gal) plus AMS*** (2-4 lb/A) 	<ul style="list-style-type: none"> - 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 Verium @ 1 qt/100 gal.

**Upland MSO @ 1 gal/A or Verium @ 1 qt/100 gal.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply 60 days PHI.



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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	Advatrol/Covrex/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	Prefer 90 @ 1 qt/100 or Covrex @ 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	Prefer 90 @ 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	Prefer 90 @ 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	Covrex @ 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	Covrex @ 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	Covrex @ 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	Bromoxynil 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	Prefer 90 @ 1 qt/100 or Covrex @ 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.

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- Liquid AMS or combination Liquid AMS products; Adium, Encloux, or Mediate Plus can be used to replace dry AMS at equivalent AMS rates.
- Enerpex, Jackhammer, or Veracity Elite II, can be used as AMS and surfactant replacements in most situations. Consult your local Rep for details.

- Verium can be used to replace Covrex or Prefer 90 in many situations @ 1 qt/100 gal.
 - Upland MSO can be used to replace Advatrol @ 2x the use rate.
 - Crop Oil can be used to replace Covrex @ 2x the use rate.
 - Petrichor should be included for drift and deposition at 3 fl oz/A.
- All trademarks and registered trademarks are the property of their respective owners.

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	Covrex @ 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	Prefer 90 @ 1qt/100 or Covrex @ 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	Covrex @ 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	Prefer 90 @ 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 Petrichor @ 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	Covrex/Advatrol/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 Petrichor @ 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	Prefer 90 @ 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	Last Chance 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. Enloax @ 3.5 pt/A can be substituted with glufosinate.

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- Liquid AMS or combination Liquid AMS products; Adium, Enloax, or Mediate Plus can be used to replace dry AMS at equivalent AMS rates.
- Enerpex, Jackhammer, or Veracity Elite II, can be used as AMS and surfactant replacements in most situations. Consult your local Rep for details.

- Verium can be used to replace Covrex or Prefer 90 in many situations @ 1 qt/100 gal.
 - Upland MSO can be used to replace Advatrol @ 2x the use rate.
 - Crop Oil can be used to replace Covrex @ 2x the use rate.
 - Petrichor 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	Prefer 90 @ 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	Prefer 90 @ 1 qt/100 gal + AMS @ 2 lb/A	9	9	7	7	-	7	8+	-	Up to V6 or 20"	Verium @ 1 qt/100 or Advatrol/Covrex @ 2 qt/100 may be substituted for Prefer 90.
Impact / Armezon	0.75-1.0 oz/A	Advatrol 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	Advatrol 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	Advatrol 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	Advatrol 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	Advatrol/Covrex/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 Prefer 90 at 1 qt/100 in place of oils. Adding atrazine enhances the control of ragweeds, kochia and pigweeds.
Kyro	30-60 fl oz/A	Advatrol/Covrex/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, topamezone and clopyralid. May use CHS Hypertonic at 1 qt/100 in place of oils when using atrazine as a tank mix partner.

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- Liquid AMS or combination Liquid AMS products; Adium, Encloax, or Mediate Plus can be used to replace dry AMS at equivalent AMS rates.
- Enerpex, Jackhammer, or Veracity Elite II, can be used as AMS and surfactant replacements in most situations. Consult your local Rep for details.

- Verium can be used to replace Covrex or Prefer 90 in many situations @ 1 qt/100 gal.
 - Upland MSO can be used to replace Advatrol @ 2x the use rate.
 - Crop Oil can be used to replace Covrex @ 2x the use rate.
 - Petrichor 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	Prefer 90 @ 1 qt/100 gal or Covrex @ 2 qt/100 gal	8	8	8-9	9	9	7	9	8-9	V6 or 18"	Maverick is a premix of mesotrione, clopyralid and pyroxasulfone. Do not apply to popcorn post. To achieve best weed control atrazine should be tank mixed.
Mesotrione	3.0 oz/A	Covrex @ 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	Covrex @ 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	Prefer 90 @ 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	Covrex @ 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	Covrex @ 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	Covrex @ 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	Advatrol/Covrex @ 1 pt/A + AMS @ 8.5 lb/100	9	9	8	9	9	9	9	9	36" or V10	Premix of dicamba, diflufenopyr and safener. Add Petrichor @ 3 fl oz/A for drift control and be aware of sensitive crops nearby.
Stinger	0.4-0.6 pt/A	Prefer 90 @ 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	Covrex @ 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 Petrichor @ 3 fl oz/A for drift control and be aware of sensitive crops nearby.

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- Liquid AMS or combination Liquid AMS products; Adium, Enclaox, or Mediate Plus can be used to replace dry AMS at equivalent AMS rates.
- Enerpex, Jackhammer, or Veracity Elite II, can be used as AMS and surfactant replacements in most situations. Consult your local Rep for details.

- Verium can be used to replace Covrex or Prefer 90 in many situations @ 1 qt/100 gal.
 - Upland MSO can be used to replace Advatrol @ 2x the use rate.
 - Crop Oil can be used to replace Covrex @ 2x the use rate.
 - Petrichor 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

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

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

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

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

⁵Follow 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

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

²For 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.

³Follow state and soil restrictions.

⁴See label for replant restrictions.

⁵Addition 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	Covrex (2 qt/100)	None
Armezon Pro	Verium (1 qt/100) or Prefer 90 (1 qt/100) or Covrex (2 qt/100)	8.5 lb/100
Cadet	Verium (1 qt/100) or Prefer 90 (1 qt/100) or Covrex (2 qt/100)	None
Callisto	Jackhammer (1-2 qt/100) alone or Encloux (3-4 qt/100) alone or Prefer 90 (1 qt/100) with AMS	8.5-17 lb/100
Callisto Xtra	Jackhammer (1-2 qt/100) alone or Encloux (3-4 qt/100) alone or Prefer 90 (1 qt/100) with AMS	8.5-17 lb/100
Capreno	Covrex (2 qt/100) or Verium (1 qt/100) with AMS	8.5-17 lb/100
Clarity/Banvel	Veracity Elite II (2 qt/100) alone or with AMS	2.5 lb/A ⁵
DiFlexx	Veracity Elite II (2 qt/100) alone or Prefer 90 (1 qt/100) or Covrex or Advatrol (2 qt/100) with AMS	8.5-17 lb/100 gal ⁵
DiFlexx DUO	Covrex or Advatrol at (2 qt/100), Verium (1 qt/100 gal) with AMS	8.5-17 lb/100 gal ⁵
Hornet WDG	Verium or Prefer 90 (1 qt/100) or Advatrol or Covrex (2 qt/100) with AMS	2 lb/A
Impact/Armezon	Covrex or Advatrol at (2 qt/100) or Verium (1 qt/100) with AMS	8.5-17 lb/100
ImpactZ	Upland MSO (1 gal/100) with AMS	
Laudis	Advatrol or Covrex (2 qt/100)	8.5 lb/100
Permit/Sandea	Verium (1 qt/100) or Prefer 90 (1 qt/100) or Covrex or Advatrol at (2 qt/100) with AMS	2.0-4.0 lb/A
Realm Q	Verium (1 qt/100) or Prefer 90 (1 qt/100) or Covrex at (2 qt/100) with AMS	2.0 lb/A
Resolve Q	Verium (1 qt/100) or Prefer 90 (1 qt/100) or Covrex at (2 qt/100) with AMS	2.0 lb/A
Resource	Verium (1 qt/100) or Prefer 90 (1 qt/100) or Covrex or Advatrol at (2 qt/100) with AMS	2.0 lb/A
Status	Veracity Elite II alone or Verium (1 qt/100) or Prefer 90 (1 qt/100) or Covrex or Advatrol (2 qt/100) with AMS	5.0-17.0 lb/100 gal ⁵
Stinger	Verium (1 qt/100) or Prefer 90 (1 qt/100) or Covrex at (2 qt/100) with AMS	
Yukon	Verium (1 qt/100) or Covrex or Advatrol at (2 qt/100) with AMS	2.0-4.0 lb/A

2, 4-D

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: Several	<ul style="list-style-type: none"> • Jackhammer/ Last Chance Pro* (1 qt/100 gal) 	Many broadleaf weeds. Corn: Up to 4 leaf collars or 8", whichever comes first.
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.: I.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		

*Jackhammer Elite can be used at equivalent rates.

Accent Q (nicosulfuron + safener)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 352-773	<ul style="list-style-type: none"> • Linkage (1 gal/100 gal) or • Covrex* (2 qt/100 gal) plus AMS*** (2-4 lb/A) or • Advatrol** (2 qt/100 gal) plus AMS*** (2-4 lb/A) or • Tapran (2 qt/100 gal) 	- barnyardgrass - foxtail - pigweed - quackgrass - wild proso millet - woolly cup Timing/Comments Apply to corn up to 20" or 6 or fewer collars.
Rate/A: 0.9 oz		
Spray Volume: min 10 gpa		
Rainfast: 4 hours		
S.O.A.: ALS Inhibitor (Group 2)		
P.P.E.: I.s. shirt, l. pants, w.p. gloves, shoes, socks		
R.E.I.: 4 hours		
W. Notification: Oral		
S. Word: Caution		

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

**Upland MSO @ 1 gal/100 can be substituted for Advatrol.

***Jackhammer @ 2 qt/100 or Enclax @ 2.5 gal/100 gal can be substituted for AMS.

Acuron (metolachlor+mesotrione+bicyclopyrone+atrazine)

	Adjuvant(s)/Comments	Timing/Comments
EPA Reg. #: 100-1466	<ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) or • Covrex* (2 qt/100 gal) 	Apply up to 12" corn. Do not apply post to sweet corn or yellow popcorn.
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.: I.s. shirt, l. pants, w.p. gloves, shoes, socks		
R.E.I.: 24 hours		
W. Notification: Oral		
S. Word: Caution		

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

Acuron Flexi (metolachlor+mesotrione+bycyclopyrone)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) or • Covrex* (2 qt/100 gal) 	<p>Timing/Comments</p> <p>Apply up to 30 inches tall or V-8. Do not apply post to sweet corn or yellow popcorn.</p>
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*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

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

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) plus AMS (8.5 lb/100 gal) or • Last Chance Pro* (1 qt/100 gal) plus AMS (8.5 lb/100 gal) or • Jackhammer (2 qt/100 gal) 	<p>Timing/Comments</p> <p>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</p>
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*Last Chance Pro can be added to any adjuvant program at 1 qt/100 gal for maximum efficacy.

Aim EC (carfentrazone-ethyl)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Jackhammer*/Last Chance 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. 	<p>Target Weeds</p> <table border="0"> <tr><td>- black nightshade</td><td>4"</td></tr> <tr><td>- kochia</td><td>2"</td></tr> <tr><td>- lambsquarters</td><td>3"</td></tr> <tr><td>- morning glory</td><td>3 leaves</td></tr> <tr><td>- redroot pigweed</td><td>4"</td></tr> <tr><td>- velvetleaf</td><td>12"</td></tr> <tr><td>- waterhemp</td><td>2"</td></tr> </table>	- black nightshade	4"	- kochia	2"	- lambsquarters	3"	- morning glory	3 leaves	- redroot pigweed	4"	- velvetleaf	12"	- waterhemp	2"
- black nightshade	4"															
- kochia	2"															
- lambsquarters	3"															
- morning glory	3 leaves															
- redroot pigweed	4"															
- velvetleaf	12"															
- waterhemp	2"															
		<p>Timing/Comments</p> <p>Apply up to 14-leaf collar corn. Corn larger than V8, use drop nozzles.</p>														

*Verium can be used at equivalent rates.

Anthem Flex (pyroxasulfone + carfentrazone-ethyl)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 279-3464	<ul style="list-style-type: none"> • Jackhammer/ Last Chance Pro* (2 qt/100 gal) or • Covrex** (1/2-1 pt/A) or • Advatrol*** (0.5-1 pt/A) or • Tapran (2 qt/100 gal) • Apply up to V4 corn. • Do not apply by aerial equipment. 	- lambsquarters 3"
Rate/A: 2.25-6.5 fl oz		- morning glory 3"
Spray Volume: Refer to equipment instructions		- nightshade species 4"
Rainfast: 1 hour		- pigweed species 4"
S.O.A.: Very Long Chain Fatty Acid Inhibitor (Group 15)		- velvetleaf 4"
P.P.O. Inhibitor (Group 14)		- waterhemp 4"
P.P.E.: I.s. shirt, l. pants, w.p. gloves, shoes, socks		
R.E.I.: 12 hours		
W. Notification: Oral		
S. Word: Caution		

*Verium can be used at equivalent rates.

**Crop Oil @ 1-2 pt/A or Verium @ 1 qt/100 can be substituted for Covrex.

***Upland MSO @ 1-2 pt/A can be substituted for Advatrol.

Timing/Comments

Apply through V4 stage.

Anthem Maxx (pyroxasulfone + fluthiacet-methyl)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 279-3468	<ul style="list-style-type: none"> • Jackhammer/ Last Chance Pro* (2 qt/100 gal) or • Covrex** (1/2-1 pt/A) or • Advatrol*** (2 qt/100 gal) • Tapran (2 qt/100 gal) • Apply up to V4 corn. • Do not apply by aerial equipment. 	- burcucumber
Rate/A: 2-6 fl oz		- jimsonweed
Spray Volume: Refer to equipment instructions		- kochia
Rainfast: 1 hour		- lambsquarters
S.O.A.: Very Long Chain Fatty Acid Inhibitor (Group 15)		- morning glory
P.P.O. Inhibitor (Group 14)		- nightshade species
P.P.E.: I.s. shirt, l. pants, w.p. gloves, shoes, socks		- pigweed species
R.E.I.: 12 hours		- Pennsylvania smartweed
W. Notification: Oral		- velvetleaf
S. Word: Caution		- waterhemp

*Verium can be used at equivalent rates.

**Crop Oil @ 1-2 pt/A or Verium @ 1 qt/100 can be substituted for Covrex.

***Upland MSO @ 1-2 pt/A can be substituted for Advatrol.

Timing/Comments

Apply through V4 stage.

Armezon Pro (topramezone+dimethenamid)

EPA Reg. #:	7969-372	Adjuvant(s)/Comments
Rate/A:	14–24 fl oz	• Advatrol** (2 qt/100 gal) plus AMS (8.5–17 lb/100 gal)
Spray Volume:	10 or greater/2–10 Air	or
Rainfast:	1 hour	• Covrex* (2 qt/100 gal) plus AMS (8.5–17 lb/100 gal)
S.O.A.:	HPPD Inhibitor (Group 27) Very Long Chain Fatty Acid Inhibitor (Group 15)	or
P.P.E.:	I.s. shirt, l. pants, w.p. gloves, shoes, socks	• Verium (1 qt/100 gal) plus AMS (8.5–17 lb/100 gal)
R.E.I.:	12 hours	or
W. Notification:	Oral	• Tapran (2 qt/100 gal)
S. Word:	Caution	or

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

**Upland MSO @ 1 gal/100 can be substituted for Advatrol.

Atrazine 4L or 90DF

	Adjuvant(s)/Comments	Target Weeds
Brand Name: EPA Reg. #:	• Covrex* (1 pt/A)	– pigweed 6"
Atrazine 4L (Mana) 66222-36	or	– lambsquarters 6"
Atrazine 4L (Tenkoz) 35915-4-55467	• Advatrol** (1 pt/A)	– other weeds 1.5"
Atrazine 90 DF (Mana) 66222-37	or	
Atrazine 90 DF (Sipcam) 35915-3-60063	• Tapran (2 qt/100 gal)	
Drexel Atra 5 19716-80	• Follow local specifications relating to the use of atrazine or atrazine products.	Timing/Comments
EPA Reg. #: 11773-1 or 11773-13		Atrazine and all applications that include atrazine as a tank mix partner may only be applied to corn up to 12" tall.
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.: I.s. shirt, l. pants, c.r. gloves, c.r. footwear, socks, coveralls		
R.E.I.: 12 hours		
W. Notification: Oral		
S. Word: Caution		

*Crop Oil @ 1 qt/A or Verium @ 1 qt/100 can be substituted for Covrex.

**Upland MSO @ 1 qt/A can be substituted for Advatrol.

Balance Flexx (isoxaflutole)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • 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. <p>Timing/Comments</p> <p>Spike through V2.</p>	<p>Target Weeds</p> <p>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.</p> <p>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.</p> <p>Consult label for restrictions on course textured soils with a shallow water table.</p> <table border="0" style="margin-top: 20px;"> <thead> <tr> <th style="text-align: left;">Rotation</th> <th style="text-align: left;">Crop</th> </tr> </thead> <tbody> <tr> <td>0 mo.</td> <td>Field corn</td> </tr> <tr> <td>4 mo.</td> <td>Wheat, triticale</td> </tr> <tr> <td>6 mo.</td> <td>Barley, soybean, sweet corn, potato, sorghum, and sunflower</td> </tr> <tr> <td>10 mo.</td> <td>Rice, cotton, alfalfa dry bean and sugarbeet east of Mississippi River</td> </tr> <tr> <td>18 mo.</td> <td>Dry bean and sugarbeet west of Mississippi River and all other crops</td> </tr> </tbody> </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
Rotation	Crop													
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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)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Jackhammer/Level Best Pro* (2 qt/100 gal) or • Covrex** (2 qt/100 gal) • May add: AMS (2.5 lb/A) • Use AMS or Jackhammer (2 qt/100 gal) for velvetleaf control 	<table border="0"> <thead> <tr> <th style="text-align: left;">Target Weeds</th> <th style="text-align: left;">1 pt</th> <th style="text-align: left;">1.5 pt</th> <th style="text-align: left;">2 pt</th> </tr> </thead> <tbody> <tr> <td>– cocklebur</td> <td>4"</td> <td>6"</td> <td>10"</td> </tr> <tr> <td>– lambsquarters</td> <td>1"</td> <td>1.5"</td> <td>2"</td> </tr> <tr> <td>– common ragweed</td> <td>-</td> <td>-</td> <td>3"</td> </tr> <tr> <td>– giant ragweed</td> <td>-</td> <td>-</td> <td>6"</td> </tr> <tr> <td>– annual smartweed</td> <td>4"</td> <td>6"</td> <td>10"</td> </tr> <tr> <td>– velvetleaf</td> <td>2"</td> <td>2"</td> <td>5"</td> </tr> <tr> <td>– venice mallow</td> <td>2"</td> <td>2"</td> <td>4"</td> </tr> <tr> <td>– wild buckwheat</td> <td>-</td> <td>3"</td> <td>5"</td> </tr> <tr> <td>– wild mustard</td> <td>2"</td> <td>4"</td> <td>8"</td> </tr> <tr> <td>– wild sunflower</td> <td>3"</td> <td>5"</td> <td>8"</td> </tr> </tbody> </table> <p>Timing/Comments</p> <p>Split applications needed for Canada thistle.</p>	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"
Target Weeds	1 pt	1.5 pt	2 pt																																											
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– common ragweed	-	-	3"																																											
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– wild sunflower	3"	5"	8"																																											

*Verium can be used at equivalent rates.

**Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

Bromoxynil Products

		Adjuvant(s)/ Comments	Target Weeds	1 pt	1.5 pt
Brand Name:	EPA Reg. #:	• Prefer 90* (1 qt/100 gal)	- black nightshade	6"	6"
Buctril	264-437	*Adjuvant not required.	- common ragweed	4"	6"
Maestro 2EC	71368-29	May make weed control more	- cocklebur	8"	10"
Brox 2EC	42750-48	consistent but can increase	- giant ragweed	4"	6"
Rate/A:	1.0-1.5 pt	leaf burn on corn.	- lambsquarters	6"	8"
Spray Volume:	min 10 gpa		- pigweed	-	2"
Rainfast:	1 hour		- venice mallow	-	2"
S.O.A.:	Photosystem II Inhibitor (Group 6)		- velvetleaf	3"	5"
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				

Cadet (fluthiacet-methyl)

		Adjuvant(s)/ Comments	Target Weeds	0.6 oz	0.9 oz
EPA Reg. #:	279-3338	• Jackhammer/ Last Chance Pro* (2 qt/100 gal)	- burcucumber	2"	2"
Rate/A:	0.6-0.9 oz		- nightshade	2"*	2"*
Spray Volume:	min 10 gpa	or	- common lambsquarters	2"*	2"
Rainfast:	4 hours		- kochia	2"	2"
S.O.A.:	PPO Inhibitor (Group 14)	• Covrex** (0.5-1 pt/A)	- pigweed	2"*	4"
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear	When tank mixing, use the adjuvant that is recommended for the tank mix partner.	- velvetleaf	36"	36"
R.E.I.:	12 hours		- waterhemp	-	2"
W. Notification:	Oral		Suppression only		
S. Word:	Warning		Timing/ Comments		
			Can be applied from spike to 48" corn.		

*Verium can be used at equivalent rates.

**Crop Oil @ 1-2 pt/A or Verium @ 1 qt/100 can be substituted for Covrex.

Callisto (mesotrione)

		Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #:	100-1131	• Covrex* (2 qt/100 gal) plus AMS** (8.5 lb/100 gal)	Controls many broadleaf weeds including pigweed, lambsquarters, giant ragweed, cocklebur, nightshade, sunflower, and smartweed.
Rate/A:	3.0 fl oz	Note: Do not use MSO as severe crop injury may occur.	
Spray Volume:	10-30 gpa	Add atrazine @ (0.25-0.5 lb/A) for more consistent control.	Timing/ Comments
Rainfast:	1 hour	Do not use oil adjuvant when tank mixing with Liberty.	Apply when weeds < 5".
S.O.A.:	HPPD Inhibitor (Group 27)		Callisto used without an herbicide tank mix can be applied to corn up to 30".
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks		When applied with atrazine, can be applied to corn up to 12".
R.E.I.:	12 hours		
W. Notification:	Oral		
S. Word:	Caution		

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

**Jackhammer @ 2 qt/100 gal or Encloux @ 2.5 gal/100 gal can be substituted for AMS.

Callisto Xtra (mesotrione + atrazine)

<p>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.: I.s. shirt, l. pants, c.r. gloves, c.r. footwear, socks, coveralls R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Adjuvant(s)/ Comments</p> <ul style="list-style-type: none"> • Covrex* (2 qt/100 gal) plus AMS** (8.5 lb/100 gal) <p>Note: Do not use MSO as severe crop injury may occur.</p> <ul style="list-style-type: none"> • Do not use oil adjuvant when tank mixing with Liberty. • Follow local specifications relating to the use of atrazine or atrazine products. 	<p>Target Weeds</p> <p>Controls many broadleaf weeds including pigweed, lambsquarters, giant ragweed, cocklebur, nightshade, sunflower, and smartweed.</p> <p>Timing/Comments</p> <p>20 oz when weeds < 5". 24 oz when weeds 5–10". Can be applied to corn up to 12".</p>
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*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

**Jackhammer @ 2 qt/100 gal or Encloax @ 2.5 gal/100 gal can be substituted for AMS.

Capreno (tembotrione + thiencazabone-methyl)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Adjuvant(s)/ Comments</p> <ul style="list-style-type: none"> • Covrex* (2 qt/100 gal) plus AMS** (8.5–17 lb/100 gal) • Add atrazine (0.25–0.5 lb/A) for more consistent control. <p>Timing/Comments</p> <p>Emergence to V6.</p>	<p>Target Weeds</p> <table border="0"> <tr> <td>– cocklebur</td> <td>< 6" C</td> <td>< 6" C</td> </tr> <tr> <td>– lambsquarters</td> <td>< 6" C</td> <td>< 6" C</td> </tr> <tr> <td>– nightshade</td> <td>< 6" C</td> <td>< 6" C</td> </tr> <tr> <td>– common ragweed</td> <td>< 6" C</td> <td>< 6" C</td> </tr> <tr> <td>– giant ragweed</td> <td>< 6" C</td> <td>< 6" C</td> </tr> <tr> <td>– smartweed</td> <td>< 6" C</td> <td>< 6" C</td> </tr> <tr> <td>– giant foxtail</td> <td>3" C</td> <td>4" C</td> </tr> <tr> <td>– green foxtail</td> <td>2" PC</td> <td>2" PC</td> </tr> <tr> <td>– yellow foxtail</td> <td>3" C</td> <td>4" C</td> </tr> <tr> <td>– barnyardgrass</td> <td>5" C</td> <td>6" C</td> </tr> </table> <p>C = Control PC = Partial Control</p>	– 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
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– barnyardgrass	5" C	6" C																														

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

**Jackhammer @ 2 qt/100 gal or Encloax @ 2.5 gal/100 gal can be substituted for AMS.

Corvus (thiencazabone-methyl + isoxaflutole)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Adjuvant(s)/ Comments</p> <ul style="list-style-type: none"> • 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. <p>Timing/Comments</p> <p>Spike through V2.</p>	<p>Target Weeds</p> <p>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.</p> <p>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.</p> <p>Consult label for restrictions on course textured soils with a shallow water table.</p> <table border="0"> <tr> <td>Rotation</td> <td>Crop</td> </tr> <tr> <td>0 mo.</td> <td>Field corn</td> </tr> <tr> <td>4 mo.</td> <td>Wheat, triticale</td> </tr> <tr> <td>9 mo.</td> <td>Barley, soybean, sweet corn</td> </tr> <tr> <td>10 mo.</td> <td>Rice, cotton</td> </tr> <tr> <td>17 mo.</td> <td>Alfalfa, dry bean, oat, canola, sorghum, sunflower, potato, sugarbeet, all other crops</td> </tr> </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
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 (cloprialid + 2,4-D amine)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear R.E.I.: 48 hours W. Notification: Oral S. Word: Danger</p>	<p>Adjuvant(s)/ Comments</p> <ul style="list-style-type: none"> • Linkage (2 qt/100 gal) or • Jackhammer/ Last Chance Pro* (1 qt/100 gal) • Adjuvant not required but may enhance weed control. 	<p>Target Weeds</p> <p>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.</p> <p>Controls Canada thistle and many other broadleaf weeds.</p> <p>Timing/ Comments</p> <p>Corn: up to 4 leaf collars or 8", whichever comes first.</p>
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*Jackhammer Elite can be used at equivalent rates.

Dicamba Products

<p>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.: I.s. shirt, l. pants, s.p. gloves, shoes, socks, eyewear R.E.I.: 24 hours W. Notification: Oral S. Word: Caution</p>	<p>Adjuvant(s)/ Comments</p> <ul style="list-style-type: none"> • Jackhammer/ Last Chance Pro* (1 qt/100 gal) or • Prefer 90 (1 qt/100 gal) 	<p>Target Weeds</p> <ul style="list-style-type: none"> - black nightshade - common ragweed - Canada thistle - cocklebur - giant ragweed - kochia - lambsquarters - pigweed - venice mallow - velvetleaf <p>Timing/ Comments</p> <p>Apply spike through 8" corn.</p>
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*Jackhammer Elite can be used at equivalent rates.

DiFlexx (dicamba+safener)

<p>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.: I.s. shirt, l. pants, w.p. gloves, shoes, socks R.E.I.: 24 hours W. Notification: Oral S. Word: Caution</p>	<p>Adjuvant(s)/ Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) plus AMS*** (8.5-17 lb/100 gal) or • Verium (1 qt/100 gal) plus AMS*** (8.5-17 lb/100 gal) or • Covrex* (2 qt/100 gal) plus AMS*** (8.5-17 lb/100 gal) or • Advatrol** (2 qt/100 gal) plus AMS*** (8.5-17 lb/100 gal) or • Tapran (2 qt/100 gal) 	<p>Timing/ Comments</p> <p>Apply spike through V10 or 36".</p>
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*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

**Upland MSO @ 1 gal/100 can be substituted for Advatrol.

***Jackhammer/Verium at 2 qt/100 gal can be substituted for AMS.

DiFlexx DUO (dicamba+Tembotrione+safener)

	Adjuvant(s)/ Comments	Timing/ Comments
EPA Reg. #: 264-1184	<ul style="list-style-type: none"> • Verium (1 qt/100 gal) plus AMS*** (8.5-17 lb/100 gal) or • Covrex* (2 qt/100 gal) plus AMS*** (8.5-17 lb/100 gal) or • Advatrol** (2 qt/100 gal) plus AMS*** (8.5-17 lb/100 gal) or • Tapran (2 qt/100 gal) 	Apply spike through V7 or 36". V7-V10 Directed Spray.
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.: I.s. shirt, I. pants, w.p. gloves, shoes, socks		
R.E.I.: 24 hours		
W. Notification: Oral		
S. Word: Caution		

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex

**Upland MSO @ 1 gal/100 can be substituted for Advatrol.

***Jackhammer/Verium at 2 qt/100 gal can be substituted for AMS.

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

	Adjuvant(s)/ Comments	Timing/ Comments
EPA Reg. #: 62719-649	Refer to www.enlisttankmix.com for approved CHS adjuvants.	Corn: Emergence through V8 or 30". Enlist Corn Only DO NOT tank mix any tank mix partner not listed on www.enlisttankmix.com .
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.: I.s. shirt, I. pants, w.p. gloves, shoes, socks, p. eyewear		
R.E.I.: 48 hours		
W. Notification: Oral		
S. Word: Warning		

Enlist One (2,4-D Choline)

	Adjuvant(s)/ Comments	Timing/ Comments
EPA Reg. #: 62719-695	Refer to www.enlisttankmix.com for approved CHS adjuvants.	Corn: Emergence through V8 or 30". Enlist Corn Only DO NOT tank mix any tank mix partner not listed on www.enlisttankmix.com .
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.: I.s. shirt, I. pants		
R.E.I.: 48 hours		
W. Notification: Oral		
S. Word: Warning		

Glufosinate

		Adjuvant(s)/Comments	Target Weeds	<u>32 fl oz</u>
Brand Name:	EPA Reg. #:	<ul style="list-style-type: none"> • Last Chance Pro (1 qt/100) plus AMS (1.5-3.0 lb/A) 	- wild buckwheat	6"
Liberty 280 SL	264-829		- cocklebur	6"
Autonomy	7969-448-55467	or	- kochia	4"
Cheetah	71368-112	<ul style="list-style-type: none"> • Jackhammer (3 qt/100) 	- morning glory	6"
Noventa	7696-448		- wild mustard	4"
Interline	70506-310	or	- nightshade	6"
Spray Volume:	15-20 gpa	<ul style="list-style-type: none"> • Encloax (3.5 pt/A) 	- pigweed species	3"
Rainfast:	4 hours		- ragweed species	6"
M.O.A.:	Glutamine Synthase Inhibitor		- velvetleaf	6"
P.P.E.:	I.s. shirt, l. pants, shoes, socks		- waterhemp	3"
R.E.I.:	12 hours		- barnyardgrass	4"
W. Notification:	Oral		- foxtail species	3"
S. Word:	Warning		- wild oat	3"
			- volunteer corn	6"
			- crabgrass	3"

Glufosinate - High Load

		Adjuvant(s)/Comments	Target Weeds	<u>16.3 fl oz</u>
Brand Name:	EPA Reg. #:	<ul style="list-style-type: none"> • Last Chance Pro (1 qt/100) plus AMS (1.5-3.0 lb/A) 	- wild buckwheat	6"
Surmise 5	42750-401		- cocklebur	6"
Spray Volume:	15-20 gpa	or	- kochia	4"
Rainfast:	4 hours	<ul style="list-style-type: none"> • Jackhammer (3 qt/100) 	- morning glory	6"
M.O.A.:	Glutamine Synthase Inhibitor		- wild mustard	4"
P.P.E.:	I.s. shirt, l. pants, shoes, socks	or	- nightshade	6"
R.E.I.:	12 hours	<ul style="list-style-type: none"> • Encloax (3.5 pt/A) 	- pigweed species	3"
W. Notification:	Oral		- ragweed species	6"
S. Word:	Warning		- velvetleaf	6"
			- waterhemp	3"
			- barnyardgrass	4"
			- foxtail species	3"
			- wild oat	3"
			- volunteer corn	6"
			- crabgrass	3"

Glufosinate - Liberty Ultra

		Adjuvant(s)/Comments	Target Weeds	<u>24 fl oz</u>
EPA Reg. #:	7969-500	<ul style="list-style-type: none"> • Last Chance Pro (1 qt/100 gal) plus AMS (1.5 lb/A) 	- wild buckwheat	6"
Rate/A:	24-29 fl oz		- cocklebur	6"
Spray Volume:	15 gpa minimum	or	- kochia	4"
Rainfast:		<ul style="list-style-type: none"> • Encloax (3.5 pt/A) 	- morning glory	6"
M.O.A.:	Glutamine Synthase Inhibitor (Group 10)		- wild mustard	4"
P.P.E.:	I.s. shirt, l. pants, w.p. gloves, shoes, socks, p eyewear	or	- Nightshade	6"
R.E.I.:	12 hours	<ul style="list-style-type: none"> • Jackhammer (3 qt/100 gal) 	- pigweed species	3"
W. Notification:	Oral		- Ragweed species	6"
S. Word:	Danger		- Velvetleaf	6"
			- waterhemp	3"
			- barnyardgrass-	4"
			- Foxtail species	3"
			- wild oat	6"
			- crabgrass	3"

Glyphosate

	# A.E.	=0.75 AE	Surfactant/Comments
Brand Name: EPA Reg. #:			
Buccaneer Plus 55467-9	3.00	32.0	• Last Chance Pro (1 qt/100) plus AMS (8.5-17 lb/100)
Gly Star Original 42750-60	3.00	32.0	or
Gly Star Plus 42750-61	3.00	32.0	• Jackhammer (2-3 qt/100)
Durango DMA 62719-556	4.00	24.0	or
Buccaneer 5 Extra 55467-15	4.00	24.0	• Encloax (2.5-5 gal/100)
Gly Star 5 Extra 42750-59	4.00	24.0	or
Gly Star K-Plus 42750-122	4.50	21.3	• Prefer 90 (1 qt/100) plus AMS (8.5-17 lb/100)
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			

Hallex GT (s-metolachlor + glyphosate + mesotrione)

	Adjuvant(s)/Comments	Timing/Comments
EPA Reg. #: 100-1282	• Prefer 90 (2 pt/100 gal) plus AMS (8.5-17 lb/100 gal)	Apply to corn from emergence up to V8 (8 leaves with collars) or until corn reaches 30", whichever comes first.
Rate/A: 3.6-4.0 pt	or	Roundup Ready Corn Only
Spray Volume: 10-30 gpa	• Jackhammer/ Last Chance Pro* (2 pt/100 gal)	
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		

*Verium can be used at equivalent rates.

*Last Chance Pro can be added to any adjuvant program at 1 qt/100 gal for maximum efficiency.

Impact Core (topramezone+acetochlor)

	Adjuvant(s)/ Comments	Timing/ Comments
EPA Reg. #: 5481-648	<ul style="list-style-type: none"> • Advatrol* or Tapran* (2 qt/100 gal) plus AMS (8.5 lb/100 gal) or • Last Chance Pro/Prefer 90 (1 qt/100 gal) plus AMS (8.5 lb/100 gal) 	Apply to corn from spike to 11" corn.
Rate/A: 20-40 fl oz		Note: 4 month rotation restriction to wheat.
Spray Volume: 10 gpa minimum		9 month rotation restriction to barley, oat, rye, alfalfa, and grain sorghum.
Rainfast:		
S.O.A.: HPPD Inhibitor (Group 27) Very Long Chain Fatty Acid Inhibitor (Group 15)		10 month rotation restriction to cotton, peanut, potato, soybean and sunflower.
P.P.E.: l.s. shirt, l. pants, w.p. gloves, shoes, socks, p eyewear		18 month rotation to all other crops.
R.E.I.: 12 hours		When oil-based adjuvants are used in tank mixtures with other herbicides leaf burn may occur.
W. Notification: Oral		
S. Word: Warning		

*Upland MSO @ 1.0 gal/100 gal can be substituted for Advatrol or Tapran.

Impact Z

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 5481-612	<ul style="list-style-type: none"> • Covrex* (2-3 qt/100 gal) plus AMS*** (8.5-17 lb/100 gal) or • Advatrol** (2-3 qt/100 gal) plus AMS*** (8.5-17 lb/100 gal) or • Tapran (2 qt/100 gal) 	- cocklebur 8"
Rate/A: 8.0-10.7 fl oz		- lambsquarters 6"
Spray Volume: min 10 gpa		- nightshade 6"
Rainfast: 1 hour		- pigweeds 6"
S.O.A.: HPPD Inhibitor (Group 27) Photosystem II Inhibitor (Group 5)		- common ragweed 6"
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks, and chemical resistant apron		- giant ragweed 8"
R.E.I.: 12 hours		- smartweed 3"
W. Notification: Oral		Suppression of certain grasses
S. Word: Caution		
		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 Verium @ 1 qt/100 can be substituted for Covrex.

**Upland MSO @ 1.0-1.5 gal/100 can be substituted for Advatrol.

***Jackhammer or Jackhammer Elite @ 2 qt/100 can be substituted for AMS.

Kyro (topramezone+clopyralid+acetochlor)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Advatrol* or Tapran* (2 qt/100 gal) plus AMS (8.5 lb/100 gal) or • Covrex** (2 qt/100 gal) plus AMS (8.5 lb/100 gal) 	<p>Timing/Comments</p> <p>Apply to corn up to 24".</p> <p>Oil-based adjuvants are not recommended when tank mixing with Atrazine. Use Last Chance Pro or Prefer 90 at 1 qt/100 when tank mixing with Atrazine.</p>
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*Upland MSO @ 1.0 gal/100 gal can be substituted for Advatrol or Tapran.

**Crop Oil @ 1.0 gal/100 gal can be substituted for Covrex.

Laudis (tembotrione)

	Adjuvant(s)/Comments	Target Weeds	3 fl oz	3 fl oz + atrazine 0.5 lb/A
<p>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</p>	<ul style="list-style-type: none"> • Covrex* (2 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal) or • Advatrol** (2 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal) or • Tapran (2 qt/100 gal) 	<ul style="list-style-type: none"> – cocklebur – lambsquarters – nightshade – common ragweed – giant ragweed – smartweed – giant foxtail – green foxtail – yellow foxtail – barnyardgrass 	<ul style="list-style-type: none"> < 6" C 3" C 2" PC 3" C 5" C 	<ul style="list-style-type: none"> < 6" C 4" C 4" C 4" C 6" C
			<p>C = Control PC = Partial Control</p>	

Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

**Upland MSO @ 1 gal/100 can be substituted for Advatrol.

***Jackhammer or Jackhammer Elite @ 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)

	Adjuvant(s)/Comments	Target Weeds
<p>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</p>	<ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) or • Covrex* (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. 	<ul style="list-style-type: none"> – buffalobur – black nightshade – common ragweed – cocklebur – giant ragweed – kochia – lambsquarters – morning glory – pigweed – smartweed – velvetleaf – waterhemp
		<ul style="list-style-type: none"> 1–3"
		<p>Timing/Comments</p> <p>Corn: emergence to 12" tall.</p> <p>Follow local specifications relating to the use of atrazine or atrazine products.</p>

*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

Lumax EZ (mesotrione + s-metolachlor + atrazine)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 100-1442	• Prefer 90 (1 qt/100 gal)	- buffalobur 1-3"
Rate/A: 2.7-3.25 qt	or	- black nightshade 1-3"
Spray Volume: 10-30 gpa	• Covrex* (2 qt/100 gal)	- common ragweed 1-3"
Rainfast: 1 hour	• Oil may be used if cosmetic crop injury is acceptable to control more difficult-to-control weeds.	- cocklebur 1-3"
S.O.A.: HPPD Inhibitor (Group 27)		- giant ragweed 1-3"
Very Long Chain Fatty Acid Inhibitor (Group 15)		- kochia 1-3"
Photosystem II Inhibitor (Group 5)	• Lumax EZ may also be applied PRE.	- lambsquarters 1-3"
P.P.E.: coveralls, l.s. shirt and l. pants, shoes, socks, apron, Cat. A c.r. gloves		- morning glory 1-3"
R.E.I.: 24 hours		- pigweed 1-3"
W. Notification: Oral		- smartweed 1-3"
S. Word: Caution		- velvetleaf 1-3"
PHI: 60 days		- 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 Verium @ 1 qt/100 gal can be substituted for Covrex.

Maverick (Mesotrione+clopyralid+Pyroxasulfone)

	Adjuvant(s)/Comments	Timing/Comments
EPA Reg. #: 59639-255	• Prefer 90 or Last Chance Pro (1 qt/100 gal) plus AMS (8.5 lb/100 gal)	Apply to corn up to V6 or 18", whichever comes first.
Rate/A: 14 fl oz		Do not use oil-based adjuvants or crop injury may occur.
Spray Volume: 10-30 gpa		Do not apply to popcorn post.
Rainfast: 6 hours		To achieve best weed control include atrazine as a tank mix partner.
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		

Metribuzin Products

	Adjuvant(s)/Comments	Target Weeds
Brand Name: EPA Reg. #:	• Use NIS and AMS as allowed or prescribed by the labeled tank mix partner.	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.
Metribuzin 75DF 66222-106	Tank mixes:	
Glory 66222-106	• Atrazine, Banvel, Basagran, 2,4-D, Clarity, Marksman Laddok, Pursuit (IMI Corn), Buctril, Resource, Tough, Butril/Atrazine	
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		

Permit (halosulfuron-methyl)

	Adjuvant(s)/Comments	Target Weeds	0.66 fl oz	1.33 fl oz
Brand Name: EPA Reg. #:	<ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) plus AMS*** (2 lb/A) or • Linkage (1 gal/100 gal) or • Covrex* (2 qt/100 gal) plus AMS*** (2-4 lb/A) or • Advatrol** (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.	<ul style="list-style-type: none"> - common ragweed - cocklebur - giant ragweed - pigweed - velvetleaf - yellow nutsedge 	1-9"	9-12"
Sandea 81880-18-10163			1-9"	9-14"
Permit 81880-2-10163			1-3"	4-6"
Rate/A: 0.67-1.33 oz DF			1-9"	9-12"
Spray Volume: min 10 gpa			-	4-12"
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				
		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 Verium @ 1 qt/100 can be substituted for Covrex.

**Upland MSO @ 1 gal/100 can be substituted for Advatrol.

***Jackhammer or Jackhammer Elite @ 2 qt/100 can be substituted for AMS.

Realm Q (rimsulfuron + mesotrione)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 352-837	<ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) plus AMS** (2 lb/A) or • Verium (1 qt/100 gal) plus AMS** (2 lb/A) or • Linkage (1 gal/100 gal) or • Covrex* (2 qt/100 gal) plus AMS** (2 lb/A) 	- barnyardgrass 1-2"
Rate/A: 4.0 oz		- large crabgrass 1/2"
Spray Volume: min 15 gpa		- woolly cupgrass 1"
Rainfast: 4 hours		- foxtail 1-2"
S.O.A.: ALS Inhibitor (Group 2) HPPD Inhibitor (Group 27)		- wild proso millet suppression
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks		- quackgrass suppression
R.E.I.: 12 hours		- kochia < 5"
W. Notification: Oral		- pigweed < 5"
S. Word: Caution		- cocklebur < 5"
		- lambsquarters < 5"
	- common ragweed < 5"	
	- velvetleaf < 5"	

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

**Jackhammer/Jackhammer Elite at 2 qt/100 can be substituted for AMS.

Timing/Comments

Corn: up to 20" or 7 leaf collars.

Resicore (acetochlor+mesotrione+clopyralid)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 62719-693	<ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) or • Verium (1 qt/100 gal) or • Covrex* (2 qt/100 gal) 	- Weeds < 3".
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		Timing/Comments
S. Word: Caution		Corn: up to 11".

