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Weed Control Guide for Field Crops

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WEED CONTROL GUIDE for Field Crops

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Pesticides must be registered with the U.S. Environmental Protection Agency and the Michigan Department of Agriculture before they can be legally used in Michigan. This bulletin suggests using pesticides in the management of crop pests. Purchase only those pesticide products labeled for 1) the crop you wish to use it on and 2) the pest you wish to manage on that crop. Remember, the pesticide label is the legal document on pesticide use. The label must be read carefully and all instructions and limitations followed closely. The use of a pesticide in a manner not consistent with the label can lead to the injury of crops, humans, animals, and the environment, and also lead to civil fines and/or condemnation of the crop. Pesticides are management tools for the control of pests in crops but only when they are used in an effective, economical, and environmentally sound manner.

See pesticide emergency information — See last page of book.

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Weeds reduce crop yields by competing for water, nutrients and light. Some weeds release toxins that inhibit crop growth, and others may harbor insects, diseases, or nematodes that attack crops. Weeds often interfere with harvesting operations, and at times contamination with weed seeds or other plant parts may render a crop unfit for market. Profitable crop production depends on effective weed control.

Effective weed control in field crops requires the use of a combination of management techniques, including cultural methods and herbicides. Growing the same crop year after year and using the same weed control techniques encourage the development of problem weeds. Rotation of crops, herbicides, and tillage methods help reduce this problem.

Cultural Control of Weeds

Crop competition is a very useful method of weed control. Maintaining production practices that optimize crop growth means the crop plants can compete more effectively with weeds. Several crop management practices can improve the competitive ability of the crop. These practices include crop and variety selection, planting date, population, soil fertility, drainage, etc. Recommended crop production practices are also beneficial weed control practices.

Crop and herbicide rotation may also be helpful in maintaining adequate weed control. Many weeds cannot tolerate crop rotation. Using the same herbicide program each year allows weeds tolerant of the herbicides to expand. Rotate herbicide programs to prevent this problem and to reduce the likelihood of resistant weeds (e.g., triazine-resistant weeds) becoming a problem.

Cultivation

Timely, shallow cultivation may be necessary following herbicide treatment. Be sure to cultivate as shallowly as possible to prevent bringing new weed seeds from below the herbicide layer to the soil surface.

Do not cultivate most preemergence herbicides for at least 2 weeks after application unless weeds appear. If dry weather persists for 2 weeks after herbicide application, rotary hoe or cultivate shallowly. Delay cultivation after postemergence herbicide applications for at least 7 to 10 days to allow the chemical to move into weed stems and roots.

Chemical Control of Weeds

No one chemical used as a herbicide will kill all species of weeds. The first step for successful weed control with herbicides is to identify the weed species present. Note that some weed species are resistant to all of the present selective herbicides.

Annual weeds are easier to kill when they are small seedlings and when conditions favor rapid growth. However, crop plants are also easily injured under these conditions. Selective herbicides should control the weeds with little or no injury to the crop.

Timing and rate of application are very important with chemical weed control. Spraying at the wrong time often results in poor weed control and crop injury. No crop plant is completely resistant to injury from herbicides. Too much chemical can damage the crop.

Types of Herbicides

Chemical control of weeds can be obtained with either preplant incorporated, preemergence, or postemergence herbicides. Many herbicides can be applied by more than one of these methods.

Preplant incorporated herbicides are compounds incorporated into the soil prior to planting. Incorporation of some of these compounds is necessary to prevent losses of volatile active ingredients (ex., *Treflan, Eptam*) or to overcome photodecomposition losses if the materials are left on the soil surface. Preplant incorporated herbicides have increased activity in the absence of rainfall required to move the herbicide into the weed-seed germination zone. This concept is often referred to as herbicide "activation." Incorporation is also often required to obtain perennial weed suppression from soil-applied herbicides.

Advantages of preplant incorporated herbicides:

(1) No weed competition to the crop with early control of weeds;

(2) Weeds already controlled where wet weather later delays cultivation or spraying;

(3) Less reliance on rainfall to position the herbicides in the soil. Generally more reliable weed control than preemergence sprays;

(4) Much more effective control on some perennial weeds (nutsedge) than with preemergence sprays.

Disadvantages of preplant incorporated herbicides:

(1) Incorporation operation represents added cost and fuel usage in herbicide application;

(2) Soil compaction is increased by the incorporation operation;

(3) Herbicide may be diluted by improper incorporation (too deep) resulting in reduced weed control;

(4) "Streaking" pattern of good and poor weed control can result from incomplete incorporation. Two pass incorporation helps prevent this problem;

(5) Planting operations may be slowed somewhat due to herbicide application and incorporation operation.

Preemergence herbicides are compounds that are applied to the soil surface after the crop has been planted but before the crop seedlings emerge through the soil.

Advantages of preemergence herbicides:

(1) No weed competition to the crop with early control of weeds;

(2) Weeds already controlled where wet weather delays cultiva-

tion or spraying;

(3) Planting and herbicide application may be one operation;

(4) In the case of corn, herbicides can be used which will not present a hazard to nearby 2,4-D- or *Banvel*-sensitive crops and plants.

Disadvantages of preemergence herbicides:

(1) Preemergence applications are generally ineffective under dry soil conditions. Some preemergence herbicides are ineffective if dry conditions persist for only a few days; other herbicides may give weed control after as much as 10 days to 2 weeks of dry weather;

(2) On sandy soil, heavy rains may leach the herbicide down to the germinating crop seed and cause injury;

(3) Perennial weeds usually are not controlled by preemergence herbicide applications.

Postemergence herbicides are compounds applied to the foliage of weeds. They may burn off the above-ground parts of weeds (contact herbicides) or they may be translocated throughout the plants and kill the growing points (translocated or systemic herbicides).

Advantages of postemergence herbicides:

(1) Can be used in an emergency, since they are not applied until the weeds are present in the field;

(2) Can be used on any soil type, and soil moisture conditions are usually not a problem;

(3) Are usually more effective (though more injurious to the crop) at high temperatures.

Disadvantages of postemergence herbicides:

(1) Should not be applied to weeds when the foliage is wet with dew or rain;

(2) There is a greater risk of crop injury for certain crops;

(3) With many postemergence herbicides, timing of application is critical for effective control;

(4) There is a risk that rain may prevent application at the proper time.

Temperature greatly influences the effectiveness and volatility of many postemergence herbicides. Ideally, herbicides should be applied when temperatures range between 65° and 80°F. Low temperatures (below 60°F.) can result in reduced weed control, while temperatures above 80°F. can result in crop injury. Late afternoon herbicide applications are less likely to result in injury than are early morning applications. Early morning application predisposes the crop plant to danger periods of high temperatures, which increase the potential for herbicide injury.

Volatile herbicides, such as dicamba *(Banvel),* or ester formulations of 2,4-D, may vaporize at temperatures as low as 70°F. Wind may then move sufficient vapors to areas with sensitive crops and cause crop injury. Amine formulations of 2,4-D may eliminate some of the danger of vapor drift; however, spray drift (droplets) may still occur. Extreme caution is required when applying herbicides near sensitive crops.

Herbicide Formulations and Additives

Herbicides are available in a variety of formulations; granular and those mixed in water are most common. Usually, equal weed control can be expected from granular and those mixed in water. In some cases, granules have given less control. Generally, this has been due to (1) use of equipment giving nonuniform distribution of the granules or (2) formulations with too high a concentration, resulting in inadequate volume for uniform distribution.

The use of granular formulations does not eliminate the need for calibration. Various materials will "feed" differently because of variations in carrier and particle size. Therefore, granular applicators, like sprayers, should be accurately calibrated.

Herbicide Formulations

DC — *Dry Concentrate*
DF — *Dry Flowable Granule*
DG — *Dispersible Granule*
DS — *Dry Soluble Granule*
EC — *Emulsifiable Concentrate*
F — *Flowable*
G — *Granule*
L — *Liquid*
S — *Soluble Powder*
SC — *Suspension Concentrate*
SL — *Soluble Liquid*
SP — *Soluble Powder*
WP— *Wettable Powder*

Registration of Herbicides

Recommendations in this bulletin are based on field trials conducted in Michigan and other North Central states over a period of several years. Herbicides must be registered with the U.S. Environmental Protection Agency and the Michigan Department of Agriculture before they can be legally used in Michigan. The pesticide label is the legal document on pesticide use. The label must be read carefully and all the instructions followed closely. Use of a herbicide in a manner not consistent with the label can lead to civil fines and/or condemnation of the crop. Do not mix and apply any pesticides and fertilizers if forbidden on either label.

Combinations of Herbicides

Two or more herbicides are usually applied as a tank mix versus separate applications. Combinations are used to give more consistent or broader spectrum weed control, to decrease herbicide residue (for example, atrazine carryover) or to obtain adequate season-long weed control. Growers and commercial applicators are responsible for poor weed control, crop injury and/or unwanted herbicide residue from herbicides labeled for single application but misused in combinations.

Compatibility of Pesticide-Fertilizer Combinations

Combinations of herbicides, insecticides and/or fungicides applied in either water or liquid fertilizer carriers decrease trips over the field and application costs; however, compatibility is critical. Always test the compatibility of each mix-

ture to be applied even though the product labels allow mixing. Follow the label instructions closely during any mixing operation after you have tested for compatibility.

A single compatibility test requires only a glass quart jar and the pesticides and liquid fertilizer to be mixed. Place one pint of liquid fertilizer in the quart jar and add two teaspoons of the liquid pesticide. If the pesticide is a wettable powder, add two teaspoons of powder in sufficient water to form a slurry and add the slurry to the fertilizer. Cover the jar, shake well, and observe the mixture for 30 seconds. Check the mixture again after 30 minutes. If the mixture does not separate, it is compatible; however, check each batch of liquid fertilizer, as they may vary in mixing properties. Also, check compatibility if water source changes, as water pH and mineral content influence compatibility.

If more than one pesticide is to be mixed with liquid fertilizer or water, the pesticides should be premixed in liquid fertilizer or water and tested for compatibility by mixing appropriate proportions of all components. The combination should be thoroughly agitated before each additional pesticide is added, and a specific mixing order should be followed. Generally, unless label directions state otherwise, add the pesticides being tested in the following order:

1. wettable powders or dispersible granules,
2. flowables or aqueous liquids,
3. emulsifiable concentrates,
4. crop oil concentrates.

Spray tanks should be at least half filled with the carrier before the pesticide premixes are added. If the mixture foams excessively, separates or becomes syrupy, do not apply the mixture. Compatibility agents are available which may be added to improve mixing ability.

Even if all components appear compatible, the field tank mixture will require constant, vigorous agitation to prevent separation or improper pesticide distribution in the tank. Be sure the entire tank is agitated and mixed before spraying. Do not store pesticide mixtures overnight unless they are constantly agitated. Best results are obtained by applying the entire mixture in one day. (See Extension Bulletin E-1858, "Using Spray Additives with Herbicides.")

Additives for Herbicides — Some Definitions

(1) Adjuvant — any substance which enhances the herbicide effectiveness, an "added ingredient."
(2) Surfactant — a surface active material which can facilitate emulsifying, dispersing, spreading, wetting, sticking, or other surface-modifying characteristics of herbicide solutions.
(3) Emulsifier — an agent that promotes the dispersion of one liquid in another.
(4) Wetting agent spreader) — reduces water surface tension, causing better contact between spray solution and treated surfaces.
(5) Soap — sodium or potassium salts of fatty acids. Can form insoluble materials in hard water. *Detergents* are synthetic materials used for cleaning.
(6) Sticker — Deposit builder, increases herbicide adhesion to plant surfaces.
(7) Defoaming agent — self-explanatory.
(8) Compatibility agent or cosolvent — may aid in dispersion of otherwise incompatible mixtures.

During the development of a herbicide, the chemical company attempts to formulate the active ingredient to optimize performance, mixing, and handling under diverse conditions. Every commercially available herbicide formulation contains its own paticular set of additives to accomplish this. Sometimes additional additives are required for specific applications or when compatibility or mixing problems occur. The herbicide label will describe the need and use of these additives. The indiscriminate use of additives should be avoided since they may not improve herbicide performance and may actually reduce weed control, or cause crop injury.

Additives can be referred to as "adjuvants." This term merely denotes an added ingredient. Surface active additives are called surfactants. Therefore, all surfactants are also additives or adjuvants. All herbicide formulations contain surfactants. Emulsifiable concentrates contain emulsifiers, which aid in the dispersion of the formulation into the water phase. Wettable powders contain wetting agents and dispersants, which facilitate moistening the tiny particles and prevent clumping.

When to Use Additives

Herbicides may be applied either to the soil or to the foliage, so the addition of a surfactant is left to the user. Sometimes additives are only required for postemergence treatments made during adverse climatic conditions. In other cases, the nature of the herbicide may necessitate addition of the surfactant to the spray mixture rather than the formulation. The herbicide label always gives directions for such additive requirements.

Although claims have been made that additives increase the effectiveness of soil-applied herbicides, there is no independent data to support these claims. Experiments conducted by several universities failed to show any benefit from the inclusion of spray additives with soil-applied herbicides. Additives are used with postemergence applications to aid coverage of leaf surfaces and increase penetration into the leaf.

Crop Oil Concentrates

Crop oil concentrates contain a mixture of emulsifiers and surfactants. A common ratio is 80% oil and 20% surfactant. Crop oil concentrates are generally recommended at a rate of 1 quart per acre or less.

These additives are recommended with postemergence applications of several herbicides. Herbicide labels contain specific directions on the use of additives.

There is a greater risk for crop injury when using additives with postemergence atrazine applica-

tions. Injury is frequently associated with cold, wet or cloudy conditions. The injury appears as a temporary stunting plus necrosis of the leaf margins. *Banvel,* 2,4-D, or *Bladex* should not be included in a spray mix of atrazine plus crop oil concentrate or severe injury to the crop may occur.

Adjuvants, Surfactants, Wetting Agents

Many spray additives are currently available and many exaggerated claims have been made. In most cases, these materials are no better than crop oil concentrates. In fact, under poor environmental conditions for postemergence weed control, the crop oil concentrates can be slightly superior. Remember that any benefit comes only in postemergence, not preemergence, applications. Additives aid performance of the herbicide in adverse conditions but are not a way to use less herbicide.

Compatibility Problems

Compatibility problems in tank mixing herbicides usually occur when mixing directions are not followed. Some common causes of compatibility problems: mixing two herbicides in concentrated form, adding an EC to the spray tank before suspending the wettable powder, insufficient agitation, excessive agitation, and air leaks. Problems are much more likely when mixing herbicides with fluid fertilizers. The fertilizer solution is already loaded to near capacity with nutrients. Adding an herbicide to the already loaded solution may cause problems. Also, the fertilizer may interfere with the herbicide formulation additives. Since fertilizer may vary greatly from batch to batch, the only safe procedure is to test for compatibility in a small container before mixing a large quantity. If compatibility problems are encountered, the addition of *compatibility agents* may help.

Foaming is usually due to excessive agitation or a bypass line that empties above the spray solution level in the spray tank. When foaming is a problem, addition of a *defoamer* can help.

Pre-slurry the powder if you have problems in getting a wettable powder to wet and become suspended in solution. Adding a wetting agent to the spray tank will sometimes correct a floating powder problem.

Herbicide Application Equipment

Sprayer Implements — A good weed control sprayer should be made of non-corrosive materials, be easy to clean, and have the following features:

(1) A *tank* with a volume of 100 to 300 gallons to reduce filling and mixing operations.
(2) A *pump* with a capacity of at least 4 gallons per minute and pressure up to 100 pounds per square inch (PSI).
(3) An *agitation system* — The bypass from the pressure control is a good source of agitation. Direct the bypass line into the bottom of the tank.
(4) *Screens* — There should be 50-mesh screens in the intake line and at each nozzle.
(5) *Pressure gauge* — The pressure gauge should accurately measure pressures up to 100 PSI.
(6) *Adjustable spray boom* — The boom should be adjustable from 18 to 36 inches above the ground.
(7) *Nozzles* — Flat fan nozzles of 73 to 110° angle with replacement tips are best suited for most weed control work. Nozzle volume can vary from 1 to 10 gallons per minute, depending on the applications. Good general-use nozzles are 8002 or 8004. These nozzles permit the boom to be carried closer to the ground and thus reduce spray drift.