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

Resource (flumiclorac pentyl ester)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 59639-82	<ul style="list-style-type: none"> • Covrex* (1 pt/A) plus AMS*** (2-2.5 lb/A) 	Adjuvant recommendations refer to Resource as a tank mix partner with glyphosate or other approved tank mix partners for corn.
Rate/A: 2.0-4.0 oz in tank mix		
Spray Volume: min 15 gpa	<ul style="list-style-type: none"> • Advatrol** or Tapran**(1 pt/A) plus AMS*** (2-2.5 lb/A) 	Resource helps on buckwheat, morning glory, pigweed, waterhemp, common lambsquarters, common ragweed, and velvetleaf.
Rainfast: 1 hour		
S.O.A.: PPO Inhibitor (Group 14)	<ul style="list-style-type: none"> • Use the surfactant required by the tank mix partner. 	Timing/Comments Apply to 2-10 leaf stage corn.
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		

*Crop Oil @ 1 qt/A or Verium @ 1 qt/100 can be substituted for Covrex.

**Upland MSO @ 1 qt/A can be substituted for Advatrol or Tapran.

***Jackhammer/Jackhammer Elite @ 2 qt/100 can be substituted for AMS.

Revulin Q (nicosulfuron + mesotrione)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 352-900	<ul style="list-style-type: none"> • Covrex* (2 qt/100 gal) plus AMS** (2-4 lb/A) 	<ul style="list-style-type: none"> - barnyardgrass - nightshade - foxtail - sunflower - pigweed - cocklebur - quackgrass - wild proso millet - woolly cup - lambsquarter - g. ragweed
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		
		Timing/Comments Apply to corn less than 12 inches.

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

**Encloax @ 2.5 gal/100 gal can be substituted for AMS.

Sequence (glyphosate + s-metolachlor)

	Adjuvant(s)/ Comments	Timing/ Comments
EPA Reg. #: 100-1185	<ul style="list-style-type: none"> • AMS* (8.5-17 lb/100 gal) 	Apply to corn from emergence up to V8 (8 leaves with collars) or until corn reaches 30", whichever comes first.
Rate/A: 2.5 pt		
Spray Volume: 10-40 gpa		Use drop nozzles for 30-48" corn.
Rainfast: 2 hours		
S.O.A.: EPSP Synthase Inhibitor (Group 9) Very Long Chain Fatty Acid Inhibitor (Group 15)		Roundup Ready Corn Only
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks		
R.E.I.: 24 hours		
W. Notification: Oral		
S. Word: Caution		

*Jackhammer/Jackhammer Elite @ 2 qt/100 can be substituted for AMS.

Solstice (Fluthiacet + Mesotrione)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 279-3461	<ul style="list-style-type: none"> • Verium plus AMS** (8.5 lb/100 gal) or • Covrex* (2 qt/100 gal) plus AMS** (8.5 lb/100 gal) 	<ul style="list-style-type: none"> - common waterhemp 3" - morning glory 3" - giant ragweed 3" - common ragweed PC - lambsquarters C - velvetleaf C
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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear		
R.E.I.: 12 hours		
W. Notification: Oral		
S. Word: Caution		
		<p>Timing/Comments</p> <p>Apply to corn V8 to 30" corn.</p> <p>PHI 45 day forage.</p> <p>PHI 70 day grain or fodder.</p>

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

**Jackhammer/Jackhammer Elite @ 2 qt/100 can be substituted for AMS.

Status (dicamba + diflufenopyr + safener)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 7969-242	<ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) plus AMS*** (5-17 lb/100 gal) or • Covrex* (1 pt/A) plus AMS*** (5-17 lb/100 gal) or • Advatrol** 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. 	<p>Controls most annual broadleaf weeds and suppresses many perennial broadleaf weeds.</p> <p>Provides some suppression of small annual grasses.</p>
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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear		
R.E.I.: 24 hours		
W. Notification: Oral		
S. Word: Caution		
		<p>Timing/Comments</p> <p>Apply to corn between 4" (V2) to 36" (V10).</p> <p>Addition of a drift control product such as Sedate Max is recommended.</p>

*Crop Oil @ 1 qt/A or Verium @ 1 qt/100 can be substituted for Covrex.

**Upland MSO @ 1 qt/A can be substituted for Advatrol or Tapran.

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

Steadfast Q (nicosulfuron + rimsulfuron + safener)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 352-774	• Prefer 90 (1 qt/100 gal)	- barnyardgrass 4"
Rate/A: 1.5 oz	plus	- volunteer cereals 2"
Spray Volume: min 10 gpa	AMS*** (2-4 lb/A)	- large crabgrass 1"
Rainfast: 4 hours	or	- woolly cupgrass 3"
S.O.A.: ALS Inhibitor (Group 2)	• Linkage (1 gal/100 gal)	- foxtail 4"
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks	or	- wild proso millet 4"
R.E.I.: 4 hours	• Covrex* (2 qt/100 gal)	- quackgrass 8"
W. Notification: Oral	plus	- sandbur 2"
S. Word: Caution	AMS*** (2-4 lb/A)	- wild oat 2"
	or	- wild mustard 4"
	• Advatrol** (1 qt/100 gal)	- pigweed 4"
	plus	- morning glory 4"
	AMS*** (2-4 lb/A)	
	or	
	• Tapran (2 qt/100 gal)	
	• Use adjuvant system as required by tank mix partner.	

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

**Upland MSO @ 1 gal/100 can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 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)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 62719-73	• Prefer 90 (2 pt/100 gal)	- common/giant 5 leaf
Rate/A: 1/3-2/3 pt	or	ragweed
Spray Volume: min 10 gpa	• Jackhammer/Last Chance Pro* (1-2 qt/100 gal)	- Canada thistle 5 leaf
Rainfast: 6 hours	or	- cocklebur 5 leaf
S.O.A.: Plant Growth Regulator (Group 4)		- sunflower 5 leaf
P.P.E.: l.s. shirt, l. pants, eyewear, c.r. gloves, shoes, socks	• Verium (1 qt/100 gal)	
R.E.I.: 12 hours	Adjuvants are not usually necessary. They may increase effectiveness on weeds, but may reduce selectivity to the crop.	Timing/ Comments
W. Notification: Oral		Apply to corn from emergence to 24" tall.
S. Word: Caution		

*Jackhammer Elite can be used at equivalent rates.

Topramezone Products

<p>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</p>	<p>Adjuvant(s)/ Comments</p> <ul style="list-style-type: none"> • Covrex* (2-3 qt/100 gal) plus AMS*** (8.5-17 lb/100 gal) or • Advatrol** (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. 	<p>Target Weeds</p> <ul style="list-style-type: none"> - cocklebur 5" - lambsquarters 4" - nightshade 4" - pigweeds 4" - common ragweed 4" - giant ragweed 5" - smartweed 2" <p>Suppression of certain grasses</p> <p>Timing/Comments</p> <p>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.</p> <p>All corn: emergence to 45 days prior to harvest.</p>
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*Crop Oil @ 1.0-1.5 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

**Upland MSO @ 1.0-1.5 gal/100 can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 can be substituted for AMS.

Widematch (fluroxypyr + clopyralid)

<p>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</p>	<p>Adjuvant(s)/ Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) or • Jackhammer/ Last Chance Pro* (1 qt/100) <p>Addition of adjuvant may increase efficacy but could increase crop response.</p>	<p>Target Weeds</p> <p>Controls many annual and perennial broadleaf weeds but is weak on mustard species and does not control pigweed or lambsquarters.</p> <p>Timing/Comments</p> <p>Apply to corn up to and including V5 leaf.</p>
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*Jackhammer Elite can be used at equivalent rates.

Yukon (halosulfuron + dicamba)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 81880-6-10163	• Prefer 90 (1 qt/100 gal)	- kochia 1-6"
Rate/A: 4 oz	plus	- jimsonweed 1-4"
Spray Volume: min 10 gpa	AMS** (2-4 lb/A)	- lambsquarters 1-6"
Rainfast: 4 hours	or	- venice mallow 1-12"
S.O.A.: ALS Inhibitor (Group 2)	• Linkage (1 gal/100 gal)	- milkweed 1-6"
Plant Growth Regulator (Group 4)	or	- morning glory 1-6"
P.P.E.: I.s. shirt, l. pants, w.p. gloves, shoes, socks	• Covrex* (2 qt/100 gal)	- wild mustard 1-6"
R.E.I.: 12 hours	plus	- nightshade species 1-6"
W. Notification: Oral	AMS** (2-4 lb/A)	- redroot pigweed 1-12"
S. Word: Caution		- ragweed species 1-6"
		- smartweed 1-3"
		- sunflower 1-15"
		- velvetleaf 1-12"

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

**Jackhammer/Jackhammer Elite @ 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)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 100-1410	• Prefer 90 (1 qt/100 gal)	Recommended rate controls Palmer amaranth, Powell amaranth, barnyardgrass, buffalobur, crabgrass, foxtail, common lambsquarters, black nightshade, fall panicum, smartweed species, velvetleaf, and tall waterhemp.
Rate/A: 2.0-2.4 qt	or	
Spray Volume: 10-30 gpa	• Covrex* (2 qt/100 gal)	
Rainfast: 1 hour	• Oil may be used if cosmetic crop injury is acceptable to obtain more consistent weed control.	
S.O.A.: HPPD Inhibitor (Group 27)	• AMS may also be added to NIS or COC to increase weed control consistency but also risks crop injury.	
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		Timing/Comments
R.E.I.: 24 hours		Corn: apply up to 30" tall or V8 stage.
W. Notification: Oral		Zemax may also be applied PRE
S. Word: Caution		
PHI: 45 days		

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 can be substituted for Covrex.

Corn // Plant Health Fungicides

Fungicides can improve corn yield by improving plant health through preventing disease, improving stress tolerance, increasing water use efficiency, CO₂ 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)
Proline [®] 480 SC		Prothioconazole	5.7	U	VG	E	U	VG	G	NL	14 days	
Tilt [®] Many Generics		Propiconazole	2.0-4.0	NL	VG	E	G	G	F	NL	30 days	
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	
	Approach [®]	Picoxystrobin	3.0-12.0	VG	VG-E	VG	F-VG	VG	G	G ³	7 days	
	Evito [®] 480 SC	Fluoxastrobin	2.0-5.7	VG*	E*	VG*	E*	G*	G*	NL	30 days	
	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	
	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	
	Miravis [®] Neo	Propiconazole (3) Pydiflumetofen (7) Azoxystrobin (11)	13.7	U	U	U	E	VG-E	VG	G-VG	30 days	
	Revytek [™]	Mefentrifluconazole(3) Fluxapyroxad (7) Pyraclostrobin (11)	8.0-15.0	U	U	U	VG-E	VG-E	VG	VG	21 days	
	Trivapro [®]	Propiconazole (3) Benzovindiflupyr (7) Azoxystrobin (11)	13.7	U	U	U	E	VG	E	G-VG	30 days	
	Lucento [™]	Flutriafol (3) Bixafen (7)	3.0-5.5	U	U	U	VG-E	VG	VG	G ³	R4	
	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

Petrichor and Verium are APE/NPE free and can be used for drift control and deposition.

Refer to labels for ground and aerial application recommendations.

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.

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

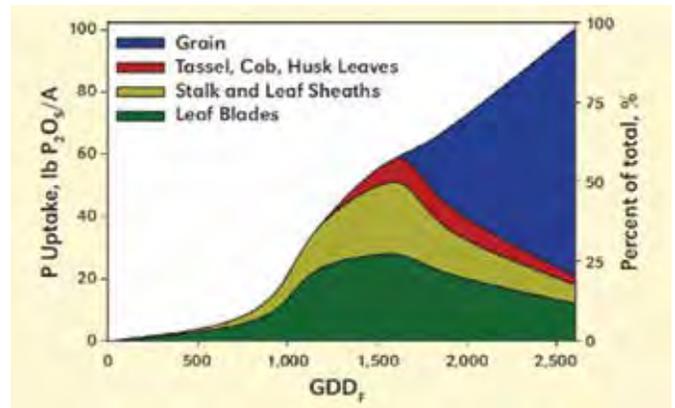
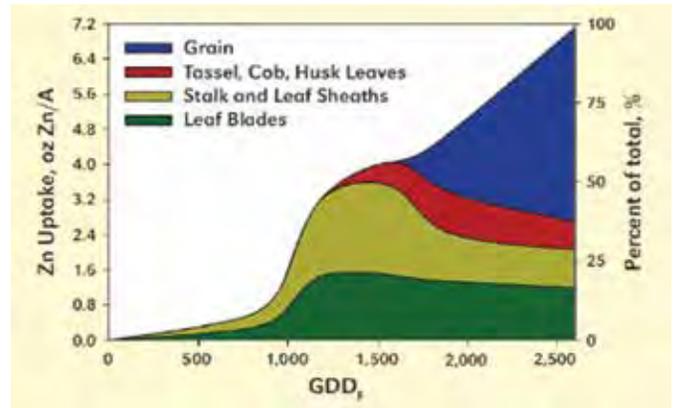
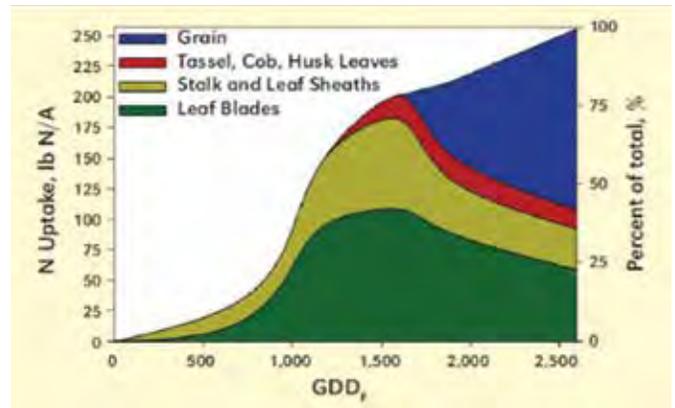
*IRAC MOA Classification: 1B = Organophosphates, 3A = Synthetic Pyrethroid

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.

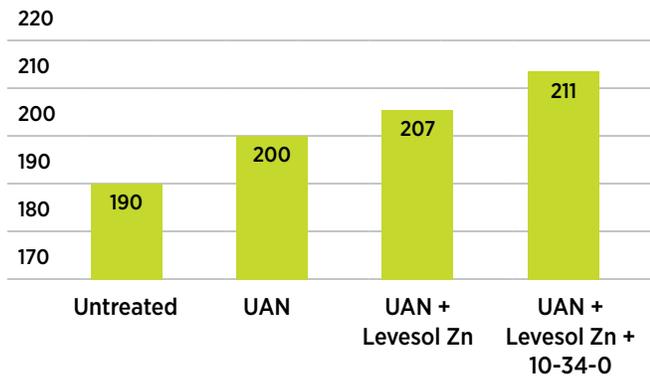
During periods of rapid growth, corn plants take up 7.8 lbs. of nitrogen, 2.1 lbs. of phosphorus and 0.21 oz of zinc per day (University of Illinois Department of Plant Physiology). Recent research has shown that adding Levesol Zn to your Y-drop program can increase macro and micro-nutrient availability 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.

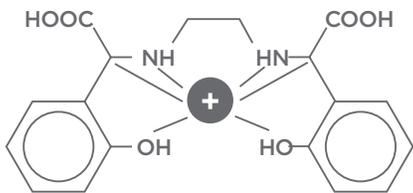
Trivar is the first-of-its-kind phosphorus efficiency agent that can be impregnated directly to a dry phosphate fertilizer and broadcast on the field. It’s a proprietary blend of the strongest and most effective chelate, nutrient focused enzyme, and plant critical micronutrients.



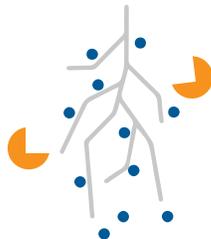
ANALYSIS:	
Phosphatase Enzyme	
GRADE 4-0-0	
Boron (B)	0.10%
Zinc (Zn)	5.00%
Derived from: Aqua Ammonia, Boric Acid, Zinc EDDHA, Zinc EDTA, and Ortho-Ortho EDDHA	

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 NaNO_3 . High salt levels can be toxic to the seed and negatively impact germination.

Using Paralign 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. Paralign 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

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	Wierstem 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	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	F		
Acuron	G	G	G	F	G	F	F	G	G	G	F	F	G	F	F	P	E	G	E	E	E	E	E	E	E	F	F	E	E	E	E	E	E	E	E	E	G	F	F	P	G	
Acuron Flexi	G	G	G	F	G	F	F	G	G	G	F	F	G	F	F	P	E	G	E	E	E	E	E	E	E	G	F	E	E	E	E	E	E	E	E	E	E	G	F	P	G	
Acuron GT	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	E	G	E	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	P	F	F	G	G	F	G	N	G	P	F	F	F	P	P	G	G	P	G	P	P	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	E	E	E	E	E	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	E	G	E	E	E	G	E	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	E	G	E	E	E	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	P	P	P	F	N	P	P	G	E	E	E	E	E	E	E	G	E	E	E	G	E	E	E	E	E	E	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	E	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	F	N	N	N	E	E	E	G	E	F	E	G	E	P	G	G	G	G	E	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	E	E	E	E	E	E	E	E	E	E	E	E	F	G	P	
Callisto Xtra	E	N	F	N	P	P	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	E	E	E	E	F	P	N		
Capreno	G	G	F	G	G	G	G	G	G	G	G	G	G	G	-	-	F	G	G	E	E	F	E	G	E	F	E	E	E	G	E	E	E	E	E	E	E	-	-	-	-	
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	F	G	E	F	E	E	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

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F = Fair

P = Poor

N = No Control

- = Insufficient Information

¹Apply to Glyphosate-Resistant (Glyphosate-Resistant) corn only.²Apply to Liberty Link or Enlist (Glufosinate-Resistant) corn only.³Apply to Enlist corn only (Resistant to Glyphosate and 2,4-D).

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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	E	E	E	E	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	E	E	G	G	G	F	N		
Enlist Duo ³	E	E	G	G	E	E	E	E	E	-	-	E	E	E	E	-	G	G	E	G	E	E	E	G	G	E	E	E	E	G	G	E	E	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	G	E	F	G	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	G	E	F	G	G	G	G		
ImpactZ	E	G	G	P	G	-	N	P	-	-	-	P	F	F	N	-	G	E	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	E	G	F	E	-	-	-	N	P		
Lexar EZ	G	G	G	F	G	G	F	F	F	F	F	F	G	F	-	-	G	G	E	E	E	E	E	E	E	G	E	F	E	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	G	E	E	E	F	F	P	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	E	E	F	E	E	E	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	E	G	E	F	E	E	F	E	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	F	G	G	-	F	P	P	P		
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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	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	E	G	E	F	E	E	F	E	E	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	F	G	F	F	E	N	P	P	P	P		
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Revolin 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	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	E	G	E	G	-	E	G	E	G	E	G	G	G	G	G	G	E	F	G	G	G	G		
Solstice	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	G	E	E	E	E	G	G	E	E	G	E	G	E	G	G	E	G	G	G	E	F	P	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	F	F	F	F	-	P	P	N	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	E	G	E	E	E	G	E	E	E	G	G	E	G	G	F	G	N	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	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	N			
Widematch	G	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	N				
Yukon	G	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	F	P	E	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	P	N			

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2,4-D ester and amine

<p>Brand Name: EPA Reg. #: Tenkoz Amine 4 42750-19-55467 Tenkoz Lo-Vol 6 42750-20-55467</p> <p>Rate/A: 1-4 pt (Amine 4) 0.66-2.66 pt (Lo-Vol 6)</p> <p>Application Timing: Fall, Preplant</p> <p>Spray Volume: min 10 gpa</p> <p>Rainfast: 1 hour</p> <p>S.O.A.: Growth Regulator (Group 4)</p> <p>P.P.E.: I.s. shirt, l. pants, c.r. gloves, c.r. apron, eyewear, shoes, socks</p> <p>R.E.I.: 12 hours (Lo-Vol 6) 48 hours (Amine 4)</p> <p>W. Notification: Oral</p> <p>S. Word: Danger (Amine 4) Caution (Lo-Vol 6)</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1-2 pt/100 gal) plus Jackhammer/Jackhammer Elite (1 qt/100 gal) <p>or</p> <ul style="list-style-type: none"> • AMS (2.5 lb/A) • Linkage (2 qt/100 gal) <p>or</p> <ul style="list-style-type: none"> • Last Chance Pro (1 qt/100 gal) plus AMS (1.5-2 lb/A) 	<p>Timing/Comments</p> <p>For amine and ester formulations, wait at least 30 days after the application and at least 1" rainfall or irrigation before planting.</p>
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AIM EC (carfentrazone)

<p>EPA Reg. #: 279-3241</p> <p>Rate/A: 0.5-2 fl oz</p> <p>Application Timing: Post-direct/hood, Defoliation</p> <p>Spray Volume: min 10 gpa</p> <p>Rainfast: 1 hour</p> <p>S.O.A.: PPO Inhibitor (Group 14)</p> <p>P.P.E.: I.s. shirt, l. pants, w.p. gloves, shoes, socks</p> <p>R.E.I.: 12 hours</p> <p>W. Notification: Oral</p> <p>S. Word: Caution</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Jackhammer/Jackhammer Elite (2 qt/100 gal) • Prefer 90 (1-2 pt/100 gal) <p>or</p> <ul style="list-style-type: none"> • Covrex* (0.5 gal/100 gal) plus AMS (2.5 lb/A) <ul style="list-style-type: none"> • 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. 	<p>Target Weeds</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">0.5-1 fl oz</td> <td style="width: 50%;">1.5-2 fl oz</td> </tr> <tr> <td>Controlled</td> <td>Controlled</td> </tr> <tr> <td>- lambsquarters</td> <td>- lambsquarters</td> </tr> <tr> <td>- black nightshade</td> <td>- black nightshade</td> </tr> <tr> <td>- pigweed</td> <td>- pigweed</td> </tr> <tr> <td>- velvetleaf</td> <td>- velvetleaf</td> </tr> <tr> <td></td> <td>- wild buckwheat</td> </tr> <tr> <td>Suppression</td> <td>- kochia</td> </tr> <tr> <td>- wild buckwheat</td> <td>- Russian thistle</td> </tr> <tr> <td>- kochia</td> <td></td> </tr> <tr> <td>- mustards</td> <td></td> </tr> <tr> <td>- Russian thistle</td> <td></td> </tr> <tr> <td colspan="2">Split applications needed for Canada thistle.</td> </tr> </table>	0.5-1 fl oz	1.5-2 fl oz	Controlled	Controlled	- lambsquarters	- lambsquarters	- black nightshade	- black nightshade	- pigweed	- pigweed	- velvetleaf	- velvetleaf		- wild buckwheat	Suppression	- kochia	- wild buckwheat	- Russian thistle	- kochia		- mustards		- Russian thistle		Split applications needed for Canada thistle.	
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*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

Assure II / Targa (quizalofop P-ethyl)

<p>EPA Reg. #: 352-541 / 33906-9-81880</p> <p>Rate/A: 4-10 fl oz</p> <p>Application Timing: Post-emerge broadcast</p> <p>Spray Volume: min 10 gpa</p> <p>Rainfast: 1 hour</p> <p>S.O.A.: ACC-ase Inhibitor (Group 1)</p> <p>P.P.E.: I.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks</p> <p>R.E.I.: 12 hours</p> <p>W. Notification: Oral</p> <p>S. Word: Danger</p> <p>P.H.I.: 80 days</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Covrex* (0.5-1 gal/100 gal) plus AMS*** (2-4 lb/A) <p>or</p> <ul style="list-style-type: none"> • Advatrol** (0.5 gal/100 gal) plus AMS (2-4 lb/A) <ul style="list-style-type: none"> • Maximum use rate is 18 fl oz/A per year. • Application intervals should be 7+ days apart. 	<p>Target Weeds</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 33%;"></td> <td style="width: 16.5%;">4 fl oz</td> <td style="width: 16.5%;">6 fl oz</td> <td style="width: 35%;">8 fl oz</td> </tr> <tr> <td>- barnyardgrass</td> <td>-</td> <td>-</td> <td>2-6"</td> </tr> <tr> <td>- field sandbur</td> <td>-</td> <td>-</td> <td>2-6"</td> </tr> <tr> <td>- crabgrass</td> <td>-</td> <td>-</td> <td>2-6"</td> </tr> <tr> <td>- giant foxtail</td> <td>-</td> <td>-</td> <td>2-8"</td> </tr> <tr> <td>- green foxtail</td> <td>-</td> <td>-</td> <td>2-4"</td> </tr> <tr> <td>- volunteer corn</td> <td>6-24"</td> <td>24"+</td> <td>-</td> </tr> <tr> <td>- wild proso millet</td> <td>-</td> <td>-</td> <td>2-6"</td> </tr> <tr> <td>- yellow foxtail</td> <td>-</td> <td>-</td> <td>2-4"</td> </tr> <tr> <td>- wild oat</td> <td>-</td> <td>-</td> <td>2-6"</td> </tr> <tr> <td></td> <td>9 fl oz</td> <td>10 fl oz</td> <td></td> </tr> <tr> <td>- woolly cupgrass</td> <td>2-4"</td> <td>-</td> <td></td> </tr> <tr> <td>- quackgrass</td> <td>-</td> <td>6-10"</td> <td></td> </tr> </table>		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"	
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*Crop Oil @ 1-2 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

BAPMA Dicamba (over the top applications on DT Cotton)

		Adjuvant(s)/Comments	Timing/Comments
Brand Name:	EPA Reg. #:	Refer to: www.engeniatankmix.com for a full listing of approved CHS adjuvants to be used with Engenia Herbicide.	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.
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.:	I.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		

Brake FX (Fluridone + Fluometuron)

		Adjuvant(s)/Comments
EPA Reg. #:	67690-74	<ul style="list-style-type: none"> • 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.
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.:	I.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	

Caparol 4L (prometryn)

		Adjuvant(s)/Comments	Target Weeds		
EPA Reg. #:	100-620	<ul style="list-style-type: none"> • 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. 	Caparol 4L applied according to directions will selectively control annual weeds in cotton. Weeds include, but are not limited to:		
Rate/A:	1.6-3.2 pt				
Application Timing:	At planting, post-direct/hood		Annual Grasses	Annual Broadleaf	
Spray Volume:	20 gpa		- crabgrass	- annual morning glory	
Rainfast:	NA		- foxtail	- black nightshade	
S.O.A.:	Photosystem II Inhibitor (Group 5)		- goosegrass	- pigweed	
P.P.E.:	I.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks		- junglerice	- smartweed	
R.E.I.:	12 hours				
W. Notification:	Oral				
S. Word:	Caution				
P.H.I.:	NA				

Clethodim products

		Adjuvant(s)/Comments	Target Weeds	6 fl oz	8 fl oz
Brand Name:	EPA Reg. #:	<ul style="list-style-type: none"> • Crop Oil* (1 qt/A) plus AMS*** (2.5–4 lb/A) or • Upland MSO** (1 qt/A) plus AMS*** (2.5–4 lb/A) 	<ul style="list-style-type: none"> – barnyardgrass – crabgrass – giant foxtail – green foxtail – quackgrass (2nd application may be needed) – volunteer cereals – volunteer corn – wild proso millet – woolly cupgrass – yellow foxtail 	6"	8"
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				

*Covrex @ 1 pt/A or Trophy Gold / Verium @ 1 qt/100 gal can be substituted for Crop Oil.

**Advatrol @ 1 pt/A can be substituted for Upland MSO.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Cobra (lactofen)

		Adjuvant(s)/Comments	Timing/Comments
EPA Reg. #:	59639-34	<ul style="list-style-type: none"> • Covrex* (0.5–1 pt/A) 	<p>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.</p> <p>Calibrate sprayer for banded applications. Multiple tank mixes are available with Cobra. See label for specific directions. Misapplication will result in crop injury.</p>
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		

*Crop Oil @ 1–2 pt/A or Verium @ 1 qt/100 gal can be substituted for Covrex.

Cotoran 4L (fluometuron)

		Adjuvant(s)/Comments	Target Weeds										
EPA Reg. #:	66222-181	<ul style="list-style-type: none"> • 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. 	<p>Cotoran 4L applied according to directions will selectively control annual weeds in cotton. Weeds include, but are not limited to:</p> <table border="0"> <thead> <tr> <th>Annual Grasses</th> <th>Annual Broadleaf</th> </tr> </thead> <tbody> <tr> <td>– barnyardgrass</td> <td>– cocklebur</td> </tr> <tr> <td>– fall panicum</td> <td>– pigweed</td> </tr> <tr> <td>– foxtail</td> <td>– prickly sida</td> </tr> <tr> <td>– signalgrass</td> <td>– lambsquarters</td> </tr> </tbody> </table>	Annual Grasses	Annual Broadleaf	– barnyardgrass	– cocklebur	– fall panicum	– pigweed	– foxtail	– prickly sida	– signalgrass	– lambsquarters
Annual Grasses	Annual Broadleaf												
– barnyardgrass	– cocklebur												
– fall panicum	– pigweed												
– foxtail	– prickly sida												
– signalgrass	– lambsquarters												
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												

DGA Dicamba (over the top applications on XtendFlex)

		Adjuvant(s)/Comments	Timing/Comments
Brand Name:	EPA Reg. #:	<p>Refer to: www.xtendimaxapplicationrequirements.com for a full listing of approved CHS adjuvants to be used with XtendiMax with Vapor Grip</p> <p>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.</p>	<p>ONLY for use with XTENDFLEX Technology.</p> <p>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.</p>
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.:	I.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		

Dicamba products

		Adjuvant(s)/Comments	Timing/Comments
Brand Name:	EPA Reg. #:	<ul style="list-style-type: none"> • Jackhammer/Jackhammer Elite (1 qt/100 gal) • Prefer 90 may be used (1 qt/100 gal) <p>or</p> <ul style="list-style-type: none"> • Last Chance 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. 	<p>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.</p>
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.:	I.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear		
R.E.I.:	24 hours		
W. Notification:	Oral		
S. Word:	Caution		

Diuron products

		Adjuvant(s)/Comments	Timing/Comments
Brand Name:	EPA Reg. #:	<ul style="list-style-type: none"> • Prefer 90 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. 	<p>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.</p> <p>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.</p>
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.:	I.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		

Enlist One (2,4, D Choline)

	Adjuvant(s)/Comments	Timing/Comments
EPA Reg. #: 62719-695	<ul style="list-style-type: none"> • Last Chance Pro (1 qt/100 gal) plus AMS (1.5–2 lb/A) Refer to www.enlisttankmix.com for approved CHS adjuvants.	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.
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.: I.s. shirt, I. pants		
R.E.I.: 48 Hours		
W. Notification: Oral		
S. Word: Warning		
P.H.I.: 30 days		

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

	Adjuvant(s)/Comments	Timing/Comments
EPA Reg. #: 62719-649	Refer to www.enlisttankmix.com for approved CHS adjuvants.	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.
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.: I.s. shirt, I. pants, w.p. gloves, shoes, socks, p. eyewear		
R.E.I.: 48 Hours		
W. Notification: Oral		
S. Word: Warning		

Fierce (flumioxazin + pyroxasulfone)

	Adjuvant(s)/Comments	Timing/Comments
EPA Reg. #: 59639-193	<ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) 	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.
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.: I.s. shirt, I. pants, c.r. gloves, shoes plus socks		
R.E.I.: 12 hours		
W. Notification: Oral		
S. Word: Caution		
P.H.I.: 60 Days		

FirstShot (thifensulfuron-methyl + tribenuron-methyl)

	Adjuvant(s)/Comments	Timing/Comments
EPA Reg. #: 352-755	• Linkage (1 gal/100 gal)	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.
Rate/A: 0.5–0.8 oz	or	
Application Timing: Preplant burndown	• Crop Oil (1 gal/100 gal) or Covrex (2 qt/100 gal)	
Spray Volume: 5–20 gpa	plus	
Rainfast: 4 hours	AMS* (2–4 lb/A)	
S.O.A.: ALS Enzyme Inhibitors (Group 2)	or	
P.P.E.: I.s. shirt, l. pants, shoes, socks, c.r. gloves	• Upland MSO (1 gal/100 gal)	
R.E.I.: 12 hours	or	
W. Notification: Oral	• Advatrol (2 qt/100 gal)	
S. Word: Caution	plus	
	AMS* (2–4 lb/A)	

*Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Fomesafen products

	Adjuvant(s)/Comments	Timing/Comments
Brand Name: Reflex	• Crop Oil (1 gal/100 gal)	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.
EPA Reg. #: 100-993	or	
Preplant Rate/A: 1–1.5 pt*	• Covrex (2 qt/100 gal)	
Post-Directed Rate/A: 1 pt**	plus	
Spray Volume: 10–20 gpa	AMS*** (10 lb/100 gal)	
Rainfast: 1 hour	or	
S.O.A.: PPO Inhibitor (Group 14)	• Upland MSO (1 gal/100 gal)	
P.P.E.: coveralls over I.s. shirt, l. pants, c.r. gloves, c.r. footwear, socks, apron	or	
R.E.I.: 24 hours	• Advatrol (2 pt/100 gal)	
W. Notification: Oral	plus	
S. Word: Warning	AMS*** (10 lb/100 gal)	
P.H.I.: 70 days		

*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.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Fusilade DX (fluazifop-P-butyl)

	Adjuvant(s)/Comments	Target Weeds	8 fl oz	12 fl oz
EPA Reg. #: 100-1070	• Advatrol* (0.75–1 pt/A)	– barnyardgrass	-	1–2"
Rate/A: 6–12 fl oz	or	– crabgrass	-	1–2"
Application Timing: Post	• Covrex** (1 pt/A)	– giant foxtail	-	2–6"
Spray Volume: 5–40 gpa	• Add AMS*** when weeds are stressed.	– seedling johnsongrass	2–4"	-
Rainfast: 1 hour	• Use the surfactant required by the broadleaf herbicide tank mix.	– volunteer milo	-	2–4"
S.O.A.: ACC-ase Inhibitor (Group 1)		– volunteer cereals	-	2–4"
P.P.E.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear, apron		– volunteer corn	-	12–18"
R.E.I.: 12 hours		– fall panicum	-	2–6"
W. Notification: Oral		– Texas panicum	-	2–8"
S. Word: Caution				
P.H.I.: 90 days				

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.

*Upland MSO @ 1.5–2 pt/A or Verium @ 1 qt/100 gal can be substituted for Advatrol.

**Crop Oil @ 1 qt/A or Verium @ 1 qt/100 gal can be substituted for Covrex.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Fusion (fluazifop-P-butyl + fenoxyprop-P-ethyl)

	Adjuvant(s)/Comments	Target Weeds	8 fl oz	12 fl oz
EPA Reg. #: 100-1059	<ul style="list-style-type: none"> • Advatrol* (0.75-1 pt/A) plus AMS*** (1-4 lb/A) or • Covrex** (1 pt/A) plus AMS*** (1-4 lb/A) • Use the surfactant required by the broadleaf herbicide tank mix. 	- barnyardgrass	-	1-2"
Rate/A: 4-12 fl oz		- crabgrass	-	1-2"
Application Timing: Post		- seedling johnsongrass	2-4"	-
Spray Volume: 5-40 gpa		- fall panicum	-	2-6"
Rainfast: 1 hour		- Texas panicum	-	8"
S.O.A.: ACC-ase Inhibitor (Group 1)		- volunteer corn	-	12-18"
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks		- volunteer cereals	-	2-4"
R.E.I.: 24 hours				
W. Notification: Oral				
S. Word: Caution				
P.H.I.: 90 days				
		Apply 24 fl oz/A max per growing season. Do not apply after boll set.		

*Upland MSO @ 1.5-2 pt/A or Verium @ 1 qt/100 gal can be substituted for Advatrol.

**Crop Oil @ 1 qt/A or Verium @ 1 qt/100 gal can be substituted for Covrex.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Glufosinate

	Adjuvant(s)/Comments	Target Weeds	32 fl oz
Brand Name: EPA Reg. #:	<ul style="list-style-type: none"> • Last Chance Pro plus AMS (1.5-3.0 lb/A) or • Jackhammer (3 qt/100) or • Encloax (3.5 pt/A) 	- wild buckwheat	6"
Liberty 280 SL 264-829		- cocklebur	6"
Autonomy 7969-448-55467		- kochia	4"
Cheetah 71368-112		- morning glory	6"
Noventa 7696-448		- wild mustard	4"
Interline 70506-310		- nightshade	6"
Spray Volume: 15-20 gpa	- pigweed species	3"	
Rainfast: 4 hours	- ragweed species	6"	
M.O.A.: Glutamine Synthase Inhibitor	- velvetleaf	6"	
P.P.E.: l.s. shirt, l. pants, shoes, socks	- waterhemp	3"	
R.E.I.: 12 hours	- barnyardgrass	4"	
W. Notification: Oral	- foxtail species	3"	
S. Word: Warning	- wild oat	3"	
	- volunteer corn	6"	
	- crabgrass	3"	

Glufosinate - High Load

	Adjuvant(s)/Comments	Target Weeds	16.3 fl oz
Brand Name: EPA Reg. #:	<ul style="list-style-type: none"> • Last Chance Pro plus AMS (1.5-3.0 lb/A) or • Jackhammer (3 qt/100) or • Encloax (3.5 pt/A) 	- wild buckwheat	6"
Surmise 5 42750-401		- cocklebur	6"
Spray Volume: 15-20 gpa		- kochia	4"
Rainfast: 4 hours		- morning glory	6"
M.O.A.: Glutamine Synthase Inhibitor		- wild mustard	4"
P.P.E.: l.s. shirt, l. pants, shoes, socks		- nightshade	6"
R.E.I.: 12 hours	- pigweed species	3"	
W. Notification: Oral	- ragweed species	6"	
S. Word: Warning	- velvetleaf	6"	
	- waterhemp	3"	
	- barnyardgrass	4"	
	- foxtail species	3"	
	- wild oat	3"	
	- volunteer corn	6"	
	- crabgrass	3"	

Glyphosate

		# A.E.	=0.75 AE	Surfactant/Comments
Brand Name:	EPA Reg. #:			
Buccaneer Plus	55467-9	3.00	32.0	• Last Chance Pro (1 qt/100) plus AMS (8.5-17 lb/100)
Gly Star Original	42750-60	3.00	32.0	or
Gly Star Plus	42750-61	3.00	32.0	• Jackhammer/Jackhammer Elite (2-3 qt/100)
Durango DMA	62719-556	4.00	24.0	or
Buccaneer 5 Extra	55467-15	4.00	24.0	• Encloax (2.5-5 gal/100)
Gly Star 5 Extra	42750-59	4.00	24.0	or
Gly Star K-Plus	42750-122	4.50	21.3	• Prefer 90 (1 qt/100) plus AMS (8.5-17 lb/100)
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.:	I.s. shirt, l. pants, shoes, socks			
R.E.I.:	12 hours			
W. Notification:	Oral			
S. Word:	Caution			

MSMA

Target Weeds

EPA Reg. #:	19713-42	For control of many grasses and broadleaves including: barnyardgrass, cocklebur, dayflower, johnsongrass, morning glory, nutsedge, pigweed, and sicklepod.
Postemergence Rate/A:	2.5 pt/A over the top	Only one application at 2 lb/A per season is allowed, except in a salvage situation where a second app can be made.
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	

Paraquat

<p>Brand Name: EPA Reg. #:</p> <p>Parazone 3 SL 5481-615</p> <p>Quik-Quat 19713-617</p> <p>Helmquat 3 SL 74530-48</p> <p>Paraquat Concentrate 82542-3</p> <p>Gramoxone 100-1652</p> <p>Spray Volume: 10–20 gpa</p> <p>Rainfast: 30 minutes</p> <p>M.O.A.: Photosystem 1 inhibitor (22)</p> <p>P.P.E.: I.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</p> <p>R.E.I.: 24 hours</p> <p>W. Notification: Oral</p> <p>S. Word: Danger Poison</p> <p>P.H.I.: 3 days when used for late-season desiccation or suppression of regrowth</p>	<p>Adjuvant Rec</p> <ul style="list-style-type: none"> • Last Chance Pro (1 qt/100) or • Prefer 90 (1 qt/100) or • Jackhammer (2 qt/100) or • Covrex/Advatrol (2 qt/100) or • Encloax (2.5 gal/100) 	<p>Timing/Comments</p> <p>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.</p>
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Pendimethalin

<p>Brand Name: EPA Reg. #:</p> <p>Prowl H₂O 241-418 (3.8 lb/gal a.i.)</p> <p>Acumen 241-337-55467 (3.3 lb/gal a.i.)</p> <p>Rate/A: 1–4 pt (Prowl H₂O) 1.2–4.8 pt (Acumen)</p> <p>Application Timing: PPI, pre, post, at planting, post-direct</p> <p>Spray Volume: 5–20 gpa</p> <p>Rainfast: 1 hour</p> <p>S.O.A.: Mitotic Inhibitor (Group 3)</p> <p>P.P.E.: I.s. shirt, l. pants, c.r. gloves, shoes, socks</p> <p>R.E.I.: allow spray to dry</p> <p>W. Notification: Oral</p> <p>S. Word: Caution</p> <p>P.H.I.: 60 days</p>	<p>Comments</p> <ul style="list-style-type: none"> • 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) 	<p>Timing/Comments</p> <p>Pendimethalin applied according to directions will selectively control annual weeds in cotton. Weeds include, but are not limited to:</p> <table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top;"> <p>Annual Grasses</p> <ul style="list-style-type: none"> – barnyardgrass – fall panicum – foxtail – field sandbur </td> <td style="vertical-align: top;"> <p>Annual Broadleaf</p> <ul style="list-style-type: none"> – common lambsquarters – Palmer amaranth – prickly sida – waterhemp species </td> </tr> </table>	<p>Annual Grasses</p> <ul style="list-style-type: none"> – barnyardgrass – fall panicum – foxtail – field sandbur 	<p>Annual Broadleaf</p> <ul style="list-style-type: none"> – common lambsquarters – Palmer amaranth – prickly sida – waterhemp species
<p>Annual Grasses</p> <ul style="list-style-type: none"> – barnyardgrass – fall panicum – foxtail – field sandbur 	<p>Annual Broadleaf</p> <ul style="list-style-type: none"> – 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)

		Adjuvant(s)/Comments	Target Weeds	0.5 pt	1 pt	1.5 pt
EPA Reg. #:	7969-58-51036	<ul style="list-style-type: none"> • Crop Oil* (1 qt/A) plus AMS*** (2.5 lb/A) or • Upland MSO** (1.5-2 pt/A) plus AMS*** (2.5 lb/A) • Use the surfactant required by the broadleaf herbicide for the tank mix. 	- barnyardgrass	-	8"	-
Rate/A:	0.5-1.5 pt		- crabgrass	-	6"	-
Application Timing:	Post		- field sandbur	-	-	3"
Spray Volume:	5-20 gpa		- foxtails	-	8"	-
Rainfast:	1 hour		- volunteer cereals	-	-	4"
S.O.A.:	ACC-ase Inhibitor (Group 1)		- volunteer corn	-	20"	-
P.P.E.:	coveralls, l.s. shirt, l. pants, c.r. gloves, c.r. footwear, head gear, eyewear, shoes, socks, apron		- wild proso millet	10"	-	-
R.E.I.:	12 hours		- wild oat	-	4"	-
W. Notification:	Oral		- woolly cupgrass	-	8"	-
S. Word:	Warning					

*Covrex @ 2 pt/A or Trophy Gold/Verium @ 1 qt/100 gal can be substituted for Crop Oil.

**Advatrol @ 1 pt/A can be substituted for Upland MSO.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

S-metolachlor

		Comments	Target Weeds
			Partial List of Weeds Controlled
			Grasses
			Broadleaf
Brand Name:	EPA Reg. #:	<ul style="list-style-type: none"> • 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. 	- barnyardgrass
Dual Magnum/Brawl	100-816/100-816-55467		- large crabgrass
Dual II Magnum/Brawl II	100-818/100-818-55467		- smooth crabgrass
Rate/A:	1-1.33 pt		- green foxtail
Application Timing:	PPI, pre		- fall panicum
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		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.
S. Word:	Caution		

Select Max (clethodim)

	Adjuvant(s)/Comments	Target Weeds	9 fl oz	12 fl oz
EPA Reg. #: 59639-132	<ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) plus AMS**** (2.5-4 lb/A) or • Covrex** (1 pt/A) or • Advatrol*** (1 pt/A) plus AMS**** (2.5-4 lb/A) • Max 32 fl oz/A per application. • Max 64 fl oz/A per season. 	- barnyardgrass	6"	8"
Rate/A: 9-32 fl oz*		- crabgrass	2"	6"
Application Timing: Post		- giant foxtail	6"	12"
Spray Volume: 5-40 gpa		- green foxtail	6"	8"
Rainfast: 1 hour		- quackgrass	-	4"-12"
S.O.A.: ACC-ase Inhibitor (Group 1)		(second app. may be needed)		
P.P.E.: l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks		- volunteer cereals	6"	8"
R.E.I.: 24 hours		- volunteer corn	12"	18"
W. Notification: Oral		- wild proso millet	8"	10"
S. Word: Caution		- woolly cupgrass	6"	8"
P.H.I.: 60 days		- 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 Verium @ 1 qt/100 gal can be substituted for Covrex.

***Upland MSO @ 1 qt/A or Verium @ 1 qt/100 gal can be substituted for Advatrol.

****Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Sequence (glyphosate + S-metolachlor)

	Adjuvant(s)/Comments	Timing/Comments
EPA Reg. #: 100-1185	<ul style="list-style-type: none"> • 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. 	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.
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		

*Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Sharpen (saflufenacil)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • For optimum activity with Sharpen, an adjuvant system must be used. • Upland MSO* (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. 	<p>Timing/Comments</p> <p>Use Sharpen as an early preplant burndown treatment.</p> <p>Wait to plant cotton until at least 42 days and an accumulation of 1" of rainfall or irrigation.</p> <p>Do not apply more than a maximum cumulative amount of 2 fl oz/A of Sharpen per cropping season.</p> <p>Potential for carryover exists in arid climates when using maximum rates of Sharpen.</p> <p>Please consult your local supplier or BASF representative when using Sharpen in arid climates for cotton production.</p>
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*MSO must contain at least 60% methylated seed oil or poor performance is possible.

Staple LX (pyrithiobac sodium)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100 gal) or • Prefer 90 (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 traired cotton. Consult label for directions. 	<p>Timing/Comments</p> <p>Partial List of Weeds Controlled</p> <table border="0" style="width: 100%;"> <tr> <td>– cocklebur</td> <td>– nightshade species</td> </tr> <tr> <td>– common sunflower</td> <td>– common waterhemp</td> </tr> <tr> <td>– devils claw</td> <td>– Russian thistle</td> </tr> <tr> <td>– morning glory species</td> <td>– smell melon</td> </tr> <tr> <td>– pigweed species</td> <td>– velvetleaf</td> </tr> </table> <p>Carryover restrictions exist with Staple LX. Please consult local supplier and refer to herbicide label for specific restrictions.</p>	– cocklebur	– nightshade species	– common sunflower	– common waterhemp	– devils claw	– Russian thistle	– morning glory species	– smell melon	– pigweed species	– velvetleaf
– cocklebur	– nightshade species											
– common sunflower	– common waterhemp											
– devils claw	– Russian thistle											
– morning glory species	– smell melon											
– pigweed species	– velvetleaf											

Trifluralin

<p>Brand Name: EPA Reg. #: Treflan 4D 68156-4 Triflurex HFP 66222-46 Trifluralin 11773-17 (Cornbelt Brand) Multiple Brands</p> <p>Rate/A: Spring applied: 1–2 pt Fall applied: 1.5–2.5 pt</p> <p>Application Timing: PPI, pre, post-direct</p> <p>Spray Volume: 5–40 gpa</p> <p>Rainfast: NA</p> <p>S.O.A.: Mitotic Inhibitor (Group 3)</p> <p>P.P.E.: I.s. shirt, l. pants, eyewear, c.r. gloves, shoes, socks</p> <p>R.E.I.: 12 hours</p> <p>W. Notification: Oral</p> <p>S. Word: Caution (Treflan, Triflurex HFP) Warning (Trifluralin)</p> <p>P.H.I.: 60 days</p>	<p>Comments</p> <ul style="list-style-type: none"> • 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. 	<p>Timing/Comments</p> <p>Trifluralin applied according to directions will selectively control annual weeds in cotton.</p> <table border="0"> <tr> <td style="vertical-align: top;"> <p>Annual Grasses</p> <ul style="list-style-type: none"> – barnyardgrass – fall panicum – foxtail – field sandbur </td> <td style="vertical-align: top;"> <p>Annual Broadleaf</p> <ul style="list-style-type: none"> – common lambsquarters – henbit – kochia – Russian thistle </td> </tr> </table>	<p>Annual Grasses</p> <ul style="list-style-type: none"> – barnyardgrass – fall panicum – foxtail – field sandbur 	<p>Annual Broadleaf</p> <ul style="list-style-type: none"> – common lambsquarters – henbit – kochia – Russian thistle
<p>Annual Grasses</p> <ul style="list-style-type: none"> – barnyardgrass – fall panicum – foxtail – field sandbur 	<p>Annual Broadleaf</p> <ul style="list-style-type: none"> – common lambsquarters – henbit – kochia – Russian thistle 			

Valor SX (flumioxazin)

<p>EPA Reg. #: 59639-99</p> <p>Postemergence Rate/A: 2.0 oz/A</p> <p>Application Timing: Postemergence or Directed</p> <p>Spray Volume: 15–30 gpa</p> <p>Rainfast: 1 hour</p> <p>S.O.A.: PPO Inhibitor (Group 14)</p> <p>P.P.E.: coveralls over, I.s. shirt, l. pants, c.r. gloves, c.r. footwear, socks</p> <p>R.E.I.: 12 hours</p> <p>W. Notification: Oral</p> <p>S. Word: Caution</p> <p>P.H.I.: 60 days</p>	<p>Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) 	<p>Timing/Comments</p> <p>Addition of MSMA, glyphosate, or glufosinate can assist in weed control. Good residual control of pigweed and morning glory.</p> <p>Apply under conditions favoring active weed growth, to cotton with at least 4 inches of bark.</p>
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Warrant (acetochlor)

<p>EPA Reg. #: 524-591</p> <p>Rate/A: 1.25–2 qt</p> <p>Application Timing: Pre, Post</p> <p>Spray Volume: 10+ gpa</p> <p>Rainfast: NA</p> <p>S.O.A.: Very Long-chain Fatty Acid Inhibitors (Group 15)</p> <p>P.P.E.: I.s. shirt, l. pants, c.r. gloves, shoes, socks</p> <p>R.E.I.: 12 hours</p> <p>W. Notification: Oral</p> <p>S. Word: Caution</p>	<p>Comments</p> <ul style="list-style-type: none"> • 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. 	<p>Timing/Comments</p> <p>Partial List of Weeds Controlled</p> <table border="0"> <tr> <td style="vertical-align: top;"> <p>Grasses</p> <ul style="list-style-type: none"> – barnyardgrass – crabgrass – foxtail species – fall panicum – witchgrass </td> <td style="vertical-align: top;"> <p>Broadleaf</p> <ul style="list-style-type: none"> – carpetwood – pigweed species – purslane – lambsquarters – smartweed </td> </tr> </table>	<p>Grasses</p> <ul style="list-style-type: none"> – barnyardgrass – crabgrass – foxtail species – fall panicum – witchgrass 	<p>Broadleaf</p> <ul style="list-style-type: none"> – carpetwood – pigweed species – purslane – lambsquarters – smartweed
<p>Grasses</p> <ul style="list-style-type: none"> – barnyardgrass – crabgrass – foxtail species – fall panicum – witchgrass 	<p>Broadleaf</p> <ul style="list-style-type: none"> – 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 Cygin.

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 and 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

MICRO PAK

Micro Pak is a mix of nitrogen 4%, potash 5%, sulfur 3%, boron 0.5%, manganese 1%, and zinc 4.5%. Micro Pak is a foliar fertilizer that is recommended for many crops including food & fiber crops such as cotton. Micro Pak 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. Micro Pak has been shown to be compatible with most pesticides and liquid fertilizers. Conducting a jar test is always recommended. Micro Pak 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 micronutrient 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

PARALIGN®

Paralign 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, Paralign 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.

CYGIN™

Cygin is a PGR that aids in bloom retention as pollination takes place during early bloom period.

Levesol Zn & Paralign 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	Prefer 90	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	Prefer 90 Upland MSO 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 Prefer 90 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	Prefer 90	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 Upland MSO Prefer 90	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	Prefer 90	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.

Cotton // Foliar Insecticide Products

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	Prefer 90 Verium	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	Upland MSO 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	Verium	14	Max 11.4 oz/A per season
stinkbug, lygus, bollworm	Bifenthrin (3)	Brigade 2 EC*	1.3–6.4 oz/A	Verium	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	Verium	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	Verium	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	Verium	14	Max 11.4 oz/A per season Max 3.8 oz/A per application
thrips, c.fleahopper, lygus, cotton aphid, plant bugs	Diclotophos (1B)	Bidrin 8*	1.6–3.2 oz/A (early season) 4.0–8.0 oz/A (late season)	Verium	30	Only ONE Early Season application Max 16.0 oz/A during late season
cotton aphid, bollworm, pink bollworm, plant bug	Diclotophos + bifenthrin	Bidrin XP II*	8.0–12.8 oz/A	Verium	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	Verium	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	Verium	21	Max 0.5 lb ai/A per season Min 2 gpa air Min 4 gpa ground
c.fleahopper, lygus, cotton aphid	Fonicamid (9C)	Carbine 50 WG	1.4–2.8 oz/A	Verium	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	Verium	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	Prefer 90 Crop Oil Upland MSO	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 Prefer 90 Upland MSO Verium	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	Verium	15	Max 6.0 pt/A per season Min 2 gpa air
cabbage looper, beet armyworm	Methoxyfenozide (18)	Intrepid 2F	4–10 oz/A	Verium	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	Verium	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)	Verium	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 Upland MSO	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	Verium	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	Verium	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)	Verium	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	Verium	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	Last Chance Pro	24	5	65	Excellent	Excellent	Excellent	None
Ginstar, Cut Out, Adios	Diruron Thidiazuron	6.4-16 oz	16 oz	Last Chance Pro	12	5	60	Excellent	Excellent	Excellent	None
Folex 6 Def 6	Sss T Phosph	16-24 oz	24 oz	Last Chance Pro	1	7	60	Excellent	Fair	Poor	None
Aim	Carfentazone	0.5-1.6 oz	3.2 oz	Last Chance Pro	8	7	55	Excellent	Excellent	Poor	None
Display	Fluthiacet Carfentrazone	1 oz	2 oz	Last Chance Pro	8	7	55	Excellent	Excellent	Poor	None
ET ETX	Pyraflufen	1.5-2.7 oz	5.5 oz	Last Chance Pro	1	7	55	Excellent	Excellent	Poor	None
Sharpen	Salflufenacil	2 oz	2 oz	Last Chance Pro	1	5	55	Excellent	Excellent	Poor	None
Ethephon 6, Prep, Super Bowl	Ethephon	21-42 oz	42 oz	Last Chance Pro	6	7	60	Fair	Poor	Poor	Excellent
Finish 6	Ethephon, Cyclanilide	21-42 oz	42 oz	Last Chance Pro	6	7	60	Excellent	Poor	Fair	Excellent
Glyphos Rdup	Glyphosate	11-44 oz	44 oz	Last Chance Pro	4	7	55	Fair	Fair	Excellent	None
Desiccants											
Helmquat 3L	Paraquat	4-32 oz	32 oz	Last Chance Pro	1	3	55	Fair	Excellent	Poor	Fair
Defol 5	Sodium Chlorate	4.5 Lbs AI	9 lb	Last Chance 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 Last Chance Pro 4-5 oz/A & 12-15 gpa.
- 2nd Paraquat 2 pts/A + Aim 1 oz/A + Last Chance 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 (<i>Corynespora cassiicola</i>). Also use in-furrow at 6 oz/A for seedling diseases caused by <i>Pythium</i> and <i>Rhizoctonia</i> 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 <i>Pythium</i> and <i>Rhizoctonia</i> 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 <i>Pythium</i> and <i>Rhizoctonia</i> 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 <i>Pythium</i> and <i>Rhizoctonia</i> 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 <i>Pythium</i> and <i>Rhizoctonia</i> 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 + Imdachloprid)	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 Verium at 1 qt/100 gal water for foliar fungicides can aid in coverage and control.

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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

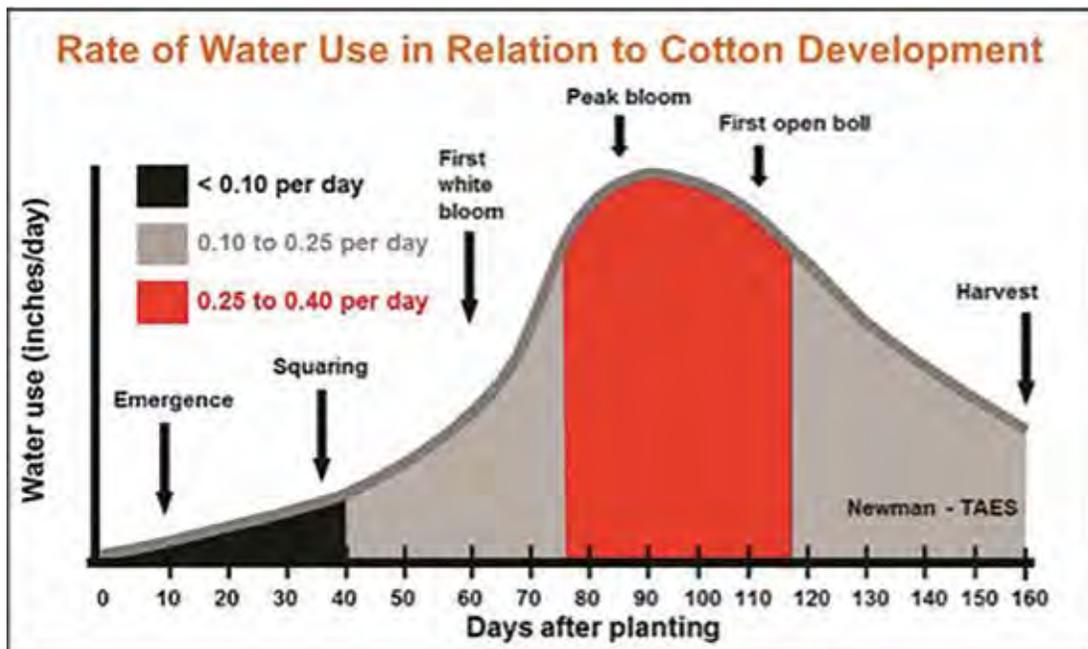


Figure 1. The seasonal water demand curve of cotton.

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
Micro Pak	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
Paralign	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



Cotton // Insecticide Miticide Options

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 12-2.5 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 Advatrol 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 Advatrol @ 0.5% v/v or Verium @ 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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Desiccating Field Pea and Preventing Harvest Loss	109
Dry Edible Bean Fungicides	110



Assure II (quizalofop P-ethyl)

	Labeled Crops	Target Weeds	4 fl oz	6 fl oz	8 fl oz
EPA Reg. #: 352-541	• Dry bean, Field pea, Lentil	- barnyardgrass	-	-	2-6"
Rate/A: 5-12 fl oz		- field sandbur	-	-	2-6"
Spray Volume: min 10 gpa	Adjuvant(s)/Comments	- crabgrass	-	-	2-6"
Rainfast: 1 hour	• Covrex* (2 qt/100 gal)	- giant foxtail	-	-	2-8"
M.O.A.: ACC-ase Inhibitor	plus	- green foxtail	-	-	2-4"
P.P.E.: l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks	AMS*** (2-4 lb/A)	- volunteer corn	6-24"	24"+	-
R.E.I.: 12 hours	or	- wild proso millet	-	-	2-6"
W. Notification: Oral	• Advatrol** (2 qt/100 gal)	- yellow foxtail	-	-	2-4"
S. Word: Danger	plus	- wild oat	-	-	2-6"
	AMS*** (2-4 lb/A)	- woolly cupgrass		2-4" @ 9 oz	
		- quackgrass		6-10" @ 10 oz	

*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal.

**Upland MSO @ 1 gal/100 gal or Verium @ 1 qt/100 gal.

***Jackhammer/Jackhammer Elite @ 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 60 day PHI.

Basagran (bentazon)

	Labeled Crops	Target Weeds	1 pt	1.5 pt	2 pt
EPA Reg. #: 7969-45-66330	• Dry bean, Field pea	- cocklebur	4"	6"	10"
Rate/A: 1-2 pt		- lambsquarters	1"	1.5"	2"
Spray Volume: 10-20 gpa	Adjuvant(s)/Comments	- common ragweed	-	-	3"
Rainfast: 1 hour	• Prefer 90 (1 qt/100 gal)	- giant ragweed	-	-	6"
M.O.A.: Photosystem II Inhibitor	or	- annual smartweed	4"	6"	10"
P.P.E.: l.s. shirt, l. pants, w.p. gloves, shoes, socks	• Verium (1 qt/100 gal)	- velvetleaf	2"	2"	5"
R.E.I.: 48 hours	or	- venice mallow	2"	2"	4"
W. Notification: Oral	• Linkage (1 gal/100 gal)	- wild buckwheat	-	3"	5"
S. Word: Caution	• Use AMS for velvetleaf control.	- wild mustard	2"	4"	8"
	• May use Crop Oil in dry bean.	- wild sunflower	3	5"	8"
		- woolly cupgrass		2-4" @ 9 oz	
		- quackgrass		6-10" @ 10 oz	

Timing/Comments

Dry bean: apply after first trifoliolate.

Field pea: apply at 3 leaf pairs or more.

Split applications needed for C. Thistle.

Beyond (imazamox)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Clearfield lentil <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) or • Linkage (1 gal/100 gal) or • Advatrol** (0.75-1 pt/A) plus AMS*** (12-15 lb/100 gal) or • Covrex* (1 pt/A) plus AMS*** (12-15 lb/100 gal) 	<p>Target Weeds</p> <p><u>4" or less</u></p> <ul style="list-style-type: none"> - black nightshade - common cocklebur - foxtail - giant ragweed - lambsquarters - pigweed - sunflower - volunteer corn - venice mallow <p>Timing/Comments</p> <p>Apply to 2 leaf-before flower bud formation.</p>
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*Crop Oil @ 2 pt/100 gal or Verium @ 1 qt/100 gal.

**Upland MSO @ 2 pt/100 gal or Verium @ 1 qt/100 gal.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Beyond Xtra (imazamox)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Clearfield lentil, Dry bean, Field pea <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) or • Linkage (1 gal/100 gal) or • Advatrol** (0.75-1 pt/A) plus AMS*** (12-15 lb/100 gal) or • Covrex* (1 pt/A) plus AMS*** (12-15 lb/100 gal) 	<p>Target Weeds</p> <p><u>4" or less</u></p> <ul style="list-style-type: none"> - black nightshade - common cocklebur - foxtail - giant ragweed - lambsquarters - pigweed - sunflower - volunteer corn - venice mallow <p>Timing/Comments</p> <p>Apply to 2 leaf-before flower bud formation.</p>
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*Crop Oil @ 2 pt/100 gal or Verium @ 1 qt/100 gal.

**Upland MSO @ 2 pt/100 gal or Verium @ 1 qt/100 gal.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Clethodim Products

	Brand Name	EPA Reg. #	Labeled Crops	Target Weeds	Clethodim 2E,		
					Arrow, Volunteer	Shadow 3EC	
					6 fl oz	8 fl oz	5.33 fl oz
	Arrow	66222-60	• Dry bean, Field pea, Lentil	- barnyardgrass	6"	8"	8"
	Select Max	59639-132		- crabgrass	2"	6"	6"
	Shadow 3EC	66330-414	Adjuvant(s)/Comments	- giant foxtail	6"	12"	12"
	Volunteer	59639-3-55467		- green foxtail	6"	8"	8"
Rate/A:	6-8 fl oz		• Covrex* (1 pt/A)	- quackgrass	-	4-12"	4-12"
	9-16 fl oz		plus	<i>2nd application may be needed</i>			
	4-5.33 fl oz		AMS*** (2.5-4 lb/A)				
	6-16 fl oz		or	- volunteer cereals	6"	8"	8"
Spray Volume:	5-40 gpa		• Advatrol** (1 pt/A)	- volunteer corn	12"	18"	18"
Rainfast:	1 hour		plus	- wild proso millet	8"	10"	10"
M.O.A.:	ACC-ase Inhibitor		AMS*** (2.5-4 lb/A)	- woolly cupgrass	6"	8"	8"
P.P.E.:	I.s. shirt, I. pants, c.r. gloves, p. eyewear, shoes, socks			- yellow foxtail	6"	8"	8"
R.E.I.:	24 hours			- cheat	6"	6"	6"
W. Notification:	Oral			- downy brome	6"	6"	6"
S. Word:	Caution						
				Timing/Comments			
				Apply up to 30 day PHI.			

*Crop Oil @ 1.5-2 pt/A or Verium @ 1 qt/100 gal.

**Upland MSO @ 1.5-2 pt/A or Verium @ 1 qt/100 gal.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Glyphosate

	Brand Name	EPA Reg. #	# A.E.	=0.75 AE	Surfactant/Comments
	Buccaneer Plus	55467-9	3.00	32.0	• Last Chance Pro (1 qt/100)
	Gly Star Original	42750-60	3.00	32.0	plus
	Gly Star Plus	42750-61	3.00	32.0	AMS (8.5-17 lb/100)
	Durango DMA	62719-556	4.00	24.0	or
	Buccaneer 5 Extra	55467-15	4.00	24.0	• Jackhammer/Jackhammer Elite
	Gly Star 5 Extra	42750-59	4.00	24.0	(2-3 qt/100)
	Gly Star K-Plus	42750-122	4.50	21.3	or
	Buccaneer K	42750-122-55467	4.50	21.3	• Encloax (2.5-5 gal/100)
	Roundup RT 3	524-544	4.50	21.3	or
	Roundup	524-659	4.80	19.7	• Prefer 90 (1 qt/100)
	PowerMax 3				plus
Rate/A:	Variable				AMS (8.5-17 lb/100)
Spray Volume:	5-20 gpa				
Rainfast:	1-6 hours				
M.O.A.:	EPSP Inhibitor				
P.P.E.:	I.s. shirt, I. pants, shoes, socks				
R.E.I.:	12 hours				
W. Notification:	Oral				
S. Word:	Caution				

Metribuzin 75 DF (metribuzin)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Lentil, Field pea 	<p>Target Weeds</p> <p>Suppression of lambsquarters, henbit, chickweed, and mustard. Control of kochia, Russian thistle, venice mallow.</p>
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Permit (halosulfuron)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Dry bean <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1-2 qt/100 gal) plus AMS (2-4 lb/A) or • Linkage (1 gal/100 gal) or • Covrex* (2 qt/100 gal) plus AMS (2-4 lb/A) 	<p>Target Weeds</p> <p><u>6" or less</u></p> <ul style="list-style-type: none"> - cocklebur - wild mustard - common ragweed - sunflower - venice mallow - velvetleaf - giant ragweed <p>Timing/Comments</p> <p>Apply 1st trifoliolate and prior to flowering.</p>
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*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal.

Poast (sethoxydim)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Dry bean, Field pea, Lentil <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Advatrol** (0.75-1 pt/A) plus AMS*** (2.5 lb/A) or • Covrex* (1 pt/A) plus AMS*** (2.5 lb/A) • Use the surfactant required by the broadleaf herbicide. 	<p>Target Weeds</p> <table border="0"> <tr> <td>- barnyardgrass</td> <td>-</td> <td>8"</td> <td>-</td> </tr> <tr> <td>- crabgrass</td> <td>-</td> <td>6"</td> <td>-</td> </tr> <tr> <td>- field sandbur</td> <td>-</td> <td>-</td> <td>3"</td> </tr> <tr> <td>- foxtail</td> <td>-</td> <td>8"</td> <td>-</td> </tr> <tr> <td>- volunteer cereals</td> <td>-</td> <td>-</td> <td>4"</td> </tr> <tr> <td>- volunteer corn</td> <td>-</td> <td>20"</td> <td>-</td> </tr> <tr> <td>- wild proso millet</td> <td>10"</td> <td>-</td> <td>-</td> </tr> <tr> <td>- wild oat</td> <td>-</td> <td>4"</td> <td>-</td> </tr> <tr> <td>- woolly cupgrass</td> <td>-</td> <td>8"</td> <td>-</td> </tr> </table>	- 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"	-	<table border="0"> <tr> <td></td> <td>0.5 pt</td> <td>1 pt</td> <td>1.5 pt</td> </tr> </table>		0.5 pt	1 pt	1.5 pt
- barnyardgrass	-	8"	-																																								
- crabgrass	-	6"	-																																								
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*Crop Oil @ 1 qt/A or Verium @ 1 qt/100 gal.

**Upland MSO @ 1 qt/A or Verium @ 1 qt/100 gal.

***Jackhammer/Jackhammer Elite @ 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

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Labeled Crops

- Dry bean, Field pea, Lentil

Adjuvant(s)/Comments

- **Prefer 90 (1 qt/100 gal) plus AMS*** (12-15 lb/100 gal)**
- or
- **Verium (1 qt/100 gal)**
- or
- **Linkage (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 trifoliolate 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

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Labeled Crops

- Dry bean, Field pea

Adjuvant(s)/Comments

- **Prefer 90 (1 qt/100 gal) plus AMS*** (12-15 lb/100 gal)**
- or
- **Linkage (1 gal/100 gal)**
- or
- **Verium (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 trifoliolate 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

Labeled Crops

- Dry bean

Adjuvant(s)/Comments

- **Covrex* (1 pt/A) plus AMS*** (2.5 lb/A)**
- or
- **Advatrol** (0.75-1 pt/A) plus AMS*** (2.5 lb/A)**

Target Weeds

- black nightshade
- common ragweed
- common waterhemp
- cocklebur
- giant ragweed
- lambsquarters
- morning glory
- pigweed
- smartweed
- venice mallow
- wild mustard

Leaf Stage

2"	4"
-	4"
2"	2"
2"	4"
2"	4"
-	2"
-	3"
2"	4"
-	4"
4"	6"
4"	6"

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

**Upland MSO @ 1 qt/A or Verium @ 1 qt/100 gal.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply to 1st trifoliolate and prior to flowering.
 *See label for geographical and rate restrictions.

Result (bentazon + sethoxydim)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Dry bean, Field pea <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Covrex* (0.5 pt/A) plus AMS*** (1 lb/A) 	<p>Target Weeds</p> <table border="0"> <tr><td>- cocklebur</td><td style="text-align: right;">10"</td></tr> <tr><td>- lambsquarters</td><td style="text-align: right;">2"</td></tr> <tr><td>- common ragweed</td><td style="text-align: right;">3"</td></tr> <tr><td>- wild buckwheat</td><td style="text-align: right;">5"</td></tr> <tr><td>- wild mustard</td><td style="text-align: right;">8"</td></tr> <tr><td>- crabgrass</td><td style="text-align: right;">4"</td></tr> <tr><td>- foxtail</td><td style="text-align: right;">4"</td></tr> <tr><td>- volunteer corn</td><td style="text-align: right;">10"</td></tr> <tr><td>- wild proso millet</td><td style="text-align: right;">8"</td></tr> <tr><td>- barnyardgrass</td><td style="text-align: right;">4"</td></tr> <tr><td>- woolly cupgrass</td><td style="text-align: right;">4"</td></tr> </table>	- 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"
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- wild proso millet	8"																							
- barnyardgrass	4"																							
- woolly cupgrass	4"																							

*Crop Oil @ 1 pt/A or Verium @ 1 qt/100 gal.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Dry bean: apply after first trifoliolate.

Field pea: apply at 3 leaf pairs or more.

Select Max (clethodim)

	Labeled Crops	Target Weeds	<u>9 fl oz</u>	<u>12 fl oz</u>																				
<p>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</p>	<p>• Dry bean, Field pea, Lentil</p> <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Covrex* (1 pt/A) plus AMS*** (2.5-4 lb/A) or • Advatrol** (1 pt/A) plus AMS*** (2.5-4 lb/A) 	<ul style="list-style-type: none"> - barnyardgrass - crabgrass - giant foxtail - green foxtail - quackgrass <li style="padding-left: 20px;"><i>2nd application may be needed</i> - volunteer cereals - volunteer corn - wild proso millet - woolly cupgrass - yellow foxtail 	<table border="0"> <tr><td>6"</td></tr> <tr><td>2"</td></tr> <tr><td>6"</td></tr> <tr><td>6"</td></tr> <tr><td>-</td></tr> <tr><td>6"</td></tr> <tr><td>12"</td></tr> <tr><td>8"</td></tr> <tr><td>6"</td></tr> <tr><td>6"</td></tr> </table>	6"	2"	6"	6"	-	6"	12"	8"	6"	6"	<table border="0"> <tr><td>8"</td></tr> <tr><td>6"</td></tr> <tr><td>12"</td></tr> <tr><td>8"</td></tr> <tr><td>4-12"</td></tr> <tr><td>8"</td></tr> <tr><td>18"</td></tr> <tr><td>10"</td></tr> <tr><td>8"</td></tr> <tr><td>8"</td></tr> </table>	8"	6"	12"	8"	4-12"	8"	18"	10"	8"	8"
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*Crop Oil @ 1 pt/A or Verium @ 1 qt/100 gal.

**Upland MSO @ 1 qt/A or Verium @ 1 qt/100 gal.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply up to 30 day PHI.

Targa (quizalofop P-ethyl)

	Labeled Crops	Target Weeds	4 fl oz	6 fl oz	8 fl oz
EPA Reg. #: 33906-9-81880	• Dry bean, Field pea, Lentil	- barnyardgrass	-	-	2-6"
Rate/A: 5-10 fl oz		- field sandbur	-	-	2-6"
Spray Volume: min 10 gpa	Adjuvant(s)/Comments	- crabgrass	-	-	2-6"
Rainfast: 1 hour	• Covrex* (2 qt/100 gal)	- giant foxtail	-	-	2-8"
M.O.A.: ACC-ase Inhibitor	plus	- green foxtail	-	-	2-4"
P.P.E.: l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks	AMS*** (2-4 lb/A)	- volunteer corn	6-24"	24"+	-
R.E.I.: 12 hours	or	- wild proso millet	-	-	2-6"
W. Notification: Oral	• Advatrol** (2 qt/100 gal)	- yellow foxtail	-	-	2-4"
S. Word: Danger	plus	- wild oat	-	-	2-6"
	AMS*** (2-4 lb/A)	- woolly cupgrass		2-4" @ 9 oz	
		- quackgrass		6-10" @ 10 oz	

*Crop Oil @ 1 pt/A or Verium @ 1 qt/100 gal.

**Upland MSO @ 1 gal/100 gal or Verium @ 1 qt/100 gal.

***Jackhammer/Jackhammer Elite @ 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)

	Labeled Crops	Target Weeds	16 oz	21 oz
EPA Reg. #: 241-447	• Dry bean, Field pea	- cocklebur	4"	4"
Rate/A: 16-21 fl oz		- lambsquarter	-	1.5"
Spray Volume: 10-20 gpa	Adjuvant(s)/Comments	- redroot pigweed	3"	3"
Rainfast: 4 hours	• Prefer 90 (1 qt/100 gal)	- velvetleaf	2"	3"
M.O.A.: ALS Inhibitor	or	- annual smartweed	4"	4"
P.P.E.: l.s shirt, l.pants, w.p. gloves, shoes, socks	• Linkage (1 gal/100 gal)	- black nightshade	3"	3"
R.E.I.: 48 hours	or	- venice mallow	2"	3"
W. Notification: Oral	• Covrex* (2 qt/100 gal)	- wild mustard	3"	3"
S. Word: Caution	plus	- cheatgrass	-	3"
	AMS*** (12-15 lb/100 gal)	- downy brome	-	3"
	or	- quackgrass	-	3"
	• Advatrol** (2 qt/100 gal)	- Persian darnel	-	3"
	plus	- foxtail	-	3"
	AMS*** (12-15 lb/100 gal)	- Italian ryegrass	-	3"
		- Japanese brome	-	3"

*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal.

**Upland MSO @ 1 gal/100 gal or Verium @ 1 qt/100 gal.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Dry bean: apply to 1st trifoliolate and prior to flowering.

Field pea: apply to 3 leaf pairs and prior to flowering.

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* + Jackhammer	1.2-2 pt/A OR 0.8-1.3 pt/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.	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 + Upland MSO + 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 + Upland MSO + 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	Jackhammer @ 0.5% v/v + Last Chance 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	Jackhammer @ 0.5% v/v OR Last Chance Pro @ 0.25% v/v	7 days
Aim @ 1-6 fl oz/A	Upland MSO @ 1 qt/A	0 days
Sharpen @ 1-2 fl oz/A	Jackhammer @ 0.5% v/v + Upland MSO @ 1 qt/A	2 days - Do not apply to dry beans intended for seed production
Valor SX/EZ @ 2-3 oz/A	Jackhammer @ 0.5% v/v + Upland MSO @ 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.

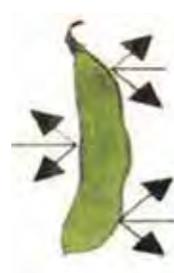
Desiccant	Adjuvant	PHI	Stage of Application*
Glyphosate @ up to 2.25 lb ae	Jackhammer @ 0.5% v/v + Last Chance Pro @ 0.25% v/v	7 days	Apply when physiologically mature and < 15% green pods. Use higher rates where crops or weeds are dense or where faster desiccation is required. Do not apply to peas grown for seed.
Sharpen @ 1-2 fl oz/A	Upland MSO @ 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	Upland MSO @ 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	Jackhammer @ 0.5% v/v OR Last Chance 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.

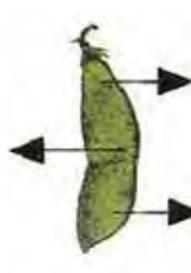
Pod Ceal DC can be applied in combination with desiccants. Pod Ceal DC should be applied at a rate of 1 pt/A at the timing of the desiccant or applied alone when peas are a light green color and the outline of the seed can be seen through the pod case.

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.

Dry Bean, Field Pea, Lentil // Dry Edible Bean Fungicides

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
Approach	Picoxystrobin (11)	6-12 oz	Preventative application at beginning of bloom, continue on a 7 to 14 day interval.	Verium*	Anthracnose, Rust, White Mold
Aprovia Top	Difenconazole (3) + Benzovindiflupyr (7)	10.5-11 oz	Apply prior to the onset of disease.	Verium*	Anthracnose, Rust
AzoxyStar	Azoxystrobin (11)	6-15 fl oz	Apply prior to the onset of disease, continue on a 7 to 14 day interval.	Verium*	Anthracnose, Rust
Bravo Ultrex	Chlorothalonil (M5)	1.25-1.80 lb	Apply prior to the onset of disease.	Verium*	Anthracnose, Rust
Bravo WeatherStik, Echo 720	Chlorothalonil (M5)	1.4-2.0 pt	Apply prior to the onset of disease.	Verium*	Anthracnose, Rust
Bravo ZN	Chlorothalonil (M5)	2-3 pt	Apply prior to the onset of disease.	Verium*	Anthracnose, Rust
Cannonball	Fludioxonil (12)	7 oz	Apply application at 10-20% bloom.	Verium*	White Mold
Endura	Boscalid (7)	8-11 oz	Apply at the beginning of flowering.	Verium*	White Mold
Evito	Fluoxastrobin (11)	2-4.75 oz	Apply prior to onset of disease.	Verium*	Anthracnose, Rust
Orius, TebuStar, Tebuzol, Toledo	Tebuconazole (3)	4-6 oz	Apply prior to the onset of disease.	Verium*	Rust
Headline / SC	Pyraclostrobin (11)	6-9 oz	Apply prior to onset of disease.	Verium*	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.	Verium*	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.	Verium*	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.	Verium*	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.	Verium*	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.	Verium*	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.	Verium*	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.	Verium*	Rust, White Mold

Adjuvants are generally used to increase disease control of fungicide applications. Verium is a unique surfactant with oil mimicking properties that improves plant canopy penetration both vertically and horizontally for more uniform fungicide coverage.

*Verium 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.	Verium*	White Mold
Provysol	Mefentrifluconazole (3)	2.5-5 oz	Apply prior to onset of disease	Verium*	Anthracnose, Rust, Alternaria leaf and pod spot, powdery mildew
Quadris	Azoxystrobin (11)	6.2-15.4 oz	Apply prior to onset of disease.	Verium*	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.	Verium*	Anthracnose, Rust
Quash	Metconazole (3)	4 oz	Apply prior to onset of disease.	Verium*	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.	Verium*	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.	Verium*	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.	Verium*	White Mold
Tebustar 3.6L	Tebuconazole (3)	4-6 oz	Apply prior to onset of disease	Verium*	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.	Verium*	Anthracnose, White Mold
Vertisan	Penthiopyrad (7)	14-20 oz	Apply prior to onset of disease.	Verium*	Anthracnose, Rust, White Mold
Vetyrna	Metentrifluconazole (3) + Pyraclostrobin (11)	7-10 oz	Apply prior to onset of disease.	Verium*	Anthracnose, Rust, Alternaria leaf and pod spot, powdery mildew
Viathon	Potassium phosphite (33) + Tebuconazole (3)	2-3 pt	Apply prior to onset of disease.	Verium*	Rust

Adjuvants are generally used to increase disease control of fungicide applications. Verium is a unique surfactant with oil mimicking properties that improves plant canopy penetration both vertically and horizontally for more uniform fungicide coverage.

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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.

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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 barnyardgrass 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 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.
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.	ACCCase Inhibitor (Group 1)	1-2 leaf fb 4-5 leaf prefflood.	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.	ACCCase Inhibitor (Group 1) + Synthetic Auxin (Group 4)	4-5 leaf prefflood, second application in program.	See above notes. Add 0.5 pt/A MSO.

AIM EC (carfentrazone)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 279-3241	• Jackhammer/Jackhammer Elite (1-2 qt/100 gal)	For control of morning glory, hemp sesbania, groundcherry, and smartweed.
Rate/Acre: 1.25 oz/A	or	
Spray Volume: Min. 10 gpa	• Prefer 90* (1 qt/100)	Timing/Comments
Rainfast: 1 hour	or	
S.O.A.: PPO inhibitor (Group 14)	• Covrex** (2 qt/100 gal)	Apply after rice reaches 2-leaf stage through flag leaf. Leaf speckling may occur.
P.P.E.: I.s. shirt, l. pants, w.p. gloves, shoes, socks		
R.E.I.: 12 hours		
W. Notification: Oral		
S. Word: Caution		

*Verium (1 qt/100) can be substituted for Prefer 90.

**Crop Oil (1 gal/100) can be substituted for Covrex.

Basagran 5L (bentazon)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 7969-112	• Prefer 90* (1-2 qt/100)	For control of up to 6" broadleaves, except 10" cocklebur and 4" redstem, others listed include dayflower, flatsedge, smartweed, yellow nutsedge.
Rate/Acre: 1.2-1.6 pt/A	or	
Spray Volume: Min. 10 gpa up to 20 gpa	• Covrex** (2 qt/100)	Timing/Comments
Rainfast: 4 hours	or	
S.O.A.: Photosystem II Inhibitor (Group 6)	• Advatrol*** (2 qt/100)	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.
P.P.E.: I.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		

*Verium (1 qt/100) can be substituted for Prefer 90.

**Crop Oil (1 gal/100) can be substituted for Covrex.

***Upland MSO (1 gal/100) can be substituted for Advatrol.

Clincher (cyhalofop)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 62719-357	• Covrex* (1 pt/A)	Many grasses and broadleaves including: barnyardgrass, cocklebur, dayflower, Johnsongrass, morning glory, nutsedge, pigweed, and sicklepod.
Rate/A: 15 oz/A	or	
Spray Volume: 10 gpa or more	• Advatrol** (1 pt/A)	Timing/Comments
Rainfast: None Listed		
S.O.A.: ACC-ase Inhibitor (Group 1)		Only one application at 2 lb/A per season is allowed, except in a salvage situation where a second app can be made.
P.P.E.: Coveralls over, I.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		

*Crop Oil (1 qt/A) can be substituted for Covrex.

**Upland MSO (1 qt/A) can be substituted for Advatrol.

Gambit (halosulfuron + prosulfuron)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90* (1-2 qt/100) or • Covrex** (2 qt/100) or • Advatrol*** (2 qt/100) 	<p>Target Weeds</p> <p>Weeds Controlled: Grasses, sedges, smartweed, and other broadleaf weeds.</p> <p>Timing/Comments</p> <p>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.</p>
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*Verium (1 pt/A) can be substituted for Prefer 90.
 **Crop Oil (1-2 qt/100) can be substituted for Covrex.
 ***AMS 1-2 lb/A or 2.5 lb if not using NIS or COC.

Grandstand 3L (triclopyr)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90* (1-2 qt/100) or • Covrex** (2 qt/100) 	<p>Target Weeds</p> <p>For control of cocklebur, jointvetch spp., morning glory spp., hemp sesbania, eclipta, sicklepod, smartweed, and redstem.</p> <p>Timing/Comments</p> <p>Do not apply to non-flooded rice or apply prior to the 2-3-leaf or after 1/2" internode elongation.</p>
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*Verium (1 qt/100) can be substituted for Prefer 90.
 **Crop Oil (1 gal/100) can be substituted for Covrex.

Grasp Xtra (penoxsulam + triclopyr)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Covrex* (2 qt/100) or • Advatrol** (2 qt/100) 	<p>Target Weeds</p> <p>For control of broadleaves including pigweed, morning glory, hemp sesbania, smartweed, and day flower. Also controls barnyardgrass.</p> <p>Timing/Comments</p> <p>Apply from 2-3 leaf to 1/2" internode elongation stage, do not apply past booting stage.</p> <p>Avoid soil pH > 7.8 and soils with salt related problems.</p>
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*Crop Oil (1 gal/100) can be substituted for Covrex.
 **Upland MSO (1 gal/100) can be substituted for Advatrol.

Loyant (florpyrauxifen-benzyl)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 62719-698	• Advatrol* (0.25 pt/A)	For selective postemergence control of grass, sedge, and broadleaf control in the states of Arkansas, Louisiana, Mississippi, Tennessee, and Texas.
Rate/Acre: 16 oz/A		
Spray Volume: Min. 10 gpa		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.
Rainfast: 2 hours		
S.O.A.: Plant Growth Regulator (Group 4)		
P.P.E.: I.s. shirt, l. pants, waterproof gloves, p. eyewear		
R.E.I.: 12 hours		
W. Notification: Oral		
S. Word: Caution		
P.H.I.: 60 days		

*Upland MSO (0.5 pt/A) can be substituted for Advatrol.