Herbicide Incorporation

Disks, especially large tandem disks, are poor tools for incorporation. Depth and riding are difficult to control and non-uniform distribution of the herbicide in the soil is likely.

A disk does have a place for special applications, such as chopping the quackgrass rhizomes, which is required for *Eradicane* activity. The disk should be used at a depth of 4 to 5 inches and a speed of 4 to 6 mph. Incorporation must be done in two directions.

A field cultivator can give acceptable one-pass incorporation of herbicides if special care is taken in setup and operation. Wide sweeps give better incorporation than points. Shanks should be close enough to allow for this, and three sets of sweeps are also required. It is important to follow with a leveling tool, such as a flex-tine drag or spring-tooth harrow, to smooth out ridges behind the cultivator.

The speed of the cultivator should be at least 6 mph, at a depth of 3 to 4 inches. Actual incorporation will occur at one-half the tool depth. Caution must be taken not to run the rear portion of the cultivator lower than the front. If the back of the tool is lower, untreated soil can be brought to the surface, burying the herbicide.

Danish-type harrows equipped with "S" tines and rolling baskets can do a good job of one-pass incorporation. Rolling baskets outperform other trailing operations.

Operation considerations are similar to those with the field cultivator. Again, good soil tilth is a prerequisite for one-pass incorporation.

PTO-driven tools do a good job of one-pass incorporation. However, their application in Michigan may be limited. These tools are operated at lower speeds and are not as wide as other implements.

The most consistent incorporation (no streaking), especially when using a disk or field cultivator alone, is achieved with two passes at an angle to each other. However, new tillage implements have made one-pass incorporation of herbicides a possibility. Although a majority of the questions concerning incorporation concern the best implement to use for one-way incorporation, soil condition influences the success of incorporation more than the tool used. The reliability of one-pass incorporation will also be influ-

enced by the tillage system used.

In clean tillage (low crop residue) situations, preemergence applications made on wet soil will likely perform as well or better than two-pass incorporated treatments. One-pass incorporation is not a good approach with less than optimum soil tilth.

High crop residue levels (corn stalks disked or chisel plowed with one or two secondary tillage operations) make one-pass incorporation difficult. If the residue level is great enough to clog the incorporation tool, two-pass incorporation is advisable. The soil should also have good tilth, as outlined above.

Where ridges are left from fall plowing or use of a chisel plow in the spring, it is advisable to level the ground before herbicide application. Streaking is favored by application of the herbicide to rough ground.

Soil Types

Soil texture (sand, silt, clay) and organic matter influence the effectiveness of soil-applied herbicides. In general, lower rates of herbicides are used on sandy (coarse textured) soils than on clays or soils high in organic matter (fine textured) to obtain the same level of control. **Herbicide rate recommendations in this bulletin are given for medium-textured soils with greater than 3% organic matter.** Clay and organic matter adsorb herbicides, making them less available to kill weeds. Soils with high clay and organic matter content require higher herbicide rates for adequate weed control. Sandy soils with low organic matter content require careful herbicide rate selection to avoid crop injury.

Soil pH can influence the activity of soil-applied herbicides. Some herbicides are more persistent at higher soil pH, and crop rotation must be considered before applying a herbicide. Some herbicides (metribuzin) are more available at higher soil pH. Rates must be reduced to avoid crop injury. Knowledge of the soil pH in a field is critical, as soil pH may vary from 6.5 to 7.5 in areas within a field.

Organic matter analysis is available through Cooperative Extension Service county offices or directly through the MSU Soil Testing Laboratory. Organic matter analysis may be determined on soil samples submitted for N-P-K analysis for an additional charge. Organic matter levels change slowly and may need to be checked every four years.

Soil sample analyses are only as accurate or representative as the soil sample, so each field should be checked individually. See Extension Bulletin E-498, "Sampling Soils," for proper soil sampling procedures.

Remember, follow herbicide label recommendations, always know the soil pH, and adjust herbicide rates for soil texture and organic matter as specified on the label.

Accurate Calibration

Accurate applicator calibration is essential for effective chemical weed control without crop injury. Calibrate a new sprayer before use and routinely re-calibrate the sprayer during the growing season.

Use the following steps as a guide to calibrate a ground sprayer for broadcast application.

1. Determine the desired application volume of carrier (usually water) in gallons per acre (GPA). For most weed control application, 5-30 GPA at 30-40 PSI is sufficient.
2. Adjust the boom height so that the spray overlaps about 30% at the ground (or other surface to be sprayed). With 80 degree nozzles, this places the nozzles about 20 inches apart on the boom; and 20 inches above the sprayed surface. Check each nozzle at the recommended pressure for output. Replace any defective nozzles and screens. All nozzles should deliver within 10% of each other.
3. Fill the spray tank and system with water.
4. Spray a measurable area in the field, at a fixed speed and at the desired pressure. Spray at least 20% of the total tank volume and at least 2 acres of area.
5. Measure the volume of water (in gallons) needed to refill the tank.
6. Determine the area (in acres) that was test sprayed, using the following formula: length of area sprayed (in feet) × boom width (in feet) ÷ 43,560 = acres sprayed.
7. Divide the volume sprayed by the area sprayed to obtain the actual output of the sprayer in gallons per acre.
8. Make adjustments to tractor speed, pressure, or nozzle size and repeat steps 3-7 to change application rate to the recommended values.
9. Calculate the amount of formulated pesticide needed to treat the desired area.

The following procedures can be used to calibrate a ground sprayer for either banded or broadcast applications.

(1) Determine the desired application volume of GPA.

(2) Check each nozzle at the recommended pressure for output. Replace any defective nozzles and screens. All nozzles should deliver within 10% of each other.

(3) For band application, accurately determine the width, in inches, of the band sprayed. For broadcast application, measure the distance, in inches, between adjacent nozzles.

(4) Locate this width in the table below and read off the corresponding course distance.

WIDTH (inches)	COURSE DISTANCE (feet)
8	510
10	408
12	340
14	291
16	255
18	227
20	204
22	185
24	170
26	157

(5) In the field to be sprayed, mark off the course of the proper distance.

(6) Fill the tank completely with water only.

(7) Tie a quart container (graduated in ounces) to one nozzle on the sprayer to catch all of that nozzle's spray.

(8) Start a distance back from the beginning of the course to get up to

operating speed, and turn the sprayer ON at the beginning of the course and OFF at the end.

(9) Remove the quart container, and read the volume collected IN OUNCES.

(10) OUNCES Collected = GPA.

Pesticide Use Precautions

Herbicides, like all pesticides, should be handled with extreme caution and respect. There are three important reasons for using pesticides safely and wisely:

- To protect yourself and others from poisoning.
- To avoid harming and polluting the environment.
- To avoid crop injury.

These three points cannot be emphasized enough.

Pesticide accidents occur most often during mixing and tank filling operations. Although accidental ingestion of chemicals is considered the greatest health hazard, there is also great danger of poisoning when pesticides contact skin or eyes, or when the dust or vapors are inhaled. Protective clothing should be worn at all times during the handling and application of pesticides and the cleaning of spray equipment. Such equipment should include full coverage clothing, chemical-resistant rubber gloves and boots, splash-guard goggles, and a MSHA/NIOSH-approved respirator for the chemical compound being used. Care for these items as you would your implements. Heed all the precautionary statements on the product label and cover-up to protect yourself.

Using more chemical than is recommended on any label is illegal and can result in the carryover of residues in the soil. Pesticides may also leach into ground and surface water. Herbicide residues can also damage sensitive crops the following year. Some long-residual herbicides last more than one year in the soil; keep this in mind when planning a crop rotation program. The herbicides recommended in this bulletin should dissipate in one growing season unless otherwise noted. Check the product labels for precautions on rotational crops.

Herbicides offer an effective and economical means of weed control. Crop plants are seldom completely resistant to herbicide injury but have some level of tolerance. The ability of a herbicide to kill weeds without harming crop plants (selectivity) may be partially lost under unfavorable weather conditions. Herbicide drift to non-target crops often results in crop injury. Do not spray under windy conditions.

Herbicide Residues and Bioassays

With the advent of preplant and preemergence herbicides which give season-long weed control, the accumulation of herbicides in the soil and their influence on subsequent crops in the rotation have become important in crop management. However, when used at recommended rates in seasons of normal rainfall and temperature, most recommended herbicides for field crops do not present a problem on crops planted the following season. Exceptions are listed in the "Remarks" column of Tables 1-11 and Table 22 for each herbicide combination.

Atrazine carryover to rotation crops is a common problem. A problem with herbicide residues is more likely to occur the year following a season of limited rainfall and cool temperatures because of the slow dissipation of the herbicide.

Herbicide bioassays can indicate whether enough herbicide is present to harm the crop. Obtain soil for a bioassay late in the fall prior to freeze-up or early in the spring. The bioassay procedure is a relatively simple test, but a few basic steps should be followed.

(1) Collect soil from several locations in the field. Reliability of the assay depends on accurate sampling. Sample soil to the depth the field has been tilled. Approximately 5 lb of soil are needed for each sample. Collect an equal amount of soil from an adjacent field where no herbicide has been applied. This second sample is used as a check.

(2) Start the bioassay within one or two weeks after soil is collected to prevent the loss of herbicide under warm conditions. If the assay cannot be run immediately, store the soil in a cool place, or even allow it to freeze.

(3) If the soil is wet, allow it to dry so that it may be worked easily. If the soil is cloddy, crush the clods but do not pulverize.

(4) Partially fill two, 1-qt containers with soil, one with the soil being tested and the other with soil from the "check" field. Punch holes in the bottoms of the containers to allow drainage. Tin cans or milk cartons make satisfactory containers.

(5) Plant 15 seeds of a sensitive crop in each container and cover with 1/2 inch of soil. Wet the soil, but do not saturate. Oats are very sensitive to both triazines and dinitroanilines. Place exactly the same number of seeds in each container. Knowing the exact number of seeds planted enables seedling emergence to be measured. Do not plant too many seeds or the seedlings may compete for the herbicide and decrease the injurious effects.

(6) Place containers in a warm place (70 to 75°F), preferably in a window to receive as much sunlight as possible. Additional artificial light should also be supplied to obtain approximately a 15-hour day length. Water plants sparingly, but do not let the soil dry out.

(7) Determine plant emergence, and monitor plant growth for at least three weeks after planting. Compare "check" plants with those in the soil being tested.

(8) Atrazine injury may cause yellowing of the oat leaves, with the plant becoming droopy and finally dying; if carryover is marginal, stunting may occur. Stunting can be determined by a comparison with "check" plants. Dinitroaniline injury may result in a decrease in seedling emergence and/or stunting of the seedlings.

(9) If any evidence of herbicide carryover is observed, it is advisable to plant a resistant crop.

Soil can also be analyzed in a laboratory for the amount of herbicide remaining in the soil. Most herbicides can be detected with a chemical soil analysis. This procedure is

more expensive than a plant bioassay. Consult your county Cooperative Extension Service agent for a listing of commercial laboratories.

Herbicide Application

Herbicide Spray Volumes and Rates

Tables 1-8 list chemicals which will give satisfactory weed control without injury to crops, except as noted under "Remarks." The volume of water to use will vary with the herbicide, although generally 10 to 40 gal per acre and a spraying pressure of 30 to 40 psi is recommended. With wettable powders use nozzles that deliver at least 15 gal per acre. Use 30 to 40 gal of water per acre when spraying quackgrass with atrazine. Use 10 gal of water per acre or less when spraying quackgrass or annual grasses with *Poast.*

Some contact-type postemergence herbicides (*Basagran, Ultra Blazer*) require a minimum of 20 gallons per acre spray volume and 40 psi spray pressure to insure adequate coverage. Flat fan nozzles are effective for herbicide applications. Hollow cone nozzles can also give good results, especially for postemergence applications at higher pressures. If higher pressures are used, be sure the nozzles are designed to be operated at the increased pressure. Operating nozzles beyond the specified pressure range will result in a poor spray pattern, insufficient coverage, and lack of weed control.

Herbicides are available in a number of different formulations and concentrations. For this reason, the recommended rates are given as pounds of active ingredient per acre. Thus, when a liquid formulation contains 4 lb of active ingredient (or acid equivalent) per gallon, 1 pt will provide ½ lb of active ingredient, or 1 qt will provide 1 lb of active ingredient.

Band Application

In cultivated crops, spraying narrow bands of herbicide over the rows will take less material per acre, reducing the cost per acre for the chemical. Where chemical costs are high, band spraying may be justified. Timely cultivation of weeds in the unsprayed area between rows is necessary.

In seasons when the soil is too wet to cultivate, overall spraying has the advantage of controlling weeds between the rows.

When band spraying, be very careful to maintain the proper rate of application on the area sprayed. (If you lower the spray boom to narrow the area covered by a given nozzle, remember that each nozzle is still delivering the same amount of spray mixture as it did on the wider area.) Use nozzles designed for banding, as the spray volume with these nozzles is the same across the entire band.

Cleaning of Pesticide Sprayers

It is important to clean pesticide sprayers after each use, especially if they are used for more than one crop and for the application of insecticides and fungicides. The need for extensive cleaning can be minimized if one sprayer is dedicated to herbicide application only.

Do not use a sprayer to apply insecticides or fungicides if the sprayer has been used to apply 2,4-D type herbicides.

When cleaning a sprayer used only for soil applications of herbicides, usually only a thorough water rinse is necessary. Exceptions are sulfonyl urea herbicides, such as *Accent, Beacon, Basis, Basis Gold, Synchrony STS, Classic, Express, Harmony Extra, Pinnacle,* and *Canopy XL, Canopy;* and also *Command.* Consult these specific herbicide labels for detailed spray tank cleaning procedures.

In general, rinse the entire sprayer, inside and out, including the boom, hoses, and nozzles. Partially fill the spray tank with water and keep the pump running so that the water is circulated throughout the entire system. Spray the water rinsate out through the nozzles. This process should be repeated when changing soil-applied herbicides and at the end of each day. Money can be saved and the environment protected if the water rinsing is done in the field using a water-filled nurse tank and if the water rinsate is applied to the crop according to label rates. Many herbicide labels have specific instructions for cleaning the spray system. Always read and follow these directions carefully.

Unless otherwise specified, thoroughly wash the entire spray system after all postemergence applications. Use 1 gal household ammonia in 100 gal of water as a cleaning agent.

Run the pump so that the cleaning solution is circulated throughout the entire system for at least 2 hours and then pump it out through the nozzles. Do not dump this cleaning solution, and do not apply it to any crop or crop land. Discard the cleaning solution in an appropriate pesticide rinsate degradation pit. Rinse the entire system with water after all the cleaning solution has drained from the sprayer. Do not leave pesticide solutions or cleaning solutions in the tank overnight.

Corrosion and mechanical damage to pumps, tanks, nozzles, etc. may result from leaving water in the spray system over the winter. To prepare the spray equipment for storage, disconnect all the hoses, and allow all water to drain out. Coat all bare metal parts with oil or a rust inhibitor. Disassemble metal nozzles, and store them in oil. Prepare the spray pump for storage based on the manufacturer's recommendations.