Permit (halosulfuron)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 81880-2-10163	• Prefer 90* (1-2 qt/100)	For control of sedges, including yellow nutsedge and flatsedge, as well as hemp sesbania, and northern jointvetch.
Rate/Acre: 1 oz/A	or	
Spray Volume: Enough to ensure uniform coverage	• Covrex** (2 qt/100)	Timing/Comments Temporary yellowing or stunting of the crop may be observed following application. Avoid drift on non STS/BOLT soybeans.
Rainfast: 4 hours	or	
S.O.A.: ALS Inhibitor (Group 2)	• Advatrol*** (2 qt/100)	
P.P.E.: I.s. shirt, l. pants, shoes, socks		
R.E.I.: 12 hours		
W. Notification: Oral		
S. Word: Caution		
P.H.I.: 48 days		

*Verium (1 qt/100) can be substituted for Prefer 90.

**Crop Oil (1 gal/100) can be substituted for Covrex.

***Upland MSO (1 gal/100) can be substituted for Advatrol.

Permit Plus (halosulfuron + thifensulfuron)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 81880-26-10163	• Prefer 90* (1-2 qt/100)	Same weeds controlled as Permit, but with better broadleaf weed control.
Rate/Acre: 0.75 oz/A	or	
Spray Volume: 10 or more gpa	• Covrex** (2 qt/100)	Timing/Comments Control us usually seen within 7-14 days of application. Avoid applications under stressed conditions. Avoid drift on non STS/BOLT soybeans.
Rainfast: 4 hours	or	
S.O.A.: ALS Inhibitor (Group 2)	• Advatrol*** (2 qt/100)	
P.P.E.: I.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		

*Verium (1 qt/100) can be substituted for Prefer 90.

**Crop Oil (1 gal/100) can be substituted for Covrex.

***Upland MSO (1 gal/100) can be substituted for Advatrol.

Propanil (4lb formulations)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: Multiple		Postemergence control of sedges, barnyardgrass, fall panicum, hemp sesbania, northern jointvetch, spike rushes, flat sedges, morning glory, aquatics.
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		
		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)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 62719-607	<ul style="list-style-type: none"> • Covrex* (2 qt/100) or • Advatrol** (2 qt/100) 	For control of sprangletop, barnyardgrass, junglerice, hemp sesbania, rice flatsedge, jointvetch, redstem, alligatorweed, eclipta, and smartweed.
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		
		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 Covrex.

**Upland MSO (1 gal/100) can be substituted for Advatrol.

Regiment 80 WP (bispyribac)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 59639-105	<ul style="list-style-type: none"> • Concord (1% v/v ground or 3-6 oz/A aerial) 	Lower flood to 70% weeds above the water surface prior to application. For control of duck salad, barnyardgrass, smartweed, and Johnsongrass.
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		
		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)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 71085-30		Grasses including sprangletop, barnyardgrass, signalgrass, and flatsedge as well as hemp sesbania and other listed broadleaves.
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		
		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)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 264-682		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.
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		
		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)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 7969-278	• Covrex* (2 qt/100)	For control of pigweed, groundcherry, marehail, and other broadleaf weeds.
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		
		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 Covrex.

Storm (bentazon + acifluorfen)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 70605-09	<ul style="list-style-type: none"> • Prefer 90* (1-2 pt/100) or • Covrex** (1-2 pt/A) plus Jackhammer/Jackhammer Elite*** (2 qt/100 gal) 	<p>For control of small actively growing weeds, except cocklebur (10"), hemp sesbania (1-4') & redstem (4"). Also controls barnyardgrass, morning glory, smartweed, & eclipta.</p> <p>Timing/Comments</p> <p>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.</p>
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.: I.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		

*Verium (1 pt/A) can be substituted for Prefer 90.

**Crop Oil (1-2 qt/100) can be substituted for Covrex.

***AMS 1-2 lb/A or 2.5 lb if not using NIS or COC.

Strada Pro (orthosulfamuron + halosulfuron-methyl)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 71711-47	<ul style="list-style-type: none"> • Prefer 90* (1-2 qt/100) or • Covrex* (2 qt/100) 	<p>For control of yellow nutsedge, hemp sesbania, flatsedge, and northern jointvetch.</p> <p>Timing/Comments</p> <p>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.</p>
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.: I.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		

*Verium (1 qt/100) can be substituted for Prefer 90.

**Crop Oil (1 gal/100) can be substituted for Covrex.

Ultra Blazer (acifluorfen)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 70506-60	<ul style="list-style-type: none"> • Prefer 90* (1-2 pt/100) or • Covrex** (1-2 pt/A) plus Jackhammer/Jackhammer Elite*** (2 qt/100 gal) 	<p>For control of pigweed species, smartweed, hemp sesbania, morning glory.</p> <p>Timing/Comments</p> <p>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.</p>
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.: I.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		

*Verium (1 qt/100) can be substituted for Prefer 90.

**Crop Oil (1-2 qt/100) can be substituted for Covrex.

***AMS 1-2 lb/A or 2.5 lb if not using NIS or COC.

Herbicide			Traditional Surfactant and Oil Adjuvants			Surfactant/ Oil Replacement	High Surfactant Oil Concentrates			NIS/AMS Replacement	Invert Oil Emulsion/ DRT		Other Adjuvants or Comments
	Common Use Rate	Crops Labeled	Prefer 90	Crop Oil	Upland MSO	Verium	Covrex	Advatrol	AMS	Jackhammer/ Jackhammer Elite	Petrichor	Parachute II	
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 Prefer 90
Clincher	15 oz/A	Rice		1 qt/A	1 qt/A	1 pt/A	1 pt/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	1 pt/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 Prefer 90 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 Verium 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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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

	Labeled Crops	Target Weeds
EPA Reg. #:	71368-1-55467 (4 lb Amine) 228-139-55467 (4 lb Ester) 71368-11-55467 (6 lb Ester)	• Barley, Oat, Wheat
Rate/A:	0.5-1 pt	
Spray Volume:	10 gpa min	– Controls most broadleaf weeds.
Rainfast:	Ester: 1 hour Amine: 6-8 hours	
S.O.A.:	Plant Growth Regulator (Group 4)	Timing/Comments Apply from tillering until prior to boot.
P.P.E.:	I.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	

Affinity BroadSpec / Audit 1:1 (thifensulfuron + tribenuron, 1:1 ratio)

	Labeled Crops	Target Weeds
EPA Reg. #:	352-661 Affinity BroadSpec 66330-418 Audit 1:1	• Wheat, Barley, Oat, Rye, Triticale (Audit 1:1 not labeled in Oat, Rye, Triticale)
Rate/A:	0.4-1 oz	
Spray Volume:	3 gpa min	– Controls most broadleaf weeds.
Rainfast:	4 hours	
S.O.A.:	ALS Inhibitor (Group 2)	Timing/Comments Apply to crop from 2 leaf to prior to flag leaf emergence. Apply to oat before jointing.
P.P.E.:	I.s. shirt, l. pants, shoes, socks	
R.E.I.:	12 hours	
W. Notification:	Oral	
S. Word:	Caution	
	Adjuvant(s)/Comments	
	• Linkage (1 gal/100 gal) or	
	• Prefer 90 (2-4 pt/100 gal) plus AMS (2 lb/A) or	
	• Covrex* (2 qt/100 gal) plus AMS (2 lb/A) or	
	• Advatrol** (2 qt/100 gal) plus AMS (2 lb/A)	

*Crop Oil at 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO at 1 gal/100 gal can be substituted for Advatrol.

Affinity Tank mix / Audit 4:1 (thifensulfuron + tribenuron, 4:1 ratio)

<p>EPA Reg. #: 352-641 Affinity Tank mix 66330-419 Audit 4:1</p> <p>Rate/A: 0.6-1 oz 0.6-0.75 oz (oat)</p> <p>Spray Volume: 3 gpa min</p> <p>Rainfast: 4 hours</p> <p>S.O.A.: ALS Inhibitor (Group 2)</p> <p>P.P.E.: l.s. shirt, l. pants, shoes, socks</p> <p>R.E.I.: 12 hours</p> <p>W. Notification: Oral</p> <p>S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Wheat, Barley, Oat, Rye, Triticale (Audit 4:1 not labeled in Oat) <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100 gal) or • Prefer 90 (2-4 pt/100 gal) plus AMS (2 lb/A) or • Covrex* (2 qt/100 gal) plus AMS (2 lb/A) or • Advatrol** (2 qt/100 gal) plus AMS (2 lb/A) 	<p>Target Weeds</p> <ul style="list-style-type: none"> - Controls most broadleaf weeds. <p>Timing/Comments</p> <p>Apply to crop from 2 leaf to prior to flag leaf emergence.</p> <p>Apply to oat before jointing.</p>
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*Crop Oil at 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO at 1 gal/100 gal can be substituted for Advatrol.

Agility SG (dicamba + thifensulfuron + tribenuron + metsulfuron)

<p>EPA Reg. #: 352-751</p> <p>Rate/A: 1.6-3.2 oz</p> <p>Spray Volume: 5 gpa min (ground) 1-5 gpa (air)</p> <p>Rainfast: 6 hours</p> <p>S.O.A.: ALS Inhibitor (Group2) Growth Regulator (Group 4)</p> <p>P.P.E.: coveralls, l.s. shirt, pants, c.r. socks footwear and socks, waterproof c.r. gloves, c.r. headgear and eyewear</p> <p>R.E.I.: 24 hours</p> <p>W. Notification: Oral</p> <p>S. Word: Warning</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Wheat, Barley, Triticale <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100 gal) or • Covrex* (2 qt/100 gal) plus AMS (2 lb/A) or • Advatrol** (2 qt/100 gal) plus AMS (2 lb/A) or • Prefer 90 (1-4 pt/100 gal) plus AMS (2 lb/A) 	<p>Target Weeds</p> <ul style="list-style-type: none"> - 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 <p>Timing/Comments</p> <p>Fall seeded wheat, barley, triticale: 2 leaf but before jointing.</p> <p>Spring wheat and triticale: 2 leaf but before exceeds 6 leaf.</p> <p>Spring barley: 2 leaf but before exceeds 4 leaf.</p> <p>See label for rotational restrictions.</p>
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*Crop Oil at 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO at 1 gal/100 gal can be substituted for Advatrol.

Aim EC (carfentrazone)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Millet, Oat, Rye, Triticale, Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (2 qt/100 gal) or • Prefer 90 (2 pt/100 gal) plus AMS (2–4 lb/A) 	<p>Target Weeds</p> <table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top;"> <p><u>0.5–1 fl oz</u></p> <p>Control</p> <ul style="list-style-type: none"> – lambsquarters (3") – black nightshade – pigweed – velvetleaf <p>Suppression</p> <ul style="list-style-type: none"> – wild buckwheat – kochia – mustards – Russian thistle </td> <td style="vertical-align: top;"> <p><u>1.5–2 fl oz</u></p> <p>Control</p> <ul style="list-style-type: none"> – lambsquarters (4") – black nightshade – pigweed – velvetleaf – wild buckwheat – kochia – Russian thistle </td> </tr> </table> <p>Timing/Comments</p> <p>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 sulfonyleurea herbicides may reduce cosmetic speckling.</p>	<p><u>0.5–1 fl oz</u></p> <p>Control</p> <ul style="list-style-type: none"> – lambsquarters (3") – black nightshade – pigweed – velvetleaf <p>Suppression</p> <ul style="list-style-type: none"> – wild buckwheat – kochia – mustards – Russian thistle 	<p><u>1.5–2 fl oz</u></p> <p>Control</p> <ul style="list-style-type: none"> – lambsquarters (4") – black nightshade – pigweed – velvetleaf – wild buckwheat – kochia – Russian thistle
<p><u>0.5–1 fl oz</u></p> <p>Control</p> <ul style="list-style-type: none"> – lambsquarters (3") – black nightshade – pigweed – velvetleaf <p>Suppression</p> <ul style="list-style-type: none"> – wild buckwheat – kochia – mustards – Russian thistle 	<p><u>1.5–2 fl oz</u></p> <p>Control</p> <ul style="list-style-type: none"> – lambsquarters (4") – black nightshade – pigweed – velvetleaf – wild buckwheat – kochia – Russian thistle 			

Ally Extra SG (metsulfuron+thifensulfuron+tribenuron)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Wheat, Triticale <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100 gal) or • Prefer 90 (0.5–4 pt/100) plus AMS (2–4 lb/100 gal) or • Covrex* (2 qt/100 gal) plus AMS (2 lb/A) or • Advatrol** (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. 	<p>Target Weeds</p> <ul style="list-style-type: none"> – Canada thistle – lambsquarters – pigweed – Russian thistle – smartweed – volunteer sunflower – wild mustard – wild buckwheat <p>Timing/Comments</p> <p>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.</p>
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*Crop Oil at 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO at 1 gal/100 gal can be substituted for Advatrol.

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

- **Linkage (1 gal/100 gal)**
or
- **Prefer 90 (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

- **Linkage (1 gal/100 gal)**
or
- **Prefer 90 (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)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Spring and Winter Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100) or • Prefer 90 (1 qt/100 gal) plus AMS (1.5–3 lb/A) or • Covrex* (0.5–1 pt/A) plus AMS (1.5–3 lb/A) or • Advatrol** (0.5–1 pt/A) plus AMS (1.5–3 lb/A) or • Verium (1 qt/100 gal) plus AMS (1.5–3 lb/A) 	<p>Target Weeds</p> <ul style="list-style-type: none"> – lambsquarters – morning glory – eastern black nightshade – redroot pigweed – velvetleaf – waterhemp <p>Timing/Comments</p> <p>Apply to crop at spiking up to the 4th tiller growth stage.</p>
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*Crop Oil at 1–2 pt/A can be substituted for Covrex.

**Upland MSO at 1–2 pt/A can be substituted for Advatrol.

Axial Bold (Pinoxaden + fenoxaprop-p-ethyl)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Wheat • Do not apply to durum <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • For drift reduction – Petrichor (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 Upland MSO at 1 pt/100 gal is suggested. 	<p>Target Weeds</p> <table border="0"> <tr><td>– volunteer/wild oat</td><td>1–6 leaf</td></tr> <tr><td>– foxtail sp.</td><td>1–5 leaf</td></tr> <tr><td>– barnyard grass</td><td>1–5 leaf</td></tr> <tr><td>– wild proso millet</td><td>1–5 leaf</td></tr> <tr><td>– Persian darnel</td><td>1–6 leaf</td></tr> <tr><td>– Italian ryegrass</td><td>1–5 leaf</td></tr> <tr><td>– windgrass</td><td>1–5 leaf</td></tr> <tr><td>– volunteer flax</td><td>less than 4"</td></tr> </table> <p>Timing/Comments</p> <p>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.</p>	– 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"
– 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"																	

Axial Star (pinoxaden + fluroxypyr)

<p>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.: I.s. shirt, I. pants, shoes, socks, c.r. gloves, p. eyewear R.E.I.: 48 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Wheat • Do not apply to durum <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (2 qt/100 gal) • For drift reduction – Petrichor (3 oz/A) • See label for a complete list of tank mix partners. 	<p>Target Weeds</p> <ul style="list-style-type: none"> - 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 <p>Timing/Comments</p> <p>Apply to wheat and barley from 2 leaf to preboot stage.</p>
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Axial XL (pinoxaden)

<p>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, I. pants, c.r. shoes, socks, c.r. gloves R.E.I.: 48 hours W. Notification: Oral S. Word: Warning</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Wheat • Do not apply to durum <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (2 qt/100 gal) • For drift reduction – Petrichor (3 oz/A) • See label for a complete list of tank mix partners. 	<p>Target Weeds</p> <ul style="list-style-type: none"> - wild oat 1-6 leaf - foxtails 1-5 leaf - barnyardgrass 1-5 leaf - wild proso millet 1-5 leaf - Persian darnel 1-6 leaf <p>Timing/Comments</p> <p>Apply to wheat and barley from 2 leaf to preboot stage.</p>
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Batalium (flucarbazone + fluroxypyr + bromoxynil + safener)

<p>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.: I.s. shirt, I. pants, c.r. gloves, shoes, socks R.E.I.: 24 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Spring Wheat, Winter Wheat, Durum <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (2-4 qt/100 gal) or • Prefer 90 (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 	<p>Target Weeds</p> <p>Grass weeds 1-4 leaf Broadleaf weeds up to 4 inches Consult label for more information</p> <p>Timing/Comments</p> <p>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.</p>
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Beyond (imazamox)

<p>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.: I.s. shirt, I. pants, c.r. gloves, shoes, socks R.E.I.: 4 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Clearfield wheat varieties only. <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100 gal) or • Prefer 90 (1 qt/100 gal) plus AMS (12-15 lb/100 gal) 	<p>Target Weeds</p> <p>(See label for weed sizes)</p> <ul style="list-style-type: none"> - common cocklebur - volunteer canola - foxtail - mallows - giant ragweed - mustards - lambsquarters - nightshades - pigweeds - velvetleaf - sunflower - volunteer corn - venice mallow <p>Timing/Comments</p> <p>Spring wheat: apply to 4 leaf prior to jointing. Winter wheat: apply after tiller initiation prior to jointing.</p>
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Bromoxynil Products

<p>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 I.s. shirt, I. pants, c.r. gloves, apron, headgear, eyewear, shoes, socks R.E.I.: 12 hours W. Notification: Oral S. Word: Warning</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Oat, Wheat 	<p>Target Weeds</p> <p>Many broadleaf weeds including:</p> <ul style="list-style-type: none"> - wild buckwheat - common sunflower - kochia - Russian thistle <p>Timing/Comments</p> <p>Apply from emergence until boot.</p>
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Brox M (bromoxynil + MCPA)

<p>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.: I.s. shirt, I. pants, c.r. gloves, apron, footwear, socks, p. eyewear R.E.I.: 24 hours W. Notification: Oral S. Word: Warning</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Oat, Wheat 	<p>Target Weeds</p> <p>Many broadleaf weeds including:</p> <ul style="list-style-type: none"> - wild buckwheat - common sunflower - kochia - Russian thistle <p>Timing/Comments</p> <p>Apply from 3 leaf until boot.</p>
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Cleansweep M (bromoxynil + fluroxypyr + MCPA)

<p>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.: I.s. shirt, l. pants, c.r. gloves, apron, shoes, socks R.E.I.: 24 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Oat, Wheat 	<p>Target Weeds</p> <p>Controls many broadleaf weeds under 8" including:</p> <ul style="list-style-type: none"> - field bindweed - wild buckwheat - cocklebur - lambsquarters - mustards - pigweed - common ragweed - sunflower - Russian thistle - velvetleaf <p>Timing/Comments</p> <p>Apply from 2 leaf up to and including flag leaf emergence.</p>
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Curtail (clopyralid + 2,4-D)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear R.E.I.: 48 hours W. Notification: Oral S. Word: Danger</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Wheat, Barley 	<p>Target Weeds</p> <p>Many broadleaf weeds including Canada thistle.</p> <p>Timing/Comments</p> <p>Apply from 4 leaf until jointing. Apply to Canada thistle from rosette to early bolting.</p>
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Curtail M (clopyralid + MCPA)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Oat, Wheat 	<p>Target Weeds</p> <p>Many broadleaf weeds including Canada thistle.</p> <p>Timing/Comments</p> <p>Apply from 3 leaf until jointing. Apply to Canada thistle from rosette to early bolting.</p>
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Dicamba Products

<p>EPA Reg. # 7969-137 7969-137-55467 42750-40 Rate/A: 2-4 fl oz Spray Volume: 3-50 gpa Rainfast: 4 hours S.O.A.: Growth Regulator (Group 4) P.P.E.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear R.E.I.: 24 hours W. Notification: Oral S. Word: Warning</p>	<p>Clarity Detonate Dicamba DMA</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Oat, Wheat • See label for a list of tank mix options. 	<p>Target Weeds</p> <p>Many broadleaf weeds including:</p> <ul style="list-style-type: none"> - wild buckwheat - common sunflower - kochia - Russian thistle <p>Timing/Comments</p> <p>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.</p>
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Discover NG / NextStep NG (clodinafop)

<p>EPA Reg. # 100-1173 100-1173-66330 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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Discover NG NextStep NG</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Advatrol* (2 qt/100 gal) 	<table border="0"> <tr> <td style="text-align: left;">Target Weeds</td> <td style="text-align: center;">12.8 fl oz</td> <td style="text-align: center;">16.4 fl oz</td> </tr> <tr> <td>- wild oat</td> <td style="text-align: center;">1-6 leaf</td> <td style="text-align: center;">-</td> </tr> <tr> <td>- yellow foxtail</td> <td style="text-align: center;">1-5 leaf</td> <td style="text-align: center;">-</td> </tr> <tr> <td>- green foxtail</td> <td style="text-align: center;">1-5 leaf</td> <td style="text-align: center;">-</td> </tr> <tr> <td>- barnyardgrass</td> <td style="text-align: center;">1-5 leaf</td> <td style="text-align: center;">-</td> </tr> <tr> <td>- Persian darnel</td> <td style="text-align: center;">-</td> <td style="text-align: center;">1-5 leaf</td> </tr> <tr> <td>- annual ryegrass</td> <td style="text-align: center;">-</td> <td style="text-align: center;">1-5 leaf</td> </tr> <tr> <td>- giant foxtail</td> <td style="text-align: center;">-</td> <td style="text-align: center;">1-5 leaf</td> </tr> </table> <p>Timing/Comments</p> <p>Apply to crop from 2 leaf until preboot.</p>	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
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																									

*Upland MSO at 1 qt/100 gal can be substituted for Advatrol.

Everest 3.0 (flucarbazone + cloquintocet safener)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Wheat, Durum, Winter Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100 gal) • Tank mixes with products containing tribenuron improves control of barnyardgrass, Italian ryegrass, Persian darnel, yellow foxtail, and wild oat. 	<p>Target Weeds</p> <ul style="list-style-type: none"> - 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 <p>Timing/Comments</p> <p>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.</p>
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Express SG (tribenuron)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Wheat, Oat, Triticale <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (2 qt/100 gal) or • Prefer 90 (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. 	<p>Target Weeds</p> <ul style="list-style-type: none"> - common chickweed - field pennycress - common lambsquarters - Russian thistle - kochia - wild mustard <p>Apply when weeds are past the cotyledon stage and less than 4" tall or 4" in diameter.</p> <p>Timing/Comments</p> <p>Apply to crop from 2 leaf to prior to flag leaf emergence. Oat: apply after 3 leaf prior to jointing.</p>
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Glean XP (chorsulfuron)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Oat, Triticale, Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100 gal) or • Prefer 90 (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. 	<p>Target Weeds</p> <table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top;"> <p><u>1/6-1/4 fl oz</u></p> <ul style="list-style-type: none"> - curly dock - field pennycress - prostrate pigweed - redroot pigweed - smooth pigweed - wild mustard </td> <td style="vertical-align: top;"> <p><u>1/3 fl oz</u></p> <ul style="list-style-type: none"> - common chickweed - false chamomile - ladythumb - common purslane - common lambsquarters </td> </tr> </table> <p>Timing/Comments</p> <p>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.</p>	<p><u>1/6-1/4 fl oz</u></p> <ul style="list-style-type: none"> - curly dock - field pennycress - prostrate pigweed - redroot pigweed - smooth pigweed - wild mustard 	<p><u>1/3 fl oz</u></p> <ul style="list-style-type: none"> - common chickweed - false chamomile - ladythumb - common purslane - common lambsquarters
<p><u>1/6-1/4 fl oz</u></p> <ul style="list-style-type: none"> - curly dock - field pennycress - prostrate pigweed - redroot pigweed - smooth pigweed - wild mustard 	<p><u>1/3 fl oz</u></p> <ul style="list-style-type: none"> - common chickweed - false chamomile - ladythumb - common purslane - common lambsquarters 			

Glyphosate

	# A.E.	=0.75 AE	Surfactant/Comments
Brand Name: EPA Reg. #:			
Buccaneer Plus 55467-9	3.00	32.0	<ul style="list-style-type: none"> • Last Chance Pro (1 qt/100) plus AMS (8.5-17 lb/100) or
Gly Star Original 42750-60	3.00	32.0	
Gly Star Plus 42750-61	3.00	32.0	<ul style="list-style-type: none"> • Jackhammer/Jackhammer Elite (2-3 qt/100) or
Durango DMA 62719-556	4.00	24.0	
Buccaneer 5 Extra 55467-15	4.00	24.0	<ul style="list-style-type: none"> • Encloax (2.5-5 gal/100) or
Gly Star 5 Extra 42750-59	4.00	24.0	
Gly Star K-Plus 42750-122	4.50	21.3	<ul style="list-style-type: none"> • Prefer 90 (1 qt/100) plus AMS (8.5-17 lb/100)
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			

GoldSky (pyroxsulam + florasulam + fluroxypyr)

	Labeled Crops	Target Weeds	Target Weeds Spring Applications
EPA Reg. #: 62719-582	• Wheat	Grass: 2-If to 2-tiller	Broadleaf: < 2"
Rate/A: 1 pt		– annual ryegrass	– volunteer canola
Spray Volume: 5 gpa min (air) 10 gpa min (ground)	Adjuvant(s)/Comments	– barnyard grass	– mustards
Rainfast: 4 hours	• Linkage (2 qt/100 gal)	– downy brome (fall)	– redroot pigweed
S.O.A.: ALS Inhibitor (Group 2) Growth Regulator (Group 4)	• To improve control of lambsquarters and Russian thistle, tank mix with 8 oz MCPA ester or 2,4-D ester.	– Japanese brome	– annual smartweed
P.P.E.: I.s. shirt, l. pants, p. eyewear, c.r. gloves, shoes, socks	• See label for rotational restrictions.	– cheat	
R.E.I.: 24 hours		– yellow foxtail	
W. Notification: Oral			
S. Word: Warning			

Harmony Extra SG (thifensulfuron + tribenuron 2:1)

	Labeled Crops	Target Weeds
EPA Reg. #: 352-714	• Barley, Oat, Wheat	– common chickweed
Rate/A: 0.45–0.9 oz		– field pennycress
0.45–0.6 oz (oat)	Adjuvant(s)/Comments	– common lambsquarters
Spray Volume: 5 gpa min	• Linkage (2 qt/100 gal)	– Russian thistle
Rainfast: 4 hours	or	– kochia
S.O.A.: ALS Inhibitor (Group 2)	• Prefer 90	– wild mustard
P.P.E.: I.s. shirt, l. pants c.r. gloves, shoes, socks	(2 pt/100 gal)	Apply when weeds are past the cotyledon stage and less than 4" tall or 4" in diameter.
R.E.I.: 12 hours	plus	
W. Notification: Oral	AMS (2–4 lb/100)	Timing/Comments
S. Word: Caution		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)

	Labeled Crops	Target Weeds
EPA Reg. #: 352-633	• Barley, Oat, Wheat	– common chickweed
Rate/A: 0.75 oz		– common purslane
0.45–0.6 oz (oat)	Adjuvant(s)/Comments	– kochia
Spray Volume: 5 gpa min	• Linkage (2 qt/100 gal)	– field pennycress
Rainfast: 4 hours	or	– lambsquarters
S.O.A.: ALS Inhibitor (Group 2)	• Prefer 90 (2 pt/100 gal)	– pigweed
P.P.E.: I.s. shirt, l. pants, c.r. gloves, socks	plus	– prickly lettuce
R.E.I.: 4 hours	AMS (2–4 lb/100)	– Russian thistle
W. Notification: Oral		– shepherd's purse
S. Word: Caution		– 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)

<p>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.: I.s. shirt, l. pants, c.r. gloves, socks, shoes, p. eyewear R.E.I.: 24 hours W. Notification: Oral S. Word: Warning</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Rye, Triticale, Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • AMS (0.5-1 lb/A) or • Linkage (2 qt/100 gal) or • Jackhammer/ Jackhammer Elite (1-2 qt/100 gal) 	<p>Target Weeds</p> <p>Most annual broadleaf weeds.</p> <p>Timing/Comments</p> <p>Apply between 1 leaf and up to flag leaf emergence.</p>
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Huskie Complete (thiencarbazone-methyl + pyrasulfatole + bromoxynil)

<p>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.: I.s. shirt, l. pants, c.r. gloves, p. eyewear, socks, shoes R.E.I.: 24 hours W. Notification: Oral S. Word: Danger</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (2 qt/100 gal) 	<p>Target Weeds</p> <p>Grass weeds: 1 leaf to 2-tiller. Broadleaf weeds: emergence to 4". Consult label for more information.</p> <p>Timing/Comments</p> <p>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.</p>
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Maverick (sulfosulfuron)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Spring and Winter Wheat (not recommended in Durum) <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (2-4 qt/100 gal) • Rotational Warning: Bioassay required before rotating to certain crops. See label. 	<p>Target Weeds</p> <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;"><u>Spring Wheat</u></td> <td style="text-align: center;"><u>W. Wheat-Fall</u></td> <td style="text-align: center;"><u>W. Wheat-Spring</u></td> </tr> <tr> <td style="vertical-align: top;"> <ul style="list-style-type: none"> - wild oat - common sunflower </td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> - downy brome - Japanese brome - cheat - mustards </td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> - mustards - quackgrass - shepherd's purse </td> </tr> </table> <p>Timing/Comments</p> <p>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.</p>	<u>Spring Wheat</u>	<u>W. Wheat-Fall</u>	<u>W. Wheat-Spring</u>	<ul style="list-style-type: none"> - wild oat - common sunflower 	<ul style="list-style-type: none"> - downy brome - Japanese brome - cheat - mustards 	<ul style="list-style-type: none"> - mustards - quackgrass - shepherd's purse
<u>Spring Wheat</u>	<u>W. Wheat-Fall</u>	<u>W. Wheat-Spring</u>						
<ul style="list-style-type: none"> - wild oat - common sunflower 	<ul style="list-style-type: none"> - downy brome - Japanese brome - cheat - mustards 	<ul style="list-style-type: none"> - mustards - quackgrass - shepherd's purse 						

Osprey XTRA (Mesosulfuron-methyl + Thien carbazono-methyl)

<p>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.: I.s. shirt, l. pants, shoes, socks, c.r. gloves, safety glasses R.E.I.: 4 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Winter Wheat, fall-sown Triticale <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • For drift reduction – Petrichor (3 oz/A) • Linkage (1 gal/100 gal) or • Prefer 90 (2 qt/100 gal) plus AMS (1.5-3 lb/A) or • Advatrol* (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. 	<p>Target Weeds</p> <table border="0"> <tr> <td style="text-align: center;">Controlled</td> <td style="text-align: center;">Suppressed</td> </tr> <tr> <td> <ul style="list-style-type: none"> - 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 </td> <td> <ul style="list-style-type: none"> - Downy brome: 1 leaf to 2 tiller - Rattail fescue: 1 leaf to 2 tiller </td> </tr> </table> <p>Timing/Comments</p> <p>Apply to winter wheat or fall-sown triticale from emergence to jointing. See label for tank mix options, rotational restrictions and PHI.</p>	Controlled	Suppressed	<ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - Downy brome: 1 leaf to 2 tiller - Rattail fescue: 1 leaf to 2 tiller
Controlled	Suppressed					
<ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - Downy brome: 1 leaf to 2 tiller - Rattail fescue: 1 leaf to 2 tiller 					

*Upland MSO at 1.3-1.5 pt/A can be substituted for Advatrol.

Parity (fenoxyprop-p-ethyl)

<p>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</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (2 qt/100 gal) • Linkage may be added when Puma is used alone to improve consistency of control. 	<p>Target Weeds</p> <table border="0"> <tr> <td style="text-align: center;">0.33 pt</td> <td style="text-align: center;">0.4 pt</td> <td style="text-align: center;">0.66 pt</td> </tr> <tr> <td> <ul style="list-style-type: none"> - giant foxtail - foxtail millet - volunteer corn </td> <td> <ul style="list-style-type: none"> - yellow foxtail - volunteer proso millet - wild proso millet </td> <td> <ul style="list-style-type: none"> - barnyardgrass - wild oat - field sandbar - woolly cupgrass </td> </tr> </table> <p>Timing/Comments</p> <p>Wheat: emergence to 60 to 70 days prior to harvest, state dependent. Barley: crop emergence up to 5 leaf.</p>	0.33 pt	0.4 pt	0.66 pt	<ul style="list-style-type: none"> - giant foxtail - foxtail millet - volunteer corn 	<ul style="list-style-type: none"> - yellow foxtail - volunteer proso millet - wild proso millet 	<ul style="list-style-type: none"> - barnyardgrass - wild oat - field sandbar - woolly cupgrass
0.33 pt	0.4 pt	0.66 pt						
<ul style="list-style-type: none"> - giant foxtail - foxtail millet - volunteer corn 	<ul style="list-style-type: none"> - yellow foxtail - volunteer proso millet - wild proso millet 	<ul style="list-style-type: none"> - barnyardgrass - wild oat - field sandbar - woolly cupgrass 						

Peak (prosulfuron)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Oat, Rye, Sorghum, Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100 gal) or • Prefer 90 (1-2 qt/100 gal) plus AMS (2 lb/A) or • Covrex* (0.5-2 pt/A) plus AMS (2 lb/A) or • Advatrol** plus AMS (2 lb/A) 	<p>Target Weeds</p> <p>Controls many broadleaf weeds including:</p> <ul style="list-style-type: none"> - wild buckwheat - cocklebur - mustards - common ragweed - Russian thistle - sunflower <p>Timing/Comments</p> <p>Emergence before 2nd node, if detectable. See label for tank mix and rotational restrictions.</p>
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*Crop Oil at 1-4 pt/A or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO at 1-4 pt/A can be substituted for Advatrol.

PerfectMatch (clopyralid + fluroxypyr + pyroxsulam)

<p>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.: I.s. shirt, I. pants, c.r. gloves, shoes, socks, p. eyewear R.E.I.: 24 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Spring and Winter Wheat, Durum, Triticale <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage @ 1.0% v/v or • Prefer 90 (2 qt/100 gal) plus AMS (1.5-3 lb/A) 	<p>Target Weeds</p> <p>Grass</p> <ul style="list-style-type: none"> - barnyardgrass - cheat - Persian darnel - yellow foxtail - wild oat - Italian ryegrass <p>Broadleaf</p> <ul style="list-style-type: none"> - cocklebur - dandelion - kochia - lambsquarters - mustards - nightshades - ragweeds, common and giant - redroot pigweed - Russian thistle - volunteer canola - wild buckwheat <p>Timing/Comments</p> <p>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.</p>
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Pixxaro (fluroxypyr + Halauxifen-methyl)

<p>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.: I.s. shirt, I. pants, shoes, socks, c.r. gloves R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Winter Wheat, Spring Wheat, Durum, Barley and Triticale <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Jackhammer/ Jackhammer Elite (1 qt/100 gal) • For drift reduction - Petrichor (3 oz/A) • Caution with surfactants when fluid fertilizers are applied 	<p>Target Weeds Controlled</p> <ul style="list-style-type: none"> - catchweed bedstraw - flixweed - nightshade sp. - wild buckwheat <p>Timing/Comments</p> <p>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.</p>	<p>Weeds Suppressed</p> <ul style="list-style-type: none"> - Canada thistle - field pennycress - Russian thistle
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PowerFlex HL (pyroxsulam)

<p>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.: I.s. shirt, I. pants, p. eyewear, c.r. gloves, shoes, socks R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Winter Wheat, Triticale <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (2 qt/100 gal) or • Prefer 90 (1-2 qt/100 gal) plus AMS (1.5-3 lb/A) or • Covrex* (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. 	<p>Target Weeds</p> <p>Spring Applications</p> <table border="0"> <tr> <td style="vertical-align: top;"> <p>Grass: 2 leaf to 2-tiller</p> <ul style="list-style-type: none"> - annual ryegrass - barnyardgrass - downy brome (fall) - Japanese brome - cheat - yellow foxtail </td> <td style="vertical-align: top;"> <p>Broadleaf: < 2"</p> <ul style="list-style-type: none"> - volunteer canola - mustards - redroot pigweed - annual smartweed </td> </tr> </table> <p>Timing/Comments</p> <p>Apply from 3 leaf to jointing. Suppression control other grasses when applied in the fall.</p>	<p>Grass: 2 leaf to 2-tiller</p> <ul style="list-style-type: none"> - annual ryegrass - barnyardgrass - downy brome (fall) - Japanese brome - cheat - yellow foxtail 	<p>Broadleaf: < 2"</p> <ul style="list-style-type: none"> - volunteer canola - mustards - redroot pigweed - annual smartweed
<p>Grass: 2 leaf to 2-tiller</p> <ul style="list-style-type: none"> - annual ryegrass - barnyardgrass - downy brome (fall) - Japanese brome - cheat - yellow foxtail 	<p>Broadleaf: < 2"</p> <ul style="list-style-type: none"> - volunteer canola - mustards - redroot pigweed - annual smartweed 			

*Crop Oil at 1-1.25 gal/100 gal can be substituted for Covrex.

Quelex (halauxifen + florasulam)

<p>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.: I.s. shirt, l. pants, c.r. gloves, socks, shoes R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Spring and Winter Wheat, Barley, Triticale <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1-2 pt/100 gal) or • Covrex* (2-4 pt/100 gal) or • Advatrol** (2-4 pt/100 gal) 	<p>Target Weeds</p> <ul style="list-style-type: none"> - common lambsquarters - redroot pigweed - cleavers - henbit - wild buckwheat - mustards - volunteer canola - volunteer flax - smartweeds - chamomiles - horseweed/marestail - field pennycress <p>Apply to weeds in the 2 to 4 leaf or less than 4 inches tall.</p> <p>Timing/Comments</p> <p>Apply from 2-leaf to flag leaf emergence.</p>
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*Crop Oil at 4-8 pt/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO at 4-8 pt/100 gal can be substituted for Advatrol.

Rave (triasulfuron + dicamba)

<p>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.: I.s. shirt, l. pants, coveralls, c.r. gloves, shoes, socks, p. eyewear R.E.I.: 24 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90 (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. 	<p>Target Weeds</p> <p>Controls most broadleaf weeds. See label for crop rate, weeds, and weed sizes.</p> <p>Timing/Comments</p> <p>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.</p>
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Rezuvant (fluroxypyr + halauxifen-methyl + pinoxaden)

<p>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.: I.s. shirt, l. pants, c.r. gloves, socks, shoes R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Spring and Winter Wheat, Barley <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1-2 pt/100 gal) or • Covrex* (2-4 pt/100 gal) or • Advatrol** (2-4 pt/100 gal) 	<p>Target Weeds</p> <ul style="list-style-type: none"> - common lambsquarters - redroot pigweed - kochia - wild buckwheat - mustards - Persian darnel - wild oat - yellow foxtail - green foxtail - Italian ryegrass - prickly lettuce <p>Apply to weeds in the 2 to 4 leaf or less than 4 inches tall.</p> <p>Timing/Comments</p> <p>Apply from 2-leaf to flag leaf emergence.</p>
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*Crop Oil at 4-8 pt/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO at 4-8 pt/100 gal can be substituted for Advatrol.

Rimfire Max (mesosulfuron + propoxycarbazone)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear R.E.I.: 12 hours W. Notification: Oral S. Word: Warning</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Wheat only <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100 gal) or • Prefer 90 (1-2 qt/100 gal) plus AMS (1.5-3 lb/A) or • Advatrol* (0.6-0.75 pt/A) • See label for rotational restrictions. 	<p>Target Weeds</p> <p>Grass: 1 leaf to 2-tiller</p> <ul style="list-style-type: none"> - cheat - barnyardgrass - foxtail barley - giant foxtail - yellow foxtail - Japanese brome - wild oat <p>Broadleaf: < 2"</p> <ul style="list-style-type: none"> - mustards - volunteer canola <p>Timing/Comments</p> <p>Apply from 1 leaf to flag leaf emergence.</p>
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*Upland MSO at 1.2-1.5 pt/A can be substituted for Advatrol.

Starane Flex (fluroxypyr + florasulam)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear R.E.I.: 24 hours W. Notification: Oral S. Word: Warning</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Oat, Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Jackhammer/ Jackhammer Elite (1-2 qt/100 gal) 	<p>Target Weeds</p> <ul style="list-style-type: none"> - common ragweed - common sunflower - kochia - morning glory - mustards - prickly lettuce - smartweed - venice mallow - volunteer flax - wild buckwheat <p>Timing/Comments</p> <p>Apply to barley, oat or wheat from 3 leaf up to flag leaf emergence.</p>
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Starane NXT (fluroxypyr + bromoxynil)

<p>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.: I.s. shirt, l. pants, c.r. gloves shoes, socks, p. eyewear R.E.I.: 24 hours W. Notification: Oral S. Word: Warning</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Oat, Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Jackhammer/ Jackhammer Elite (1 qt/100 gal) 	<p>Target Weeds</p> <p>Controls most annual broadleaf weeds.</p> <p>Timing/Comments</p> <p>Apply to barley, oat or wheat from 3 leaf up to flag leaf emergence.</p>
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Starane Ultra (fluroxypyr)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear R.E.I.: 24 hours W. Notification: Oral S. Word: Warning</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Oat, Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Jackhammer/ Jackhammer Elite (1 qt/100 gal) 	<p>Target Weeds</p> <table border="0"> <tr> <td></td> <td style="text-align: center;">0.3 pt</td> <td style="text-align: center;">0.4 pt</td> </tr> <tr> <td>- kochia</td> <td style="text-align: center;">4"</td> <td style="text-align: center;">8"</td> </tr> <tr> <td>- common ragweed</td> <td style="text-align: center;">4"</td> <td style="text-align: center;">8"</td> </tr> <tr> <td>- sunflower</td> <td style="text-align: center;">4"</td> <td style="text-align: center;">8"</td> </tr> </table> <p>Timing/Comments</p> <p>Apply to barley, oat or wheat from 2 leaf including flag leaf emergence.</p>		0.3 pt	0.4 pt	- kochia	4"	8"	- common ragweed	4"	8"	- sunflower	4"	8"
	0.3 pt	0.4 pt												
- kochia	4"	8"												
- common ragweed	4"	8"												
- sunflower	4"	8"												

Sentrallas (thifensulfuron + fluroxypyr)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, coveralls R.E.I.: 24 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Wheat, Barley, Oat (refer to label for state registrations) <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100) or • Prefer 90 (1-2 pt/100 gal) plus AMS (2 lb/A) or • Covrex* (2 qt/100 gal) plus AMS (2 lb/A) or • Advatrol** (2 qt/100 gal) plus AMS (2 lb/A) 	<p>Target Weeds</p> <p>Numerous annual broadleaf weeds. Control is dependent on rate applied. Refer to label.</p> <p>Apply to weeds less than 4 inches in height or diameter.</p> <p>Timing/Comments</p> <p>Wheat and barley: Apply from 2-leaf before flag leaf is visible. Oat: Apply after crop is the 3-leaf stage but before jointing.</p>
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*Crop Oil at 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO at 1 gal/100 gal can be substituted for Advatrol.

Supremacy (fluroxypyr + thifensulfuron + tribenuron)

<p>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.: I.s. shirt, l. pants, shoes, socks, c.r. gloves, p. eyewear R.E.I.: 24 hours W. Notification: Oral S. Word: Warning</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Durum, Oat, Triticale, Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (2-4 qt/100) 	<p>Target Weeds</p> <ul style="list-style-type: none"> - 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 <p>Timing/Comments</p> <p>Barley, durum, triticale, wheat: apply to crop from 2 leaf until before flag leaf emergence.</p> <p>Oat: apply after 2 leaf stage until prior to jointing.</p>
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Talinor (bicyclopyrone + bromoxynil)

<p>EPA Reg. #: 100-1570</p> <p>Rate/A: 13.7–18.2 fl oz</p> <p>Spray Volume: 5 gpa min (air) 10 gpa min (ground)</p> <p>Rainfast: 1 hour</p> <p>S.O.A.: HPPD Inhibitor (Group 27) Photosystem II Inhibitor (Group 6)</p> <p>P.P.E.: coveralls, l.s. shirt, l. pants, shoes, socks, c.r. gloves</p> <p>R.E.I.: 24 hours</p> <p>W. Notification: Oral</p> <p>S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • CoAct+ (2.75–3.6 fl oz/A) plus Covrex* (2 qt/100 gal) or • CoAct+ (2.75–3.6 fl oz/A) plus Prefer 90 (1 qt/100 gal) • No AMS containing products. 	<p>Target Weeds</p> <ul style="list-style-type: none"> – 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" – waterhemp 2–4" <p>Timing/Comments</p> <p>PNW Recommendations Use NIS (Prefer 90) to reduce crop response Winter wheat - max of 5% UAN in spray solution Spring wheat - Do not add UAN to spray solution</p>
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*Crop Oil at 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

Tarzac (pyroxsulam + halauxifen-methyl)

<p>EPA Reg. #: 62719-719</p> <p>Rate/A: 1 oz (Winter Wheat, Triticale)</p> <p>Spray Volume: 10 gpa min (ground) 5 gpa min (air)</p> <p>Rainfast: 4 hours</p> <p>S.O.A.: ALS Inhibitor (Group 2) Growth Regulator (Group 4)</p> <p>P.P.E.: protective eyewear, l.s. shirt and pants, shoes, socks</p> <p>R.E.I.: 24 hours</p> <p>W. Notification: Oral</p> <p>S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Winter Wheat, Triticale <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (2 qt/100 gal) or • Prefer 90* (1–2 qt/100 gal) plus AMS (1.5–3 lb/A) 	<p>Target Weeds</p> <p>Controls many broadleaf weeds including:</p> <ul style="list-style-type: none"> – barnyardgrass – cheat – foxtail barley – foxtail, yellow – ryegrass, Italian – Japanese brome – buckwheat, wild – field bindweed – kochia – lambsquarters – mustards <p>Timing/Comments</p> <p>All crops: 3 leaf up to jointing</p>
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*When tank-mixed with EC herbicides exceeding 6 oz, do not use Prefer 90.

Travallas (metsulfuron + thifensulfuron + fluroxypyr)

<p>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.: I.s. shirt, l. pants, waterproof gloves, shoes, socks, coveralls R.E.I.: 24 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Spring and Winter Wheat, Barley (refer to label for state registrations) <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100) or • Prefer 90 (1–2 pt/100 gal) plus AMS (2 lb/A) or • Covrex* (2 qt/100 gal) plus AMS (2 lb/A) or • Advatrol** (2 qt/100 gal) plus AMS (2 lb/A) 	<p>Target Weeds</p> <ul style="list-style-type: none"> – volunteer lentils – volunteer peas – mustards – cow cockle – flixweed – common chickweed – common lambsquarters – field pennycress – kochia <p>Timing/Comments</p> <p>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.</p>
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*Crop Oil at 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO at 1 gal/100 gal can be substituted for Advatrol.

Varro (thiencarbazone-methyl)

<p>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.: I.s. shirt, l. pants, socks, shoes, c.r. gloves R.E.I.: 4 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Wheat—spring and winter, Durum <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (2–4 qt/100 gal) or • Prefer 90 (1–2 qt/100 gal) plus AMS (0.5–1 lb/A) or • Prefer 90 (1 qt/100 gal) 	<p>Target Weeds</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;"><u>Grass: 1 leaf to 2-tiller</u></td> <td style="width: 50%;"><u>Broadleaf: 1–6 leaf</u></td> </tr> <tr> <td> <ul style="list-style-type: none"> – barnyardgrass – green foxtail – wild oat – yellow foxtail </td> <td> <ul style="list-style-type: none"> – common chickweed – field pennycress – redroot pigweed – shepherd’s purse – volunteer canola – wild mustard </td> </tr> </table> <p>Timing/Comments</p> <p>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.</p>	<u>Grass: 1 leaf to 2-tiller</u>	<u>Broadleaf: 1–6 leaf</u>	<ul style="list-style-type: none"> – barnyardgrass – green foxtail – wild oat – yellow foxtail 	<ul style="list-style-type: none"> – common chickweed – field pennycress – redroot pigweed – shepherd’s purse – volunteer canola – wild mustard
<u>Grass: 1 leaf to 2-tiller</u>	<u>Broadleaf: 1–6 leaf</u>					
<ul style="list-style-type: none"> – barnyardgrass – green foxtail – wild oat – yellow foxtail 	<ul style="list-style-type: none"> – common chickweed – field pennycress – redroot pigweed – shepherd’s purse – volunteer canola – wild mustard 					

WideMatch (fluroxypyr + clopyralid)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks R.E.I.: 12 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Barley, Oat, Wheat <p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Jackhammer/ Jackhammer Elite (1 qt/100 gal) 	<p>Target Weeds</p> <p>Controls most annual and perennial broadleaf weeds.</p> <p>Timing/Comments</p> <p>Barley, oat, or wheat: apply from 3 leaf to flag leaf emergence.</p>
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Wolverine Advanced (fenoxaprop + pyrasulfotole + bromoxynil)

<p>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.: I.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear R.E.I.: 24 hours W. Notification: Oral S. Word: Caution</p>	<p>Labeled Crops</p> <ul style="list-style-type: none"> • Wheat, Durum, Barley 	<p>Target Weeds</p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;"><u>Grass</u></th> <th style="text-align: left;"><u>Broadleaf</u></th> </tr> </thead> <tbody> <tr> <td>- barnyardgrass</td> <td>- cocklebur 1-4 leaf</td> </tr> <tr> <td>- green foxtail</td> <td>- kochia 1-4 leaf</td> </tr> <tr> <td>- yellow foxtail</td> <td>- lambsquarters 1-6 leaf</td> </tr> <tr> <td>- wild oat</td> <td>- mustards 1-6 leaf, 4" diameter</td> </tr> <tr> <td></td> <td>- nightshades 1-4 leaf</td> </tr> <tr> <td></td> <td>- ragweeds, 1-4 leaf</td> </tr> <tr> <td></td> <td>common and giant</td> </tr> <tr> <td></td> <td>- redroot pigweed 1-6 leaf</td> </tr> <tr> <td></td> <td>- volunteer canola 1-6 leaf, 4" diameter</td> </tr> <tr> <td></td> <td>- wild buckwheat 1-6 leaf</td> </tr> </tbody> </table> <p>Timing/Comments</p> <p>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.</p> <p>Apply to barley from emergence up to the 5 leaf stage.</p> <p>Apply to grass weeds in the 1 leaf to 2 tiller stage.</p>	<u>Grass</u>	<u>Broadleaf</u>	- 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, 1-4 leaf		common and giant		- redroot pigweed 1-6 leaf		- volunteer canola 1-6 leaf, 4" diameter		- wild buckwheat 1-6 leaf
<u>Grass</u>	<u>Broadleaf</u>																							
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	- volunteer canola 1-6 leaf, 4" diameter																							
	- wild buckwheat 1-6 leaf																							

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*	Lambquarters	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	F	G	P	F	F	E	F	E	E	E	F	E	E	E	E	F	E	F	G	P	G	G	G	F	G	F		
2,4-D Ester	E	G	E	E	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	G	G		
Affinity Broadspec + 2,4-D / MCPA	E	N	N	E	N	N	N	N	N	N	E	G	G	F	E	E	F	E	E	F	E	G	G	G	E	E	E	G	G	F	F	G	P	G	G	G		
Affinity Tank mix W + 2,4-D / MCPA	E	N	N	E	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	G	G		
Agility SG	E	N	N	E	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	P	P		
Aim EC	G	G	N	G	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	P	P		
Ally Extra	E	N	N	E	N	N	N	N	N	N	E	F	G	F	G	E	-	G	E	E	P	E	E	E	E	E	E	E	G	G	G	-	G	P	F	F	F	
Ally XP / Potter	E	N	N	E	N	N	N	N	N	N	E	F	G	F	G	G	-	-	G	G	P	G	E	E	E	E	G	G	F	G	F	-	F	P	F	F	F	
Ally XP + 2,4-D / MCPA	E	N	N	E	N	N	N	N	N	N	E	G	G	F	E	E	F	G	E	E	F	E	E	E	E	E	E	E	F	G	F	F	G	F	F	F	F	
Amber Custom Pak	E	N	N	E	N	N	F	F	F	P	E	G	G	F	G	G	-	-	E	E	P	E	E	E	E	E	G	E	G	E	G	-	P	P	P	P	P	
Amber Custom Pak + 2,4-D	E	N	N	E	N	N	F	F	F	P	E	E	G	F	E	E	F	E	E	E	F	E	E	E	E	E	E	E	G	E	G	F	F	F	F	F	F	
Audit 4:1 + 2,4-D / MCPA	E	N	N	E	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	G	G	G	
Axial Star**	G	N	N	G	G	P	P	E	E	N	E	F	G	P	F	E	F	P	E	E	F	E	G	G	E	F	E	E	E	E	E	P	F	F	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	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	N	N	
Beyond (Clearfield Wheat Only)	N	N	N	E	G	P	F	G	F	P	E	G	E	P	F	F	F	G	E	E	E	E	E	P	F	G	E	E	E	G	P	P	P	P	P	P	P	
Brox M / Maestro MA	E	G	G	E	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	E	F	F	F	F	F	F	F
Brox 2EC / Maestro 2 EC	E	G	G	E	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	F	F	F	
Clarity / Detonate / Dicamba	F	G	N	G	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	G	G	G	G
Clarity / Detonate / Dicamba + 2,4-D / MCPA	F	G	N	G	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	G	G	G	G
Cleansweep M	E	E	N	E	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	G	G	G	G
Curtail / Curtail M	E	N	N	E	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	F	F	F	F
Discover NG / NextStep NG	N	N	N	E	E	P	P	E	G	P	N	N	N	N	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	N	N	N	N	N	N	N	N	N	N	E	N	E	F	N	N	N	E	E	N	F	P	N	N	N	N	N	
Express SG + 2,4-D / MCPA	E	N	N	E	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	G	G	G	
Glean XP	E	E	N	E	N	N	G	G	G	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	N	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	P	P	
Harmony Extra SG + 2,4-D / MCPA	E	N	N	E	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	E	F	F	P	G	G	G	G	
Harmony SG + 2,4-D / MCPA	E	E	N	E	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	P	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*	Lambquarters	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	Southistle		
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	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	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	F	
Olympus 70 WDG	N	N	N	G	P	E	G	P	P	P	G	F	P	F	P	P	P	P	E	E	P	E	G	P	P	P	E	P	P	F	P	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	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	F	E	P	P	G	P	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	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	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	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	E	E	P	G	F	P	P	P	G	P	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		
Tarzac	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	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	N	N	E	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 + Linkage	0.5 fl oz	All Wheat		C										9	9	11	24	24
Everest / Sierra + Linkage	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 + Linkage	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 + Linkage	1 pt	Spring Wheat	C	S	C	C/S	S	C			S	C	C	9	9	9/18	9/18	9/18
Huskie Complete + Linkage	13.7 fl oz	All Wheat	C	C	C			S	C	S				9	10	10	18	18
Maverick + Linkage	0.67 oz	Spring, Winter Wheat	S			S	C	C/S				S	S	22	22	22	17/22	22
Olympus + Linkage	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 + Linkage	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 + Linkage	16 oz	All Wheat	C	S	C	S	S	C	C	C	S		S	9	9	10.5	18	18
PowerFlex HL + Linkage	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
Rezvant	16.4 oz	Spring, Winter, Barley	C	C	C				C	C		C		0	4	9	9	15
Rimfire Max + Linkage	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 + Linkage	1 oz	Winter Wheat, Triticale	C	S	C	C/S	S	C	C		S		C	9	9	9	9	15
Varro / Luxur B + Linkage	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 Linkage 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 Petrichor, Verium 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 XL²	(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
Besiege²	(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 ZC²	(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 LV² -Idaho, Ore., and Wash. Only	(1A)	Barley, Wheat, Sorghum ³	Aphid, Alfalfa Caterpillar, Cutworm	0.75–3 pt
		Not triticale	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.

Verium @ 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 Maxx²	(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
Silencer² Province²	(3A)	Barley, Wheat, Sorghum ³	Alfalfa Caterpillar, Green Cloverworm, Potato Leafhopper,	1.92–3.2 fl oz
			Thistle Caterpillar, Woolly Bear Caterpillar	
LambdaStar²			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 II² LambdaStar Plus²	(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.

Verium @ 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)	Approach®	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).

⁴ Verium is recommended @ 1 qt/100 gal (Ground) or 4-6 fl oz/A (Aerial) for increased fungicide efficacy, and drift control/deposition.

³ General Recommended Rates. Always read and follow all use restrictions before applying any fungicide.

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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).

⁴ Verium is recommended @ 1 qt/100 gal (Ground) or 4-6 fl oz/A (Aerial) for increased fungicide efficacy, and drift control/deposition.

³ General Recommended Rates. Always read and follow all use restrictions before applying any fungicide.

All trademarks and registered trademarks are the property of their respective owners or manufacturers.

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).

⁴ Verium is recommended @ 1 qt/100 gal (Ground) or 4-6 fl oz/A (Aerial) for increased fungicide efficacy, and drift control/deposition.

³ General Recommended Rates. Always read and follow all use restrictions before applying any fungicide.

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Small Grains // Fungicide Leaf Disease Options

Fungicide	Rate/A	Application Timing(s)	Diseases Controlled	Comments
Alto 100 SL + Verium	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.
Approach + Verium	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.	
Approach Prima + Verium	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 + Verium	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 + Prefer 90 or Verium	10 fl oz + 1 pt/100	Prior to disease development.	Tan Spot, Rust, Septoria, Blotch, Barley Scald, Powdery Mildew.	Barley, Oats, Rye, Wheat.
Custodia + Prefer 90 or Verium	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 + Prefer 90 or Verium	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 Prefer 90 or Verium when tank mixing with herbicides.
Evito T + Prefer 90 or Verium	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 + Prefer 90 or Verium	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 + Prefer 90 or Verium	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 Prefer 90 or Verium when tank mixing with herbicides.
Mancozeb + Verium	2 lb/acre	Do not apply after Feekes 10.5.	Leaf Rust, Tan Spot	Wheat, Barley, Rye, Oat, Triticale.
Miravis Ace + Verium	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.

Covrex may be substituted for either Verium 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 + Verium	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, Strip Rust, Tan Spot.	Barley, Oats, Rye, Triticale, Wheat.
Proline + Prefer 90 or Verium	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 + Prefer 90 or Verium	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 + Prefer 90 or Verium	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 Verium	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 Verium will optimize efficacy.
	7.7-10.8 fl oz + 2 qt/100 or 1 pt/100		Powdery Mildew.	
Quilt + Verium	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 pt/100		Rusts and other diseases.	
Quilt Xcel + Verium	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 + Prefer 90 or Verium	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 + Prefer 90 or Verium	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 + Prefer 90 or Verium	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 + Verium	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 + Verium	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 + Verium	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.

Covrex may be substituted for either Verium or Crop Oil @ 0.5% v/v.

Some products are not labeled in all states, confirm state registration prior to use.

Small Grains // Fungicide Options for Fusarium Head Blight

Fungicide	Rate/A	Application Timing(s)	Diseases Controlled	Comments
Approach + Verium	12 fl oz + 1 pt/100	Flag leaf emerged (Feekes 9).	Scab Suppression.	Wheat, Triticale.
Approach Prima + Verium	6.8 fl oz + 1 pt/100	Flag leaf emerged (Feekes 9).	Scab Suppression.	Wheat, Triticale.
Bumper, Propimax, or Tilt + Prefer 90 or Verium	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 + Prefer 90 or Verium	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 + Prefer 90 or Verium	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 + Prefer 90 or Verium	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 + Prefer 90 or Verium	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 + Prefer 90 or Verium	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 + Prefer 90 or Verium	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.

Covrex may be substituted for either Verium or Crop Oil @ 0.5% v/v.

Some products are not labeled in all states, confirm state registration prior to use.

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.

LEVESOL® DFC

LEVESOL® DFC ZN



MOXON™ CU

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: Apply 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

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	



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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, marestalk, 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, marestalk, 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, marestalk, 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, marestalk, 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, marestalk, 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

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
Optill	2 and 14	2.0 oz	Apply PP or PRE. PRE applications must be made prior to emergence.	Palmer amaranth, marestalk, 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, marestalk, 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, marestalk, 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, marestalk, 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, marestalk, 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

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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)

		Adjuvant(s)/ Comments	Target Weeds	3.5–4.5 fl oz	5–6 fl oz
EPA Reg. #:	279-3468	• Prefer 90 (1 qt/100 gal) plus AMS (1.5– 3 lb/A)	– Jimsonweed	2"	2"
Rate/A:	2–5.7 fl oz		– kochia	2"	2"
Spray Volume:	min 5 gpa	or	– lambsquarters	2"	3"
Rainfast:	1 hour	• Linkage (1 gal/100 gal)	– morning glory, annual	2"	3"
S.O.A.:	Very Long Chain Fatty Acid (Group 15)	or	– nightshade (black, Eastern black)	2"*	2"
P.P.E.:	PPO Inhibitor (Group 14)	• Covrex* (0.5–1 pt/A) plus AMS*** (1.5–3 lb/A)	– pigweed (redroot, smooth)	2"*	4"
R.E.I.:	12 hours	or	– velvetleaf	36"	36"
W. Notification:		• Advatrol** (0.5–1 pt/A) plus AMS*** (1.5–3 lb/A)	– waterhemp (common, tall)	2"*	2"
S. Word:	Caution	or			
		• Tapran (1 gal/100 gal)			
			Timing/Comments		
			Apply from planting through the third trifoliolate (V3) leaf stage.		

*Crop Oil @ 1–2 pt/A or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1–2 pt/A can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Assure II / Targa (quizalofop)

		Adjuvant(s)/ Comments	Target Weeds	4 fl oz	6 fl oz	8 fl oz
Brand Name:	EPA Reg. #:	• Prefer 90 (1 qt/100 gal) plus AMS*** (2–4 lb/A)	– barnyardgrass	-	-	2–6"
Assure II	352-541		or	– field sandbur	-	-
Targa	33906-9-81880	• Covrex* (2 qt/100) plus AMS*** (2–4 lb/A)	– crabgrass	-	-	2–6"
Rate/A:	4–10 fl oz	or	– giant foxtail	-	-	2–4"
Spray Volume:	min 10 gpa	• Advatrol** (2 qt/100) plus AMS*** (2–4 lb/A)	– green foxtail	6–24"	24"+	-
Rainfast:	1 hour	or	– volunteer corn	-	-	2–6"
S.O.A.:	ACC-ase Inhibitor (Group 1)	• Advatrol** (2 qt/100) plus AMS*** (2–4 lb/A)	– wild proso millet	-	-	2–4"
P.P.E.:	I.s. shirt, I. pants, c.r. gloves, eyewear, shoes, socks	or	– yellow foxtail	-	-	2–6"
R.E.I.:	12 hours	• Tapran (1 gal/100 gal)	– wild oat			
W. Notification:	Oral	or	– woolly cupgrass	2–4" @ 9 oz		
S. Word:	Danger	• Note: When tank mixing with glyphosate, add Jackhammer at 2–3 qt/100 gal.	– quackgrass	6–10" @ 10 oz		

*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Basagran (bentazon)

		Adjuvant(s)/ Comments	Target Weeds	1 pt	1.5 pt	2 pt
EPA Reg. #:	7969-45-51036	• Jackhammer/Verium (2 qt/100 gal) or • Covrex* (2 qt/100 gal) plus AMS** (2.5 lb/A)	- cocklebur	4"	6"	10"
Rate/A:	1-2 pt		- lambsquarters	1"	1.5"	2"
Spray Volume:	10-20 gpa		- common ragweed	-	-	3"
Rainfast:	1 hour		- giant ragweed	-	-	6"
S.O.A.:	Photosystem II Inhibitor (Group 6)		- annual smartweed	4"	6"	10"
P.P.E.:	I.s. shirt, I. pants, w.p. gloves, shoes, socks		- velvetleaf	2"	2"	5"
R.E.I.:	48 hours		- venice mallow	2"	2"	4"
W. Notification:	Oral		- wild buckwheat	-	3"	5"
S. Word:	Caution		- wild mustard	2"	4"	8"
			- wild sunflower	3"	5"	8"

*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Canada thistle: split applications needed.

Cadet (fluthiacet-methyl)

		Adjuvant(s)/ Comments	Target Weeds	0.6 fl oz	0.9 fl oz
EPA Reg. #:	279-3338	• Jackhammer/Jackhammer Elite (2 qt/100 gal) or • Covrex* (0.5-1 pt/100 gal) • When tank mixing, use the adjuvant for the tank mix partner.	- burcucumber	2"	2"
Rate/A:	0.6-0.9 fl oz		- nightshade	2"	2"
Spray Volume:	min 10 gpa		- lambsquarters	2"	2"
Rainfast:	4 hours		- kochia	2"	2"
S.O.A.:	PPO Inhibitor (Group 14)		- pigweed	2"	4"
P.P.E.:	I.s. shirt, I. pants, c.r. gloves, shoes, socks, eyewear		- velvetleaf	36"	36"
R.E.I.:	12 hours		- waterhemp	-	2"
W. Notification:	Oral				
S. Word:	Warning				

*Suppression only

Timing/Comments

Can be applied from cotyledon to flowering.

*Crop Oil @ 1 qt/A or Verium @ 1 qt/100 gal can be substituted for Covrex.

Classic (chlorimuron)

		Adjuvant(s)/ Comments	Target Weeds	0.5 oz	0.67 oz	0.75 oz
EPA Reg. #:	5481-681	• Prefer 90 (1 qt/100 gal) or • Covrex* (2 qt/100 gal) plus AMS** (2-4 lb/A) or • Tapran (1 gal/100 gal)	- common ragweed	-	3"	4"
Rate/A:	0.5-0.75 oz		- cocklebur	6"	8"	12"
Spray Volume:	min 10 gpa		- pigweed	2"	3"	4"
Rainfast:	1 hour		- smartweed	2"	3"	4"
S.O.A.:	ALS Inhibitor (Group 2)		- sunflower	5"	6"	8"
P.P.E.:	I.s. shirt, I. pants, c.r. gloves, shoes, socks		- velvetleaf	-	4"	6"
R.E.I.:	12 hours		- yellow nutsedge	3"	3"	4"
W. Notification:	Oral					
S. Word:	Caution					

*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Clethodim Products

	Adjuvant(s)/ Comments	Target Weeds	6 fl oz	8 fl oz
Brand Name: EPA Reg. #	• Covrex* (2 qt/100 gal) plus AMS*** (2.5–4 lb/A)	– barnyardgrass – crabgrass – giant foxtail – green foxtail – quackgrass	6"	8"
Arrow 66222-60			2"	6"
Volunteer 59639-3-55467	or	– volunteer cereals	6"	8"
Clethodim 2E 42750-72	• Advatrol** (2 qt/100 gal) plus AMS*** (2.5–4 lb/A)	<i>2nd application may be needed</i>		4–12"
Shadow 3EC 66330-414	or	– volunteer corn	6"	8"
Rate/A: 6–8 fl oz (2.67–5.33 fl oz for Shadow 3EC)	• Tapran (1 gal/100 gal)	– wild proso millet	12"	18"
Spray Volume: 5–40 gpa	• Clethodim products may be used at 4–6 fl oz for volunteer corn control when tank mixed with glyphosate.	– woolly cupgrass	8"	10"
Rainfast: 1 hour		– yellow foxtail	6"	8"
S.O.A.: ACC-ase Inhibitor (Group 1)				
P.P.E.: I.s. shirt, I. pants, c.r. gloves, p. eyewear, shoes, socks				
R.E.I.: 24 hours				
W. Notification: Oral				
S. Word: Warning				

*Crop Oil @ 1–2 pt/A or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1–2 pt /A can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Cobra, Phoenix (lactofen)

	Adjuvant(s)/ Comments	Target Weeds	8 fl oz	10 fl oz	12.5 fl oz
EPA Reg. #: 59639-34	• Prefer 90 (1 qt/100 gal) plus AMS*** (2.5 lb/A)	– common ragweed – cocklebur – nightshade – pigweed – waterhemp	4"	5"	6"
Rate/A: 8–12.5 fl oz			-	5"	6"
Spray Volume: 20–30 gpa	or		4"	5"	6"
Rainfast: 30 minutes	• Covrex* (0.5–1 pt/A)		6"	6"	6"
S.O.A.: PPO Inhibitor (Group 14)	or		-	4"	6"
P.P.E.: coveralls over I.s. shirt, I. pants, c.r. gloves, c.r. footwear, socks, apron, eyewear	• Advatrol** (0.5–1 pt/A)				
R.E.I.: 12 hours	or				
W. Notification: Oral	• Tapran (1 gal/100 gal)	Timing/Comments			
S. Word: Danger	• See label for adjuvant precautions.	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.			

*Crop Oil @ 1–2 pt/A or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1–2 pt/A can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Do not use during periods of stress or weed control
will be poor.

Engenia: (BAPMA salt of Dicamba)

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 7969-345	• Verasure (1 gal/100 gal of water)	- black nightshade
Rate/A: 12.8 fl oz	or	- common ragweed
Spray Volume: min 10 gpa	• Last Chance Pro (1-2 qt/100 gal)	- Canada thistle
Rainfast: 4 hours	plus	- cocklebur
S.O.A.: Plant Growth Regulator (Group 4)	Cognitive 1 or Mediate (2 qt/100 gal)	- giant ragweed
P.P.E.: I.s. shirt, l. pants, c.r gloves, shoes, socks, dust/mist filtering respirator	or	- kochia
R.E.I.: 24 hours	• Jackhammer Elite (2 qt/100 gal)	- lambsquarters
W. Notification: Oral	plus	- pigweed
S. Word: Caution/Precaution	Cognitive 1 or Mediate (2 qt/100 gal)	- venice mallow
	• No acidifying water conditioners; DO NOT use ammonium additives (e.g., AMS, UAN), DO NOT use in aerial application	- velvetleaf
	• Pre-harvest interval for application to Roundup Ready 2 Xtend soybeans: 7-10 days for soybean forage and 13-15 days for soybean hay	- wormwood
	• Visit www.engeniatankmix.com for a list of approved tank mix partners and adjuvants	- 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

	Adjuvant(s)/Comments	Target Weeds
EPA Reg. #: 62719-649	• Energex (2 qt/100 gal)	- common lambsquarters
Rate/A: 3.5-4.75 pt	or	- common ragweed
Spray Volume: min 10 gpa	• Adium (2.5 gal/100 gal)	- Eastern black nightshade
Rainfast: 24 hours	or	- giant ragweed
S.O.A.: Plant Growth Regulator (Group 4), EPSP Synthase Inhibitor (Group 9)	• Jackhammer (2 qt/100 gal)	- marestail
P.P.E.: I.s. shirt, l. pants, c.r gloves, shoes, socks, eyewear	plus	- morning glory
R.E.I.: 48 hours	Covrex (4 oz/A)	- Palmer amaranth
W. Notification: Oral	or	- velvetleaf
S. Word: Warning	• Encloax (2.5 gal/100 gal)	- waterhemp
	plus	- prickly sida
	Covrex (4 oz/A)	
	• Use only with E3 soybeans	Timing/Comments
	• Refer to www.enlisttankmix.com for approved CHS adjuvants	Refer to product label for application timings for different crops (corn, soybean and cotton).
	• Refer to "Allowable nozzles and operating pressure (PSI)" mentioned on product label	

Enlist One (2,4-D Choline)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 62719-695	• Enerpex (2 qt/100 gal)	- common lambsquarters
Rate/A: 1.5–2.0 pt	or	- common ragweed
Spray Volume: min 10 gpa	• Adium (2.5 gal/100 gal)	- Eastern black nightshade
Rainfast: 4 hours	or	- giant ragweed
S.O.A.: Plant Growth Regulator (Group 4)	• Jackhammer (2 qt/100 gal) plus Covrex (4 oz/A)	- marestalk
P.P.E.: I.s. shirt, l. pants, c.r. gloves, shoes, socks	or	- morning glory
R.E.I.: 48 hours	• Encloax (2.5 gal/100 gal) plus Covrex (4 oz/A)	- Palmer amaranth
W. Notification: Oral	• Use with E3 soybeans.	- velvetleaf
S. Word: Warning	• Refer to www.enlisttankmix.com for approved CHS adjuvants.	- waterhemp
	• 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.	- prickly sida
		Timing/Comments
		Refer to product label for application timings for different crops (corn, soybean and cotton).

FirstRate (cloransulam)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 62719-275	• Prefer 90 (1–2 pt/100 gal) plus AMS*** (2 lb/A)	- common ragweed 8"
Rate/A: 0.3 oz	or	- common sunflower 12"
Spray Volume: min 10 gpa	• Linkage (1 gal/100 gal)	- cocklebur 10"
Rainfast: 2 hours	or	- giant ragweed 10"
S.O.A.: ALS Inhibitor (Group 2)	• Covrex* (5 pt/100 gal) plus AMS*** (2 lb/A)	- marestalk 6"
P.P.E.: I.s. shirt, l. pants, c.r. gloves, shoes, socks	or	- morning glory 4"
R.E.I.: 12 hours	• Advatrol** (5 pt/100 gal) plus AMS*** (2 lb/A)	- Pennsylvania smartweed 6"
W. Notification: Oral	or	- venice mallow < 3"
S. Word: Caution	• Tapran (1 gal/100 gal)	- velvetleaf 6"
		Timing/Comments
		Apply from 1st trifoliolate to 50% flowering.

*Crop Oil @ 1–2 pt/A or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 10 pt/100 gal/A can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Flexstar GT 3.5 (fomesafen + glyphosate)

EPA Reg. #:	100-1385	Adjuvant(s)/Comments	Target Weeds
Rate/A:	2.68–4.5 pt	• Covrex* (2 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)	Controls many annual and perennial grass and broadleaf weeds under 8" tall.
Spray Volume:	15–20 gpa	or	
Rainfast:	1 hour	• Advatrol** (2 qt/100 gal) plus AMS*** (8.5–17 lb/100 gal)	Timing/Comments
S.O.A.:	PPO Inhibitor (Group 14) EPSP Synthase Inhibitor (Group 9)	or	See label for geographical rate restrictions.
P.P.E.:	I.s. shirt, l. pants, shoes, socks, c.r. gloves, apron	• Tapran (1 gal/100 gal)	Apply prior to bloom.
R.E.I.:	24 hours		Roundup Ready Soybeans Only.
W. Notification:	Oral		
S. Word:	Caution		

*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Flexstar, Reflex, others (fomesafen)

	Adjuvant(s)/Comments	Target Weeds	0.75 pt	1 pt
Brand Name:	EPA Reg. #	• Covrex* (2 qt/100 gal) plus AMS*** (10 lb/100 gal)	- black nightshade 2"	4"
Reflex	100-993	or	- common ragweed -	4"
Flexstar	100-1101	• Advatrol** (2 qt/100 gal) plus AMS*** (10 lb/100 gal)	- waterhemp 2"	2"
Rate/A:	0.75–1.3 pt	or	- cocklebur 2"	4"
Spray Volume:	min 15 gpa	• Tapran (1 gal/100 gal)	- giant ragweed -	4"
Rainfast:	1 hour	• See label for geographical rate restrictions.	- lambsquarters -	2"
S.O.A.:	PPO Inhibitor (Group 14)		- morning glory -	3"
P.P.E.:	coveralls, I.s. shirt, l. pants, c.r. gloves, c.r. footwear, socks, apron		- pigweed 2"	4"
R.E.I.:	24 hours		- smartweed -	4"
W. Notification:	Oral		- venice mallow 4"	6"
S. Word:	Warning		- wild mustard 4"	6"
		Timing/Comments		
		Apply prior to bloom.		

*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Fusilade DX (fluazifop-P-butyl)

	Adjuvant(s)/Comments	Target Weeds	4 fl oz	6 fl oz	8 fl oz
EPA Reg. #:	100-1070	• Prefer 90 (1–2 qt/100 gal)	- barnyardgrass -	-	2–4"
Rate/A:	6–12 fl oz	or	- crabgrass -	-	1–4"
Spray Volume:	5–40 gpa	• Covrex* (1–2 qt/100 gal)	- giant foxtail -	-	2–4"
Rainfast:	1 hour	• Add: AMS** when weeds are stressed.	- green and yellow foxtail -	-	2–4"
S.O.A.:	ACC-ase Inhibitor (Group 1)	• Use the surfactant required by the broadleaf herbicide tank mix.	- wild oat -	-	2–6"
P.P.E.:	I.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear, apron		- volunteer cereals -	2–6"	-
R.E.I.:	12 hours		- volunteer corn 10–24"	2–6"	2–6"
W. Notification:	Oral		- wild proso millet -	24"+	2–4"
S. Word:	Caution		- woolly cupgrass -	4–8"	6–8"
			- quackgrass 6–10" @ 12 fl oz		
			<i>May require a second treatment</i>		

*Crop Oil @ 0.5–1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Glufosinate

		Adjuvant(s)/Comments	Target Weeds	<u>32 fl oz</u>
Brand Name:	EPA Reg. #:	• Last Chance Pro plus AMS (1.5-3.0 lb/A)	- wild buckwheat	6"
Liberty 280 SL	264-829		- cocklebur	6"
Autonomy	7969-448-55467	or	- kochia	4"
Cheetah	71368-112	• Jackhammer (3 qt/100)	- morning glory	6"
Noventa	7696-448		- wild mustard	4"
Interline	70506-310	or	- nightshade	6"
Spray Volume:	15-20 gpa	• Encloax (3.5 pt/A)	- pigweed species	3"
Rainfast:	4 hours		- ragweed species	6"
M.O.A.:	Glutamine Synthase Inhibitor		- velvetleaf	6"
P.P.E.:	l.s. shirt, l. pants, shoes, socks		- waterhemp	3"
R.E.I.:	12 hours		- barnyardgrass	4"
W. Notification:	Oral		- foxtail species	3"
S. Word:	Warning		- wild oat	3"
			- volunteer corn	6"
			- crabgrass	3"

Glufosinate

		Adjuvant(s)/Comments	Target Weeds	<u>16.3 fl oz</u>
Brand Name:	EPA Reg. #:	• Last Chance Pro plus AMS (1.5-3.0 lb/A)	- wild buckwheat	6"
Surmise 5	42750-401		- cocklebur	6"
Spray Volume:	15-20 gpa	or	- kochia	4"
Rainfast:	4 hours	• Jackhammer (3 qt/100)	- morning glory	6"
M.O.A.:	Glutamine Synthase Inhibitor		- wild mustard	4"
P.P.E.:	l.s. shirt, l. pants, shoes, socks	or	- nightshade	6"
R.E.I.:	12 hours	• Encloax (3.5 pt/A)	- pigweed species	3"
W. Notification:	Oral		- ragweed species	6"
S. Word:	Warning		- velvetleaf	6"
			- waterhemp	3"
			- barnyardgrass	4"
			- foxtail species	3"
			- wild oat	3"
			- volunteer corn	6"
			- crabgrass	3"

Glyphosate

		# A.E.	=0.75 AE	Surfactant/Comments
Brand Name:	EPA Reg. #:			• Last Chance Pro (1 qt/100) plus AMS (8.5-17 lb/100)
Buccaneer Plus	55467-9	3.00	32.0	
Gly Star Original	42750-60	3.00	32.0	or
Gly Star Plus	42750-61	3.00	32.0	• Jackhammer/Jackhammer Elite (2-3 qt/100)
Durango DMA	62719-556	4.00	24.0	
Buccaneer 5 Extra	55467-15	4.00	24.0	or
Gly Star 5 Extra	42750-59	4.00	24.0	• Encloax (2.5-5 gal/100)
Gly Star K-Plus	42750-122	4.50	21.3	
Buccaneer K	42750-122-55467	4.50	21.3	or
Roundup RT 3	524-544	4.50	21.3	• Prefer 90 (1 qt/100) plus AMS (8.5-17 lb/100)
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			

Harmony SG (thifensulfuron-methyl)

<p>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</p>	<p>Adjuvant(s)/ Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1–2 pt/100 gal) plus AMS** (2–4 lb/A) or • Linkage (1 gal/100 gal) • Under dry or cool conditions, replace Prefer 90 with: Covrex* (1 qt/100 gal) 	<p>Target Weeds</p> <ul style="list-style-type: none"> – wild mustard 4" diameter – lambsquarters 4" – pigweed 8–12" dependent on species – smartweed 6" – velvetleaf 6" <p>Timing/Comments</p> <p>Apply after 1st trifoliolate.</p>
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*Crop Oil @ 2 qt/100 gal or Verium at 1 qt/100 gal can be substituted for Covrex.

**Jackhammer @ 2 qt/100 gal can be substituted for AMS.

Marvel (fluthiacet methyl + fomesafan)

<p>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</p>	<p>Adjuvant(s)/ Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1–2 qt/100 gal) plus AMS*** (1.5–3 lb/A) or • Covrex* (1–2 qt/100 gal) plus AMS*** (1.5–3 lb/A) or • Advatrol** (1–2 qt/100 gal) plus AMS*** (1.5–3 lb/A) or • Tapran (1 gal/100 gal) • See label for geographical restrictions. 	<p>Target Weeds</p> <ul style="list-style-type: none"> – lambsquarters 3" 4" – nightshade 2" 4" – redroot pigweed 2" 4" – waterhemp 2" 4" – common ragweed < 2" 2" – velvetleaf 24" 36" – venice mallow 3" 4" <p>Timing/Comments</p> <p>Apply prior to flowering.</p>	<p><u>6 fl oz</u></p>	<p><u>7.25 fl oz</u></p>
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*Crop Oil @ 2–4 qt/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 2–4 qt/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Poast (sethoxydim)

	Adjuvant(s)/ Comments	Target Weeds	5 pt	1 pt	1.5 pt
EPA Reg. #: 7969-58-51036	<ul style="list-style-type: none"> • Covrex* (1 pt/A) plus AMS*** (2.5 lb/A) 	- barnyardgrass	-	8"	-
Rate/A: 0.5-1.5 pt		- crabgrass	-	6"	-
Spray Volume: 5-20 gpa	or	- field sandbur	-	-	3"
Rainfast: 1 hour	<ul style="list-style-type: none"> • Advatrol** (0.75 pt/A) plus AMS*** (2.5 lb/A) 	- foxtail	-	8"	-
S.O.A.: ACC-ase Inhibitor (Group 1)		- volunteer cereals	-	-	-
P.P.E.: coveralls, l.s. shirt, l. pants, c.r. gloves, c.r. footwear, headgear, eyewear, shoes, socks, apron	or	- volunteer corn	-	20"	-
R.E.I.: 12 hours	<ul style="list-style-type: none"> • Tapran (1 gal/100 gal) 	- wild proso millet	10"	-	-
W. Notification: Oral		• Use the surfactant required by the broadleaf herbicide for the tank mix.	- wild oat	-	4"
S. Word: Warning	• Use lower rate for most grasses and higher rates for volunteer corn control.	- woolly cupgrass	-	8"	-

*Crop Oil @ 1 qt/A gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 0.75-1 pt/A can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Prefix (fomesafen + s-metolachlor)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 100-1268	<ul style="list-style-type: none"> • Prefer 90 (1 qt/100 gal) 	- cocklebur
Rate/A: 2-2.33 pt		• Do not apply with COC or MSO.
S.O.A.: Very Long Chain Fatty Acid (Group 15), PPO Inhibitor (Group 14)	• Do not apply postemergence to fields that have received a PP/PE treatment of fomesafen.	- giant ragweed
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks, p. eyewear		- Palmer amaranth
R.E.I.: 24 hours		- waterhemp
S. Word: Warning		

Pursuit 2EC, Thunder (imazethapyr)

	Adjuvant(s)/ Comments	Target Weeds
Brand Name: EPA Reg. #: Pursuit 2EC 241-310 Thunder 42750-146	<ul style="list-style-type: none"> • Linkage (1 gal/100 gal) 	See label for complete list of weeds controlled at different rates.
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	<ul style="list-style-type: none"> • Covrex* (2 qt/100 gal) plus AMS*** (12-15 lb/100 gal) 	Timing/Comments Apply after the first fully expanded first trifoliate leaf but prior to flowering.
Rainfast: 1 hour		
S.O.A.: ALS Inhibitor (Group 2)	<ul style="list-style-type: none"> • Advatrol** (2 qt/100 gal) plus AMS*** (12-15 lb/100 gal) 	
P.P.E.: l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks		or
R.E.I.: 4 hours	• Tapran (1 gal/100 gal)	
W. Notification: Oral		
S. Word: Caution		

*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite at 2 qt/100 gal can be substituted for AMS.

Raptor, Vulture (imazamox)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Linkage (1 gal/100 gal) or • Prefer 90 (1 qt/100 gal) plus AMS*** (12-15 lb/100 gal) or • Covrex* (2 qt/100 gal) plus AMS*** (12-15 lb/100 gal) or • Advatrol** (2 qt/100 gal) plus AMS*** (12-15 lb/100 gal) or • Tapran (1 gal/100 gal) 	<p>Target Weeds</p> <ul style="list-style-type: none"> - 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" <p>Timing/Comments</p> <p>Apply after the first fully expanded first trifoliate leaf but prior to flowering.</p>
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*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Resource (flumiclorac pentyl ester), Perpetuo (flumiclorac pentyl ester + pyroxasulfone)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Covrex* (1 pt/A) plus AMS*** (2-2.5 lb/A) or • Advatrol** (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.
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*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Select Max (clethodim)

	Adjuvant(s)/ Comments	Target Weeds	9 fl oz	12 fl oz
EPA Reg. #: 59639-132	<ul style="list-style-type: none"> • Covrex* (2 qt/100 gal) plus AMS*** (2.5- 4 lb/A) 	- barnyardgrass - crabgrass - giant foxtail - green foxtail - quackgrass <i>2nd application may be needed</i>	6"	8"
Rate/A: 6-12 fl oz				
Spray Volume: 5-40 gpa	or			
Rainfast: 1 hour	<ul style="list-style-type: none"> • Advatrol** (2 qt/100) plus AMS*** (2.5- 4 lb/A) 	- volunteer cereals - volunteer corn - wild proso millet - woolly cupgrass - yellow foxtail	6"	8"
S.O.A.: ACC-ase Inhibitor (Group 1)				
P.P.E.: l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks	or			
R.E.I.: 24 hours	<ul style="list-style-type: none"> • Tapran (1 gal/100 gal) 	- volunteer corn - wild proso millet - woolly cupgrass - yellow foxtail	12"	18"
W. Notification: Oral				
S. Word: Caution	<ul style="list-style-type: none"> • Select Max may be used at 6 fl oz for volunteer corn control when tank mixing with glyphosate. 			