Pesticides and the Environment

Many people who live in rural Michigan get their drinking water from wells. Well water is groundwater, so it is easy to see why you should be concerned about keeping herbicides out of groundwater. Several processes determine the fate of herbicides and whether they will end up in your drinking supply. Sometimes these processes are beneficial and enhance weed control. For example, the leaching of a root-absorbed herbicide into the root zone can enhance weed control. The degradation of pesticides can remove non-essential pesticide

residues from the environment. Often, however, these processes are detrimental. Runoff can move a herbicide away from target weeds. As a result, chemical is wasted, weed control is reduced and there is an increased chance of damage to nontarget plants, hazard to human health, and pollution of nearby soil and water.

In this section we will examine the fate of pesticides and the various processes that affect their stability and persistence following an application, disposal, or spill.

Adsorption is the binding of chemicals to soil particles. (This term is sometimes confused with absorption, the process by which plants intake chemicals.) The amount and persistence of pesticide adsorption varies with pesticide properties, soil moisture content, soil pH, and soil texture. Soils high in organic matter or clay are the most adsorptive; coarse, sandy soils that lack organic matter or clay are much less adsorptive.

A soil-adsorbed herbicide is less likely to volatilize, leach or be degraded by microorganisms. When herbicides are tightly held by soil particles, they are less available for absorption by plants. Therefore certain herbicides used on highly adsorptive soils may require higher rates or more frequent applications to compensate for the portion of the herbicide that binds to the soil particles and is unavailable for plant uptake.

Volatilization occurs when a solid or a liquid turns into a gas. Volatilization of pesticides increases with higher air temperature and air movement, higher temperature at the treated surface (soil, plant, etc.), low relative humidity, and decreasing size of spray droplets. Pesticides also volatilize more readily from coarse-textured soils and from medium- to fine-textured soils with high moisture content.

A pesticide in a gaseous state can be carried away from the treated area by air currents. The movement of pesticide vapors in the atmosphere is called vapor drift. Unlike the drift of sprays and dusts that can sometimes be seen during an application, **vapor drift** is invisible.

Avoid applying volatile herbicides such as *Banvel* (dicamba) or *Eptam* (EPTC) when conditions favor volatilization. The vapor pressure rating of the herbicide may help indicate the volatility of the material. The higher the vapor pressure rating, the more volatile the pesticide. Herbicide labels usually mention the potential for volatility of the herbicides. Volatilization can sometimes be reduced through the use of low volatile formulations or soil incorporation of the herbicide (e.g. *Eptam*).

Photodegradation is the breakdown of herbicides, such as *Treflan,* by the action of sunlight. Herbicides applied to foliage, the soil surface, or structures vary considerably in their stability when exposed to natural light. Like other degradation processes, photodegradation reduces the amount of chemical present, which can subsequently reduce the level of weed control. Soil incorporation by mechanical means during or after application, or by irrigation water or rainfall following application, can reduce herbicide exposure to sunlight.

Microbial degradation occurs when microorganisms such as fungi and bacteria use an herbicide as a food source. Microbial degradation can be rapid and thorough under soil conditions favoring microbial growth. These conditions include warm temperatures, favorable pH levels, adequate soil moisture, aeration (oxygen), and fertility. The amount of adsorption also influences microbial degradation. Adsorbed herbicides are more slowly degraded because they are less available to some microorganisms.

Chemical degradation is the breakdown of a herbicide by soil processes not involving a living organism. The adsorption of herbicides to the soil, soil pH levels, soil temperature and moisture all influence the rate and type of chemical reactions that occur. Some pesticides, especially the organophosphate insecticides, are susceptible to degradation by hydrolysis in high pH (alkaline) soils or spray mixes. Some herbicides, such as atrazine and *Classic,* are more rapidly degraded on low pH soils.

Absorption of plant uptake is the process by which plants and microorganisms take up chemicals. It is another process that can transfer herbicides in the environment. Once absorbed, most herbicides are degraded within plants. Residues may persist inside the plant or be released back into the environment as the plant tissues decay.

Crop removal is another herbicide transfer process. When treated crops are harvested, the herbicide residues are removed with them and transferred to a new location. After harvest, many agricultural commodities are washed or processed, which can remove or degrade much of the remaining residue.

Runoff moves herbicides in water. Runoff occurs as water moves over a sloping surface, carrying herbicides either mixed in the water or bound to eroding soil. The amount of herbicide runoff depends on the grade or slope of the field, the erodibility and texture of the soil, the soil moisture content, the amount and timing of irrigation or rainfall (especially in relation to the time of herbicide application), and properties of the herbicide. For example, a herbicide application made to a heavy clay soil already saturated with water is highly susceptible to runoff. Established vegetation or plant residues also influence runoff because of their ability to retain soil and moisture.

Herbicide losses from runoff are greatest when heavy rainfall occurs shortly after an herbicide application. If heavy rainfall is expected, delay applying pesticides. Some no-tillage and minimum-tillage cropping systems have been found to reduce herbicide runoff, as do soil incorporation application methods. In addition, adjuvants that promote postemergence herbicide retention on leaf surfaces can reduce the pesticide content in runoff water. Finally, surface grading, drainage ditches and dikes, and the use of border vegetation can help reduce the amount and control the movement of runoff waters.

Surface water contamination is a

major concern associated with the runoff of herbicides from treated fields, mixing and rinsing sites, waste disposal areas, and manufacturing facilities. In the 1988 inventory of water quality, pesticides were ranked sixth as river and stream pollutants, behind siltation, nutrients, pathogens, organic enrichment, and metals. Refer to the next section, "Groundwater and Surface Water Contamination" for information on how to prevent contamination.

Leaching is another process that moves herbicides in water. In contrast to runoff, which occurs as water moves on the surface of the soil, leaching occurs as water moves through the soil. Several factors influence the leaching of herbicides. These include the water solubility of the herbicide. A herbicide dissolved in water can move readily with the water as it seeps through the soil. Soil structure and texture influence soil permeability (how fast the water moves through soil), as well as the amount and persistence of herbicide adsorption to soil particles. Adsorption is probably the most important factor influencing leaching of herbicides. If an herbicide is strongly adsorbed to soil particles, it is less likely to leach, regardless of its solubility, unless the soil particles themselves move with the water flow.

Groundwater contamination is a major concern associated with the leaching of herbicides from treated fields, mixing and rinsing sites, waste disposal areas, and manufacturing facilities. Refer to the next section, "Groundwater and Surface Water Contamination", for information on how to prevent contamination.

Groundwater and Surface Water Contamination

Groundwater is the water beneath the earth's surface occupying the saturated zone (the area where all the pores in the rock or soil are filled with water). It is stored in water-bearing geological formations known as **aquifers.** Groundwater moves through aquifers and can be obtained at points of natural discharge such as springs or streams, or by drilling a well into the aquifer.

The upper level of the saturated zone in the ground is call the **water table**. The water table depth below the soil surface fluctuates throughout the year, depending on the amount of water removed from the ground and the amount of water added by recharge and connected surface waters. **Recharge** is water that seeps through the soil from rain, melting snow, or irrigation. **Surface waters** are visible bodies of water such as lakes, rivers, and oceans.

Both surface water and groundwater are subject to contamination by **point source and non-point source pollution**. The key to preventing pesticides in groundwater and surface waters is identification of the source and route to the water. Point source contamination refers to situations where movement of a pesticide into water can be traced to a specific site. Nonpoint sources occur over a wide area and most pesticides detected in groundwater and surface water can be traced to nonpoint sources. This type of pollution generally results from land runoff, precipitation, acid rain, or percolation rather than from a discharge at a specific, single location, such as a single pipe or well head.

The potential for the pollution of groundwater and surface water from improper waste disposal is a major concern. Problems result from domestic waste (e.g., septic systems, landfills, waste treatment plants), industrial waste (e.g., landfills, brine and mine wastes, deep well disposal), and government-generated waste (e.g., radioactive wastes).

Improper agricultural practices are another concern. Inadequate handling of livestock waste storage facilities and improper application of manures and fertilizers can cause unacceptable levels of nitrate in groundwater. Pesticides in groundwater and surface water are receiving considerable national attention. Evidence suggests that, in certain areas, agriculture's relative contribution to groundwater and surface water contamination may be significant.

Herbicides in Groundwater

Earlier we discussed herbicide fate and the numerous transfer and breakdown processes that occur in the environment. Those processes help determine whether herbicides reach groundwater or are degraded before reaching these underground waters. Geological characteristics, such as the depth of the water table and the presence of sinkholes, are also critical. If the water table is close to the soil surface, fewer opportunities may exist for adsorption and degradation to occur.

On the soil surface and within the first few inches of soil, herbicides can be volatilized, adsorbed to soil particles, taken up by plants, broken down by sunlight, or degraded by soil microorganisms and chemical reactions. The extent of herbicide leaching is affected by both pesticide and soil properties. Weather conditions and management practices also affect leaching of herbicides through the soil. Too much rain or irrigation water can leach herbicides beyond the zone where weeds are controlled. A herbicide that is not volatilized, absorbed by plants, bound to soil, or degraded can potentially move through the soil to groundwater.

After herbicides reach groundwater, they may continue to break down, but at a much slower rate, because of less available light, heat and oxygen. The movement of groundwater is often slow and difficult to predict. Substances that enter the groundwater in one location can turn up years later in other locations. A major difficulty in dealing with groundwater contaminants is that the sources of pollution are not easily recognizable. The problem is occurring underground, out of sight.

Herbicides in Surface Water

Nonpoint source contamination of surface water can occur in several ways. Pesticides can reach surface water through drift or volatilization or by wind erosion of dust particles carrying pesticides into the atmos-

phere followed by rainfall deposition in the water; from groundwater discharging into surface water; and in surface water runoff.

Pesticides have been detected in rainfall in many states in the midwest, including Iowa, Indiana, Wisconsin and Ohio. The greatest number of detections and the highest concentrations were observed in May. When detected, most pesticide concentrations are below 1 ppb.

The majority of pesticides detected in surface water are from surface runoff events. The pesticides are either attached to the soil particles that are being transported in the runoff water or the pesticides are dissolved in the runoff water. The degree of pesticide loss to surface water is dependent on the degree of surface water runoff in the field. This is dependent on the slope of the field, the vegetative and/or residue cover on the field site, the soil texture, and the soil moisture content at the time of the rainfall that produces the runoff event. Pesticide application methods have a strong influence on the potential for the pesticide to be carried in surface water runoff. Preemergence herbicide applications have a greater potential for surface loss compared to applications where the herbicide is incorporated and applications where the herbicide is applied postemergence. The pesticide application rate is important too. The higher the pesticide application rate, the greater the potential amount of pesticide that could be lost in runoff.

Once a pesticide reaches surface water it may or may not degrade. Some pesticides degrade by hydrolysis or by direct or indirect photodegradation. Our knowledge of which pesticides are degraded in surface waters is quite limited.

Keeping Herbicides Out of Groundwater and Surface Water

It is very difficult to purify or clean contaminated groundwater or surface water. Treatment is complicated, time consuming, expensive, and often not feasible. The best solution to groundwater and surface water contamination is to prevent the problem in the first place. Management practices can be implemented to effectively reduce pesticide runoff and leaching and protect groundwater and surface water.

- **Use integrated pest management programs**—Minimize herbicide use by combining chemical control with other pest management practices such as tillage, cultivation, crop rotation, and pest scouting.
- **Reduce compaction**—Surface water runoff increases when soils are compacted.
- **Rotate crops**—Crop rotation improves water infiltration which reduces runoff. Crop rotations also may provide more surface crop residue and may reduce the application of specific pesticides repeatedly to a given field site.
- **Utilize conservation practices that reduce erosion and surface runoff**—These practices include but are not limited to no-till and other forms of conservation tillage, increasing crop residues or planting of cover crops, planting grass waterways to retard soil and water runoff, and keeping buffer strips to protect surface water boundaries.
- **Consider the geology of your area**—When planning herbicide applications, be aware of the water table depth and the permeability of the geological layers between the surface soil and groundwater.
- **Consider soil and field characteristics**—The susceptibility of the soil or field site to leaching or runoff should be determined. Soil texture and organic matter content, in particular, influence chemical movement into groundwater while slope of the field influences surface runoff.
- **Select herbicides carefully**—Remember, herbicides that are highly soluble, relatively stable, and not readily adsorbed to soil tend to be the most likely to leach. Choose herbicides with the least potential for leaching into groundwater or for runoff into surface water. Read labels carefully and consult a specialists from an Extension office or your chemical dealer, if necessary.

The following herbicides contain advisory statements regarding groundwater protection:

Aatrex
Accent Gold
Atrazine
Axiom
Basis Gold
Bicep
Bicep II
Bicep II Magnum
Bicep Lite II
Bicep Lite II Magnum
Bladex
Boundary
Broadstrike + Treflan
Broadstrike + Dual
Bronco
Buctril-Atrazine
Bullet
Canopy
Curtail
Degree
Degree Xtra
Domain
Extrazine II
Fieldmaster
FirstRate
Fultime
Gauntlet
Guardsman
Harness
Harness Xtra
Harness Xtra 5.6L
Hornet
Hornet WDG
Laddok
Lariat
Lasso
Lead Off
Liberty ATZ
Marksman
Micro-Tech
Outlook
Partner
Python
Ready Master ATZ
Salute
Scorpion III
Sencor
Shotgun
Stinger
Surpass
Surpass 100
TopNotch
Turbo

The following herbicides contain advisory statements regarding surface water protection:

Aatrex
Atrazine

Axiom
Basis Gold
Bicep II
Bicep Lite II
Bicep II Magnum
Bicep Lite II Magnum
Bladex
Boundary
Buctril-Atrazine
Bullet
Degree Xtra
Domain
Extrazine II
Fultime
Guardsman
Harness Xtra
Laddok
Lariat
LeadOff
Liberty ATZ
Marksman
Outlook
Ready Master ATZ
Shotgun
Surpass 100

These herbicides may not be mixed or loaded within 50 feet of perennial or intermittent streams and rivers, lakes, or reservoirs. These herbicides may not be mixed or loaded within 50 feet of any well unless conducted on an impervious pad designed and maintained to contain any product spills, leaks, or rinse water.

These herbicides cannot be applied within 66 feet of the points where field surface water runoff enters perennial or intermittent streams and rivers or within 200 feet of lakes or reservoirs.

These herbicides can only be applied to HEL (highly erodible land) acres if the 66 foot buffer or setback from runoff points is planted to a crop or seeded with grass.

• **Follow label directions**—The label carries crucial information about the proper rate, timing, and placement of the herbicide.

• **Reduce herbicide application rates**—Use the lowest rate of the pesticide which provides adequate pest control. Band applications of preemergence herbicides reduce the potential of herbicides to leach or runoff by 50% or more.

• **Incorporate pesticides**—On fields not considered highly erodible, incorporation of pesticides can be used to reduce runoff by moving some of the pesticide below the soil surface away from overland water flow. Incorporation of herbicides will not be compatible with surface residue requirements in some fields.

• **Calibrate accurately**—Equipment should be calibrated carefully and often. During calibration, check the equipment for leaks and malfunctions.

• **Measure accurately**—Concentrates need to be carefully measured before they are placed into the spray tank. Do not "add a little extra" to ensure the herbicide will do a better job. Such practices only increase the likelihood of injury to the treated crop, the cost of pest control, and the chance of groundwater and surface water contamination.

• **Avoid back-siphoning**—The end of the fill hose should remain above the water level in the spray tank at all times to prevent back-siphoning of chemical into the water supply. Use an anti-backflow device when siphoning water directly from a well, pond, or stream. These practices also reduce the likelihood of the hose becoming contaminated with herbicides.

• **Consider weather and irrigation**—If you suspect heavy or sustained rain, delay applying herbicides. Control the quantity of irrigation to minimize the potential for herbicide leaching and runoff.

• **Avoid spray drift and volatilization**—Preemergence herbicide applications have the greatest potential for volatilization and runoff.

• **Clean up spills**—Avoid spills. When they do occur, contain and clean them up quickly with an absorbent material such as cat litter. Chemicals spilled near wells and sinkholes can move directly and rapidly into groundwater. Chemicals spilled near ditches, streams, or lakes can move rapidly into surface water.

• **Change the location of mixing areas**—Mix and load pesticides on an impervious pad, if possible. If mixing is done in the field, change the location of the mixing area regularly. Do not mix herbicides adjacent to the water source, and do not let the water run inadvertently on the soil near the mixing area. This will increase herbicide leaching and/or runoff.

• **Dispose of wastes properly**—All herbicide wastes must be disposed of in accordance with local, state, and federal laws. Triple-rinse containers. Pour the rinsewater into the spray tank for use in treating the site or the crop. *Do not* pour rinsate on the soil, particularly repeatedly in the same location. This will saturate the soil and increase the potential for herbicide leaching.

• **Store herbicides away from water sources**—Herbicide storage facilities should be situated away from wells, cisterns, springs, and other water sources.

Michigan's water resources currently provide a vast supply of clean water for agriculture, homes, and industry. They can ensure high water quality for future needs only if they are protected now. Be sure to understand how your activities, including herbicide usage, can affect them.

Michigan Groundwater Stewardship Program (MGSP)

The MGSP *HAS BEEN AUTHORIZED THROUGH THE YEAR 2010* by the state legislature. It is funded by assessments on the sale of nitrogen fertilizers and pesticides, generating $3.5 million dollars each year. The program delivers educational programs, technical assistance and cost share that meet the needs and interests of local pesticide and fertilizer users. Growers may request an assisted farmstead pollution risk assessment (Farm*A*Syst), develop a groundwater stewardship plan, install groundwater stewardship practices using cost share funds, attend an on-farm demonstration and participate in an educational workshop sponsored by the MGSP.

The MGSP also sponsors the Spill Response Program (1-800-405-0101) to assist individuals dealing with pesticide, fertilizer and manure spills; Clean Sweep to dispose of unused and unwanted pesticides in an environmentally sound manner; and Container Recycling to boost the industry's efforts for collecting plastic and aerosol pesticide containers.

Contact your MSU Extension, Conservation District or USDA NRCS representative to learn more about the MGSP serving your county.

Pesticide Emergency Preparedness

When purchasing a pesticide, obtain a specimen label from the dealer and keep it on file on the farm. This label will be available immediately if an emergency involving a pesticide occurs. Take the label along to a medical treatment center if an individual has suffered pesticide poisoning.

Read and observe closely the *Precautionary Statements* section of the label. Make sure that several people are aware of and can administer treatments for pesticide poisoning contained in the *Statement of Practical Treatment* on the label.

Transporting Pesticides

Have pesticides delivered directly to your pesticide storage facility to avoid liability and potential accidents and spills in transit whenever possible. DOT shipping rules must be followed for transporting large quantities of pesticides, including proper placarding of the vehicle, liability insurance, special handling requirements, etc.

Storing Pesticides

Pesticides must be stored in a facility that will protect them from temperature extremes, high humidity, and direct sunlight. The storage facility should be heated, dry and well ventilated. It should be designed for easy containment and cleanup of pesticide spills and made of materials that will not absorb any pesticide material that leaks out of a container. Store only pesticides in such a facility and always store them in their original containers.

Do not store any feed, seed, food, or fertilizer with pesticides. Do not store any protective clothing or equipment in the pesticide storage facility. Store herbicides separately from insecticides and fungicides to avoid contamination of one material by another and accidental misuse.

Keep the facility locked at all times when not in use to prevent animals, children, and irresponsible adults from entering and becoming poisoned. Post the facility as a *Pesticide Storage Facility* to warn others that the area is off limits. Maintain an accurate inventory of the pesticides stored in the facility at all times in case of emergency.

Always read and follow the Storage and Disposal section of pesticide labels for specific storage and handling instructions.

For additional information on pesticide storage, refer to Midwest Plan Service bulletin 37, *Designing Facilities for Pesticide and Fertilizer Containment,* and MSU Bulletin E-2335.

Handling and Mixing Pesticides

Always wear protective clothing and equipment when handling, mixing, and applying pesticides and during cleanup of application equipment. Protective clothing should include full coverage clothing, chemical resistant gloves and boots, eye protection, hard hat and a MSHA/NIOSH approved respirator with a chemical absorbent material as specified on the pesticide label.

Mix pesticides downwind and below eye level. Avoid excessive splashing and sloshing. If pesticides are spilled on you, wash them off immediately with lots of water and change clothing. Resume spraying only after cleaning up any spills. Try to use closed handling/mixing systems when appropriate.

Mix only what is required for the area to be sprayed according to label directions. Avoid mixing excessive amounts. To do otherwise will create a hazardous waste which is difficult and expensive to dispose of. Keep unauthorized persons out of the area in which you handle pesticides.

Handling and Disposing of Pesticide Containers

Pesticide containers are considered hazardous waste until they are cleaned or disposed of properly. When possible, reduce the number of pesticide containers by using bulk or returnable containers. Buy pesticides in larger volume containers, containers that may be recycled, or in water soluble bags to avoid disposal problems.

All pesticide containers can be rendered nonhazardous waste by triple rinsing (or equivalent). The rinsate should be added to the spray tank. After triple rinsing, perforate both ends so the container cannot be reused.

All metal and plastic triple-rinsed containers should be recycled, if possible. If this option is not available, dispose of them in a state-licensed sanitary landfill. Dispose of all paper containers in a sanitary landfill or a municipal waste incinerator. Do not bury or burn any pesticide containers. Do not reuse any empty pesticide containers for any purpose.

Unused and Unwanted Pesticides/Clean Sweep

The proper disposal of unused and unwanted pesticides is the goal of the Clean Sweep program in Michigan. The Michigan Groundwater Stewardship Program (MGSP), in cooperation with county and local units of government, has established permanent Clean Sweep sites located throughout the state.

Individual Michigan residents may dispose of unused and unwanted pesticides by taking them to one of these Clean Sweep sites where they will be collected, packaged for shipping, and disposed of properly. There is no charge for this service. Program costs are covered by MGSP, a grant from the U.S. Environmental Protection Agency, and services provided by the local cooperators.

Pesticide dealers and individuals who sell and/or apply pesticides for hire may also, at the Clean Sweep site manager's discretion, dispose of unused or unwanted pesticides at cost. This cost is typically less than 20% of the normal cost of pesticide waste disposal because of economies of scale and competitive bidding of waste disposal accounts.

Persons interested in participating in the Clean Sweep program should contact their local MSU Extension office for the location nearest them.

Protect Nontarget Organisms

Applying pesticides carelessly can harm nontarget organisms that are beneficial to agriculture and our environment. The best way to avoid injury of beneficial insects and microorganisms is to minimize pesticide use. Selective pesticides should be used whenever possible and applied only when necessary as part of a total pest management program.

Bees and other pollinating insects are essential for successful production of many crops, such as deciduous tree fruits, small fruits, most seed crops and certain vegetables. Many pesticides, particularly insecticides, are highly toxic to pollinating honeybees and wild bees. Check herbicide labels to identify those that are toxic to bees. *Gramoxone Extra* (paraquat), for example, is an herbicide toxic to bees. Be aware of how bee poisoning can occur and how to prevent them.

The following precautions reduce the chance of bee poisoning.

- Do not apply herbicides (such as *Gramoxone Extra*) that are toxic to bees during bloom. Even shade trees and weeds should not be sprayed during bloom. Mow cover crops and weeds to remove blooms before spraying.
- Reduce drift during application. Aerial applications usually are more hazardous to bees than ground applications.
- Time pesticide applications carefully. Evening applications are less hazardous than early morning ones; both are safer than midday application.
- Do not treat near hives. Bees may need to be moved or covered before you use insecticides near colonies.

Pesticides can be harmful to all kinds of vertebrates such as **fish and wildlife**. Most recognizable are the direct effects from acute poisoning. Fish kills often result from water pollution by a pesticide (usually insecticides). Pesticides can enter water via drift, surface runoff, soil erosion, and leaching.

Bird kills from pesticides can occur when birds ingest the toxicant in granules, baits, or treated seed; or are exposed directly to the spray; or consume a treated crop; or drink and use contaminated water; or feed on pesticide-contaminated prey.

Worker Protection Standard

New federal rules for farm worker protection, issued during 1992, require farmers to provide additional training and notification to farm workers to prevent accidental or occupational exposure to pesticides. Farmers should contact Extension agents to learn the details of this standard and availability of training materials for education of workers and handlers.

Read and follow the label instructions on **Restricted Entry Intervals (REI)** for every pesticide used. Some pesticide labels require both oral warning and posted signs to notify workers of pesticide applications. If the label doesn't require *both* forms of notification, notify workers *either* orally *or* by posting warning signs at entrances to treated areas. (Greenhouses *must* post warning signs for every application.) When using posted signs, post 24 hours or less before the pesticide application and remove signs within three days after the end of the restricted entry interval. Keep workers out during the entire time the signs are posted (except for early-entry workers wearing the proper personal protective equipment).

Record Keeping

The 1990 Farm Bill requires that all applicators who apply restricted use pesticides (RUP) keep records and maintain them for two years. Records to be kept include:

- brand name or product name and the EPA registration number.
- total amount of the product used.
- size of the area treated.
- crop, commodity, stored product or site to which the pesticide was applied.
- location of the application.
- month, day and year of the application.
- name and certification number of the applicator or applicator's supervisor.

The spray record sheet at the end of this publication, or E-2340 to E-2345 which includes directions and forms for a complete farm record keeping system, can be used for recording your sprays. Any record form is acceptable as long as the required data is included. Penalties are up to $500 for the first violation and up to $1000 for subsequent violations. Provisions for protecting the identity of the individual producers are included in the law. Commercial applicators must furnish a copy of the required records to the customer of the RUP application. Revisions to this rule may be finalized by January 1995. Contact your Extension office for final revisions.

Endangered Species Act

To minimize the adverse impact of pesticides on endangered species, the EPA has initiated The Endangered Species Act. The Michigan Department of Natural Resources (MDNR) administers the Michigan Endangered Species Act and maintains the federal and state endangered species lists in the state. Pesticide applications are a potential problem, particularly affecting birds, butterflies and moths. Alteration of the farm landscape can also negatively affect resident endangered species.

The Environmental Protection Agency (EPA) has determined threshold pesticide application rates that may affect listed species. This information is or will be included on pesticide labels. Counties with vulnerable endangered or threatened species will be identified on pesticide labels. Farmers must take the initiative and consult with the MDNR and the Fish and Wildlife Service (FWS) to be sure there are no endangered species in their area. The Nature Conservancy, a private land and habitat conservation organization, is working with the MDNR and the FWS and is conducting a landowner contact program to work with landowners who own property important for endangered species protection.

SARA Title III Emergency Planning and Community Right to Know Act

The Emergency Planning and Community Right to Know Law, under SARA Title III, requires farmers to notify their State Emergency Response Commission (SERC), Local Emergency Planning Committee (LEPC), and local fire department that they store extremely hazardous materials along with the name and telephone number of the facility representative. Check with your state Department of Natural Resources or Extension to receive a list of EPA established "Extremely Hazardous Substances" and their threshold planning quantities.

The LEPC and fire chief may request maps of your storage facility and detailed lists of materials you store.

This law also requires, in the event of a spill, the SERC, LEPC and National Response Commission be notified. The reportable quantities for spills is much less than for storage and can be obtained from the above sources.

Right to Farm

Farmers in Michigan are protected from nuisance lawsuits under the Right to Farm Act if they follow specific acceptable management practices. The Generally Accepted Agricultural and Management Practices for pesticide utilization and pest control, nutrient utilization, and manure management have been completed and are revised annually. Contact your Extension agent or regional office of the Michigan Department of Agriculture to obtain copies. In addition, the latest version of the voluntary guidelines are available at the following web address: www.mda.state.mi.us/right2farm/farm.htm

Restricted Use Pesticides

Several herbicides are currently classifed as Restricted Use Pesticides and as such, can be purchased and applied only by Certified Commercial or Private Pesticide Applicators. Certification of pesticide applicators is administered by the Michigan Department of Agriculture. The following list contains the herbicides included in this guide that are classified as Restricted Use Pesticides.

Aatrex
Atrazine
Basis Gold
Bicep Lite II
Bicep Lite II Magnum
Bicep II
Bicep II Magnum
Bladex
Bronco
Buctril-Atrazine
Bullet
Degree
Degree Xtra
DoublePlay
Extrazine II
Fieldmaster
Fultime
Gramoxone Extra
Gramoxone Max
Guardsman
Harness
Harness Xtra
Harness Xtra 5.6L
Laddok
Lariat
Lasso
LeadOff
Liberty ATZ
Marksman
Micro-Tech
Option II
Partner
Ready Master ATZ
Shotgun
Surpass
Surpass 100
TopNotch

Herbicide Resistance in Weeds

Triazine-resistant common lambsquarters has been confirmed in sites throughout most of the corn production regions of Michigan. In addition, resistance has been confirmed in pigweed species, common ragweed, common groundsel, and marestail (horseweed). The occurrence of triazine-resistance is generally associated with cropping systems where triazine herbicides (i.e., atrazine, *Bladex*, and *Princep*) have been frequently used for weed control. Triazine-resistant common lambsquarters are often identified in fields where corn is grown continuously. Triazine-resistant biotypes of several other species have been identified in other states and countries.

There is growing concern about resistance to sulfonylureas and imidazolinones. Resistance to these herbicides has been observed in Michigan and has become a serious problem in western regions of the U.S. Resistance to these herbicides has been recently confirmed in many sites throughout the north central region of the U.S. Resistance to these herbicide groups is a major concern because both affect the same process in plants.

An understanding of the practices that lead to herbicide resistance is important since prevention is the best approach. This is particularly important with the introduction of herbicide resistant crops such as Pursuit resistant corn hybrids. Herbicide resistant crops increase the possibilities for one herbicide to be applied for multiple years to the same field even with rotation of crops.

Farmers should include weed control practices that delay or prevent the development of herbicide resistance. The following list of practices was modified from a list developed by the North Central Weed Science Society Herbicide Resistance Committee. Some practices may be impractical in certain situations. However, no single practice is likely to be successful alone.

Practices to Reduce Risk of Herbicide Resistant Weeds

(1) Rotate herbicides using herbicides of differing modes of action. Do not make more than two consecutive applications of herbicides with the same mode of action against the same weed unless other effective control practices are also included in the management system.

(2) Apply herbicides in tank-mixed, prepackaged, or sequential mixtures which include multiple modes of action. Combining herbicides with different modes of action and similar persistence in soil will help prevent herbicide resistance. **Note: The herbicide modes of action which are at greatest risk of developing resistant weed populations are the following:**

A. ACCase Inhibitors
B. ALS Inhibitors
C. Photosynthesis Inhibitors (See description of modes of action below.)

(3) Scout fields regularly and identify weeds present.

(4) Rotate crops, particularly those with different life cycles.

(5) Combine mechanical control practices such as rotary hoeing and

cultivation with herbicide treatments.

(6) Clean tillage and harvest equipment before moving from fields infested with resistant weeds to those which are not infested.

Herbicide Mode-of-Action

Herbicide Mode-of-Action refers to the method by which the herbicide kills plants. An understanding of herbicide mode of action is useful in developing herbicide programs that prevent herbicide resistance. The following list categorizes herbicides into general modes of action. Individual herbicide families and herbicide examples are listed within each mode of action. In addition, the mode-of-action is listed for each herbicide on the weed response tables for each crop. For additional details on herbicide mode of action, refer to NCR 377 "Herbicide Mode of Action and Injury Symptoms."