*Crop Oil @ 1 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Synchrony XP (chlorimuron ethyl + thifensulfuron methyl)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 352-648	<ul style="list-style-type: none"> • Prefer 90 (2 qt/100 gal) plus AMS* (2- 4 lb/A) 	Target 1-4" weeds. Cocklebur, pigweed, wild sunflower.
Rate/A: 0.375 oz (max conv. soybean rate) 1.125 oz (max STS soybean rate)		
Spray Volume: min 10 gpa	or	
Rainfast: 1 hour	<ul style="list-style-type: none"> • Linkage (1 gal/100 gal) • See label for geographical rate restrictions. 	
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		

*Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Tavium Plus VaporGrip Technology (dicamba + s-metolachlor)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 100-1623	• Versure (5 pt/100 gal)	– Palmer amaranth
Rate/A: 56.5 fl oz	or	– Powell amaranth
Rainfast: 4 hours	• Last Chance Pro (1–2 qt/100 gal) plus Cognitive 1 or Mediate (2 qt/100 gal)	– spiny amaranth
S.O.A.: Very Long Chain Fatty Acid (Group 15), Plant Growth Regulator (Group 4)		– burcucumber
P.P.E.: coveralls over s.s. shirt and s. pants, c.r. gloves, c.r. footwear plus socks, c.r. headgear, p. eyewear		– cocklebur
R.E.I.: 24 hours		– cooperleaf, hophornbeam
S. Word: Caution		– 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, ladythumb 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)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 42750-147	• Prefer 90 (1 pt/100 gal) plus AMS (8.5–17 lb/100 gal)	Controls many annual and perennial grass and broadleaf weeds under 8" tall.
Rate/A: 2.25–3 pt*	or	Roundup Ready Soybeans Only.
Spray Volume: 10–20 gpa	• Jackhammer/Jackhammer Elite (2 qt/100 gal)	
Rainfast: 1 hour	• Use 2.25 pt/A in N.D. and north of Highway 210 in Minn.	
S.O.A.: ALS Inhibitor (Group 2) EPSP Synthase Inhibitor (Group 9)	• Use 3 pt/A in S.D. and south of Highway 210 in Minn.	
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		

Torment (imazethapyr + fomesafen)

		Adjuvant(s)/Comments	Target Weeds	12 fl oz (# of true leaves)	16 fl oz
EPA Reg. #:	66222-249	<ul style="list-style-type: none"> • Prefer 90 (1-2 qt/100 gal) plus AMS*** (8.5 lb/A) 	- balloonvine	2	2
Rate/A:	12-16 fl oz (see label for geographical restrictions)		- cocklebur	2	4
Rainfast:	1 hour	or	- copperleaf, hophornbeam	-	4
S.O.A.:	ALS Inhibitor (2), PPO Inhibitor (Group 14)	<ul style="list-style-type: none"> • Covrex* (2 qt/100 gal) plus AMS*** (10 lb/100 gal) 	- eclipta	-	2
P.P.E.:	l.s. shirt, l. pants, shoes, socks, p. eyewear, c.r. gloves		or	- foxtail species	PC
R.E.I.:	24 hours	<ul style="list-style-type: none"> • Advatrol** (2 qt/100 gal) plus AMS*** (10 lb/100 gal) 	- giant green	PC	3
W. Notification:			or	- yellow	PC
S. Word:	Danger	<ul style="list-style-type: none"> • Tapran (1 gal/100 gal) 	- Jimsonweed	4	6
			or	- ladythumb	S
		<ul style="list-style-type: none"> • Use of COC or MSO permitted but may slightly reduce crop tolerance. 	- morning glory species	S	3
			or	- entireleaf	S
		<ul style="list-style-type: none"> • See label for geographical restrictions of fomesafen and imazethapyr rates. 	- ivyleaf	S	3
				- pitted	S
			- 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 Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

TIMING/COMMENTS

Application should be made to weeds < 3" in height.

Ultra Blazer (acifluorfen)

<p>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</p>	<p>Adjuvant(s)/Comments</p> <ul style="list-style-type: none"> • Prefer 90 (1–2 pt/100 gal) plus AMS** (1–2 lb/A) or • Linkage (1 gal/100 gal) or • Covrex* (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. 	<p>Target Weeds</p> <p>Controls many annual broadleaves, including:</p> <ul style="list-style-type: none"> – cocklebur – nightshade – pigweed – smartweed – wild mustard <p>Timing/Comments</p> <p>Apply to weeds 1"–4" tall.</p>
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*Crop Oil @ 1 pt/A or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Varisto (imazamox + bentazon)

	Adjuvant(s)/Comments	Target Weeds	<u>21 oz</u>	<u>27 oz</u>
<p>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</p>	<p>• Prefer 90 (1 qt/100 gal) plus AMS*** (12–15 lb/100 gal)</p> <p>or</p> <p>• Linkage (1 gal/100 gal)</p> <p>or</p> <p>• Covrex* (2–4 qt/100) plus AMS*** (12–15 lb/100 gal)</p> <p>or</p> <p>• Advatrol** (2 qt/100) plus AMS*** (12–15 lb/100 gal)</p> <p>or</p> <p>• Tapran (1 gal/100 gal)</p>	<ul style="list-style-type: none"> – cocklebur – lambsquarters – redroot pigweed – velvetleaf – annual smartweed – black nightshade – venice mallow – wild mustard – cheatgrass – downy brome – quackgrass – Persian darnel – foxtails – Italian ryegrass – Japanese brome – volunteer canola 	<p>4"</p> <p>1.5"</p> <p>3"</p> <p>3"</p> <p>4"</p> <p>3"</p> <p>2"</p> <p>3"</p>	<p>2–8"</p> <p>2–8"</p> <p>4"</p> <p>3"</p> <p>6"</p> <p>3"</p> <p>3"</p> <p>1–4"</p> <p>3"</p> <p>3"</p> <p>3"</p> <p>3"</p> <p>3"</p> <p>3"</p> <p>3"</p> <p>3"</p>

*Crop Oil @ 1–2 gal/100 gal or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply after emergence, but before crop bloom.

Warrant Ultra (acetochlor + fomesafen)

		Adjuvant(s)/Comments	Target Weeds	50 fl oz (# of true leaves)	60 fl oz
EPA Reg. #:	524-620	<ul style="list-style-type: none"> • Prefer 90 (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. 	- copperleaf,	2	2
Rate/A:	48-70 fl oz (see label for soil texture and OM restrictions)		- hopornbeam		
Rainfast:	1 hour		- eclipta	2	2
S.O.A.:	Very Long Chain Fatty Acid (Group 15), PPO Inhibitor (Group 14)		- Jimsonweed	4	6
P.P.E.:	l.s. shirt, l. pants, shoes, socks, p. eyewear		- ladysthumb	2	2
R.E.I.:	24 hours		- morning glory (ivyleaf, entireleaf, tall)	2	2
W. Notification:			- nightshade, black	4	4
S. Word:	Danger		- 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	
		- 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)

		Adjuvant(s)/Comments	Target Weeds
EPA Reg. #:	524-617	<ul style="list-style-type: none"> • Verasure (1 gal/100 gal of water) or • Last Chance Pro (1-2 qt/100 gal) plus • Cognitive 1 or Mediate (2 qt/100 gal) or • Jackhammer Elite (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. • Maximum 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. 	- black nightshade
Rate/A:	22 fl oz		- common ragweed
Spray Volume:	min 10 gpa		- Canada thistle
Rainfast:	4 hours		- cocklebur
S.O.A.:	Plant Growth Regulator (Group 4)		- giant ragweed
P.P.E.:	l.s. shirt, l. pants, c.r. gloves, shoes, socks, eyewear		- kochia
R.E.I.:	24 hours		- lambsquarters
W. Notification:	Oral		- pigweed
S. Word:	Caution		- venice mallow
			- velvetleaf
		- wormwood	
		- volunteer sunflower	
		- marestalk	
		- 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 Covrex or Advatrol @ 2 qt/100 gal or Prefer 90 @ 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 Covrex or Advatrol @ 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 Prefer 90 @ 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 Verasure @ 19.2 fl oz/A or Suralta @ 20 fl oz/A + Veracity Elite II @ 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 Covrex or Advatrol @ 2 qt/100 gal or Prefer 90 @ 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 Covrex or Advatrol @ 2 qt/100 gal or Prefer 90 @ 1 qt/100 gal.

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Soybean Postemergence Herbicide Efficacy Chart

Herbicide ¹	Annual Grasses ²													Perennial Grasses ²		Broadleaves ²																														
	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	Vernice 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	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	N	N	N	P	N	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	P	G	G	G	G	E	G	G	E	P	E	F	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	P	E	P	G	P	P	P	P	P				
Classic	E	N	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	E	G	P	F	E	P	P	G	P			
Cobra/Phoenix	G	P	P	P	P	N	P	P	P	N	N	N	N	N	N	N	F	F	P	E	F	F	E	G	G	E	E	F	E	G	P	F	G	F	G	F	G	E	F	P	P	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	E	-	G	-	E	-	E	-	-	-	-	-	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	E	P	G	N	N	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	G	E	P	E	P	P	P	P			
Flexstar GT 3.5	G	G	E	G	E	E	G	E	E	E	E	E	E	E	E	G	E	G	E	G	G	G	G	F	G	E	F	G	G	G	E	E	G	G	G	E	E	G	E	G	F	F	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	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	F	G	G	P	P	N	N	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	P	N	N			
Marvel	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	-	-	N	G	F	G	F	E	E	E	E	E	F	E	F	F	E	F	E	F	E	G	E	E	P	P	N	N	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	N	G	N	N	N		
Prefix	F	G	-	-	G	-	F	-	-	-	-	-	F	-	-	-	-	-	-	G	N	N	-	-	G	G	E	-	G	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	G	F	P	G	E	F	P	P	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	G	F	P	G	E	G	P	P	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	P	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	P	E	P	P	P	P	P	P	N	N	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	-	G	E	G	E	F	-	F	N	N			
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	N	N	N	N	N	P	N
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	E	P	F	E	P	P	P	P	G	N	N	
Torment	G	F	G	G	G	-	N	G	N	-	-	-	N	G	N	N	-	-	-	G	F	F	-	-	G	E	E	-	E	G	-	E	-	E	-	E	-	G	-	-	-	-	-	N	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	F	E	E	G	P	P	P	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	E	E	N	E	E	G	G	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	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	-	G	-	-	-	-	-	-	P	N	

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.	Verium (2 qt/100 gal) or Covrex (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.	Verium (1 qt/100 gal) or Covrex (0.5-1 pt/A) or Advatrol (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.	Covrex (2 qt/100 gal) or Advatrol (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.	Verium (1 qt/100 gal) or Covrex (1-2 qt/100 gal) or Advatrol (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.	Covrex (1 pt/A) or Advatrol (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.	Verium (1 qt /100 gal) or Covrex (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 Covrex. Tapran or Upland MSO can be substituted for Advatrol. Jackhammer 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

Petrichor 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. Verium 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	Anthrachnose	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

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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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

Soybean // Insecticide Options for Dicamba-Tolerant and Enlist Technologies

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.

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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.

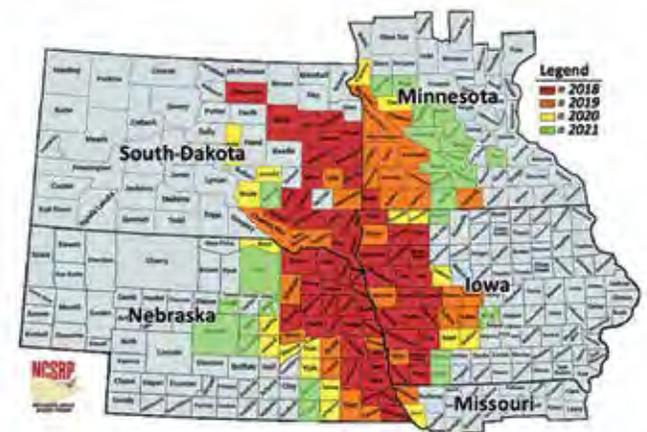


Figure 1. Counties identified as infested with SGM through larval presence on soybean and sweet clover for 2018 (red), 2019 (orange), 2020 (yellow), and 2021 (green)
Photo courtesy of cropwatch.unl

Soybean // White Mold Management in Soybeans

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	Tetraconazole 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	Tetraconazole	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 Tetraconazole	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 R1 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 Verium @ 0.25% v/v or Petrichor @ 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	Covrex or Advatrol or Tapran (0.5-1.0% v/v)	or	Verium 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

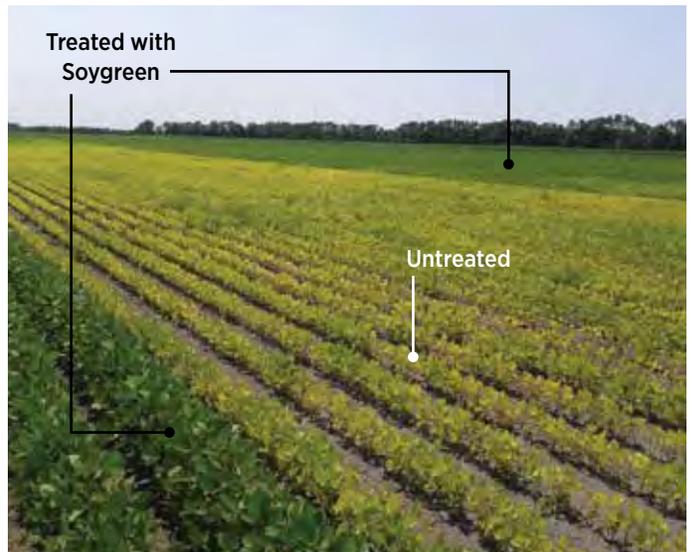
IDC is best controlled by implementing many best management practices. Selecting IDC tolerant soybean varieties may help; however, IDC tolerant soybeans often have less yield potential than susceptible varieties. Therefore, consider both IDC score as well as yield potential when selecting a soybean variety. 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

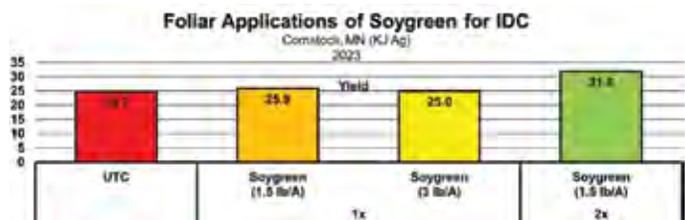
Two of the most common barriers to a nutrient entering a plant from a foliar application are: maintaining it in a form that is soluble with water and, at the same time, having the ability to pass through the waxy leaf cuticle. A product must be both water soluble and oil soluble at different times during the process of nutrient uptake. Methylated seed oils (Upland MSO), surfactants with oil-like properties (Verium), and/or adjuvants capable of mild acidification of the spray solution (Jackhammer) 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	Upland MSO @ 1% v/v + Jackhammer @ 0.25% v/v OR Advatrol @ 0.5% v/v + Jackhammer @ 0.25% v/v OR Verium @ 0.25% v/v + Jackhammer @ 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	Upland MSO @ 1% v/v + Jackhammer @ 0.25% v/v OR Advatrol @ 0.5% v/v + Jackhammer @ 0.25% v/v OR Verium @ 0.25% v/v + Jackhammer @ 0.25% v/v
	2 pt/A	2 Repeat Applications: 7 to 10 Days	

Soygreen Products Plus Glyphosate¹

Soygreen Product	Rate	Application Interval	Adjuvant Recommendation ²
Soygreen (Dry)	1.5 lb/A	1 Repeat Application: 10 to 14 Days	Advatrol @ 0.5% v/v + Jackhammer @ 0.75% v/v OR Verium @ 0.25% v/v + Jackhammer @ 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	Advatrol @ 0.5% v/v + Jackhammer @ 0.75% v/v OR Verium @ 0.25% v/v + Jackhammer @ 0.75% v/v
	2 pt/A	2 Repeat Applications: 7 to 10 Days	

¹Note: Risk of weed control antagonism is possible. Apply to small weeds and use full rates herbicides and adjuvants.

²Note: Jackhammer rates are dependent on mixing with or without glyphosate.

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 impellers.

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 impellers 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.

SOYGREEN®

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/ft³) 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 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.

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

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

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 H₂O 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

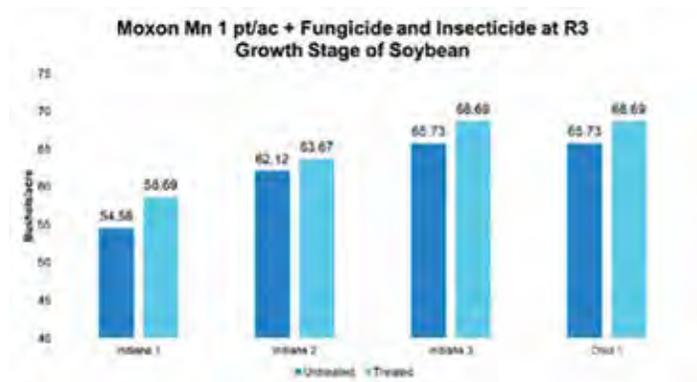
Moxon Mn is a 5% Manganese (2-0-0-5 Mn) equipped with the patented Levesol chelate. Moxon Mn has a low use rate of 1-2 pt/acre, with 1 pint being used in hidden hunger situations and the 2 pints use rate where visual deficiencies are evident. Multiple applications may be needed through the growing season 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.

MOXON™ MN





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Assure II / Targa (quizalofop P-ethyl)

	Adjuvant(s)/ Comments	Target Weeds	4 fl oz	6 fl oz	8 fl oz
EPA Reg. #: 352-541/33906-9-81880	• Covrex* (2 qt/100) plus AMS*** (2-4 lb/A)	- barnyardgrass	-	-	2-6"
Rate/A: 7-12 fl oz		- field sandbur	-	-	2-6"
Spray Volume: min 10 gpa	or	- crabgrass	-	-	2-6"
Rainfast: 1 hour	• Advatrol** (2 qt/100) plus AMS*** (2-4 lb/A)	- giant foxtail	-	-	2-8"
S.O.A.: ACC-ase Inhibitor (Group 1)		- green foxtail	-	-	2-4"
P.P.E.: l.s. shirt, l. pants, c.r. gloves, eyewear, shoes, socks	• Use Prefer 90 (1 qt/100 gal) in certain tank mixes.	- volunteer corn	6-24"	24"+	
R.E.I.: 12 hours		- wild proso millet	-	-	2-6"
W. Notification: Oral		- yellow foxtail	-	-	2-4"
S. Word: Danger		- wild oat	-	-	2-6"
		- woolly cupgrass	2-4" @ 9 oz		
		- quackgrass	6-10" @ 10 oz		

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply up to 60 day PHI.

Beyond Xtra (imazamox)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 241-441	• Linkage (1 gal/100 gal) or	Apply to weeds 3" or less:
Rate/A: 4 fl oz		- black nightshade
Spray Volume: min 10 gpa	• Covrex* (2 qt/100) plus AMS*** (2-4 lb/A)	- common cocklebur
Rainfast: 1 hour		- foxtail
S.O.A.: ALS Inhibitor (Group 2)	or	- giant ragweed
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks	• Advatrol** (2 qt/100) plus AMS*** (2-4 lb/A)	- lambsquarters
R.E.I.: 4 hours		- pigweed
W. Notification: Oral	• Use Prefer 90 (1 qt/100 gal) in certain tank mixes.	- sunflower
S. Word: Caution		- volunteer corn
		- venice mallow

Timing/Comments

Apply to 2-8 leaf sunflower.

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Clethodim Products

	Adjuvant(s)/ Comments	Target Weeds	Clethodim 2E, Arrow, Volunteer			Shadow 3EC
			6 fl oz	8 fl oz	5.33 fl oz	
Brand Name: EPA Reg. #:	<ul style="list-style-type: none"> • Covrex* (2 qt/100) plus AMS*** (2-4 lb/A) or • Advatrol** (2 qt/100) plus AMS*** (2-4 lb/A) • Use Prefer 90 (1 qt/100 gal) in certain tank mixes. 					
Arrow 66222-60		- barnyardgrass	6"	8"	8"	
Shadow 3EC 66330-414		- crabgrass	2"	6"	8"	
Clethodim 2E 42750-72		- giant foxtail	6"	12"	12"	
Volunteer 59639-3-55467		- green foxtail	6"	8"	8"	
Rate/A: 6-16 fl oz (Arrow, Clethodim 2E, Volunteer)		- quackgrass	-	4-12"	4-12"	
Rate/A: 4-10.67 fl oz (Shadow 3EC)		<i>2nd application may be needed</i>				
Spray Volume: 5-40 gpa		- volunteer cereals	6"	8"	8"	
Rainfast: 1 hour		- volunteer corn	12"	18"	18"	
S.O.A.: ACC-ase Inhibitor (Group 1)		- wild proso millet	8"	10"	10"	
P.P.E.: l.s. shirt, l. pants, c.r. gloves, p. eyewear, shoes, socks	- woolly cupgrass	6"	8"	8"		
R.E.I.: 24 hours	- yellow foxtail	6"	8"	8"		
W. Notification: Oral	- cheat	6"	6"	6"		
S. Word: Caution (Arrow, Clethodim 2E, Shadow 3EC) Warning (Volunteer)	- downy brome	6"	6"	6"		

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply up to 70 day PHI.

Express SG (tribenuron)

	Adjuvant(s)/ Comments	Target Weeds
EPA Reg. #: 352-632	<ul style="list-style-type: none"> • Linkage (2-4 qt/100 gal) or • Covrex* (2 qt/100) plus AMS*** (2-4 lb/A) or • Advatrol** (2 qt/100) plus AMS*** (2-4 lb/A) • Use Prefer 90 (1 qt/100 gal) in certain tank mixes. 	- common chickweed
Rate/A: 0.25-0.5 oz		- field pennycress
Spray Volume: min 5 gpa		- lambsquarters
Rainfast: 4 hours		- Russian thistle
S.O.A.: ALS Inhibitor (Group 2)		- kochia
P.P.E.: l.s. shirt, l. pants, c.r. gloves, shoes, socks		- wild mustard
R.E.I.: 12 hours		
W. Notification: Oral		
S. Word: Caution		

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Glyphosate

	# A.E.	=0.75 AE	Surfactant/Comments
Brand Name: EPA Reg. #:			• Last Chance Pro (1 qt/100) plus AMS (8.5-17 lb/100)
Buccaneer Plus 55467-9	3.00	32.0	or
Gly Star Original 42750-60	3.00	32.0	• Jackhammer/Jackhammer Elite (2-3 qt/100)
Gly Star Plus 42750-61	3.00	32.0	or
Durango DMA 62719-556	4.00	24.0	• Encloax (2.5-5 gal/100)
Buccaneer 5 Extra 55467-15	4.00	24.0	or
Gly Star 5 Extra 42750-59	4.00	24.0	• Prefer 90 (1 qt/100) plus AMS (8.5-17 lb/100)
Gly Star K-Plus 42750-122	4.50	21.3	or
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			Timing/Comments
Spray Volume: 5-20 gpa			Preharvest Weed Control / Desiccant
Rainfast: 1-6 hours			• 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.
M.O.A.: EPSP Inhibitor			• Apply up to 7 days PHI.
P.P.E.: I.s. shirt, I. pants, shoes, socks			
R.E.I.: 12 hours			
W. Notification: Oral			
S. Word: Caution			

Poast (sethoxydim)

	Adjuvant(s)/ Comments	Target Weeds	0.5 oz	1 oz	1.5 oz
EPA Reg. #: 7969-58-51036	• Covrex* (1 pt/A) plus AMS*** (2.5 lb/A)	- barnyardgrass	-	8"	-
Rate/A: 0.5-1.5 pt	or	- crabgrass	-	6"	-
Spray Volume: 5-20 gpa	• Advatrol** (0.75 pt/A) plus AMS*** (2.5 lb/A)	- field sandbur	-	-	3"
Rainfast: 1 hour	• Use Prefer 90 (1 qt/100 gal)	- foxtail	-	8"	-
S.O.A.: ACC-ase Inhibitor (Group 1)	in certain tank mixes.	- volunteer cereals	-	-	4"
P.P.E.: coveralls, I.s. shirt, I. pants, c.r. gloves, c.r. footwear, headgear, eyewear, shoes, socks, apron		- volunteer corn	-	20"	-
R.E.I.: 12 hours		- wild proso millet	10"	-	-
W. Notification: Oral		- wild oat	-	4"	-
S. Word: Warning		- woolly cupgrass	-	8"	-

*Crop Oil @ 2 pt/A or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1.5 pt/A can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply up to 70 day PHI.

Select Max (clethodim)

	Adjuvant(s)/ Comments	Target Weeds	9 oz	12 oz
EPA Reg. #: 59639-132	• Covrex* (2 qt/100) plus AMS*** (2-4 lb/A)	- barnyardgrass	6"	8"
Rate/A: 9-16 fl oz	or	- crabgrass	2"	6"
Spray Volume: 5-40 gpa	• Advatrol** (2 qt/100) plus AMS*** (2-4 lb/A)	- giant foxtail	6"	12"
Rainfast: 1 hour	• Use Prefer 90 (1 qt/100 gal)	- green foxtail	6"	8"
S.O.A.: ACC-ase Inhibitor (Group 1)	in certain tank mixes.	- quackgrass	-	4-12"
P.P.E.: I.s. shirt, I. pants, c.r. gloves, p. eyewear, shoes, socks		<i>2nd application may be needed</i>		
R.E.I.: 24 hours		- volunteer cereals	6"	8"
W. Notification: Oral		- volunteer corn	12"	18"
S. Word: Caution		- wild proso millet	8"	10"
		- woolly cupgrass	6"	8"
		- yellow foxtail	6"	8"

*Crop Oil @ 1 gal/100 or Verium @ 1 qt/100 gal can be substituted for Covrex.

**Upland MSO @ 1 gal/100 gal can be substituted for Advatrol.

***Jackhammer/Jackhammer Elite @ 2 qt/100 gal can be substituted for AMS.

Timing/Comments

Apply up to 70 day PHI.

Sunflower Herbicide Postemergence Efficacy Chart

Herbicide	Annual/Perennial Grasses													Annual Broadleaves													Perennial Broadleaves							
	Crop Tolerance	Barryardgrass	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	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	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	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	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	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
<i>Bacillus thuringiensis</i> Dipel DF Dipel ES	11A	0.5-1 lb 2.5-2.5 pt	None	Sunflower Moth
<i>Beta-cyfluthrin</i> 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
<i>Carbaryl</i> 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
<i>Chlorantraniliprole</i> Coragen Prevathon	28	3.5-5 fl oz 14-20 fl oz	21 Days	Banded Sunflower Moth, Sunflower Moth
<i>Chlorantraniliprole + Lambda-cyhalothrin</i> 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
<i>Cyantraniliprole</i> Exirel	28	7-20.5 fl oz	7 Days	Banded Sunflower Moth, Cutworm, Sunflower Moth
<i>Esfenvalerate</i> 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
<i>Flonicamid</i> Beleaf 50SG Carbine 50 WG	29	2.8 oz 2.8 oz	0 Days	Lygus Bugs
<i>Lambda-cyhalothrin</i> 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
<i>Sulfoxaflor</i> Transform WG	4C	1.5-2.75 fl oz	14 Days	Lygus Bugs
<i>Zeta-cypermethrin</i> 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 Verium @ 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	Jackhammer @ 0.5% v/v OR Last Chance 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	Jackhammer @ 0.5% v/v OR Last Chance Pro @ 0.25% v/v + AMS @ 8.5 lbs/100 gal	7 Days
Sharpen @ 1-2 fl oz/A	Jackhammer @ 0.5% v/v + Upland MSO @ 1 qt/A	7 Days - Do Not Apply to Sunflower intended for Seed Production
Valor @ 2-3 oz/A	Jackhammer @ 0.5% v/v + Upland MSO @ 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.



Iron – IDC in Sorghum	199
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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 ($\text{Fe}(2+)$) and ferric ($\text{Fe}(3+)$), but the plant can only utilize ferrous ($\text{Fe}(2+)$) 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 CaCO_3 may be present. Therefore, soil pH should only be used as a diagnostic tool to determine when it is necessary to test for CaCO_3 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 CaCO_3 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 ($\text{Fe}2+$) 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 Jackhammer 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 Jackhammer 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 a chelated-Zn and a 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 the 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 mixability 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

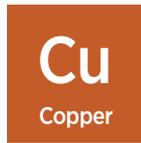
	Levesol Zn	Blue Tsunami	Zinc 9	Equation	Tachline Pro	Paralign	Four-Score
Analysis	4-0-0-4.5 Zn	8-0-0-10 Zn	8-0-0-9 Zn	0-10-10-0.5 Zn, Mn, Fe, 0.1 Cu	0-0-0-4 Zn, 3.6 S, 3 Mn, 0.1 B	5-15-3-0.8 Zn	3-0-1-2.25 Zn 1 Mn, 0.5 Fe, Cu
Chelate	EDDHA/EDTA	EDTA/Citric	EDTA	EDTA	Zn Sulfate	EDDHA/EDTA	EDTA
Mixes with 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.

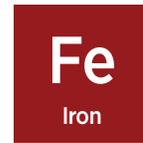
Common Micronutrients



- Cell wall formation
- Very important for reproduction and other rapid growth stages



- Helps with enzyme activation and photosynthesis
- Assists with protein synthesis



- Associated with chlorophyll production
- Taken up as ferrous (Fe²⁺)



- Contributes to photosynthesis, respiration, and N assimilation



- Component for two enzymes that convert nitrate to nitrite
- Vital for symbiotic N fixation



- 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.

MICRO PAK ZINC 9

Micro Pak 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
- Micro Pak is compatible with most polyphosphate and orthophosphate fertilizers and is compatible with other fertilizer additives such as Cygin, Levesol, and Levesol Zn

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.

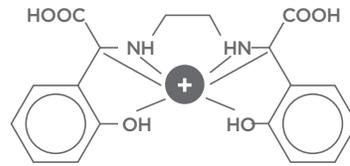


Figure 1: ortho-ortho EDDHA chelate

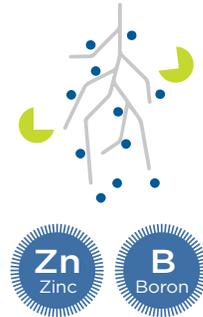


Figure 2: Trivar in a root system

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	Fungicide	seed decay, damping-off and seedling blights caused by many seed-borne and soil-borne organisms
Application Type:	Commercial	(4 lb AI/gal)		
Density:	10 lb/gal	Crops		
Rate:	Varies by crop	barley, millet, oats, rye, sorghum, triticale, wheat, beans and peas, vegetables, corn, cotton, grasses, peanuts, rice, sunflower and sugarbeets		
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	Insecticide	<i>Fusarium</i> , General seed rots, <i>Phytophthora</i> , <i>Pythium</i> , <i>Rhizoctonia</i> , Seed-borne	aphids, bean leaf beetle, grape colapis, leafhopper, seed corn maggot, three-cornered alfalfa hopper, thrips, white grub, wireworm
Application Type:	Commercial/On-farm	Mefenoxam	Fungicide	Phomopsis, Seed-borne	
Density:	9.6 lb/gal	(0.31 lb AI/gal)		<i>Sclerotinia</i>	
Rate:	3.1 fl oz/Cwt	Fludioxonil	Fungicide		
Standard Rate:	3.1 fl oz/Cwt	(0.10 lb AI/gal)			
Coverage:	4.0 fl oz/Cwt	Crops			
Package Size:	15's	soybeans			
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	Fungicide	<i>Pythium</i> , <i>Phytophthora</i>	<i>Pythium</i>
Application Type:	Commercial	(2.6 lb AI/gal)			
Density:	9.18 lb/gal	Crops			Cotton:
Rate:	Varies by crop	corn (field), wheat, oats, barley, rye, soybeans, edible beans, sunflowers, peanuts, and rice			<i>Pythium</i>
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	<i>Fusarium</i> , <i>Phytophthora</i> , <i>Pythium Rhizoctonia</i> ,
Application Type:	Commercial/On-farm	Mefenoxam (0.31 lb AI/gal)	Fungicide	seed-borne <i>Phomopsis</i> , seed-borne <i>Sclerotinia</i>
Density:	9.01 lb/gal			
Rate:	1.5 fl oz/Cwt	Crops		
Standard Rate:	1.5 fl oz/Cwt	soybeans, legume crops		
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	<i>Fusarium</i> , <i>Phytophthora</i> , <i>Pythium Rhizoctonia</i> ,
Application Type:	Commercial/On-farm	Mefenoxam (0.096 lb AI/gal)	Fungicide	seed-borne <i>Phomopsis</i> , seed-borne <i>Sclerotinia</i>
Density:	8.68 lb/gal			
Rate:	5 fl oz/Cwt	Crops		
Standard Rate:	5 fl oz/Cwt	soybeans, legume crops		
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	<i>Fusarium</i> , <i>Phytophthora</i> , <i>Pythium Rhizoctonia</i> ,
Application Type:	Commercial			seed-borne <i>Phomopsis</i> , seed-borne <i>Sclerotinia</i>
Density:	9.29 lb/gal	Crops		
Rate:	Varies by crop	soybeans, legume crops		
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			

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 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	Agricultural	halo blight
Application Type:	Commercial	Sulfate	Antibiotic	
Density:	No information	Crops		
Rate:	0.18-0.91 oz/cwt	soybeans		
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	Nematicide	dagger nematode	reniform nematode
Application Type:	Commercial	amyloliquefaciens		lance nematode	root knot nematode
Density:	10.05	Strain PTA-4838		needle nematode	soybean cyst
Rate:	0.1 fl oz per 80,000-140,000 seeds	Crops		pin nematode	nematode
Standard Rate:	Varies by crop	soybeans and corn		ring nematode	
Coverage:	Provide uniform coverage			root knot nematode	
Package Size:	4x1			root lesion nematode	
Units Treated:	Varies by crop			spiral nematode	
Colorant:	Uncolored			sting nematode	
Seed Tag:	Required—See label			stubby root nematode	
Signal Word:	Caution			stunt nematode	
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 repellent	sandhill cranes, ring-neck pheasants, red-wing
Rate:	2 oz/25 lb of seed	Crops		blackbirds, crows, blackbirds, grackles, starlings
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.

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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 repellent	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 ₂ O/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	<i>Fusarium</i> , general seed rots, <i>Phytophthora</i> ,	aphids, bean leaf beetle, grape colaspis,
Application Type:	Commercial	Thiamethoxam (1.03 lb AI/gal)	Insecticide	<i>Pythium</i> , <i>Rhizoctonia</i> ,	leafhopper, seed
Density:	9.28 lb/gal	Mefenoxam (0.15 lb AI/gal)	Fungicide	seed-borne <i>Phomopsis</i> ,	corn maggot,
Rate:	6.2 fl oz/Cwt	Fludioxonil (0.05 lb AI/gal)	Fungicide	seed-borne <i>Sclerotinia</i>	three-cornered alfalfa hopper, thrips, white grub, wireworm and nematodes
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.
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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 <i>Penicillium</i> and <i>Aspergillus</i> and seed-borne <i>Fusarium</i> Scab and <i>Septoria</i> . Control of dwarf bunt, karnal bunt*, stinking smut (common bunt), flag smut, loose smut, covered smut of barley, control of early season barley stripe, <i>Pythium</i> damping-off, <i>Septoria</i> disease complex, <i>Rhizoctonia</i> root rot, common root rot (<i>Cochiliobolus</i> spp.), <i>Fusarium</i> foot rot. Early season suppression of powdery mildew, wheat leaf rust, and <i>Septoria</i> 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			
Standard Rate:	5.0 fl oz/Cwt	Crops		
Coverage:	10.0–15.0 fl oz/Cwt	barley, oats, and wheat		
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, <i>Fusarium</i> seed scab, <i>Pythium</i> seed rot and seedling dieback, early season <i>Fusarium</i> seedling dieback, <i>Rhizoctonia</i> 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			
Standard Rate:	5.0 fl oz/Cwt	Crops		
Coverage:	10.0–15.0 fl oz/Cwt	barley, oats, and wheat		
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 <i>Phomopsis</i> , seed-borne <i>Sclerotinia</i> , seed-borne <i>Fusarium</i> , <i>Penicillium</i> and <i>Aspergillus</i> , damping-off and seedling blights caused by soil-borne <i>Pythium</i> , <i>Fusarium</i> , and <i>Rhizoctonia solani</i>	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				

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.

Cygin

General Information		Agronomic Information	
EPA Reg #:	90930-2-46661	Active Ingredients	Type
Product Type:	Plant Growth Regulator	Cytokinin, Auxin, Gibberellin	PGR
Application Type:	Commercial/On-Farm		
Density:	8.76	Crops	
Rate:	0.5–5.0 fl oz per Cwt	Multiple crops	
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		

Clariva pn

General Information		Agronomic Information		Target Pests
EPA Reg #:	100-1524	Active Ingredients	Type	cyst nematodes
Product Type:	Nematicide	Pasteuria nishizawae Pn1	Nematicide	
Application Type:	Commercial			
Density:	8.7 lb/gal	Crops		
Rate:	Varies by crop	soybeans, sugarbeet		
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			

Cruiser 5FS

General Information		Agronomic Information		Target Pests	
EPA Reg #:	100-941	Active Ingredients	Type	Insects Soybeans:	Insects Small Grains:
Product Type:	Insecticide	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
Application Type:	Commercial	Crops			
Density:	10.8 lb/gal	barley, buckwheat, millet, oats, rye, triticale, corn, cotton, cucurbit vegetables, legume vegetables, oil seed crops, peanuts, potatoes, rice, sorghum, and soybeans			
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				

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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 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	<i>Fusarium</i> , general seed rots, <i>Phytophthora</i> ,	aphids, bean leaf beetle, grape colaspis,
Application Type:	Commercial	Mefenoxam (0.31 lb AI/gal)	Fungicide	<i>Pythium</i> , <i>Rhizoctonia</i> ,	leafhopper, seed
Density:	9.6 lb/gal	Fludioxonil (0.10 lb AI/gal)	Fungicide	seed-borne <i>Phomopsis</i> ,	corn maggot, three- cornered alfalfa hopper,
Rate:	3.2 fl oz/Cwt			seed-borne <i>Sclerotinia</i>	thrips, white grub, wireworm
Standard Rate:	3.2 fl oz/Cwt				
Coverage:	4 fl oz/Cwt				
Package Size:	15's	Crops			
Units Treated:	40 Cwt/gal	soybeans			
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	aphids, wireworm, hessian fly
Application Type:	Commercial	Mefenoxam (0.05 lb AI/gal)	Fungicide	damping-off by seed- and soil-borne <i>Fusarium</i> and	
Density:	9.59 lb/gal	Difenoconazole (0.31 lb AI/gal)	Fungicide	soil-borne <i>Pythium</i> ,	
Rate:	5 fl oz/Cwt			<i>Rhizoctonia</i> root rot, covered and false loose smut, dwarf bunt, loose smut	
Standard Rate:	5 fl oz/Cwt				
Coverage:	5 fl oz/Cwt	Crops		Suppression of:	
Package Size:	2x2.5, 1x15, 1x110	barley, triticale, and wheat		common root rot, <i>Fusarium</i> crown and foot rot, take-all	
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	<i>Fusarium</i> dry rot seed decay, seed-borne	green peach aphids, colorado potato
Application Type:	Commercial	Fludioxonil (0.73 lb AI/gal)	Fungicide	<i>Rhizoctonia</i> , seed-borne	beetles, flea beetles,
Density:	9.96 lb/gal			<i>Helminthosporium solani</i>	leafhoppers, leaf miners, psyllids and whiteflies
Rate:	0.19-0.27 fl oz/Cwt	Crops			
Standard Rate:	Varies by planting rate	potato			
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				

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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	<i>Pythium</i> , <i>Phytophthora</i> , systemic downy mildew, <i>Fusarium</i> , <i>Rhizoctonia</i> , <i>Sclerotinia</i> , <i>Phomopsis</i> , seed decay, seedling blight, and damping-off caused <i>Rhizoctonia</i>	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				
Coverage:	4 fl oz/Cwt	Crops			
Package Size:	2x2.5	soybeans			
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 <i>Fusarium</i> and soil-borne <i>Pythium</i> , seed-borne <i>Septoria</i> , <i>Rhizoctonia</i> root rot, covered, false, loose and true loose smut, flag smut, common, dwarf, and karnal bunt	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		Suppression of: common root rot, <i>Fusarium</i> crown and foot rot, take-all	
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 <i>Septoria</i> , loose smut, flag smut, general seed rots, <i>Fusarium</i> seed scab, common root rot, <i>Rhizoctonia</i> root rot	barley stripe, general seed rots, covered smut, <i>Pythium</i> damping-off, common root rot, <i>Fusarium</i> seed scab, <i>Rhizoctonia</i> root rot
Application Type:	Commercial	Crops		1.0 fl oz - <i>Fusarium</i> root rot, <i>Fusarium</i> crown rot, and take-all	1.0 fl oz - take-all, <i>Fusarium</i> root rot, <i>Fusarium</i> crown rot
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				

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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	Fungicide	barley stripe, common bunt, covered smut, dwarf bunt, flag smut, <i>Fusarium</i> , general seed rots, karnal bunt, loose smut, <i>Pythium</i> , <i>Septoria</i>
Application Type:	Commercial	(0.19 lb AI/gal)		
Density:	9.93 lb/gal	Difenoconazole	Fungicide	
Rate:	1–4 fl oz/Cwt	(0.77 lb AI/gal)		
Standard Rate:	2 fl oz/Cwt	Crops		
Coverage:	Provide uniform coverage	barley, cotton, sweet corn, wheat and triticale		
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	Fungicide	barley stripe, common bunt, covered smut, dwarf bunt, flag smut, <i>Fusarium</i> , general seed rots, karnal bunt, loose smut, <i>Pythium</i> , <i>Septoria</i>
Application Type:	Commercial/On-farm	(0.025 lb AI/gal)		
Density:	9.15 lb/gal	Difenoconazole	Fungicide	
Rate:	2.5–10 fl oz/Cwt	(0.31 lb AI/gal)		
Standard Rate:	5 fl oz/Cwt	Crops		Suppression of:
Coverage:	Provide uniform coverage	barley and wheat		common root rot, <i>Fusarium</i> seed scab and crown rot, <i>Rhizoctonia</i> root rot, take-all
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	Fungicide	seed-borne diseases
Application Type:	Commercial	(0.83 lb AI/gal)		
Density:	8.6 lb/gal	Crops		
Rate:	Varies by crop	corn, sunflower, barley, brassica, bulb vegetables, canola, cucurbits, leafy vegetables, legume vegetables, pepper, potatoes, rice, sorghum, soybeans, and tomatoes		
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
Application Type:	Commercial	Prothioconazole (0.15 lb AI/gal)	Fungicide	<i>Rhizoctonia</i> , <i>Fusarium</i> and <i>Helminthosporium</i> silver scurf, resulting in a perfect skin finish and optimum size and shape
Density:	8.92 lb/gal			
Rate:	0.31–2.5 fl oz/Cwt–potato	Crops		
Standard Rate:	0.31 fl oz/Cwt–potato	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	Prothioconazole (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 <i>Rhizoctonia</i> , <i>Fusarium</i> , <i>Cochliobolus</i> , <i>Pythium</i> , common root rot, foot rot, crown rot, rust, <i>Septoria</i> , powdery mildew (early season)	seed rot and sampling-off caused by <i>Rhizoctonia</i> , <i>Fusarium</i> , <i>Pythium</i> , seed rot, damping-off and seedling blight caused by seed-borne <i>Botrytis cinerea</i> , seed decay caused by <i>Phomopsis</i> - and <i>Asochyta</i> -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	Insecticide	seed corn maggot,	aphids, hessian fly,
Application Type:	Commercial	(5.0 lb AI/gal)		wireworm, soybean aphids,	wireworm
Density:	10.3 lb/gal	Crops		and bean leaf beetles	
Rate:	Varies by crop	oil seed crops, field corn, wheat,			
Standard Rate:	1.6–3.2 fl oz/Cwt–soybean	barley, oats, rye, triticale, sorghum,			
Coverage:	Not stated	millet, cotton, sugarbeets, sweet corn,			
Package Size:	2x2.5, 15's, 260's	popcorn, soybeans, and edible beans			
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	Insecticide	<i>Pythium</i> , stinking smut,	aphids, hessian fly,
Application Type:	Commercial	(1.16 lb AI/gal)		flag smut, loose smut,	wireworm
Density:	9.4 lb/gal	Metalaxyl	Fungicide	<i>Septoria</i> , <i>Rhizoctonia</i> root	
Rate:	3.4–4.5 fl oz/Cwt	(0.075 lb AI/gal)		rot, common root rot, and	
Standard Rate:	3.4 fl oz/Cwt	Tebuconazole	Fungicide	<i>Fusarium</i>	
Coverage:	Ensure thorough coverage	(0.056 lb AI/gal)		Suppression of:	
Package Size:	2x2.5, 15's	Crops		powdery mildew, wheat leaf	
Units Treated:	37.64 Cwt/gal	barley, oats, and wheat		rust and <i>Fusarium</i> scab	
Colorant:	Uncolored			Additional Barley Diseases:	
Seed Tag:	Required—See label			covered smut, barley stripe,	
Signal Word:	Caution			<i>Fusarium</i> foot rot	
Restricted:	No			Suppression of: barley leaf	
				rust	

ILeVO

General Information		Agronomic Information		Target Pests	
EPA Reg #:	564-1167	Active Ingredients	Type	Soybeans:	
Product Type:	Nematicide/Fungicide	Fluopyram	Nematicide/	sudden death syndrome	
Application Type:	Commercial	(5 lb AI/gal)	Fungicide	(<i>Fusarium viguliforme</i>), soil	
Density:	10.34 lb/gal	Crops		borne nematodes, soybean	
Rate:	1.2–2.36 fl oz/Cwt	soybeans		cyst nematodes (heterodera	
Standard Rate:	1.2 fl oz/Cwt			glycines), root-knot	
Coverage:	Ensure thorough coverage			nematodes (meloidogyne	
Package Size:	2x2.5, 15's			incognita), reniform	
Units Treated:	54–106			nematodes (rotylechulus	
Colorant:	No			reniformis), root lesion	
Seed Tag:	Required—See label			nematodes (pratylenchus	
Signal Word:	Warning			spp.), ance nematodes	
Restricted:	No			(hoplolaimus spp.)	