HERBICIDE MODE OF ACTION:

Mode of Action	Chemical Family	Herbicide
ACCase Inhibitors	Cyclohexanediones	Sethoxydim *(Poast, Poast Plus)* Clethodim *(Select)*
	Aryloxyphenoxypropionates	Fluazifop *(Fusilade DX,* component in *Fusion)* Fenoxaprop *(Option II,* component in *Fusion)* Quizalofop *(Assure II)*
ALS Inhibitors	Imidazolinones	Imazaquin *(Scepter)* Imazethapyr *(Pursuit)* Imazethapyr + Imazapyr *(Lightning)* Imazamox *(Raptor)*
	Sulfonylureas	Chlorimuron *(Classic,* component in *Canopy, Canopy XL)* Thifensulfuron *(Pinnacle,* component in *Harmony Extra)* Tribenuron *(Express,* component in *Harmony Extra)* Triflusulfuron *(UpBeet)* Nicosulfuron *(Accent)* Primisulfuron *(Beacon)* Halosulfuron *(Permit)* Rimsulfuron + Thifensulfuron *(Basis)* Rimsulfuron + Nicosulfuron *(Basis Gold)*
	Sulfonamides	Flumetsulam *(Broadstrike, Python,* component in *Scorpion III, Hornet)* Cloransulam-methyl *(FirstRate)*
Photosynthesis Inhibitors	Triazines	Atrazine Cyanazine *(Bladex)* Simazine *(Princep)* Metribuzin *(Sencor)* Hexazinone *(Velpar)*
	Phenylureas	Linuron *(Lorox)*
	Uracils	Terbacil *(Sinbar)*
Photosynthesis Inhibitors (Nonmobile)	Benzothiadiazoles	Bentazon *(Basagran)*
	Nitriles	Bromoxynil *(Buctril, Moxy)*
Growth Regulators	Phenoxy Acetic Acids	2,4-D 2,4-DB *(Butyrac 200, Butoxone 200)* MCPA
	Benzoic Acids	Dicamba *(Banvel, Clarity,* component in *Distinct)*
	Pyridines	Clopyralid *(Stinger)*
EPSPS Inhibitors	Amino Acid Derivatives	Glyphosate *(Roundup Ultra, Touchdown, other)*
Seedling Growth Inhibitors (Root Inhibitors)	Dinitroanilines	Trifluralin *(Treflan, Tri-4)* Ethalfluralin *(Sonalan)* Pendimethalin *(Prowl)*
Seedling Growth Inhibitors (Shoot Inhibitors)	Acetamides	Alachlor *(Lasso, Micro-Tech, Partner)* Acetochlor *(Harness, Surpass, Topnotch, Degree)* Dimethenamid *(Frontier, Outlook)* Metolachlor *(Dual, II, Dual II Magnum)* Flufenacet (component of *Axiom, Domain*)
	Thiocarbamates	EPTC *(Eptam)* EPTC plus safener *(Eradicane)* Cycloate *(Ro-Neet)*

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HERBICIDE MODE OF ACTION (continued):

Mode of Action	Chemical Family	Herbicide
Cell Membrane Disrupters	Bipyridiliums	Paraquat *(Gramoxone Extra, Gramoxone Max)* Diquat *(Diquat)*
	Diphenylethers	Acifluorfen *(Ultra Blazer)* Lactofen *(Cobra)* Fomesafen *(Reflex, Flexstar)*
	unclassified	Flumiclorac *(Resource)* Sulfentrazone *(Authority,* component of *Canopy XL)* Carfentrazone *(Aim)*
Pigment Inhibitors	Isoxazolidinones	Clomazone *(Command)*
Ammonia Assimilation Inhibitors	Amino Acid Derivatives	Glufosinate *(Liberty)*

CHEMICALS FOR WEED CONTROL IN FIELD CROPS

IMPORTANT: READ THE FOLLOWING BEFORE USING

Rates are expressed in pounds of active ingredient (a.i.) per acre for the area actually sprayed; rates in formulation column are given as pounds or liquid measure of product unless otherwise noted.

(NOTE: Commercial rates are expressed in pt or qt or gal or lb or oz).

Apply all agricultural chemicals in accordance with regulations and labels as to rates, timing and crops for which they may be used.

Rates recommended in this bulletin are for medium-textured soils with 3% or greater organic matter.

Many herbicides may also be applied as granules or impregnated on dry fertilizer. With these application methods, uniform application of the herbicide is necessary for acceptable weed control.

TABLE 1A–CHEMICAL WEED CONTROL IN CORN

PREPLANT INCORPORATED — MINERAL SOIL

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses (including sandbur) **Nutsedge**	EPTC with protectant *(Eradicane)*	4	4¾ pt	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL BROADLEAVES. • Must be incorporated or mixed into top 2 to 3 in. of soil. • Increase *Eradicane* rate to 6 pt/A for more effective nutsedge control. • Do not apply *Eradicane* to fields that were treated with a thiocarbamate herbicide (*Eptam, Ro-Neet,* or *Eradicane*) the previous year. • Do not use on corn seed stocks (Breeders, Foundation, or increase).
Annual grasses **Nutsedge**	dimethenamid *(Frontier)* OR *(Outlook)*	1.17 OR 0.75	28 oz 6L OR 16 oz 6L	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL BROADLEAVES. • Fair to good control of nutsedge. • Will be more effective on nutsedge when incorporated. • *Frontier* and *Outlook* rates vary based on soil type (see label for details).
	S-metolachlor *(Dual Magnum, Dual II Magnum)*	1.27	1.33 pt	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL BROADLEAVES. • Better nutsedge control if incorporated 2 to 3 in. • Will be more effective preplant, especially on nutsedge, in areas where soils tend to be dry. • *Dual II Magnum* contains a safener which increases corn tolerance to metolachlor. • *Dual Magnum* or *Dual II Magnum* at 1.33 pt/A is equivalent to Dual or Dual II at 2 pt/A.

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CORN — PREPLANT INCORPORATED — MINERAL SOIL (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual grasses Nutsedge	alachlor *(Lasso, Micro-Tech)* OR *(Partner)*	2½	2½ qt 4L OR 3.8 lb 65% DG	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL BROADLEAVES. • Will be more effective preplant, especially on nutsedge.
	acetochlor *(Harness)* OR *(Surpass)* OR *(TopNotch)* OR *(Degree)*	1.6	1.8 pt 7L OR 2 pt 6.4L OR 4 pt 3.2L OR 3.4 pt 3.8L	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL BROADLEAVES. • Do not apply acetochlor to the following soils if ground water depth is 30 feet or less: sands with less than 3% organic matter, loamy sands with less than 2% organic matter, or sandy loams with less than 1% organic matter. • See Label or Table 11 for crop rotation restrictions. • *Harness, Surpass, TopNotch,* and *Degree* each contain a safener that increases corn tolerance to acetochlor. • Application rate varies by soil type. See label for details. • *TopNotch* and *Degree* are micro-encapsulated formulations of acetochlor.
	flufenacet + metribuzin *(Axiom)*	0.51 + 0.13	15 oz. 68% DF	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL BROADLEAVES. • Not registered for popcorn or sweet corn. • Includes the equivalent of 2.5 oz/A of Sencor 75DF. • Do not apply *Axiom* to permiable or coarse-textured soils where the water table is shallow as this may result in ground water contamination. • Do not apply *Axiom* to sites that are vulnerable to runoff and surface water contamination. • Adjust *Axiom* rate according to soil texture and organic matter. Application rates above those on the label may result in severe corn injury, especially under cool, wet conditions. The margin or crop safety can be narrow.
Annual broadleaves	atrazine (commercial product)	1	1 qt 4L OR 1.1 lb 90% DG	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL GRASSES AND NUTSEDGE. • See label or Table 11 for crop rotation restrictions. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See lable and pg. 12–13 for details.
	simazine *(Princep)*	1	1 qt 4L OR 1.25 lb 80% WP OR 1.1 LB 90% DG	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL GRASSES AND NUTSEDGE. • See label or Table 11 for crop rotation restrictions. • *PRINCEP* HAS SIMILAR CARRYOVER RISK AS ATRAZINE. • WHEN *PRINCEP* AND ATRAZINE ARE BOTH APPLIED TO CORN, CARRYOVER RISK IS ADDITIVE. • May be substituted for atrazine for slightly better grass control.

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CORN — PREPLANT INCORPORATED — MINERAL SOIL (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves	atrazine (commercial product)	½	½ qt 4L OR ¾ lb 90% DG	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL GRASSES AND NUTSEDGE.
	+	+	+	• Maximum cyanazine rate in 2001 is 1 lb/A a.i. This rate may be less consistent than the higher rates used in previous years.
	cyanazine *(Bladex)*	1	1 qt 4L OR 1.1 lb 90% DF	• Can be used to reduce risk of atrazine carryover.
				• The preferred treatment where fall panicum is a problem.
				• May substitute *Princep* for atrazine if fall panicum is a severe problem.
				• Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details.
				• An enclosed cab is required for application of cyanazine.
	flumetsulam *(Python)*	.056	1.14 oz	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL GRASSES AND NUTSEDGE.
				• **ADJUST APPLICATION RATE ACCORDING TO SOIL TYPE AND % ORGANIC MATTER. SEE LABEL FOR DETAILS.**
				• See label or Table 11 for crop rotation restrictions.
				• Do not use if soil pH exceeds 7.8 as crop injury may occur.
				• Risk of corn injury increases as soil pH increases.
				• **Do not apply to soils with less than 1.5% organic matter as severe corn injury may occur.**
				• Risk of corn injury from flumetsulam is greatly reduced if an IR or IMR corn hybrid is used.
				• Do not use if organic matter is >5% *and* soil pH is < 5.9 as poor weed control may result.
				• Do not use on peat or muck soils.
				• This product has a groundwater advisory statement.
				• Do not apply to sweet corn or popcorn.
				• Do not apply within 85 days of harvest.
				• Do not follow this treatment with a postemergence application of an ALS inhibitor herbicide *(Accent, Beacon, Basis, Basis Gold, Accent Gold, Permit)* if plants are under stress.
				• Control of only light to moderate common ragweed, cocklebur, and jimsonweed. Control may be improved by adding atrazine to the tank mix.
				INSECTICIDE INTERACTION
				Conventional and IT Corn:
				• See Table 1M.
				• Do not apply to corn treated with any formulation of *Counter* or *Thimet* insecticides. Other organophosphate insecticides should be applied in a band (surface or T-band) to reduce risk of crop injury.
				IR/IMR Corn:
				• There are no restrictions regarding insecticide application.
				• Treat IT corn as conventional non-resistant corn.

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CORN — PREPLANT INCORPORATED — MINERAL SOIL (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves	flumetsulam *(Python)*	.04	0.8 oz 80% DG	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL GRASSES AND NUTSEDGE. • **ADJUST APPLICATION RATE ACCORDING TO SOIL TYPE AND % ORGANIC MATTER. SEE LABEL FOR DETAILS.** • See label or Table 11 for crop rotation restrictions. • Do not use if soil pH exceeds 7.8 as crop injury may occur. • Risk of corn injury increases as soil pH increases. • **Do not apply to soils with less than 1.5% organic matter as severe corn injury may occur.** • Risk of corn injury from flumetsulam is greatly reduced if an IR or IMR corn hybrid is used. • Do not use if organic matter is >5% *and* soil pH is < 5.9 as poor weed control may result or 5 fully exposed leaf collars (V5). • Do not use on peat or muck soils. • This product has a groundwater advisory statement. • Do not apply to sweet corn or popcorn. • Do not apply within 85 days of harvest. • Do not follow this treatment with a postemergence application of an ALS inhibitor herbicide *(Accent, Beacon, Basis, Basis Gold, Accent Gold, Permit)* if plants are under stress. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details. **INSECTICIDE INTERACTION** **Conventional and IT Corn:** • See Table 1M. • Do not apply to corn treated with any formulation of *Counter* or *Thimet* insecticides. Other organophosphate insecticides should be applied in a band (surface or T-band) to reduce risk of crop injury. **IR/IMR Corn:** • There are no restrictions regarding insecticide application. • Treat IT corn as conventional non-resistant corn.
	+	+	+	
	atrazine (commercial product)	1	1 qt 4L OR 1.1 lb 90% DG	

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CORN — PREPLANT INCORPORATED — MINERAL SOIL (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves	flumetsulam + clopyralid *(Hornet)* OR *(Hornet WDG)* + atrazine (commercial product)	.034 + .094 + 1	 2.4 oz 86% DG OR 3.0 oz 68.5% DG + 1 qt 4L OR 1.1 lb 90% DG	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OR ANNUAL GRASSES AND NUTSEDGE. • Groundwater advisory statement. • See label or Table 11 for crop rotation restrictions. • Application rate varies by soil type. See label for details. • Do not apply to sweet corn or popcorn. • Do not apply within 85 days of harvest. • Do not use if organic matter is >5% *and* soil pH is < 5.9 as poor weed control may result. • Do not use if soil pH exceeds 7.8 as crop injury may occur. • Risk of corn injury increases as soil pH increases. • **Do not apply to soils with less than 1.5% organic matter as severe corn injury may occur.** • Risk of corn injury from flumetsulam is greatly reduced if an IR or IMR corn hybrid is used. • Do not follow this treatment with a postemergence application of an ALS inhibitor herbicide *(Accent, Beacon, Basis, Basis Gold, Accent Gold, Permit)* if plants are under stress. **INSECTICIDE INTERACTION** **Conventional and IT Corn:** • See Table 1M. • Do not apply to corn treated with any formulation of *Counter* or *Thimet* insecticides. Other organophosphate insecticides should be applied in a band (surface or T-band) to reduce risk of crop injury. **IR/IMR Corn:** • There are no restrictions regarding insecticide application. • Treat IT corn as conventional non-resistant corn.

CORN — PREEMERGENCE — MINERAL SOIL — ALL TILLAGE SYSTEMS

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses	alachlor *(Lasso, Micro-Tech)* OR *(Partner)*	2	 2 qt 4L OR 3 lb 65% DG	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL BROADLEAVES. • 2½ lb a.i./A of alachlor should be used for more effective fall panicum control.
	S-metolachlor *(Dual Magnum, Dual II Magnum)*	1.27	1.33 pt	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL BROADLEAVES. • *Dual II Magnum* contains a safener which increases corn tolerance to metolachlor. • *Dual Magnum* or *Dual II Magnum* at 1.33 pt/A is equivalent to *Dual* or *Dual II* at 2 pt/A.
	dimethenamid *(Frontier)* OR *(Outlook)*	 1.31 OR 0.75	 28 oz 6L OR 16 oz 6L	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL BROADLEAVES. • Will be more effective on nutsedge when incorporated. • *Frontier* and *Outlook* rates vary based on soil type (see label for details.).

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CORN — PREEMERGENCE — MINERAL SOIL — ALL TILLAGE SYSTEMS (cont.)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual grasses	acetochlor *(Harness)* OR *(Surpass)* OR *(TopNotch)* OR *(Degree)*	1.6	1.8 pt 7L OR 2 pt 6.4L OR 4 pt 3.2L OR 3.4 pt 3.8L	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL BROADLEAVES. • Do not apply acetochlor to the following soils if ground water depth is 30 feet or less: sands with less than 3% organic matter, loamy sands with less than 2%organic matter, or sandy loams with less than 1% organic matter. • See Label or Table 11 for crop rotation restrictions. • *Harness, Surpass, TopNotch,* and *Degree* each contain a safener that increases corn tolerance to acetochlor. • Application rate varies by soil type. See label for details. • *Harness* and *Surpass* require less rainfall for activation than alachlor, metolachlor, or pendimethalin. • *TopNotch* and *Degree* are micro-encapsulated formulations of acetochlor.
	pendimethalin *(Prowl)*	1½	1.8 qt 3.3 EC	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL BROADLEAVES. • EXTREME CARE MUST BE TAKEN TO ASSURE COMPLETE CLOSURE OF THE SEED FURROW. IF THE SEED FURROW REMAINS OPEN (EVEN PARTIALLY OPEN) SEVERE INJURY WILL OCCUR. • APPLY AFTER PLANTING. • DO NOT INCORPORATE. • Plant at least 1½ in. deep. • Adjust *Prowl* rate according to soil type (refer to *Prowl* label for details). • Do not use on sandy soil with less than 1.5% organic matter.
	flufenacet + metribuzin *(Axiom)*	0.51 + 0.13	15 oz. 68% DF	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL BROADLEAVES. • Not registered for popcorn or sweet corn. • Includes the equivalent of 2.5 oz/A of *Sencor 75DF*. • Do not apply *Axiom* to permiable or coarse-textured soils where the water table is shallow as this may result in ground water contamination. • Do not apply *Axiom* to sites that are vulnerable to runoff and surface water contamination. • Adjust *Axiom* rate according to soil texture and organic matter. Application rates above those on the label may result in severe corn injury, especially under cool, wet conditions. The margin of crop safety can be narrow.
Annual broadleaves	atrazine (commercial product)	1	1 qt 4L OR 1.1 lb 90% DG	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL GRASSES AND NUTSEDGE. • See label or Table 11 for crop rotation restrictions. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details.

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CORN — PREEMERGENCE — MINERAL SOIL — ALL TILLAGE SYSTEMS (cont.)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves	simazine *(Princep)*	1	1 qt 4L OR 1.25 lb 80% WP OR 1.1 lb 90% DG	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL GRASSES AND NUTSEDGE. • See label or Table 11 for crop rotation restrictions. • *PRINCEP* HAS SIMILAR CARRYOVER RISK AS ATRAZINE. • WHEN *PRINCEP* AND ATRAZINE ARE BOTH APPLIED TO CORN, CARRYOVER RISK IS ADDITIVE. • May be substituted for atrazine for slightly better grass control.
	atrazine (commercial product)	½	½ qt 4L OR ⅝ lb 90% DG	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL GRASSES AND NUTSEDGE. • Maximum cyanazine rate in 2001 is 1 lb/A a.i. This rate may be less consistent than the higher rates used in previous years. • Can be used to reduce risk of atrazine carryover. • The preferred treatment where fall panicum is a problem. • May substitute *Princep* for atrazine if fall panicum is a severe problem. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details. • An enclosed cab is required for application of cyanazine.
	+	+	+	
	cyanazine *(Bladex)*	1	1 qt 4L OR 1.1 lb 90% DF	

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CORN — PREEMERGENCE — MINERAL SOIL — ALL TILLAGE SYSTEMS (cont.)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves	flumetsulam *(Python)*	.056	1.14 oz	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL GRASSES AND NUTSEDGE. • **ADJUST APPLICATION RATE ACCORDING TO SOIL TYPE AND % ORGANIC MATTER. SEE LABEL FOR DETAILS.** • See label or Table 11 for crop rotation restrictions. • Corn should be planted at least 1.5 inches deep. • Do not use if soil pH exceeds 7.8 as crop injury may occur. • Risk of corn injury increases as soil pH increases. • **Do not apply to soils with less than 1.5% organic matter as severe corn injury may occur.** • Risk of corn injury from flumetsulam is greatly reduced if an IR or IMR corn hybrid is used. • Do not use if organic matter is >5% *and* soil pH is <5.9 as poor weed control may result. • Do not use on peat or muck soils. • This product has a groundwater advisory statement. • Do not apply to sweet corn or popcorn. • Do not apply within 85 days of harvest. • Do not follow this treatment with a postemergence application of an ALS inhibitor herbicide *(Accent, Beacon, Basis, Basis Gold, Accent Gold, Permit)* if plants are under stress. • Control of only light to moderate common ragweed, cocklebur, and jimsonweed. Control may be improved by adding atrazine to the tank mix. **INSECTICIDE INTERACTION** **Conventional and IT Corn:** • See Table 1M. • Do not apply to corn treated with any formulation of *Counter* or *Thimet* insecticides. Other organophosphate insecticides should be applied in a band (surface or T-band) to reduce risk of crop injury. **IR/IMR Corn:** • There are no restrictions regarding insecticide application. • Treat IT corn as conventional non-resistant corn.

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CORN — PREEMERGENCE — MINERAL SOIL — ALL TILLAGE SYSTEMS (cont.)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
continued)				
Annual broadleaves	flumetsulam *(Python)*	.04	0.8 oz 80% DG	• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL GRASSES AND NUTSEDGE. • **ADJUST APPLICATION RATE ACCORDING TO SOIL TYPE AND % ORGANIC MATTER. SEE LABEL FOR DETAILS.** • See label or Table 11 for crop rotation restrictions. • Corn should be planted at least 1.5 inches deep. • Do not use if soil pH exceeds 7.8 as crop injury may occur. • Risk of corn injury increases as soil pH increases. • **Do not apply to soils with less than 1.5% organic matter as severe corn injury may occur.** • Risk of corn injury from flumetsulam is greatly reduced if an IR or IMR corn hybrid is used. • Do not use if organic matter is >5% *and* soil pH is < 5.9 as poor weed control may result. • Do not use on peat or muck soils. • This product has a groundwater advisory statement. • Do not apply to sweet corn or popcorn. • Do not apply within 85 days of harvest. • Do not follow this treatment with a postemergence application of an ALS inhibitor herbicide *(Accent, Beacon, Basis, Basis Gold, Accent Gold, Permit)* if plants are under stress. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details. **INSECTICIDE INTERACTION** **Conventional and IT Corn:** • See Table 1M. • Do not apply to corn treated with any formulation of *Counter* or *Thimet* insecticides. Other organophosphate insecticides should be applied in a band (surface or T-band) to reduce risk of crop injury. **IR/IMR Corn:** • There are no restrictions regarding insecticide application. • Treat IT corn as conventional non-resistant corn.
	+	+	+	
	atrazine (commercial product)	1	1 qt 4L OR 1.1 lb 90% DG	

(Continued on next page)

CORN — PREEMERGENCE — MINERAL SOIL — ALL TILLAGE SYSTEMS (cont.)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves	flumetsulam + clopyralid	.034 + .094		• MUST BE COMBINED WITH ANOTHER HERBICIDE (PREMIX, TANK MIX, OR SEQUENTIAL APPLICATION) FOR CONTROL OF ANNUAL GRASSES AND NUTSEDGE. • Groundwater advisory statement. • See label or Table 11 for crop rotation restrictions. • Corn should be planted at least 1.5 inches deep. • Application rate varies by soil type. See label for details. • Do not apply to sweet corn or popcorn. • Do not apply within 85 days of harvest. • Do not use if organic matter is >5% *and* soil pH is < 5.9 as poor weed control may result. • Do not use if soil pH exceeds 7.8 as crop injury may occur. • Risk of corn injury increases as soil pH increases. • **Do not apply to soils with less than 1.5% organic matter as severe corn injury may occur.** • Risk of corn injury from flumetsulam is greatly reduced if an IR or IMR corn hybrid is used. • Do not follow this treatment with a postemergence application of an ALS inhibitor herbicide *(Accent, Beacon, Basis, Basis Gold, Accent Gold, Permit)* if plants are under stress. **INSECTICIDE INTERACTION** **Conventional and IT Corn:** • See Table 1M. • Do not apply to corn treated with any formulation of *Counter* or *Thimet* insecticides. Other organophosphate insecticides should be applied in a band (surface or T-band) to reduce risk of crop injury. **IR/IMR Corn:** • There are no restrictions regarding insecticide application. • Treat IT corn as conventional non-resistant corn.
	(Hornet)		2.4 oz 86% DG	
	OR		OR	
	(Hornet WDG)		3.0 oz 68.5% DG	
	+	+	+	
	atrazine (commercial product)	1	1 qt 4L OR 1.1 lb 90% DG	

CORN — EARLY POSTEMERGENCE — MINERAL SOIL

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses (except crabgrass) **Annual broadleaves**	rimsulfuron + thifensulfuron *(Basis)*	0.0156	⅓ oz 75% DG	• Timing is critical. Application window is narrow. • Treatment must be made when corn is between spike and 2-collar stage. DO NOT TREAT CORN OVER 6 INCHES TALL OR CORN WITH 3 COLLARS AS SEVERE INJURY MAY OCCUR. • *Basis* can also be applied preemergence. Use caution on coarse textured and low organic matter soils. See label for details. • Do not make more than 1 application per season. • *Basis* may also be tank mixed with atrazine 90DF or *Marksman.* See label for details. • Tank mixes containing dicamba *(Banvel, Clarity, Marksman)* applied to corn under stress may increase the risk of fused leaves in the whorl (rat tail). • Weeds must be 2 in. or less for adequate control. • Since this treatment provides limited residual weed control, application when grasses are 1 to 2 inches in height will usually provide the optimum results. • Rainfall within 5–7 days after application is required for residual activity of *Basis.* • Cultivation 10–14 days after application is usually needed for adequate season-long weed control and is generally recommended. • This program fits best in sites with low to moderate weed density. • Application of *Basis* alone for broad-spectrum weed control is not recommended. • Corn hybrids with a relative maturity rating less than 88 days vary in tolerance to *Basis.* Treatment of these hybrids may result in severe crop injury and is not recommended. • Refer to Table 11 for rotation crop restrictions. **INSECTICIDE INTERACTION** **Conventional and IT Corn:** • See Table 1M. • Do not apply *Basis* to corn previously treated with *Counter 15G* or an in-furrow application of *Counter 20CR* as severe injury may occur. • *Basis* application to corn previously treated with *Counter 20CR* (T-band), *Thimet, Dyfonate,* or *Lorsban* is not recommended. Risk of injury is especially great on soils with less than 4% organic matter. **IR/IMR Corn:** • There are no restrictions for *Basis* regarding organophosphate insecticides on IR/IMR corn. • Treat IT corn as conventional non-resistant corn.
	+ dicamba *(Banvel, Clarity)*	+ ⅛	+ ¼ pt	
	+ surfactant	+ ¼%	+ ¼%	
	+ 28% liquid nitrogen	+ 2 qt	+ 2 qt	

CORN — POSTEMERGENCE — ALL TILLAGE SYSTEMS

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (except lambsquarters)	halosulfuron *(Permit)*	0.03125	2/3 oz 75% DS	• Controls several broadleaved weeds including pig weed, ragweed, cocklebur, and velvetleaf. • Ineffective on lambsquarters. • Liquid nitrogen fertilizer (28% N) added at 4 qt/A may improve velvetleaf and pigweed control. • Apply to corn from spike through lay-by stage (canopy closure). • Use drop nozzles when corn canopy will prevent complete spray coverage of the weeds. • *Permit* may be tank mixed with 2,4-D, *Banvel, Clarity, Buctril, Buctril + atrazine,* atrazine, *Marksman, Accent,* or *Beacon.* See Table 1L. • Tank mixes containing dicamba *(Banvel, Clarity, Marksman)* applied to corn under stress may increase the risk of fused leaves in the whorl (rat tail). • There are no restrictions for *Permit* use regarding organophosphate insecticides. • Refer to Table 11 for rotation crop restrictions.
	+	+	+	
	surfactant	¼%	¼%	
	OR	OR	OR	
	crop oil concentrate	1%	1%	
Annual broadleaves	2,4-D amine	½	1 pt	• For corn over 6 to 8 in., use drop nozzles. • Ester formulations will cause more crop injury and are not recommended. • Use drift control additives with some 2,4-D amine products to reduce risk of spray particle drift. Check product label. • Not effective on smartweed or wild buckwheat. • Corn hybrids vary in sensitivity to 2,4-D. Consult seed company for details. • If 2,4-D ester is used, an application rate no higher than 1/4 lb ai/A is advised. 2,4-D ester is not recommended on corn due to risk of injury. • Most effective when weeds are small (2 to 4 in.). See Table 1K.
	dicamba *(Banvel, Clarity)*	½	1 pt	• Apply postemergence to corn from emergence up to the 5-leaf stage or 8 in. tall, whichever comes first. • *Banvel/Clarity* may be applied at ½ pt/A to corn up to 36 in. tall or 15 days before tassel emergence. Drop nozzles are recommended for corn over 8 in. tall. • Most effective when weeds are small (2 to 4 in.). See Table 1K. • AMS or 28% liquid nitrogen fertilizer may be added for improved control of larger velvetleaf. See label for details. • **Corn hybrids vary in sensitivity to dicamba. Consult seed company for details.** **OFF-TARGET INJURY** • USE EXTREME CAUTION. DRIFT TO NEARBY SENSITIVE CROPS IS A HAZARD. • To reduce the risk of volatilization, do not apply if the air temperature is expected to exceed 85° F on the day of application. • Use pressure no greater than 20 psi. • Do not apply if soybeans in the vicinity are over 10 in. tall or have begun to bloom. • Drift control agents may be used to reduce the risk of spray particle drift.

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CORN — POSTEMERGENCE — ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves	dicamba + diflufenzopyr *(Distinct)*	0.19 + 0.08	6 oz 70% DS	• Apply postemergence to corn between 4 and 10 in. in height. • *Distinct* is labeled for application at 4 oz/A to corn between 10 and 24 in. in height. Drop nozzles are recommended for application to corn more than 10 in. tall. • Two applications may be made per season but must be a minimum of 15 days apart. Do not apply more than a total of 10 oz/A per season. • Do not apply to corn showing injury from a previous herbicide application. • **Corn hybrids vary in sensitivity to dicamba. Consult seed company for details.** • Do not use crop oil concentrate or methylated seed oil as severe crop injury may result. • Do not tank mix *Distinct* with other herbicides that contain growth regulators such as 2,4-D, *Banvel, Clarity, Marksman, Celebrity, Northstar, Shotgun, Scorpion III, Hornet, Stinger,* or *Accent Gold.* • Do not tank mix *Distinct* with *Lorsban 4E, Ambush EC,* or *Warrior EC,* however sequential treatments may be made at least 7 days apart. • Most effective when weeds are small (2 to 4 in.). See Table 1K. • Provides limited suppression of annual grasses. • Do not cultivate for at least 7 days after application. • Do not harvest for 72 days after application. • Corn can be planted 7 or more days after application. **OFF-TARGET INJURY** • USE EXTREME CAUTION. DRIFT TO NEARBY SENSITIVE CROPS IS A HAZARD. • Use pressure no greater than 20 psi. • Do not apply if soybeans in the vicinity are 10 in. tall or have begun to bloom. • Drift reduction nozzles and drift control agents may be used to reduce the risk of spray particle drift. • To reduce the risk of off-target injury from herbicide volatilization, do not apply if air temperature is expected to exceed 85°F on the day of application. • Risk of off-target injury from herbicide volatilization is similar to *Clarity*.
	+ surfactant	+ ¼%	+ ¼%	
	+ 28% liquid nitrogen OR ammonium sulfate	+ 1.25% OR 17 lb/100 gal	+ 1.25% OR 17 lb/100 gal	

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CORN — POSTEMERGENCE — ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves	dicamba *(Banvel, Clarity)* + atrazine (commercial product)	½ + 1	1 pt + 1qt 4L OR 1.1 lb 90% DG	• Apply postemergence to corn from emergence up to the 5-leaf stage or 8 in. tall, whichever comes first. For larger corn, reduce *Banvel/Clarity* rate to 1/2 pt/A. Do not apply to corn over 12 in. tall. Drop nozzles are recommended for corn over 8 in. tall. See Table 1K. • Use lower rates on coarser soils or soils low in organic matter. • Treatment must follow a preplant-incorporated or pre-emergence herbicide application for grass control. • **Corn hybrids vary in sensitivity to dicamba. Consult seed company for details.** • Do not use with crop oil concentrate or other additives. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details. **OFF-TARGET INJURY** • Do not apply if soybeans in the vicinity are over 10 in. tall or have begun to bloom. • Drift control agents may be used to reduce the risk of spray particle drift. • See additional remarks and limitations for dicamba (*Banvel* or *Clarity*).
	bentazon *(Basagran)* + crop oil concentrate	1 + 1 qt	1 qt + 1 qt	• Corn is tolerant to *Basagran* at all growth stages. For best results, apply early to small weeds. See Table 1K. • Weak on pigweed, nightshade, and lambsquarters. • Use a minimum of 40 psi and 20 gal of water/A. • Urea ammonium nitrate (28% liquid nitrogen) may be used at 1 gal/A instead of crop oil concentrate for improved velvetleaf control. Do not use urea ammonium nitrate if common lambsquarters is present.
	bentazon *(Basagran)* + atrazine (commercial product) + crop oil concentrate	¾ + ¾ + 1 qt	¾ qt + ¾ qt 4L OR 0.8 lb 90% DG + 1 qt	• Do not apply to corn over 12 in. tall. • Gives better control of some broadleaf weeds, especially pigweed, then *Basagran* alone. • Combination reduces risk of carryover from postemergence application of atrazine alone. • Urea ammonium nitrate (28% liquid nitrogen) may be used at 1 gal/A instead of crop oil concentrate. Do not use urea ammonium nitrate if common lambsquarters is present. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details. • Rates may be reduced to ½ lb/A for each herbicide if weeds are small. See *Laddok* label for details.
	bromoxynil *(Buctril, Moxy)*	⅜	1½ pt 2L	• Apply to corn between the 4-leaf stage (4 visible leaves) and prior to tassel emergence. • For best results, weeds must be small (see label or Table 1K). • Good spray coverage is important. • Do not mix with spray additives or liquid fertilizers unless specified for tank mixes. • For ground applications, use minimum of 20 gal of water/A and 30 psi. • Redroot pigweed and mustard must be controlled when very small (refer to label for details).