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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 <i>Phomopsis</i> , seed-borne <i>Sclerotinia</i> , seed-borne <i>Fusarium</i> , <i>Penicillium</i> and <i>Aspergillus</i> , damping-off and seedling blights caused by soil-borne <i>Pythium</i> , <i>Fusarium</i> , and <i>Rhizoctonia solani</i>	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				
Standard Rate:	4.74 fl oz/Cwt	Crops			
Coverage:	4.74 fl oz/Cwt	soybeans			
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 <i>Oomycete</i> class of fungi including <i>Pythium</i> spp., <i>Phytophthora</i> spp. and <i>Aphanomyces</i> 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, <i>Fusarium</i> seed scab, <i>Pythium</i> seed rot and seedling dieback, early season <i>Fusarium</i> seedling dieback, <i>Rhizoctonia</i> 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 <i>Phomopsis</i> , seed-borne <i>Sclerotinia</i> , seed-borne <i>Fusarium</i> , <i>Penicillium</i> and <i>Aspergillus</i> , damping-off and seedling blights caused by soil-borne <i>Pythium</i> , <i>Fusarium</i> , and <i>Rhizoctonia solani</i>	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	<i>Fusarium</i> dry rot seed decay, seed-borne <i>Rhizoctonia solani</i> , seed-borne <i>Helminthosporium solani</i> , <i>Phytophthora infestans</i>	
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	Fungicide	<i>Fusarium</i> dry rot seed decay,
Application Type:	Commercial	(0.005 lb AI/gal)		seed-borne <i>Rhizoctonia solani</i> , seed-borne
Density:	Dry—pound	Crops		<i>Helminthosporium solani</i>
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			

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	Fungicide	<i>Pythium</i> damping-off	Reduced rates in
Application Type:	Commercial	(4.0 lb AI/gal)		control and early-season	combination with
Density:	9.4 lb/gal	Crops		<i>Phytophthora</i>	other fungicides
Rate:	Varies by crop	canola, cotton, soybeans, peanuts,			0.07–0.25 fl oz/Cwt
Standard Rate:	0.5 fl oz/Cwt—soybean	sorghum, sunflower, legumes, small			Aid in control of seed
Coverage:	Not stated	grains, and vegetables			decay and damping-
Package Size:	4x1, 2x2.5, 15's, 250's				off caused by <i>Pythium</i>
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:	Cereal Grains:
Product Type:	Fungicide—Component	Metalaxyl	Fungicide	0.75–1.50 fl oz/Cwt	Reduced rates in
Application Type:	Commercial	(2.65 lb AI/gal)		<i>Pythium</i> damping-off	combination with
Density:	9.0 lb/gal	Crops		control and early-season	other fungicides
Rate:	Varies by crop	canola, cotton, soybeans, peanuts,		<i>Phytophthora</i>	0.07–0.25 fl oz/Cwt
Standard Rate:	0.75 fl oz/Cwt—soybean	sorghum, sunflower, legumes, small			Aid in control of seed
Coverage:	Not stated	grains, and vegetables			decay and damping-
Package Size:	4x1, 15's, 250's				off caused by <i>Pythium</i>
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	Insecticide	Cereal Grains: wireworm, aphids, hessian fly
Application Type:	Commercial	(5 lb AI/gal)		Canola: flea beetle, wireworm
Density:	10.43 lb/gal	Crops		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	wheat, barley, buckwheat, millet, oats,		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	rye, tesonite, triticale, corn, popcorn,		Soybeans: aphids, bean leaf beetle, grape colaspis, leafhopper, pea leaf weevil, seed corn maggot, three-cornered alfalfa hopper, thrips, white grub, wireworm
Coverage:	Not stated	soybean, sorghum, sugarbeet, and rice		
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:
Product Type:	Fungicide—Stand-alone	Pyraclostrobin	Fungicide	<i>Colletotrichum</i> , <i>Fusarium</i> seed rot, <i>Fusarium</i> seedling blight, <i>Botrytis Cinerea</i> , <i>Pythium</i> damping-off, <i>Rhizoctonia</i> root rot
Application Type:	Commercial/On-farm	Fluxapyroxad	Fungicide	Additional Rapeseed Diseases:
Density:	8.84 lb/gal	(0.14 lb AI/gal)		<i>Leptosphaeria</i> , <i>Alternaria Brassicae</i>
Rate:	4.6 fl oz/Cwt	Metalaxyl	Fungicide	
Standard Rate:	4.6 fl oz/Cwt	(0.11 lb AI/gal)		
Coverage:	May dilute w/H ₂ O	Crops		
Package Size:	2x2.5, 1x200	dried shelled pea and bean		
Units Treated:	27.8 Cwt/gal	(except soybean), flax seed, and rapeseed		
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:
Product Type:	Fungicide	Fluxapyroxad	Fungicide	• Anthracnose <i>Colletotrichum</i> spp.
Application Type:	Commercial/On-farm	Pyraclostrobin		• Root rot, seed rot, and seedling blight
Density:	9.34	(0.334 lb)		<i>Fusarium</i> spp.
Rate:	1.53 fl oz/Cwt	Metalaxyl		<i>Phytophthora</i> spp.
Standard Rate:	1.53 fl oz/Cwt	(1.377 lb)		<i>Pythium</i> spp.
Coverage:	Provide uniform coverage	Thiophanate-methyl		<i>Rhizoctonia solani</i>
Package Size:	2x2.5, 15-gal, 30-gal	(0.835 lb)		• Seed rot <i>Aspergillus</i> spp. <i>Penicillium</i> spp.
Units Treated:	836.60	Crops		• Seedling blight <i>Ascochyta</i> spp.
Colorant:	Uncolored	soybean, dry bean		• Seed rot and seedling blight <i>Botrytis cinerea</i>
Seed Tag:	Required—See label			
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.

Rancona 3.8 FS

General Information		Agronomic Information		Target Pests
EPA Reg #:	400-544	Active Ingredients	Type	Diseases:
Product Type:	Fungicide	Ipconazole	Fungicide	general seed rots, damping-off and seedling blight, loose smut, common bunt, <i>Rhizoctonia</i> root rot, common root rot, <i>Fusarium</i> crown and foot rot
Application Type:	Commercial	(3.77 lb AI/gal)		Additional barley diseases: true loose smut, covered smut, false loose smut, and leaf stripe
Density:	9.17 lb/gal	Crops		Additional soybean diseases: <i>Phomopsis</i>
Rate:	0.051–0.085 fl oz/Cwt	barley, oats, rye, triticale, wheat, dried shelled beans, peas, and soybeans		
Standard Rate:	0.051 fl oz/Cwt			
Coverage:	Apply as H ₂ O 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	Insecticide	general seed rots, damping-off and seedling blight, loose smut, common bunt, <i>Rhizoctonia</i> root rot, common root rot, <i>Fusarium</i> crown and foot rot	aphid, grasshopper, and hessian fly
Application Type:	Commercial/On-farm	Ipconazole	Fungicide	Additional barley diseases: true loose smut, covered smut, false loose smut, and leaf stripe	Suppression of: wireworm
Density:	8.77 lb/gal	(0.04 lb AI/gal)			
Rate:	5.0–8.33 fl oz/Cwt	Metalaxyl	Fungicide		
Standard Rate:	5.0 fl oz/Cwt	(0.05 lb AI/gal)			
Coverage:	Diluted with H ₂ O if desired	Crops			
Package Size:	2x2.5, 1x50	barley, oats, rye, triticale, and wheat			
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	Fungicide	damping-off, seed rot and seedling blight, <i>Pythium</i> , <i>Rhizoctonia</i> , seed and soil-borne <i>Phomopsis</i> and <i>Sclerotinia</i> , general seed rots including <i>Penicillium</i> and <i>Aspergillus</i>
Application Type:	Commercial/On-farm	(0.08 lb AI/gal)		
Density:	8.9 lb/gal	Metalaxyl	Fungicide	
Rate:	4.0 fl oz/Cwt	(0.13 lb AI/gal)		
Standard Rate:	4.0 fl oz/Cwt	Crops		
Coverage:	Diluted with H ₂ O if desired	soybeans, dried shelled beans and peas		
Package Size:	2x2.5, 1x50			
Units Treated:	32 Cwt/gal			
Colorant:	Colored			
Seed Tag:	Required—See Label			
Signal Word:	Caution			
Restricted:	No			

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Rancona V 100 Pro FS

General Information		Agronomic Information		Target Pests
EPA Reg #:	400-596	Active Ingredients	Type	Diseases:
Product Type:	Fungicide	Ipconazole	Fungicide	general seed rots,
Application Type:	Commercial	(0.208 lb AI/gal)		damping-off and seedling
Density:	9.39 lb/gal	Carboxin	Fungicide	blight, loose smut, common
Rate:	0.9–1.5 fl oz/Cwt	(3.34 lb AI/gal)		bunt, <i>Rhizoctonia</i> root rot,
Standard Rate:	0.9 fl oz/Cwt	Crops		common root rot, <i>Fusarium</i>
Coverage:	Apply as H ₂ O mixture	barley, oats, rye, triticale, and wheat		crown and foot rot
Package Size:	2x2.5, 1x50			Additional barley diseases:
Units Treated:	142 Cwt/gal			true loose smut, covered
Colorant:	No			smut, false loose smut, and
Seed Tag:	Required—See Label			leaf stripe
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	Fungicide	general seed rots,
Application Type:	Commercial/On-farm	(0.042 lb AI/gal)		damping-off and seedling
Density:	8.84 lb/gal	Metalaxyl	Fungicide	blight, <i>Pythium</i> , loose smut,
Rate:	4.6 fl oz/Cwt	(0.111 lb AI/gal)		common bunt, <i>Rhizoctonia</i>
Standard Rate:	4.6 fl oz/Cwt	Carboxin	Fungicide	root rot, common root rot,
Coverage:	Diluted with H ₂ O if desired	(1.11 lb AI/gal)		<i>Fusarium</i> crown and foot rot
Package Size:	2x2.5, 1x50	Crops		Additional barley diseases:
Units Treated:	28 Cwt/gal	barley, oats, rye, triticale, and wheat		true loose smut, covered
Colorant:	Colored			smut, false loose smut, and
Seed Tag:	Required—See Label			leaf stripe
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	Fungicide	stinking smut, flag smut,
Application Type:	Commercial/On-farm	(0.128 lb AI/gal)		loose smut, early season
Density:	8.67 lb/gal	Metalaxyl	Fungicide	<i>Septoria</i> , general seed
Rate:	5.0 fl oz/Cwt	(0.052 lb AI/gal)		rots, <i>Pythium</i> damping-
Standard Rate:	5.0 fl oz/Cwt	Tebuconazole	Fungicide	off, <i>Rhizoctonia</i> root rot,
Coverage:	Ensure thorough coverage	(0.025 lb AI/gal)		common root rot, <i>Fusarium</i>
Package Size:	2x2.5, 15's, 200 gal	Crops		scab and foot rot
Units Treated:	25.6 Cwt/gal	wheat and barley		Suppression of:
Colorant:	Colored			powdery mildew, rust and
Seed Tag:	Required—See label			barley stripe
Signal Word:	Warning			
Restricted:	No			

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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	aphids, hessian fly, wireworm
Application Type:	Commercial/On-farm	Prothioconazole (0.128 lb AI/gal)	Fungicide	<i>Septoria</i> , general seed rots, <i>Pythium</i> damping- off, <i>Rhizoctonia</i> root rot,	
Density:	9.0 lb/gal	Metalaxyl (0.51 lb AI/gal)	Fungicide	common root rot, <i>Fusarium</i> scab and foot rot	
Rate:	5.0 fl oz/Cwt	Tebuconazole (0.025 lb AI/gal)	Fungicide	Suppression of: powdery mildew, rust and barley stripe	
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:	
Product Type:	Fungicide	Prothioconazole (4.00 lb)	Fungicide	Alfalfa: Seed rot and damping-off caused by <i>Rhizoctonia</i>	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 <i>Rhizoctonia solani</i> , <i>Fusarium</i> , <i>Cochliobolus</i> seed decay common root rot, foot rot, and crown rot (early season suppression) rust, <i>Septoria</i> and powdery mildew (early season suppression)
Application Type:	Commercial	Crops		Beans and Peas (dried) including Soybean: Seed rot and damping-off caused by <i>Rhizoctonia</i> , <i>Fusarium</i> , Seed decay	
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		Agronomic Information	
EPA Reg #:	73049-42	Active Ingredients	Type
Product Type:	Plant Growth Regulator	Gibberellins	PGR
Application Type:	Commercial	(0.2736 lb AI/gal)	
Density:	6.84 lb/gal	Crops	
Rate:	0.5–3 fl oz/Cwt	cereal seed, grasses, and field corn	
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		

Resonate 600 ST

General Information		Agronomic Information		Target Pests	
EPA Reg #:	42750-133	Active Ingredients	Type	Soybeans:	Cereal Grains:
Product Type:	Insecticide—Component	Imidacloprid	Insecticide	1.6–3.2 fl oz/Cwt	0.8–2.4 fl oz/Cwt
Application Type:	Commercial	(5.0 lb AI/gal)		seed corn maggot, soybean	aphids (bird cherry-oat,
Density:	10.35 lb/gal	Crops		aphids, overwintering bean	English grain, greenbug,
Rate:	Varies by crop	canola, cotton, soybeans, sorghum,		leaf beetles, wireworm	and Russian wheat
Standard Rate:	1.6 fl oz/Cwt—soybean	sunflowers, legumes, small grains,		thrips	aphid) hessian fly
Coverage:	Thorough coverage	vegetables, and potatoes		Suppression: white grubs	0.13–0.26 fl oz/Cwt
Package Size:	4x1, 2x2.5, 15's, 250's				wireworm
Units Treated:	80 Cwt/gal				(suppression)
Colorant:	Uncolored				1.2–2.4 fl oz/Cwt
Seed Tag:	Required—See label				grasshopper
Signal Word:	Caution				
Restricted:	No				

Rizolex

General Information		Agronomic Information		Target Pests	
EPA Reg #:	59639-178	Active Ingredients	Type	Diseases:	
Product Type:	Fungicide—Auxiliary	Toldofos-methyl	Fungicide	protection against	
Application Type:	Commercial	(4.17 lb AI/gal)		<i>Rhizoctonia</i> and seed-	
Density:	9.98 fl oz/Cwt	Crops		borne and soil-borne	
Rate:	Varies by crop	soybeans, corn, popcorn, sorghum,		fungal pathogens that	
Standard Rate:	0.3 fl oz/Cwt—soybean	sugarbeet, and cotton		cause seed decay,	
Coverage:	Accurate application			damping-off and	
Package Size:	4x1			seedling blight	
Units Treated:	426 Cwt/gal				
Colorant:	Uncolored				
Seed Tag:	Required—See label				
Signal Word:	Caution				
Restricted:	No				

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Salient TMI

General Information		Agronomic Information		Target Pests
EPA Reg #:	55146-159	Active Ingredients	Type	Diseases Controlled:
Product Type:	Fungicide/Insecticide	Imidacloprid - Insecticide (0.50 lb)	Fungicide/ Insecticide	Control of seed rots such as <i>Penicillium</i> and <i>Aspergillus</i> and seed-borne <i>Fusarium</i> scab and <i>Septoria</i>
Application Type:	Commercial/On-farm	Difenoconazole (0.31 lb)		Control of dwarf bunt, karnal bunt, stinking smut (common bunt), flag smut, loose smut, covered smut of barley
Density:	8.93	Metalaxyl (0.16 lb)		Control of early season barley stripe, <i>Pythium</i> damping-off, <i>Septoria</i> disease complex, <i>Rhizoctonia</i>
Rate:	5.0–7.5 fl oz/Cwt	Tebuconazole (0.035 lb)		root rot, common root rot (<i>Cochliobolus</i> spp.), <i>Fusarium</i> root rot
Standard Rate:	5.0 fl oz/Cwt	Crops		Early season suppression of powdery mildew, wheat leaf rust, and <i>Septoria</i> leaf blotch
Coverage:	Provide uniform coverage	cereals		
Package Size:	2x2.5			
Units Treated:	256			
Colorant:	Colored			
Seed Tag:	Required—See label			
Signal Word:	Caution			
Restricted:	No			
				Insect Control:
				Control of light to moderate pressure of wireworms.
				Controls aphids (including bird cherry-oat, English grain, greenbug and Russian wheat, and hessian fly)

Salstro

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 <i>Leptosphaeria maculans</i>
Application Type:	Commercial	Crops		Sudden Death Syndrome (<i>Fusarium virguliforme</i>)
Density:	9.76	multiple crops		Early-season <i>Septoria</i> brown spot (<i>Septoria</i> <i>glycines</i>)
Rate:	1.23–1.52 fl oz/Cwt			Plant parasitic nematodes soybean cyst (<i>Heterodera glycines</i>)
Standard Rate:	1.52 fl oz/Cwt			root knot (<i>Meloidogyne incognita</i>)
Coverage:	Provide uniform coverage			reniform (<i>Rotylenchulus reniformis</i>)
Package Size:	2x2.5, 15 gal			lesion (<i>Pratylenchus</i> spp.)
Units Treated:	Varies by crop			lance (<i>Hoplolaimus</i> spp.)
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: stinking smut, flag smut, loose smut, <i>Septoria</i> , <i>Rhizoctonia</i> root rot, common root rot, <i>Fusarium</i> foot rot Suppression of: powdery mildew, and wheat leaf rust Additional barley diseases: covered smut, barley stripe (suppression), and barley leaf rust (suppression) Additional oats diseases: crown rust (suppression)
Product Type:	Fungicide—Component	Tebuconazole	Fungicide	
Application Type:	Commercial	(2.6 lb AI/gal)		
Density:	9.1 lb/gal	Crops		
Rate:	Varies by crop	barley, corn, oats, triticale and wheat		
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	Insecticide	<i>Pythium</i> damping-off,	wireworm
Application Type:	Commercial/On-farm	(0.13 lb AI/gal)		stinking smut, flag smut,	(suppression)
Density:	8.4 lb/gal	Metalaxyl	Fungicide	loose smut, <i>Septoria</i> ,	
Rate:	5 fl oz/Cwt	(0.05 lb AI/gal)		<i>Rhizoctonia</i> root rot,	
Standard Rate:	5 fl oz/Cwt	Tebuconazole	Fungicide	general seed rots, common	
Coverage:	1 part H ₂ O/1 Sativa IM RTU	(0.04 lb AI/gal)		root rot, <i>Fusarium</i> scab and	
Package Size:	2x2.5, 30's, 250's	Crops		foot rot	
Units Treated:	25.6 Cwt/gal	barley, oat, triticale and wheat		Suppression of:	
Colorant:	Colored			powdery mildew and rusts	
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	Insecticide	seed decay caused by	aphids, wireworm and
Application Type:	Commercial/On-farm	(1 lb AI/gal)		<i>Aspergillus</i> , <i>Penicillium</i>	hessian fly
Density:	8.98 lb/gal	Metalaxyl	Fungicide	and other species. <i>Pythium</i>	
Rate:	3.4–5.0 fl oz/Cwt	(0.05 lb AI/gal)		damping-off, covered smut	
Standard Rate:	3.4 fl oz/Cwt	Tebuconazole	Fungicide	(barley), stinking smut, flag	
Coverage:	Thorough coverage	(0.04 lb AI/gal)		smut, loose smut, <i>Septoria</i> ,	
Package Size:	2x2.5, 30's, 250's	Fludioxonil	Fungicide	<i>Rhizoctonia</i> root rot,	
Units Treated:	37.6 Cwt/gal	(0.03 lb AI/gal)		general seed rots, common	
Colorant:	Colored	Crops		root rot, <i>Fusarium</i> scab and	
Seed Tag:	Required—See label	barley and wheat		foot rot	
Signal Word:	Warning			Suppression of: powdery	
Restricted:	No			mildew and rusts	

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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	Fungicide	seed decay caused by <i>Aspergillus</i> , <i>Penicillium</i> and other species. <i>Pythium</i>
Application Type:	Commercial/On-farm	(0.107 lb AI/gal)		damping-off, stinking smut,
Density:	8.62 lb/gal	Tebuconazole	Fungicide	flag smut, loose smut,
Rate:	3.4–5.0 fl oz/Cwt	(0.040 lb AI/gal)		<i>Septoria</i> , <i>Rhizoctonia</i> root
Standard Rate:	3.4 fl oz/Cwt	Fludioxonil	Fungicide	rot, common root rot, and
Coverage:	Ensure thorough coverage	(0.032 lb AI/gal)		<i>Fusarium</i> foot rot
Package Size:	2x2.5, 30's, 250's	Crops		Suppression of:
Units Treated:	37.65 Cwt/gal	barley, oats, triticale, and wheat		powdery mildew and early
Colorant:	Colored			season suppression of
Seed Tag:	Required—See label			wheat leaf rust
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	Fungicide	<i>Pythium</i> , <i>Phytophthora</i>
Application Type:	Commercial/On-farm	(2.65 lb AI/gal)		
Density:	8.82 lb/gal	Crops		
Rate:	Varies by crop	brassica leafy vegetables, canola,		
Standard Rate:	0.75–1.50 fl oz/Cwt—soybean	mustard seed, rapeseed cotton,		
Coverage:	Apply with other fungicides	curcubit vegetables, forage grasses,		
Package Size:	2x2.5, 4x1, 30's, 250's	forage legumes, fruiting vegetables,		
Units Treated:	170 Cwt/gal	grain crops, leafy vegetables, onions,		
Colorant:	Uncolored	peanuts, rice, root and tuber		
Seed Tag:	Required—See label	vegetables (except potato), seed and		
Signal Word:	Caution	pod vegetables, sorghum, soybeans,		
Restricted:	No	sunflowers, and turf grasses		

Sebring 480 FS

General Information		Agronomic Information		Target Pests
EPA Reg #:	55146-106	Active Ingredients	Type	Diseases:
Product Type:	Fungicide—Auxiliary	Metalaxyl	Fungicide	<i>Pythium</i> , <i>Phytophthora</i>
Application Type:	Commercial	(4 lb AI/gal)		
Density:	9 lb/gal	Crops		
Rate:	Varies by crop	brassica leafy vegetables, canola,		
Standard Rate:	0.50–1 fl oz/Cwt—soybean	mustard seed, rapeseed cotton,		
Coverage:	Apply with other fungicides	curcubit vegetables, forage grasses,		
Package Size:	2x2.5, 4x1, 30's, 250's	forage legumes, fruiting vegetables,		
Units Treated:	256 Cwt/gal	grain crops, leafy vegetables, onions,		
Colorant:	Uncolored	peanuts, rice, root and tuber		
Seed Tag:	Required—See label	vegetables (except potato), seed and		
Signal Word:	Caution	pod vegetables, sorghum, soybeans,		
Restricted:	No	sunflowers, and turf grasses		

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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	Insecticide	seed corn maggot,	aphids, hessian
Application Type:	Commercial	(5 lb AI/gal)		wireworm, soybean aphids	fly, wireworm and
Density:	10.27 lb/gal	Crops		and bean leaf beetles	grasshopper
Rate:	Varies by crop	oil seed crops, field corn, wheat,			
Standard Rate:	1.6 fl oz/Cwt—soybean	barley, oats, rye, triticale, sorghum,			
Coverage:	Not stated	cotton, sugarbeets, popcorn,			
Package Size:	2x2.5, 4x1, 30's, 250's	soybean, and edible beans			
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	Fungicide	seed decay, damping-off	
Application Type:	Commercial	(4 lb AI/gal)		and seedling blights	
Density:	9.09 lb/gal	Crops		caused by many seed-	
Rate:	Varies by crop	barley, millet, oats, rye, sorghum,		borne and soil-borne	
Standard Rate:	2 fl oz/bu—small grains	triticale, wheat, bean and peas,		organisms, smuts, bunt	
Coverage:	Applied as a H ₂ O suspension	beet, Swiss chard, vegetables (see			
Package Size:	2x2.5, 30's, 266's	label for type and rate), corn, cotton,			
Units Treated:	64 bu/gal	flax, grasses, flower seed, peanuts,			
Colorant:	Uncolored	rice safflower, sunflower, sugarbeet,			
Seed Tag:	Required—See label	and tomato			
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	Fungicide	<i>Rhizoctonia solani</i> ,	
Application Type:	Commercial/On-Farm	(1.67 AI/gal)		black root rot	
Density:	9.6 lb/gal	Crops			
Rate:	1.52–4.75 fl oz/Cwt	cotton seed treatment			
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	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	(4 lb AI/gal)			
Density:	9.97 lb/gal	Crops			
Rate:	0.08–0.16 fl oz/Cwt	corn, soybeans, cereals, cotton, potatoes, rice, vegetables, legumes, peanuts, and sorghum			
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	Insecticide	protection against damping-off and seed rots caused by <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> spp, and <i>Phytophthora</i> root rot.	seed corn maggot, wireworm, soybean aphids, and bean leaf beetles
Application Type:	Commercial/On-farm	(1.98 lb AI/gal)			
Density:	9.78 lb/gal	Fludioxonil	Fungicide		
Rate:	4.0 fl oz/Cwt	(0.08 lb AI/gal)			
Standard Rate:	4.0 fl oz/Cwt	Metalaxyl	Fungicide		
Coverage:	Complete seed coverage	(0.49 lb AI/gal)			
Units Treated:	32	Thiophanate - Methyl	Fungicide	Suppresses seed-borne <i>Sclerotinia</i> and <i>Phomopsis</i> spp.	
Colorant:	Colored	(0.32 lb AI/gal)			
Seed Tag:	Required—See label	Crops			
Signal Word:	Warning	soybeans, dry beans, and snap beans			
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	Fungicide	protection against damping-off and seed rots caused by <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> spp, and <i>Phytophthora</i> root rot.	protection against seed- and soil-borne fungi such as <i>Pythium</i> , <i>Rhizoctonia</i> , and <i>Fusarium</i> that causes decay, damping-off, and seedling blights
Application Type:	Commercial	(1.34 lb AI/gal)			
Density:	8.91 lb/gal	Fludioxonil	Fungicide		
Rate:	1.5–3.0 fl oz/Cwt	(0.21 lb AI/gal)			
Standard Rate:	1.5 fl oz/Cwt—soybean	Crops			
Coverage:	Ensure thorough coverage	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			
Package Size:	2x2.5				
Units Treated:	85.33 Cwt/gal				
Colorant:	Colored				
Seed Tag:	Required—See label				
Signal Word:	Warning				
Restricted:	No				

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Spirato MTm 285 FS

General Information		Agronomic Information		Target Pests
EPA Reg #:	55146-154	Active Ingredients	Type	Diseases:
Product Type:	Fungicide	Fludioxonil	Fungicide	protection against
Application Type:	Commercial	(0.21 lb AI/gal)		damping-off and seed
Density:	9.19 lb/gal	Metalaxyl	Fungicide	rots caused by <i>Pythium</i> ,
Rate:	1.5 fl oz/Cwt	(1.34 lb AI/gal)		<i>Phytophthora</i> , <i>Fusarium</i> ,
Standard Rate:	1.5 fl oz/Cwt	Thiophanate -	Fungicide	<i>Rhizoctonia</i> spp, and
Coverage:	Complete seed coverage	Methyl		<i>Phytophthora</i> root rot.
Units Treated:	85	(0.833 lb AI/gal)		Suppresses seed-borne
Colorant:	Colored	Crops		<i>Sclerotinia</i> and <i>Phomopsis</i>
Seed Tag:	Required—See label	soybeans, dry beans, and snap beans		spp.
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	Fungicide	seed decay such as	seed decay such as
Application Type:	Commercial	(4.5 lb AI/gal)		<i>Phomopsis</i> , <i>Fusarium</i> ,	<i>Phomopsis</i> , <i>Fusarium</i> ,
Density:	10 lb/gal	Crops		seedling blight (soil-borne	seedling blight
Rate:	0.14–0.28 fl oz/Cwt	peanuts, soybeans, dry beans, snap		<i>Fusarium</i> and <i>Rhizoctonia</i>)	(soil-borne <i>Fusarium</i>
Standard Rate:	0.28 fl oz/Cwt—soybeans 0.14 fl oz/Cwt—wheat	beans, and wheat		Dry Beans, Snap Peas:	and <i>Rhizoctonia</i>)
Coverage:	Complete seed coverage			seed decay such as	
Package Size:	4x1, 15's			<i>Phomopsis</i> , <i>Fusarium</i> ,	
Units Treated:	457–914 Cwt/gal			seedling blight (soil-borne	
Colorant:	Uncolored			<i>Fusarium</i> and <i>Rhizoctonia</i>)	
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
Product Type:	Fungicide—Auxiliary	Pyraclostrobin	Fungicide	<i>Rhizoctonia solani</i> seed-	(Field, Pop, Sweet):
Application Type:	Commercial/On-farm	(1.67 lb AI/gal)		borne fungi causing seed	<i>Rhizoctonia solani</i>
Density:	9.1 lb/gal	Crops		decay, seedling	seed-borne fungi
Rate:	Crop dependent	alfalfa, barley, corn, dried and		damping-off	causing seed decay,
Standard Rate:	0.4 fl oz/Cwt—C and Sm Gr	succulent shelled peas and beans,			seedling damping-off
Coverage:	Apply as H ₂ O mixture	edible podded legume vegetables,		Mixes easily with water and	
Package Size:	2x2.5, 1x30	oats, rye, sorghum, sugarbeet, and		other BASF seed treatments.	
Units Treated:	320 Cwt/gal at 0.4 fl oz	wheat		When mixing with other	
Colorant:	Uncolored			manufacturers' product,	
Seed Tag:	Required—See label			jar test.	
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, <i>Fusarium</i> seed rot,	dry seed decay, false loose smut, true loose smut
Application Type:	Commercial/On-farm	Triticonazole (0.14 lb AI/gal)	Fungicide	<i>Fusarium</i> seedling blight, loose smut, <i>Pythium</i>	
Density:	8.94 lb/gal	Metalaxyl (0.08 lb AI/gal)	Fungicide	damping-off, <i>Rhizoctonia</i>	Additional Oat Diseases:
Rate:	4.6 fl oz/Cwt			root rot	covered smut
Standard Rate:	4.6 fl oz/Cwt	Crops			
Coverage:	May dilute w/H ₂ O	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				

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, <i>Fusarium</i> seed rot, <i>Fusarium</i>	dry seed decay, false loose smut, true loose smut
Application Type:	Commercial/On-farm	Triticonazole (0.14 lb AI/gal)	Fungicide	seedling blight, loose smut, <i>Pythium</i> damping-off, <i>Rhizoctonia</i>	
Density:	8.92 lb/gal	Metalaxyl (0.081 lb AI/gal)	Fungicide	root rot	Additional Oat Diseases:
Rate:	4.6 fl oz/Cwt	Fluxapyroxad (0.071 AI/gal)	Fungicide		covered smut
Standard Rate:	4.6 fl oz/Cwt	Crops			
Coverage:	May dilute w/ H ₂ O	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	loose smut, <i>Pythium</i> damping-off, early season <i>Rhizoctonia</i>
Application Type:	Commercial	Crops		<i>Septoria</i> , <i>Rhizoctonia</i> root rot, common root rot, <i>Fusarium</i> foot rot, powdery mildew, and wheat leaf rust	root rot, common root rot, <i>Fusarium</i> foot rot, powdery mildew, crown rust
Density:	8.9 lb/gal	wheat, barley, and oats		Barley: 0.10 fl oz/Cwt	
Rate:	0.1 fl oz/Cwt			covered smut, loose smut, barley stripe (suppression), early season <i>Rhizoctonia</i>	
Standard Rate:	0.1 fl oz/Cwt			root rot, common root rot, <i>Fusarium</i> foot rot, suppression of powdery mildew and barley leaf rust	
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	Fungicide	<i>Ascochyta</i> blight
Application Type:	Commercial	(4.0 lb AI/gal)		
Density:	9.6 lb/gal	Crops		
Rate:	Varies by crop	wheat, barley, and oats		
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	Fungicide	<i>Alternaria</i> spp., <i>Aspergillus</i> spp., <i>Cladosporium</i> spp.,
Application Type:	Commercial	(0.64 lb AI/gal)		<i>Penicillium</i> spp.,
Density:	9.01 lb/gal	Metalaxyl	Fungicide	<i>Rhizoctonia solani</i> ,
Rate:	Varies by crop	(0.51 lb AI/gal)		<i>Fusarium</i> spp.,
Standard Rate:	1.0 fl oz/Cwt—soybean	Crops		<i>Pythium</i> spp.
Coverage:	Not stated	corn, cotton, soybeans, edible and		Suppression of:
Package Size:	2x2.5, 15's	succulent beans, and rice		<i>Phytophthora</i> seed and root rot
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	Fungicide	seed-borne fungi causing
Application Type:	Commercial	(0.83 lb AI/gal)		seed decay and soil-borne
Density:	9.76 lb/gal	Metalaxyl	Fungicide	pathogens such as
Rate:	1.6 fl oz/Cwt	(1.25 lb AI/gal)		<i>Fusarium</i> , <i>Rhizoctonia</i> ,
Standard Rate:	1.6 fl oz/Cwt—cotton	Triadimenol	Fungicide	<i>Pythium</i> , <i>Thielaviopsis</i>
Coverage:	Uniform coverage	(0.42 lb AI/gal)		<i>basicola</i> (suppression)
Package Size:	5x32 oz, 15's	Crops		
Units Treated:	80 Cwt/gal	cotton		
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	<i>Bacillus</i>	Nematicide	dagger nematode
Application Type:	Commercial	<i>amyloliquefaciens</i>		lance nematode
Density:	8.73	strain MBI 600		needle nematode
Rate:	0.06–0.31 fl oz per Cwt	cis-Jasmone		pin nematode
Standard Rate:	0.20 fl oz/Cwt	Contains a		ring nematode
Coverage:	Provide uniform coverage	minimum of 2.0 x		root knot nematode
Package Size:	4x1	109 colony forming		root lesion nematode
Units Treated:	1280 units per gallon	units per mL		spiral nematode
Colorant:	Uncolored	Crops		sting nematode
Seed Tag:	Required—See label	corn, cotton, and soybeans		stubby root nematode
Signal Word:	Caution			stunt nematode
Restricted:	No			columbia lance nematode
				reniform nematode
				soybean cyst nematode

Vibrance

General Information		Agronomic Information		Target Pests
EPA Reg #:	100-1374	Active Ingredients	Type	Small Grain Diseases:
Product Type:	Fungicide—Add-on	Sedaxane	Fungicide	true loose smut caused by
Application Type:	Commercial	(4.3 lb AI/gal)		<i>Ustilago nuda</i> , seed decay,
Density:	9.76 lb/gal	Crops		seedling blight and
Rate:	0.08–0.16 fl oz/Cwt	barley, canola, oat, rye, soybean,		damping-off caused
Standard Rate:	0.08 fl oz/Cwt	triticale, and wheat		<i>Rhizoctonia solani</i> , loose
Coverage:	Provide uniform coverage			smut caused by <i>Ustilago</i>
Package Size:	4x1 qt, 4x1, 1x15			<i>triticales</i>
Units Treated:	160 Cwt/gal			
Colorant:	Uncolored			Soybean and Canola
Seed Tag:	Required—See label			Diseases:
Signal Word:	Caution			seed decay, seedling
Restricted:	No			blight and damping-off
				caused by <i>Rhizoctonia</i>
				<i>solani</i>

Vibrance Extreme

General Information		Agronomic Information		Target Pests
EPA Reg #:	100-1382	Active Ingredients	Type	Diseases:
Product Type:	Fungicide—Stand-alone	Sedaxane	Fungicide	general seed rots, seedling
Application Type:	Commercial	(0.155 lb AI/gal)		blight, root rot, damping-off
Density:	9.31 lb/gal	Mefenoxam	Fungicide	caused by seed- and
Rate:	2.8–5.6 fl oz/Cwt	(0.138 lb AI/gal)		soil-borne <i>Fusarium</i> spp. or
Standard Rate:	2.8 fl oz/Cwt	Difenoconazole	Fungicide	<i>Rhizoctonia</i> spp. seedling
Coverage:	Provide uniform coverage	(0.552 lb AI/gal)		blight, root rot, damping-off
Package Size:	2x2.5, 1x30, 1x110	Crops		caused by soil-borne <i>Pythium</i>
Units Treated:	45.7 Cwt/gal	barley, oats, rye, triticale, and wheat		spp., seed-borne <i>Septoria</i> ,
Colorant:	Colored			covered smut false loose
Seed Tag:	Required—See label			smut, true loose smut,
Signal Word:	Caution			common bunt, dwarf bunt,
Restricted:	No			karnal bunt, flag smut,
				<i>Fusarium</i> seed scab, loose
				smut, <i>Pythium</i> damping-off
				Suppression of:
				common root rot,
				<i>Fusarium</i> crown and
				foot rot, take-all