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CORN — POSTEMERGENCE — ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves	bromoxynil *(Buctril, Moxy)*	¼	1 pt	• Apply to corn after emergence but before corn is 12 in. tall.
	+	+	+	• Apply to weeds less than 4 in. tall for effective control. See Table 1K.
	atrazine (commercial product)	½	½ qt 4L OR 0.6 lb 90% DG	• Good spray coverage is important. • Do not mix with spray additives or liquid fertilizers. • Better control of redroot pigweed and wild mustard than *Buctril/Moxy* alone. • Combination reduces risk of carryover from post-emergence application of atrazine alone. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details.
	2,4-D amine	¼	½ pt	• DO NOT APPLY DURING OR SHORTLY AFTER PERIODS OF COOL, WET OR CLOUDY WEATHER. • For corn over 8 in. tall, use drop nozzles. • Do not treat plants under stress. • Do not use additives. • Do not apply more than 5½ oz. *Sencor* 75% DF per acre per season. • *Sencor* may also be tank mixed with atrazine, *Banvel, Clarity, Basagran, Buctril, Buctril Gel, Laddok, Marksman,* or *Pursuit* (Clearfield Corn hybrids only). See label for rates, additives, application timing, and other restrictions. • Do not graze or harvest for silage or grain for 60 days after treatment.
	+	+	+	
	metribuzin *(Sencor)*	0.09	2 oz 75% DF	
	flumetsulam + clopyralid + 2,4-D *(Scorpion III)*	0.023 + 0.06 + 0.125	.25 lb 84% DG	• Apply broadcast to corn up to 8 inches tall or 5 fully exposed leaf collars (V5). • Use drop nozzles for corn over 8 inches tall or V5 to minimize corn exposure to the herbicide. • Do not cultivate for 10 days after application. • Do not apply to field corn grown for seed. • Do not apply to sweet corn or popcorn. • Foliar-applied organophosphate insecticides may increase risk of corn injury from flumetsulam. A time interval of at least 7 days between application of *Scorpion III* and organophosphate insecticides is advised. See Table 1M. • Refer to Table 11 for rotation crop restrictions. • Do not apply to corn previously treated with a pre-emergence or preplant incorporated application of *Python* or *Hornet.* • Can be tank mixed with *Accent.* See Table 1L.
	+	+	+	
	surfactant	¼%	¼%	
	+	+	+	
	28% liquid nitrogen	2.5% (V/V)	2.5% (V/V)	

(Continued on next page)

CORN — POSTEMERGENCE — ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves	flumetsulam + clopyralid *(Hornet)* OR *(Hornet WDG)* + surfactant OR crop oil concentrate + 28% liquid nitrogen OR ammonium sulfate	.03 + .09 + ¼% OR 1% + 2.5% OR 2 lb	 2.4 oz 85.6% DG OR 3.0 oz 68.5% DG + ¼% OR 1% + 2.5% OR 2 lb	• Apply to corn up to 20 inches tall or 6 collars. • Refer to Table 11 for rotation crop restrictions. • Tank mixing required for control of pigweed and lambsquarters. • Preharvest interval is 85 days. • Do not tank mix *Hornet* with *Bladex, Basagran, Lightning, Extrazine* or *Laddok* as severe crop injury may occur. **INSECTICIDE INTERACTION** **Conventional and IT Corn:** • Do not apply to corn previously treated with *Counter* or *Thimet* insecticide, as severe injury may occur. See Table 1M. • A time interval of at least 10 days between application of *Hornet* and organophosphate insecticides is advised. **IR/IMR Corn:** • There are no restrictions regarding soil-applied insecticide interactions. • Treat IT corn as conventional non-resistant corn.
	dicamba *(Banvel, Clarity)* + primisulfuron *(Beacon)* + surfactant	.125 + 0.0234 + ¼%	4 oz. + ½ oz 75% DG + ¼%	• Apply to corn between 4 and 8 inches tall. • Application to corn between 8 and 20 inches is labeled but not recommended due to risk of corn injury. • Liquid nitrogen fertilizer (28% N) added at 4 qt/A in addition to surfactant may improve control of certain species. • Refer to Table 11 for rotation crop restrictions. • Refer to Insecticide Interaction remarks for *Beacon* in the Corn—Postemergence section. • **Corn hybrids vary in sensitivity to dicamba. Consult seed company for details.** • Tank mixes containing dicamba *(Banvel, Clarity, Marksman)* applied to corn under stress may increase the risk of fused leaves in the whorl (rat tail). • See additional remarks and limitations for dicamba. • Do not graze or feed forage from treated corn to livestock within 30 days after application. Do not harvest silage within 45 days after application. Do not harvest grain within 60 days after application. • A premix of dicamba and primisulfuron, *Northstar,* is available. See Table 11 for details.

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CORN — POSTEMERGENCE — ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Nightshade, pigweed, and velvetleaf	carfentrazone *(AIM)*	.008	⅛ oz 40% DG	• Apply to corn up to 8 collars. • Apply when weeds are 2 to 4 inches. • Will control large velvetleaf (up to 36 inches). • May be tank mixed with other postemergence corn herbicides to control additional weed species. Follow all restrictions on the tank mix herbicide label. See label for details. • Ammonium sulfate (2–4 lbs/A) or 28% liquid nitrogen (2–4 qts/100 gal) may be added if recommended on the label of the tank mix herbicide. • To avoid significant crop response, applications should not be made within 6–8 hours of either rain or irrigation. • *Aim* should be mixed first in the spray tank. • Sprayers should be adjusted to position spray tips a minimum of 18 inches above the crop and operated to avoid the application of excessive herbicide rates directly over the rows and/or into the whorl of treated crop plants. • Under extremely dry conditions, crop oil concentrate (1%) can be used in place of surfactant but is generally not recommended due to risk of severe crop injury. • There are no restrictions regarding harvesting for forage. • Any crop may be planted after 30 days following application of *Aim* except barley, rye, and oats which can be planted 12 mo. after application.
	+	+	+	
	surfactant	¼%	¼%	
ONLY ragweed, cocklebur, jimsonweed, and Jerusalem artichoke	clopyralid *(Stinger)*	0.094	¼ pt	• Apply to field corn up to 24 in. tall. • Apply in 10 gal. of water or more per acre. • Treat ragweed, cocklebur, jimsonweed, and Jerusalem artichoke up to the 5-leaf stage. • Do not apply more than ⅔ pt per acre per year.
Perennial sowthistle, Canada thistle	clopyralid *(Stinger)*	0.188	½ pt	• Apply to field corn up to 24 in. tall. • Apply in 10 gal. of water or more per acre. • Treat thistle plants at least 6 to 8 in. in diameter or height but before the bud stage. • Do not cultivate before treatment. • Cultivation may be used 14 to 20 days after treatment. • Rate may be increased to ⅔ pt per acre for dense infestations. • Do not apply more than ⅔ pt per acre per year.
Velvetleaf	flumiclorac *(Resource)*	0.027	4 oz .86L	• Very effective on velvetleaf. • Apply to corn between the 2-collar and 10-collar stage. • Use drop nozzles when corn canopy will prevent complete spray coverage of the weeds. • *Resource* may be tank mixed with atrazine, *Accent, Banvel,* and 2,4-D. See Table 1L. • There are no restrictions for *Resource* regarding organophosphate insecticides. • There are no rotation crop restrictions.
	+	+	+	
	crop oil concentrate	1 pt	1 pt	

CORN — POSTEMERGENCE — ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves **Annual grasses** (except green foxtail, giant foxtail, fall panicum, witchgrass, and crabgrass)	atrazine (commercial product) + crop oil concentrate	2 + 1 qt	2 qt 4L OR 2⅛ lb 90% DG + 1 qt	• Do not apply to corn over 12 in. tall. • Emergency use. • Grasses must be less than 1½ in. tall. See Table 1K. • Timing of application is critical to get best results. • Surfactant at 1 pt/A may be used in place of crop oil concentrate but is less effective. • Greater chance for carryover because treatment is later in season. • Do not add *Banvel/Clarity* or 2,4-D or crop injury may occur. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details.

CORN — POSTEMERGENCE — ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves **Fall panicum**	primisulfuron (*Beacon)* + crop oil concentrate OR surfactant	0.0356 + 1% OR ¼%	0.76 oz. 75% DG + 1% OR ¼%	• Apply to corn between 4 in. and 20 in. in height. • The recommended rate may be split into two applications. The second application of the split should be made when the new weed growth is at the optimum height. Do not treat corn after tassel emergence. Do not apply more than 0.76 oz. of *Beacon* per acre in one season. • Crop oil concentrate or surfactant must be added to obtain adequate results. Liquid nitrogen fertilizer (28% N) added at 4 qt/A **in addition to** crop oil concentrate or surfactant may improve control of certain species. • Cultivation 7 to 14 days after treatment may improve control. • A small number of corn hybrids are classifed as "potentially susceptible." Use of *Beacon* on these hybrids is not recommended. Consult the chemical dealer, seed dealer, or manufacturer for the current list of potentially susceptible hybrids. • Inbred lines grown for hybrid seed production may be severely injured by *Beacon* application. Therefore inbred lines should be thoroughly tested for potential sensitivity to *Beacon* before treating large acreage. • *Beacon* may be tank mixed with *Banvel, Clarity, Buctril, Buctril Gel,* or 2,4-D for control of a broader spectrum of weeds. See Table 1L for details on application timing and spray additives. • Tank mixes containing dicamba *(Banvel, Clarity, Marksman)* applied to corn under stress may increase the risk of fused leaves in the whorl (rat tail). • Refer to Table 11 for rotation crop restrictions. • Refer to label for special sprayer cleanup instructions. **INSECTICIDE INTERACTION** **Conventional and IT Corn:** • See Table 1M. • Do not apply *Beacon* to corn previously treated with *Counter 15G* (any application method) or *Counter 20CR* applied in-furrow. • *Beacon* application to corn previously treated with *Counter 20CR* banded (surface band or T-band) is not recommended. • Applying *Beacon* to corn previously treated with other soil-applied organophosphate insecticides (*Thimet, Dyfonate, Lorsban,* etc.) may result in temporary crop injury. • Soil-applied insecticides other than organophosphates do not increase corn injury from *Beacon.* • Do not treat with a foliar-applied organophosphate insecticide such as *Lorsban* or malathion or with *Basagran* or *Laddok* within 10 days before or 7 days after *Beacon* application. **IR/IMR Corn:** • There are no restrictions for *Beacon* regarding organophosphate insecticides on IR/IMR corn. • Treat IT corn as conventional non-resistant corn.

CORN — POSTEMERGENCE — ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses (except crabgrass) **Pigweed, Smartweed, Jimsonweed**	nicosulfuron (*Accent*) + crop oil concentrate OR surfactant	0.03125 + 1% + ¼%	⅔ oz 75% DF + 1% + ¼%	• Apply broadcast or with drop nozzles to corn up to 20 in. tall (free-standing) or that exhibits 6 or fewer collars, whichever is more restrictive. • For corn 20-36 in. tall use drop nozzles. Do not apply to corn taller than 36 in. or exhibiting 10 collars, whichever is more restrictive. • A second application may be made 2 to 4 weeks later. Do not apply more than 1⅓ oz. per acre in one season. • Crop oil concentrate or surfactant must be added to obtain adequate control. Liquid nitrogen fertilizer (28% N) added at 4 qt/A **in addition** to crop oil concentrate or surfactant may improve control of certain species. • Cultivation 7 to 14 days after treatment may improve control. • *Accent* may be tank mixed with atrazine, *Buctril, Buctril + Atrazine, Banvel, Clarity, Marksman* or *Northstar* for control of a broader spectrum of weeds. See Table 1L for details on application timing and spray additives. • Tank mixes containing dicamba *(Banvel, Clarity, Marksman)* applied to corn under stress may increase the risk of fused leaves in the whorl (rat tail). • Control of green and yellow foxtail may be antagonized with tank mixes of *Accent* with *Buctril, Banvel, Clarity,* or *Marksman.* Timely cultivation or a second application may be required for complete control. • Refer to Table 11 for rotation crop restrictions. • Refer to label for special sprayer cleanup instructions. **INSECTICIDE INTERACTION** **Conventional and IT Corn:** • See Table 1M. • Do not apply *Accent* to corn previously treated with *Counter 15G* insecticide as severe corn injury may result. • *Accent* may be applied to corn previously treated with a banded (surface band or T-band) application of *Counter 20CR*. However, planned programs which include both *Accent* and *Counter* are not recommended. The risk of crop injury is reduced, but not eliminated, by banded application of *Counter 20CR*. Risk of corn injury is greatest on soils with 4% or less organic matter. • Applying *Accent* to corn previously treated with other soil-applied organophosphate insecticides (*Thimet, Dyfonate, Lorsban,* etc.) may result in temporary crop injury. • Soil-applied insecticides other than organophosphates do not increase corn injury from *Accent.* • Do not apply to corn that has been treated within seven days before with foliar-applied organophosphate insecticides such as *Lorsban* or malathion or with the herbicides *Basagran* or *Laddok* as severe injury may result. Do not apply these materials within three days after *Accent* application. **IR/IMR Corn:** • There are no restrictions for *Accent* regarding organophosphate insecticides on IR/IMR corn. • Treat IT corn as conventional non-resistant corn.