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Product	Temp. (°F)	Density (g/mL)	Weight (lb/gal)	Product	Temp. (°F)	Density (g/mL)	Weight (lb/gal)
Apron Maxx + Moly 15	NTR	1.17	9.76	Obvius Plus	NTR	1.12	9.34
Apron Maxx RFC	NTR	1.08	9.01	Obvius	NTR	1.06	8.85
Apron Maxx RTA	NTR	1.04	8.68	Rancona 3.8 FS	32	1.1	9.18
Apron XL	NTR	1.11	9.26	Rancona Crest	32	1.09	9.1
Armis FI	32	1.14	9.51	Rancona Crest WR	32	1.05	8.76
Artect	32	1.03	8.6	Rancona Pinnacle	32	1.06	8.85
Artect FI	32	1.05	8.76	Rancona Summit	32	1.06	8.85
Aveo EZ	NTR	1.21	10.06	Rancona V RTU FS	32	1.06	8.85
Avipel	32	1.16	9.67	Raxil Pro MD	NTR	1.04	8.68
Captan 4L	NTR	1.2	10.01	Raxil Pro Sheild	NTR	1.08	9.01
Centynal	NTR	1.04	8.68	Recover PO4	68	1.04	8.68
Centynal EC	NTR	1.05	8.76	Redigo 480	NTR	1.18	9.85
Charter F2	NTR	1.07	8.93	Relenya	NTR	1.15	9.59
Clariva Elite Bean	NTR	1.09	9.09	Resonate 600 ST	32	1.2	10.01
Cruiser 5FS	NTR	1.3	10.85	Rizolex	NTR	1.19	9.92
CruiserMaxx	NTR	1.14	9.51	Salient 372 FS	NTR	1.12	9.35
CruiserMaxx APX	NTR	1.12	9.35	Salient TMI	NTR	1.07	8.92
CruiserMaxx Cereals	NTR	1.16	9.68	Saltro	NTR	1.17	9.76
CruiserMaxx Potato	NTR	1.19	9.93	Sativa 309 FS	NTR	1.09	9.1
CruiserMaxx Potato Extreme	NTR	1.19	9.93	Sativa IM RTU	NTR	1.01	8.43
CruiserMaxx Vibrance	NTR	1.15	9.6	Sativa IMF Max	32	1.07	8.93
CruiserMaxx Vibrance Cereals	NTR	1.11	9.26	Sativa IMF Sembolite Max	32	1.08	9.01
CruiserMaxx Vibrance Potatoes	NTR	1.15	9.6	Sativa M RTU	NTR	1.01	8.43
Cygin	32	1.06	8.85	Sativa M2F RTU	32	1.03	8.6
Diacon IGR	NTR	0.85	7.1	Sebring 318 FS	NTR	1.06	8.85
Diacon IGR Plus	NTR	1.04	8.68	Sebring 480 FS	NTR	1.09	9.1
Difenoconazole 3L ST	NTR	1.1	9.18	Senator 600 FS	32	1.28	10.68
Dividend Extreme	NTR	1.19	9.93	Signet 480 FS	32	1.16	9.68
Dynasty	NTR	1.03	8.6	Spirato 480 FS	32	1.19	9.93
Emesto Silver	NTR	1.07	8.93	Spirato IMTM 348 FS	NTR	1.173	9.78
EverGol Energy	NTR	1.07	8.93	Spirato M185 FS	NTR	1.068	8.91
Gaicho 600 FS	32	1.23	10.26	Spirato MTM 285 FS	32	1.1	9.2
Gaicho XT	32	1.12	9.35	Stamina	NTR	1.09	9.1
Halifax Fnl	32	1.14	9.51	Stamina F3 Cereals	32	1.07	8.93
ILeVO	14	1.24	10.35	Stamina F4 Cereals	NTR	1.07	8.92
Intego Fungicide CB	NTR	1.12	9.34	Storcide II	NTR	0.99	8.26
Intego Suite Soybeans	32	1.14	9.51	Teraxxa	NTR	1.15	9.64
Lumisena	NTR	1.07	8.92	Teraxxa F4	NTR	1.08	9.01
Macho 600 ST	32	1.18	9.85	Thiabendazole 4L ST	32	1.14	9.51
Maxim 4FS	NTR	1.19	9.93	Trilex 2000	NTR	1.08	9.01
Mertect 340F	32	1.16	9.68	Trilex Flowable FS	NTR	1.09	9.1
NipSit Inside	NTR	1.28	10.68	Trunemco	NTR	1.05	8.76
NipSit Suite Cereals	NTR	1.05	8.76	Vibrance	NTR	1.17	9.76
NipSit SUITE Rice System	NTR	1.28	10.68	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)	Survivability			Comments
									Shelf Life	Bare Seed	With Seed Treat	
BASF	Vault IP Plus	Retailer	Multiple	<i>Bradyrhizobium japonicum</i> <i>Bacillus amyloliquefaciens</i> (MBI600) + <i>Bacillus subtilis</i>	1.0×10 ¹⁰	1.1	2×4×50 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	<i>Bradyrhizobium japonicum</i>	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	<i>Bradyrhizobium japonicum</i>	4.0×10 ⁹	3.4	4×50 1×200	200 200	2-yr	30 days	14–30 days	See label for seed treatment compatibility.
Lallemand	LALFIX PROYIELD	Retailer	Multiple	<i>Bradyrhizobium elkanii</i> <i>Delftia acidovorans</i>	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	<i>Bradyrhizobium japonicum</i> <i>Lipo-chitooligosaccharide</i> (LCO)	1×10 ¹⁰ 2.66×10 ^{-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	<i>Bradyrhizobium japonicum</i> <i>Penicillium bilaii</i> <i>Lipo-chitooligosaccharide</i> (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	<i>Bradyrhizobium japonicum</i>	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	<i>Bradyrhizobium japonicum</i> <i>Glutamate Proline Citric Acid</i>	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)	Survivability			Comments
									Shelf Life	Bare Seed	With Seed Treat	
BASF	Rhizo Flo	On-farm	Single	<i>Bradyrhizobium japonicum</i>	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	<i>Bradyrhizobium elkanii</i> <i>Bacillus velezensis</i>	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	<i>Bradyrhizobium japonicum</i> <i>Penicillium bilaii</i>	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)	Survivability			Comments
									Shelf Life	Bare Seed	With Seed Treat	
BASF	Vault SP	On-farm	Single	<i>Bradyrhizobium japonicum</i>	3×10 ⁹	2.8	10×20	200	1-yr	24 hrs	24 hrs	
Novozymes BioAG	Cell-Tech NS	On-farm	Single	<i>Bradyrhizobium japonicum</i>	2.0×10 ⁹	3.0 oz/55 lb	4×30	120	1-yr	48 hrs	48 hrs	
Lallemand	LALFIX Peat	On-farm	Single	<i>Bradyrhizobium elkanii</i>	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)	Survivability			Comments
									Shelf Life	Bare Seed	With Seed Treat	
BASF	Nodulator	Retailer and On-farm	Single	<i>Rhizobium leguminosarum</i> bv. <i>viciae</i>	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	<i>Rhizobium leguminosarum</i>	7.2×10 ⁸	2.5	4×30 L (sold out)	9,600 (sold out)	1-yr	48 hrs	0–24 hrs	See label for seed treatment compatibility.
				<i>Penicillium bilaii</i>	7.2×10 ⁸							
Novozymes BioAG	Cell-Tech	Retailer and On-farm	Single	<i>Rhizobium leguminosarum</i>	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	<i>Rhizobium leguminosarum</i> bv. <i>viciae</i>	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)	Survivability			Comments
									Shelf Life	Bare Seed	With Seed Treat	
BASF	Nodulator Duo SCG	On-farm	Multiple	<i>Rhizobium leguminosarum</i> bv. <i>Viciae</i> <i>Bacillus subtilis</i>	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	<i>Rhizobium leguminosarum</i> bv. <i>Viciae</i> <i>Bacillus velezensis</i>	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	<i>Rhizobium leguminosarum</i>	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)	Survivability			Comments
									Shelf Life	Bare Seed	With Seed Treat	
BASF	Nodulator SA	On-farm	Single	<i>Rhizobium leguminosarum</i>	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	<i>Rhizobium leguminosarum</i> bv. <i>viciae</i>	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	<i>Rhizobium leguminosarum</i>	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	<i>Rhizobium leguminosarum</i> bv. <i>viciae</i>	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)	Survivability			Comments
									Shelf Life	Bare Seed	With Seed Treat	
BASF	Nodulator Clay	On-farm	Single	<i>Bradyrhizobium sp. (Cicer)</i>	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	<i>Mesorhizobium cicero</i> <i>Bacillus velezensis</i>	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	<i>Mesorhizobium cicero</i> <i>Penicillium bilaii</i>	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)	Survivability			Comments
									Shelf Life	Bare Seed	With Seed Treat	
Novozymes BioAG	TagTeam	On-farm	Multiple	<i>Mesorhizobium cicero</i> <i>Penicillium bilaii</i>	8×10 ⁷	1.31	7×4.8 lb	21,000	1-yr	6 hrs	4-6 hrs	
Lallemand	LALFIX Peat	On-farm	Single	<i>Mesorhizobium ciceri</i>	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)	Survivability			Comments
									Shelf Life	Bare Seed	With Seed Treat	
Lallemand	LALFIX Peat	On-farm	Single	<i>Rhizobium tropici</i>	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)	Survivability			Comments
									Shelf Life	Bare Seed	With Seed Treat	
Lallemand	LALFIX Liquid	On-farm	Single	<i>Bradyrhizobium spp.</i>	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	<i>Bradyrhizobium vigna</i>	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	<i>Penicillium bilaii</i>	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	<i>Delftia acidovorans</i>	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	<i>Penicillium bilaii</i>	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	<i>Penicillium bilaii</i> <i>Lipo-chitooligosaccharide (LCO)</i>	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	<i>Bacillus amyloliquefaciens</i> <i>Trichoderma virens</i>	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	<i>Bacillus amyloliquefaciens</i> <i>Trichoderma virens</i>	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	<i>Bacillus amyloliquefaciens</i> <i>Trichoderma virens</i>	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	<i>Bacillus amyloliquefaciens</i> <i>Trichoderma virens</i>	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	<i>Bacillus amyloliquefaciens</i> <i>Trichoderma virens</i>	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	<i>Bacillus amyloliquefaciens</i> <i>Trichoderma virens</i>	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 PO₄, 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 <i>Burkholderia rinojensis</i>	Biological	Retailer Caution	Soybean	3.0 fl oz/Cwt	2x2.5 gal	426	Soybean cyst, root-knot, reniform nematodes
BASF	ILeVO	<i>Fluopyram</i>	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, <i>Bacillus firmus</i>	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	<i>Bacillus Amylolyquefaciens</i> 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	<i>Pasteuria nishizawae</i> PNI	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	<i>Bacillus amyloliquefaciens</i>	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	<i>Bradyrhizobium Elkanii</i> <i>Delftia Acidovorans</i>	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	<i>Bradyrhizobium japonicum</i>	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	<i>Bradyrhizobiumjaponicum</i> 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	<i>Bradyrhizobium japonicum</i> <i>Penicillium bilaii</i> <i>Lipo-chitooligosaccharide</i>	1.5 fl oz/Cwt	1-yr	120 days	120 days	3-part mix with LCO technology.
Novozymes BioAG	Optimize FXC DS	<i>Bradyrhizobium japonicum</i> <i>Lipo-chitooligosaccharide</i>	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 Verium, Parachute II or Petrichor 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 Paralign 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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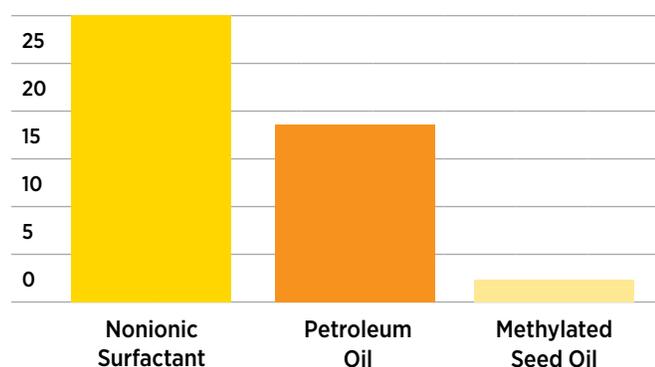
Spring Burndown

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, (Covrex) or Methylated Seed oil (Advatrol) typically increase weed control as compared to non-ionic Surfactants (Prefer 90) 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 Advatrol @ 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 Covrex @ 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.

Additional Resources // Burndown Herbicide Quick Reference

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	Covrex or Advatrol 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	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: Sulfentrazone + 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	Covrex or Advatrol or Tapran @ 0.5% v/v	1	14 d	14 d	14 d	AI: Halaxifen 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	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	Jackhammer @ 2 qt/100 or Precinct2 @ 5-6 qt/100	0	0	0	0	AI: Glyphosate If tank mix partner requires COC or MSO use Covrex or Advatrol. Under tougher conditions or larger weeds use Last Chance Pro @ 1 qt/100 + AMS.
Gramoxone SL 3.0	2.0-4.0 pt	Covrex or Advatrol @ 0.5% v/v or Prefer 90 @ 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

- Always refer to herbicide label for specific rates or when tank mixing with other herbicides.
- Dicamba labels vary on rotation restrictiveness. Consult label for specific cropping restrictions.
- Refer to label for specific soybean varieties that should not be planted after Metribuzin applications.
- Upland MSO can be used in place of Advatrol at 1.0% v/v/100 gal spray solution.
- Crop Oil can be used in place of Covrex at 1.0% v/v/100 gal spray solution.

Product	Rate/A ¹	Adjuvant Rec. ^{4/5}	Cotton	Field Corn	Rice	Soybean	Notes ¹
			Plant-back ¹ (Months before planting/d=days)				
Kyber Pro	1 pt	Covrex or Advatrol 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	Last Chance 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	9-16 oz/A	Covrex 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.
Volunteer							
Lo-Vol 4 Ester	0.5-1.0 lb ai	Jackhammer @ 2 qt/100 or Precinct2 @ 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.
Lo-Vol 6 Ester							
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	Advatrol 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	Advatrol @ 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	Covrex or Advatrol 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.
	SX		14 d-2	7 d-30 d	1-2	0	
	XLT		10-30	10-18	9-18	0	
Weedmaster	1.0-2.5 pt	Covrex 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	Advatrol 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 + Pyroxasulfone + 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 Upland MSO can be used in place of Advatrol or Tapran at 1.0% v/v/100 gal spray solution.
⁵ Crop Oil can be used in place of Covrex 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
- Drier 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 may be 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 / Maretail	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 Advatrol, Covrex, Tapran, Jackhammer at 0.5% v/v or Upland MSO or Crop Oil at 1% v/v, or Last Chance 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 Advatrol, Tapran or Upland MSO 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)

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.



Palmer amaranth leaf and with petiole folded over leaf blade.



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 Flexx² Callisto, Corvus², 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 products³, Gramoxone SL / Parazone 3SL, Halex GT³, Hornet, Huskie/Complete, Liberty 280 SL⁴, 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 not 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 Last Chance Pro at 1 qt/100 with Verasure 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 Last Chance 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-Firstate, 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 + Advatrol or Upland MSO
- 2,4-D ester + gramoxone + metribuzin
- Liberty + metribuzin
- saflufenacil (Sharpen/Verdict) + Advatrol or Upland MSO + 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.

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

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): 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):

Affinity Broadspec/Audit 1:1, Affinity Tank mix/Audit 4:1, Ally XP, Audit 75WDG, Armezon, Armezon Pro, Atrazine,



Photos courtesy of University of California, Davis.

Beyond, Brox M, Buctril/Brox 2EC, Bromoxynil/+MCPA, Callisto Extra, Capreno, Cleansweep D/M, ClearMax, Express, Extreme², Goal/Collide, GoldSky, Harmony, Huskie, Huskie Complete, Impact, Laudis, Liberty³, 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

Herbicide*	Rate/A	Canola					Corn			Soybean	
		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 Marestalk control with 2,4-D ester due to cool weather.



Photo: omafra, ALS damage on soybean leaves



Poor Marestalk control with 2,4-D ester

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.



Photo: Purdue University, 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: Iowa State University, Poor control of Giant Ragweed due to cool weather

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.

Unifoliolate to Trifoliolate 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 ($50\% \times 0.66 = 33\%$).

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.

Verium at 1 qt/100 or Petrichor 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 SEC	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 evidence 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-toothed 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 moth, 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	Storicide 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	Prefer 90 @ 0.25% v/v or Tapran @ 0.25 – 0.5% v/v Petrichor 3 oz/A for drift control	Imazapic 2 lb/gal	None
2,4-D Amine	Grass seedlings	16.0–32.0 oz/A	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125% v/v + AMS 1-3 lbs/A or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.25 – 0.50% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 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	Prefer 90 @ 0.25 – 0.50% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.25 – 0.50% v/v Petrichor 3 oz/A for drift control	Aminopyrliid 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125 – 0.25% v/v Petrichor 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	Prefer 90 @ 0.25 – 0.50% v/v Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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 Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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
Invoira	Annual and Biennial broadleaf weeds in RandP. Perennial and woody control in RandP including basal, bark and cut stump treatment	12–48 oz/A	Last Chance Pro 1-2 qt/100 on Herbaceous weeds Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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 Last Chance Pro 1-2 qt/100 Petrichor 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	Prefer 90 @ 0.125% v/v or Last Chance Pro 1-2 qt/100 Petrichor 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 Upland MSO 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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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	Green	Green	Green	Green	Green	Green	Green	Green
atrazine	Atrazine	Yellow	Green	Green	Green	Yellow	Green	Green	Yellow
chlorimuron	Classic	Green	Green	Green	Yellow	Green	Green	Green	Yellow
cloransulam	FirstRate	Green	Yellow	Green	Green	Green	Green	Yellow	Green
dicamba	Clarity	Green	Green	Green	Green	Green	Green	Green	Green
flumioxazin	Valor	Orange	Orange	Yellow	Orange	Yellow	Green	Yellow	Yellow
fomesafen	Flexstar	Orange	Orange	Green	Orange	Yellow	Yellow	Green	Green
imazethapyr	Pursuit	Yellow	Green	Green	Orange	Yellow	Green	Green	Yellow
isoxaflutole	Balance Flexx	Yellow	Green	Green	Orange	Green	Yellow	Yellow	Yellow
lactofen	Cobra	Green	Green	Green	Green	Green	Green	Green	Green
mesotrione	Callisto	Green	Yellow	Yellow	Green	Green	Green	Green	Green
metribuzin	Sencor, Tricor	Green	Orange	Green	Green	Green	Green	Green	Yellow
pyroxasulfone	Zidua	Green	Yellow	Yellow	Green	Orange	Yellow	Green	Yellow
s-metolachlor	Dual/Brawl	Yellow	Green	Yellow	Green	Orange	Green	Green	Yellow
s-metolachlor + fomesafen	Prefix, Ledger	Green	Green	Green	Orange	Yellow	Yellow	Yellow	Yellow
sulfentrazone	Spartan	Green	Yellow	Green	Green	Yellow	Yellow	Yellow	Yellow

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	Covrex (2 qt/100 gal) Verium (1 qt/100 gal) + AMS 2 lb/A
Aim	0.5 oz/A	Anytime	Prefer 90 (1 qt/100 gal) + AMS 2 lb/A
Basagran/ Broadloom ¹	1-2 pt/A	Anytime	Covrex or Advatrol (2 qt/100 gal) Verium (1 qt/100 gal) + AMS 2 lb/A
Cadet	0.6-0.9 fl oz/A	Preplant to 48" corn, 40 day PHI	Prefer 90 (1 qt/100 gal) Covrex (2 qt/100 gal)
Callisto / Explorer ¹	3 fl oz/A	Up to 30" corn or V-8	Prefer 90 (1 qt/100 gal) Covrex (2 qt/100 gal) Verium (1 qt/100 gal)
Callisto Xtra ¹	20-24 fl oz/A	Emergence up to 12" corn	Prefer 90 (1 qt/100 gal) Covrex (2 qt/100 gal) Verium (1 qt/100 gal)
Impact / Armezon	0.5-1.0 fl oz/A	Up to V8, 45 day PHI	Covrex or Advatrol (2 qt/100 gal) + AMS 8.5 to 17 lb/100 gal
Impact Z	8.0-10.7 fl oz/A	Up to 12"	Advatrol (2 qt/100 gal)
Laudis ¹	3 oz/A	Emergence up to V7 corn	Advatrol (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	Prefer 90 (1 qt/100 gal)
Primero	0.75 oz/A	Up to 12" (V5), Drop nozzles 12-18" (V6) corn	Covrex (2 qt/100 gal) Verium (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	Prefer 90 (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	

¹Sweet corn hybrid sensitivity is highly variable and not all hybrids have been tested for crop tolerance. Injury may occur to sensitive hybrids. All trademarks and registered trademarks are the property of their respective owners.

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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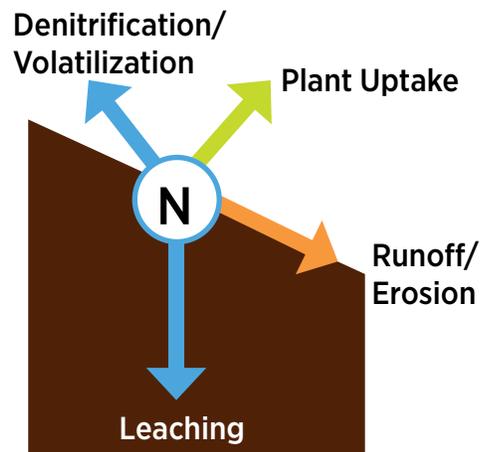
Always read and follow label directions.

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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Always read and follow label directions.

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 Verium @ 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 Maxx, 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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Additional Resources // Potato Foliar Insecticides

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 + Chloraniliprole	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	Fonicamid	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
			Sulfoxaflor	Transform WG	No	Danger	Dry
	4D	Butenolides	Flupyradifurone	Sivanto 200 SL	No	Caution	Liquid
Nicotinic acetylcholine receptor allosteric 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	Fonicamid	Fonicamid	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	Diacon-D	No	Caution	Dry
			Methoprene	Diacon-IGR EC	No	Warning	Liquid
			Methoprene	Diacon-IGR	No	Caution	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	Intrepid 2F	No	Caution	Liquid
			Tebufenozide	Confirm 2F	No	Caution	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	Movento	No	Caution	Liquid
			Spiromesifen	Oberon 4 SC Insecticide/Miticide	No	Caution	Liquid
			Spirotetramat	Ultor	No	Caution	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 Avermectins	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-cyhalothrin	Diamides Pyrethroids	28 3A	Yes	Warning	Liquid
Brigadier	FMC Corporation	Bifenthrin Imidacloprid	Pyrethroids Neonicotinoids	3A 4A	Yes	Warning	Dry
Cobalt	Dow AgroSciences	Chlorpyrifos Gamma-cyhalothrin	Organophosphates Pyrethroids	1B 3A	Yes	Danger	Liquid
Cobalt Advanced	Dow AgroSciences	Chlorpyrifos Lambda-cyhalothrin	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-cyhalothrin	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	6-10³ 1 forage 7 hay	5-10³ 21 days	6.5-6 21 days	6-10 0 graze 7 hay	6-10 30 days	6-10³ 30 days	8-10³ 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		4-10.3² 30 days grain 60 days forage 30 days graze	5.2-10.3² 14 days no graze				4-10.3² 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	2.56-3.84³ 1 day forage 7 days hay	1.92-3.84³ 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	2.56-3.84³ 30 days	3.2-3.84³ 30 days

Petrichor is APE/NPE free and can be used at 3 fl oz/A for all application timings for drift control and deposition. Verium 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.

¹Small cereal grains include barley, buckwheat, oats, rye, triticale, and wheat.

²Coverage 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.

³For large larvae use higher rate range and ensure thorough coverage.

⁴Expect 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

Petrichor is APE/NPE free and can be used at 3 fl oz/A for all application timings for drift control and deposition. Verium 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.

¹Small cereal grains include barley, buckwheat, oats, rye, triticale, and wheat.

²Coverage 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.

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Blanks indicate that a crop is not labeled.

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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?

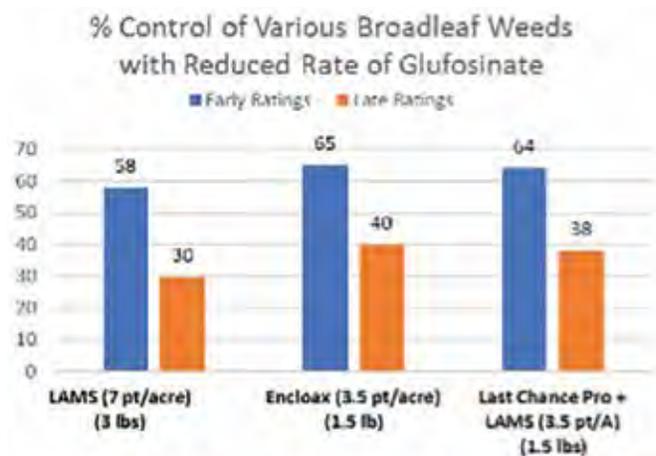
BMP: With any glufosinate application it is highly recommended to use an AMS targeting between 1.5 to 3 lbs/acre, rates may vary depending on your geography. Adjuvant systems vary considerably between Glufosinate formulations, with some containing higher loads of adjuvant than others. CHS agronomy provides good choices for not only straight AMS, but adjuvants like Last Chance Pro added to the AMS and adjuvant/AMS premixes such as, Encloax or Precinct2, have shown improved weed control over straight AMS. This bump in weed control is seen with Last Chance 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 + Last Chance 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 Enerpex, Encloux, Jackhammer, Precinct2 or Adium.

What rate of glyphosate should be applied to provide consistent weed control?

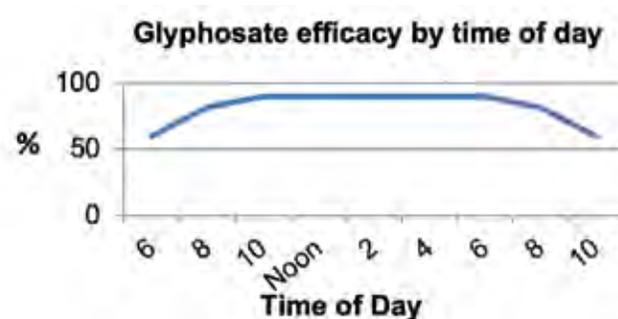
BMP: Target applications to weeds < 4" tall and ALWAYS follow the label regarding the rate for a given weed species. Cutting herbicide rates can lead to increased selection pressure on potential resistant biotypes.

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 Last Chance 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 Verium (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 Verium 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 Verium 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		DO NOT USE ORGANOSILICONES When tank-mixing with grass herbicide use Verium at 0.25% v/v.
Headline SC	N-G	9-12 fl oz (9 oz under normal disease conditions)	14 days	7		
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 Verium or Petrichor 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		
Benzimidazole 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				

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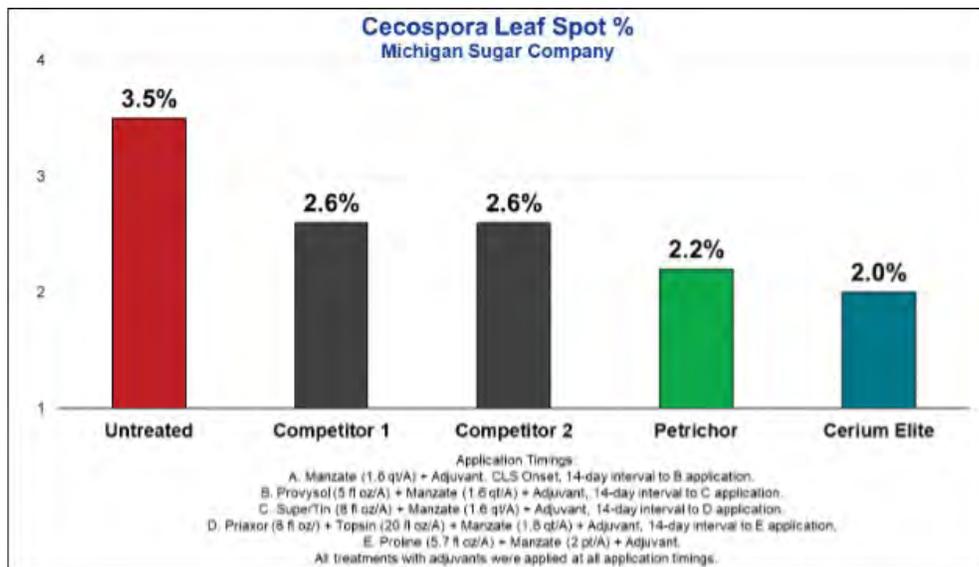
² Spray intervals can be weather- or region-specific and may be shortened if Cercospora levels are high or if heavy rainfall washes product off leaves.

³ Verium or Petrichor 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.



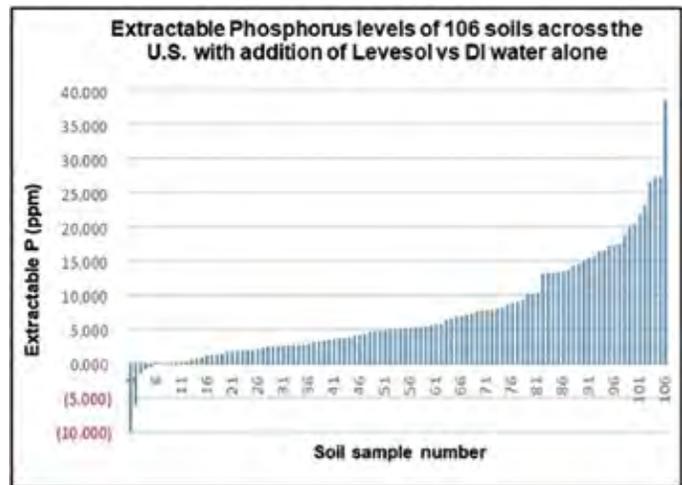
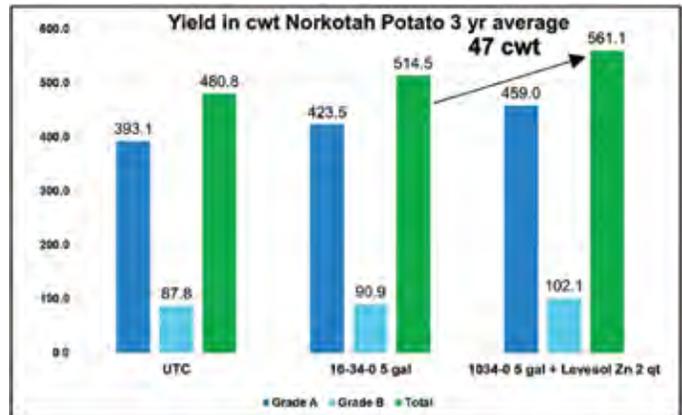
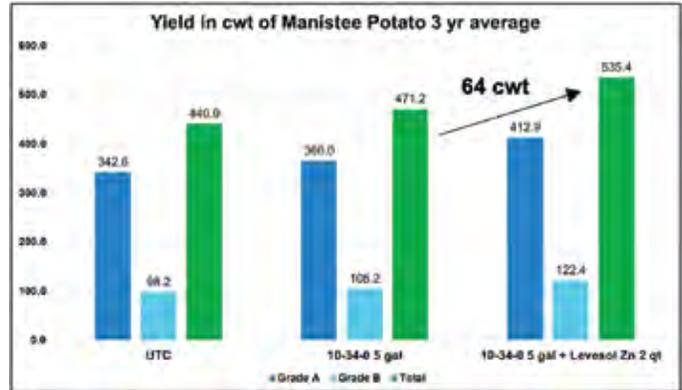
The challenge with any In-furrow fertilizer is placing important nutrients next to the seed without causing seedling damage. Another concern that goes relatively unrecognized is the reality that high Phosphorus (P) concentrations in banded zones can create complexes with other important nutrients making 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, Paralign 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.

- Paralign contains a balance of key macro and micronutrients necessary for plant growth.
- Paralign 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.
- Paralign 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

- Paralign will freeze at 10° F, but has no minimum storage temperature.

PARALIGN®

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.

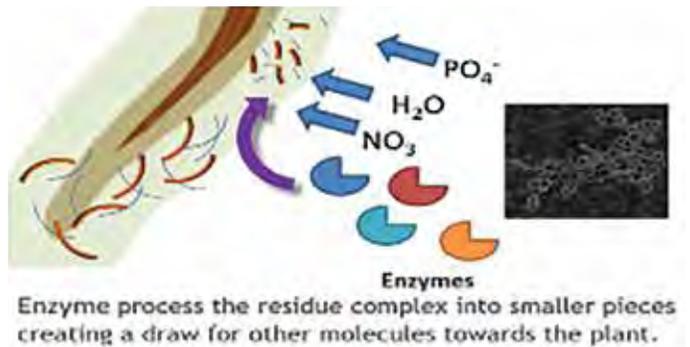


Figure 1

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.

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

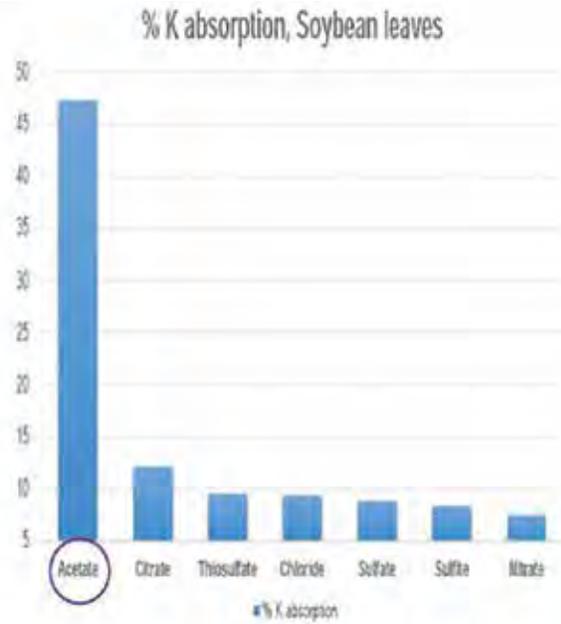
Minimum Storage Temperature

- Potassium 19 will freeze below -22° F. If frozen, thaw completely prior to use.

POTASSIUM 19

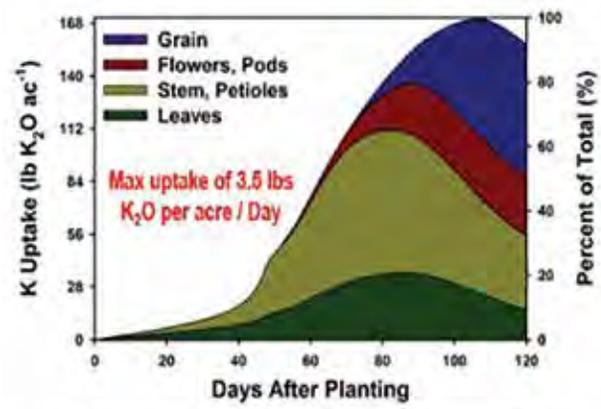
Principal Functioning Agents

Total Nitrogen (N)	0%
Total Potassium (K ₂ O)	19.0%
Total Sulfur (S)	6.0%
Derived from Potassium thiosulfate & potassium acetate.	



Journal of Plant Nutrition, 9(2), 143-157 (1986)

K Uptake & Partitioning for 60 Bushel Soybean



Crop Physiology Agtron. J. 107:563-573 (2015)

Graphs showing Potassium 19's relative K absorption, as potassium acetate form, relative to other forms of K.

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: Verium or Jackhammer.**

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.

SOYGREEN®



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

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

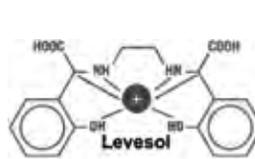
Micronutrients (lb/A) supplied per rate of Trivar EZ						
	5 lb/A	10 lb/A	15 lb/A	20 lb/A	25 lb/A	30 lb/A
Zinc	0.4	0.8	1.2	1.6	2.0	2.4
Sulfur	0.3	0.6	0.9	1.2	1.5	1.8
Calcium	0.2	0.4	0.6	0.8	1.0	1.2
Manganese	0.2	0.4	0.6	0.8	1.0	1.2

TRIVAR[®]·EZ

PRINCIPAL FUNCTIONING AGENTS

Calcium (Ca)	4.0%
Sulfur (S)	6.0%
Manganese (Mn)	4.0%
Molybdenum (Mo)0005%
Zinc (Zn)	8.0%

Derived from Calcium Sulfate, Manganese Oxide, Manganese Sulfate, Molybdc 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 CO₂ 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. Veracity Elite II, Mediate and Cognitive 1
- 6. Water Conditioners**
 - a. Dry AMS
 - b. Liquid AMS Solutions (Precint2, Encloux, etc.)
- 7. Compatibility Agent and Defoamer (If needed)**
- 8. Dispersed Liquid Formulations**
 - a. Capsule Suspension (CS, ZC)
 - b. Suspension Concentrates (SC)
 - c. Liquid Flowables (F)
 - d. Suspo-emulsions (SE)
- 9. Emulsifiable Concentrates (EC)**
- 10. Soluble Liquids (SL)**
- 11. Adjuvants**
 - a. Water Conditioners (Jackhammer, Enerpex)
 - b. Crop Oil Concentrates (Covrex)
 - c. Methylated Seed Oils (Advatrol)
 - d. Nonionic Surfactants (Last Chance Pro)
 - e. Drift and Deposition (Petrichor/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. Liquid Flowables (F)
 - d. Suspo-emulsions (SE)
- 8. Emulsifiable Concentrates (EC)**
- 9. Soluble Liquids (SL)**
- 10. Adjuvants**
 - a. Crop Oil Concentrates (Covrex)
 - b. Methylated Seed Oils (Advatrol)
 - c. Nonionic Surfactants (Last Chance Pro)
 - d. Drift and Deposition (Petrichor/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
Advatrol	NTR	7.72
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
Verium	32	8.42
Citri-Amp	NTR	8.55
Cognitive 1	NTR	8.93
Compatibility Agent	NTR	8.97
Copper 7.5	NTR	10.40
Covrex	NTR	8.09
Crop Oil	NTR	7.26
Cygin	NTR	8.88
Cygin Pro	NTR	8.93
Defoamer	40	8.27
EB Mix	NTR	10.81
Encloax	NTR	10.14
Enerpex	32	8.93
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
Jackhammer	NTR	9.56-10.60
Jackhammer Elite	NTR	9.59
K-Tone	NTR	8.51
Laser KB	50	10.92

Product	Temp ¹ (°F)	Weight ² (lb/gal)
Laser KS	50	11.42
Laser P	50	11.17
Last Chance	NTR	9.05
Last Chance Pro	NTR	9.00
Levesol	NTR	8.75
Levesol Defoamer	40	7.82
Levesol DFC Zn	12	9.78
Levesol Zn	NTR	9.69
Linkage	0	9.69
Liquid AMS	NTR	10.00
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
Micro Pak	0	10.82
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
Paralign	NTR	10.32
Petrichor	NTR	7.44
Potassium 19	NTR	10.59
Precinct2	NTR	10.13
Prefer 90	NTR	8.43-10.36
ProFyl	NTR	10.95
Redline	NTR	10.20
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
Savvy	NTR	7.89
Soiltrate	NTR	7.26

Product	Temp ¹ (°F)	Weight ² (lb/gal)
Soygreen AST	32	9.85
Soygreen Pro	NTR	10.22
Soyshot	32	10.32
Stake	NTR	7.56
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
Upland MSO	NTR	7.46
Veracity	NTR	9.83
Veracity Elite II 2x2.5	NTR	9.47
Veracity Elite II Bulk/Tote	32	9.47
Verasure	NTR	10.85
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

Product	Temp ¹ (°F)	Weight ² (lb/gal)
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

Product	Temp ¹ (°F)	Weight ² (lb/gal)
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 Restriction² Check bulk bill of lading for exact weights

Quick Reference // Minimum Storage Temperature and Average Weight Per Gallon

Product	Temp ¹ (°F)	Weight ² (lb/gal)	Product	Temp ¹ (°F)	Weight ² (lb/gal)	Product	Temp ¹ (°F)	Weight ² (lb/gal)
Flexstar GT 3.5	10	10.08	Kyro	NTR	9.20	Nuprid 4F Max	NTR	10.06
Forum	NTR	9.67	LamdaStar 1CS	NTR	8.51	Oberon 4SC	32	9.00
Fulfill	40	7.96	LamdaStar Plus	NTR	8.59	Omega 500F	NTR	10.34
Fultime NXT	NTR	9.25	Lannate LV	32	8.52	Omega Top	NTR	10.34
Fusilade DX	NTR	8.14	Laudis	NTR	10.16	Onager	NTR	8.74
Galigan	32	9.01	Ledger	NTR	9.01	Open Sky	NTR	8.37
Gly Star 5 Extra	NTR	9.65	Leverage 360	32	9.68	Optero	35	8.83
Gly Star Plus	NTR	9.85	Lexar EZ	NTR	9.15	Orion	NTR	8.08
Goal	32	8.99	Liberty 280 SL	32	9.60	Outlook	NTR	9.41
Goaltender	32	9.84	Liberty Ultra	32	9.42	Palace	NTR	9.14
GoldSky	15	8.76	Lifeline	NTR	9.60	Palisade Max	32	8.31
Gramoxone 3.0	NTR	9.49	Linex	NTR	9.80	Panther Pro	NTR	9.43
Grazon P + D	NTR	9.59	Lucento	NTR	9.09	Panther SC	NTR	9.66
GrazonNext HL	NTR	9.74	Lumax EZ	-10	9.12	Parallel	NTR	9.25
Halex GT	-10	10.15	Luna Experience	32	9.47	Parity	32	8.66
Hamper	-30	9.21	Luna Sensation	32	9.73	Pentia	32	8.65
Harness Max	NTR	8.97	Luna Tranquility	32	9.26	PerfectMatch	NTR	8.74
Harness Xtra	NTR	9.23	Macho 4.0	32	9.85	Perm-Up 3.2 EC	40	8.65
Harness Xtra 5.6L	NTR	9.25	Maestro 2EC	32	8.58	Perpetuo	NTR	9.30
Headline AMP	NTR	8.85	Maestro D	32	9.68	Pin-Dee 3.3EC	40	8.81
Headline SC	NTR	8.93	Maestro MA	3	9.48	Pixxaro EC	NTR	8.65
Helmet Maxx	NTR	8.93	Malathion	40	8.84	Poast	32	7.77
Hero	32	8.26	Manzate Max	NTR	10.21	Pramitol 25E	32	7.80
Huskie	NTR	9.44	Marvel	32	9.63	Preemptor SC	NTR	9.44
Huskie Complete	32	9.26	Maverick	NTR	9.30	Prefix	NTR	9.32
Impact	NTR	9.43	Meteor	NTR	9.77	Presidio	32	10.11
Impact Core	NTR	9.25	MiCrop	35	8.84	Prevathon	32	8.64
ImpactZ	NTR	9.35	Milestone	NTR	9.51	Preview 2.1SL	NTR	9.56
Incognito 4.5 F	NTR	10.09	Minerva	NTR	9.01	Priaxor	32	9.68
Index	40	9.35	Miravis Ace	NTR	9.16	Princep 4L	NTR	9.54
Inspire XT	NTR	9.26	Miravis Neo	NTR	8.88	Priority GT	35	8.99
Instinct II	NTR	9.36	Miravis Prime	NTR	9.76	Priority MA	35	8.99
Instinct NxtGen	-40	9.93	Miravis Top	NTR	9.05	Proline 480SC	32	9.83
Interline	NTR	9.60	Mocap EC	NTR	8.59	Propulse	32	9.60
InterMoc	NTR	9.13	Moccasin MTZ	NTR	8.60	Prosaro	32	9.51
Intrepid 2F	32	9.17	Mustang Max	20	8.72	Prosaro Pro	32	9.60
Intrepid Edge	32	8.96	Newpath	32	9.35	Province II	NTR	9.15
IronGate	NTR	9.45	Nexicor	NTR	8.92	Provysol	32	9.60
Katagon	NTR	8.54	Nortron SC	40	9.41	Prowl H2O	NTR	9.81
Keystone NXT	NTR	9.27	N-Serve 24	18	8.12	Prozio BWP	35	9.50
Keystone LA NXT	NTR	9.24	Nu-Cop 3L	32	12.94	Pursuit	32	9.20
Kyber Pro	NTR	9.35	Nuprid 2F	NTR	9.35	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

Product	Temp ¹ (°F)	Weight ² (lb/gal)
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

Product	Temp ¹ (°F)	Weight ² (lb/gal)
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

¹ NTR = No Temperature Restriction² Check bulk bill of lading for exact weights

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

Quick Reference // Herbicide Combinations

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 Totalisol				
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 Magnum		
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		

Quick Reference // Herbicide Combinations

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

Talinator				
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		Firstate
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

Hero			
Rate/Acre		Capture 2 EC	Mustang Max
6.0 oz	=	2.8 oz	+ 2.35 oz

Elevest			
Rate/Acre		Prevathon	Brigade 2EC
7.0 oz	=	14.45 oz	+ 4.7 oz

Leverage 360			
Rate/Acre		Admire Pro	Baythroid XL
2.8 oz	=	1.22 oz	+ 2.8 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

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

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



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

Approach 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		Approach	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 1/2 of the size of other seeds
5.	Yield (bu/A) = $\frac{(\text{Step 2}) \times (\text{Step 3}) \times (\text{Step 4})}{90}$	

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 = $\frac{(\text{Step 1}) \times (\text{Step 2}) \times (\text{Step 3}) \times 0.142}{\text{Step 4}}$	

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	Commodity	lb	Commodity	lb	Commodity	lb
Alfalfa Seed	60	Corn, in the ear	70	Onions	57	Red Top Seed	14
Apples, Green	47	Corn, Kaffir	56	Onion Sets, Top	30	Rough Rice	45
Apples, Dried	24	Corn, Shelled	56	Onion Sets, Bottom	32	Rutabagas	50
Barley	48	Cotton Seed	32	Orchard Grass Seed	14	Rye Meal	50
Beans, Green or String	24	Cranberries	33	Osage Orange Seed	33	Rye	56
Beans, Soy	60	Cucumbers	48	Parsnips	50	Shorts	20
Beans, Wax	24	Emmer	40	Peaches, Dried	33	Sorghum Seed	50
Beans, White	60	Flax Seed	56	Peanuts, Green	22	Spelt	40
Beets	60	Gooseberries	40	Pears	58	Spinach	12
Blue Grass Seed	14	Hemp Seed	44	Peas, Dried	60	Sweet Clover Seed Unhulled	33
Bran	20	Hickory Nuts	50	Peas, Green in pod	32	Timothy Seed	45
Buckwheat	52	Hungarian Grass Seed	50	Popcorn, in the ear	70	Tomatoes	56
Carrots	50	Lime	80	Popcorn, shelled	56	Turnips	55
Charcoal	20	Malt	34	Potatoes, Irish	60	Walnuts	50
Clover Seed	60	Millet	50	Potatoes, Sweet	50	Wheat	60
Corn Seed, Broom	48	Millet, Japanese Barnyard	35	Quinces	48		
Corn Meal, Unbolted	48	Oats	32	Rape Seed	50		

Volume Dilution: Fluid Ounces of a Liquid Needed

Dilution Desired	Gallons of Final Spray Solution						
	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 triangle is (base x height)/2



Volume of a cylinder is radius squared x 3.1416 x height of cylinder



Area of a rectangle or square is length x width



Volume of a cube or rectangular box is length x width x height



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)					

Quick Reference // Conversions

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	=	MgCO ₃
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	MgCO ₃	x	1.18	=	CaCO ₃
Grams	x	15.43	=	Grains	MgCO ₃	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
K ₂ O	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 0.1111	= 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			





5500 Cenex Drive
Inver Grove Heights, MN 55077
651-355-6000
chsinc.com

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