CORN — POSTEMERGENCE — ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses (except crabgrass) **Annual broadleaves**	nicosulfuron +rimsulfuron + atrazine *(Basis Gold)* + crop oil concentrate + 28% liquid nitrogen OR ammonium sulfate	.012 + .012 + .76 + 1% + 2 qt OR 2 lb	14 oz 89.5% DG + 1% + 2 qt OR 2 lb	• Apply to corn up to 12 inches or 6 collars. • To minimize risk of corn injury: – DO NOT treat if nighttime temperatures are below 40°F or daytime temperatures are above 92°F. – DO NOT treat Hi-Lysine corn or white corn. – Injury may occur to hybrids with relative maturities of less than 88 days. Refer to DuPont list of approved short season hybrids. – Risk of injury is greater following several days of cool, cloudy conditions. – Risk of injury increases with corn height. • *Basis Gold* may be tank mixed with *Banvel, Clarity,* or *Hornet* to improve broadleaf control, especially larger weeds and weeds under drought stress. • Tank mixes containing dicamba *(Banvel, Clarity, Marksman)* applied to corn under stress may increase the risk of fused leaves in the whorl (rat tail). • Do not tank mix with *Bladex, Basagran,* or *Laddok* as severe crop injury may occur. • Tank mixes with 2,4-D may cause severe grass control antagonism. • See Table 11 for rotation crop restrictions. • Mixing, loading, and application setbacks are required for atrazine. See label and pg. 12–13 for details. • *Basis Gold* will have very little residual activity in organic soils. **INSECTICIDE INTERACTION** **Conventional and IT Corn:** • See Table 1M. • Do not apply *Basis Gold* to corn previously treated with *Counter 15G* or an in-furrow application of *Counter 20CR* as severe injury may occur. • *Basis Gold* application to corn previously treated with *Counter 20CR* (T-band), *Thimet, Dyfonate* or *Lorsban* is not recommended. Risk of injury is especially great on soils with less than 4% organic matter. **IR/IMR Corn:** • There are no restrictions for *Basis Gold* regarding organophosphate insecticides on IR/IMR corn. • Treat IT corn as conventional non-resistant corn.

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CORN — POSTEMERGENCE — ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual grasses	nicosulfuron	.012	2.9 oz 83.8% DG	• Apply to corn up to 12 inches or 6 collars.
(except crabgrass)	+ rimusulfuron	+ .012		• To minimize risk of corn injury:
Annual broadleaves	+ flumetsulam	+ .035		– DO NOT treat if nighttime temperatures are below 40°F or daytime temperatures are above 92°F.
	+ clopyralid	+ .094		– DO NOT treat Hi-Lysine corn, or white corn.
	(Accent Gold)			– Injury may occur to hybrids with relative maturities of less than 88 days. Refer to DuPont list of approved short season hybrids.
	+	+	+	– Risk of injury is greater following several days of cool, cloudy conditions.
	crop oil concentrate	1%	1%	– Risk of injury increases with corn height.
	+	+	+	• *Accent Gold* can be tank mixed with atrazine, *Clarity, Banvel,* or *Marksman* to improve broadleaf control, especially larger weeds and weeds under drought stress.
	28% liquid nitrogen	2 qt	2 qt	• Tank mixes containing dicamba *(Banvel, Clarity, Marksman)* applied to corn under stress may increase the risk of fused leaves in the whorl (rat tail).
	OR	OR	OR	• Do not tank mix with *Bladex, Basagran,* or *Laddok* as severe injury may occur.
	ammonium sulfate	2 lb	2 lb	• Tank mixes with 2,4-D may cause severe grass control antagonism.
				• See Table 11 for crop rotation restrictions.
				• *Accent Gold* will have very little residual activity in organic soils.
				• Do not apply *Accent Gold* to corn previously treated with *Python, Hornet,* or *Broadstrike + Dual.*
				• Do not use *Accent Gold* and either *Hornet, Scorpion,* or *Stinger* in the same growing season.
				INSECTICIDE INTERACTION
				Conventional and IT Corn:
				• See Table 1M.
				• Do not apply *Accent Gold* to corn previously treated with *Counter 15G, Counter 20CR,* or *Thimet.*
				• Accent *Gold* applied to corn previously treated with *Dyfonate* or *Lorsban* is not recommended due to risk of injury.
				IR/IMR Corn:
				• There are no restrictions for *Accent Gold* regarding organophosphate insecticides on IR/IMR corn.
				• Treat IT corn as conventional non-resistant corn.

CORN — POSTEMERGENCE DIRECTED — ALL TILLAGE SYSTEMS

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves **Annual grasses**	ametryne *(Evik)* + surfactant	1¾ + ½%	2 lb + ½%	• CAUTION — KEEP OFF CORN FOLIAGE. • Do not use before corn is 12 in. tall. • Emergency use. • Use drop nozzles or directed spray. • Shields provide additional protection against corn injury. • Apply in a minimum of 20 gal of water per acre. • Do not exceed 20 psi nozzle pressure. • Double outlet 150° nozzles or two nozzles mounted double swivel are preferred. • Refer to label for rotation crop restrictions. • Generally more effective on annual grasses than *Lorox* or *Linex*. • See label and Table 1K for maximum weed size. Selectivity is based on tall corn and small weeds.
	linuron *(Lorox* or *Linex)* + surfactant	1½ + ½%	3 pt 4L OR 3 lb 50% DF + ½%	• CAUTION — KEEP OFF CORN FOLIAGE. • Do not use before corn is 15 in. tall. • Emergency use. • Use drop nozzles or directed spray. • Shields provide additional protection against corn injury. • Apply in a minimum of 20 gal of water per acre. • Do not exceed 20 psi nozzle pressure. • Double outlet 150° nozzles or two nozzles mounted double swivel are preferred. • Use lower rates on lighter soils or soils low in organic matter. • For control of small weeds not over 2 in. tall. See Table 1K. Selectivity is based on tall corn and small weeds.
	paraquat *(Gramoxone Extra)* OR *(Gramoxone Max)* + surfactant	0.38 + ¼%	 1.2 pt 2.5 L OR 1 pt 3L + ¼%	• CAUTION — KEEP OFF CORN FOLIAGE. • Do not use before corn is at least 10 in. tall. See Table 1K. • Emergency use. • Use drop nozzles or directed spray. • Shields provide additional protection against corn injury. • Apply in 20 gal or more of water per acre. • Do not exceed 20 psi nozzle pressure. • Arrange nozzles to spray no higher than the lower 3 in. of the corn stalks if corn 10 in. tall. For corn greater than 20 in. tall, arrange nozzles to spray no higher than the lower 1/3 of corn stalks. • Leaves exposed to the spray will be burned. • Weeds 6 in. or taller may not be controlled. • Do not mix with liquid fertilizer. • Use caution to avoid spray drift.

TABLE 1B–CHEMICAL WEED CONTROL IN IMIDAZOLINONE RESISTANT CORN (Clearfield Corn)

In addition to the herbicide options in Tables 1A, the following herbicides and herbicide combinations may be applied to corn hybrids warranted by the seed company to possess **resistance** to direct application of imidazolinone herbicides. These hybrids are designated as IR, IT, IMR, IPRO, IMI-CORN or Clearfield-Corn. These hybrids vary in cross-resistance to other herbicide families (ie. sulfonylureas), however they all appear to possess adequate resistance to *Lightning*. The following table describes recommended postemergence treatments with *Lightning*. These treatments should follow *Eradicane, Lasso, Micro-Tech, Partner, Dual, Dual II, Harness, Surpass, TopNotch,* or *Frontier* as listed under "Corn-Preplant — Mineral Soil" section, or *Lasso, Micro-Tech, Partner, Prowl, Dual, Dual II, Harness, Surpass, TopNotch, Degree* or *Frontier* as listed under "Corn-Preemergence — Mineral Soil" section.

IMIDAZOLINONE RESISTANT CORN

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves **Giant foxtail**	imazethapyr + imazapyr *(Lightning)* + 28% liquid nitrogen OR ammonium sulfate + surfactant	0.042 + 0.014 + 1 qt OR 2.5 lb + ¼%	1.28 oz + 1 qt OR 2.5 lb + ¼%	• **USE ONLY ON IMIDAZOLINONE RESISTANT/ TOLERANT CORN (IMI CORN).** • Apply before weeds exceed 4 inches and corn exceeds 12 inches. • *Lightning* should be tank mixed with *Banvel, Clarity, Distinct, Buctril,* or atrazine for improved ragweed control. See *Lightning* and tank mix herbicide labels for restrictions. • See practices to prevent/delay herbicide resistant weeds, pg. 15–16. • See Table 11 for rotation crop restrictions. • Do not graze or feed treated forage, silage, fodder, or grain for at least 45 days after application. • Do not harvest for 45 days after application. • Do not apply *Pursuit* or *Pursuit Plus* the same year as *Lightning.* • Do not make more than one application of *Lightning* to a field in one growing season. • See Table 1M for insecticide restrictions. • Always add both surfactant and nitrogen fertilizer (28% liquid nitrogen or ammonium sulfate). • Use of crop oil concentrate or methylated seed oil increases the risk of crop injury, especially under cool, wet weather or hot, humid conditions. • Do not use crop oil concentrate or methylated seed oil with tank mixtures including *Buctril.*

TABLE 1C–CHEMICAL WEED CONTROL IN LIBERTY RESISTANT/LIBERTY LINK CORN

In addition to the herbicides on Table 1A, the following herbicides and herbicide combinations may be applied to corn resistant to *Liberty* herbicide. These hybrids are designated as Liberty Link.

LIBERTY RESISTANT CORN

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses **Annual broadleaves**	glufosinate *(Liberty)* + ammonium sulfate	0.31 + 3.0	24 oz + 3.0 lbs	• **APPLY ONLY TO CORN RESISTANT TO LIBERTY HERBICIDE.** • One application of *Liberty* alone will not consistently provide season-long control. One of the following strategies is recommended: 1) Preemergence herbicide application followed by *Liberty* postemergence. Preemergence herbicide options include: – Atrazine (1 lb ai/A) – Any herbicide or herbicide combination labeled for preemergence application in corn. 2) Postemergence tank mixture with *Liberty.* See label for details. 3) Postemergence *Liberty* application followed by a second herbicide application or cultivation as needed. Cultivation should be 10 to 14 days after *Liberty* application. • Apply to corn up to 24 inches or V7, whichever comes first. • Always add ammonium sulfate. Sufactant is not needed. • Treat when annual weeds are 2–4 inches in height. • Minimum carrier volume of 15 gallons per acre. • Do not use drift control agents since this reduces spray coverage and may result in reduced weed control. • Do not apply *Liberty* within 60 days of harvesting corn forage or within 70 days of harvesting corn grain. • *Liberty* will not control perennnial weeds. • Application should be made between dawn and two hours before sunset to avoid the risk of reduced control of lambsquarters and velvetleaf. • Weed control may be reduced if application is made when weeds are under stress due to drought, cool temperatures, or extended periods of cloudiness. • No insecticide interaction restrictions. • Application rate ranges from 16 oz to 28 oz/A. See label.

TABLE 1D–CHEMICAL WEED CONTROL IN GLYPHOSATE RESISTANT CORN

In addition to the herbicides listed in Table 1A, the following herbicides and herbicide combinations may be applied to Roundup resistant corn. These hybrids are designated as *Roundup Ready* Corn.

ROUNDUP READY CORN

Weed Controlled	Herbicide	Rate lb/A a.e.	Formulation/A	Remarks and Limitations
Annual grasses **Annual broadleaves** **Suppression of perennials**	glyphosate *(Roundup Ultra)* OR (others—See Table 1E) + ammonium sulfate	0.56 + 17 lb/100 gal	 24 oz 3L a.e. OR (See Table 1E) + 17 lb/100 gal	• **APPLY TO *ROUNDUP READY* CORN ONLY.** • See Table 1E for glyphosate products labeled for postemergence application on *Roundup Ready* Corn. • One application of glyphosate alone will not consistently provide season-long control. One of the following strategies is recommended: 1) Preemergence herbicide application followed by glyphosate postemergence. Preemergence herbicide options include: – atrazine (1 lb ai/A) – any herbicide or herbicide combination labeled for preemergence application in corn. 2) Postemergence tank mixture with glyphosate. Refer to glyphosate product label for details. Tank mixtures with some residual herbicides may cause temporary burn, discoloration, or growth reduction. Temporary corn injury occured from tank mixtures with *Harness Xtra 5.6L* in 1998 MSU trials. 3) Postemergence glyphosate application followed by a second herbicide application or cultivation as needed. Cultivation should be 10 to 14 days after glyphosate application. • See Table 1E for recommended additives for glyphosate products. • Apply when annual weeds are 2 to 4 inches in height. • Apply to corn up to 30 inches or 8 collars. • Increase glyphosate rate to 0.75 lb a.e./A for improved control of velvetleaf, common lambsquarters, and giant ragweed. • A second glyphosate application may be made if needed at a rate up to 0.75 lb a.e./A. Make second application before weeds exceed 4 inches. • Use extreme caution to avoid spray drift to sensitive crops. • Do not apply more than 2 qt/A in-crop per season. • Do not harvest for forage within 50 days after application. • Control of perennial broadleaf weeds will be improved with a second application of glyphosate. • Addition of ammonium sulfate will minimize antagonism from hard water or tank mixtures and is always recommended.

TABLE 1E – GLYPHOSATE PRODUCTS REGISTERED FOR POSTEMERGENCE APPLICATION IN *ROUNDUP READY* CORN

BRAND NAME CONTAINING GLYPHOSATE	MANUFACTURER	GLYPHOSATE FORMULATION (lb/gal) a.e.[a]	GLYPHOSATE ACID (a.e./Acre)	TYPICAL FORMULATION RATE/A	SURFACTANT NEEDED?[b]	ADD AMS?
Glyfos X-tra	Cheminova	3	0.56	24 fl oz/A	No	Yes
Glyphomax[c]	Dow AgroSciences	3	0.56	24 fl oz/A	Yes	Yes
Glyphomax Plus[c]	Dow AgroSciences	3	0.56	24 fl oz/A	No	Yes
Mirage	UAP	3	0.56	24 fl oz/A	Yes	Yes
Roundup Original	Monsanto	3	0.56	24 fl oz/A	Yes	Yes
Roundup Ultra	Monsanto	3	0.56	24 fl oz/A	No	Yes
Roundup UltraDry	Monsanto	65%	0.56	14 oz/A	No	Yes
Roundup UltraMAX	Monsanto	3.7	0.56	19 fl oz/A	No	Yes
Silhouette	Agriliance	3	0.56	24 fl oz/A	Yes	Yes

[a]a.e. acid equivalent, lbs of active glyphosate herbicide per gallon.

[b]For products that need a surfactant, a nonionic surfactant at 1/4% v/v is the typical recommendation. Consult the herbicide label to verify the type and rate of surfactant to include.

[c]Not available for use on *Roundup Ready* Corn until January 1, 2001.

TABLE 1F – CHEMICAL WEED CONTROL IN NO-TILL CORN

BURNDOWN HERBICIDES

Effective weed control in no-tillage corn production requires complete control of all weeds, cover crops, and sod plants present at the time of planting. Alfalfa and quackgrass sods must be treated prior to planting. Burndown of annual weeds and cover crops can be accomplished with burndown herbicides. Burndown herbicides such as *Roundup Ultra, Touchdown* or other glyphosate products (Table 2C) or *Gramoxone Extra/Gramoxone Max* can be used alone prior to planting to avoid excessive cover crop growth. *Gramoxone Extra/Gramoxone Max* provides faster kill. *Roundup Ultra, Touchdown* or other glyphosate products (Table 2C) may provide better control if weed or cover crop growth is dense. They are preferred for perennial weeds or seedling grasses before completion of tillering..

Listed below are specific recommendations for control of legume sod and quackgrass sod. Table 1G contains weed response ratings for several sod species.

For weed control in no-till corn planted into grain stubble or row crop residue (with or without a cover crop) a burndown herbicide must be used. Refer to Table 1H for burndown herbicide options.

Herbicides listed in the Corn-Preemergence and Corn-Postemergence sections may be used in all tillage systems including no-till. For many preemergence herbicides, complete closure of the seed furrow is critical to avoid crop injury.

With preemergence herbicides, many situations require little or no adjustment in application rates. However, dense plant residue and the total reliance on herbicides for weed control may require that herbicides be used at the higher end of the labelled rate range for the soil type.

NO-TILL CORN — LEGUME SOD

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
FALL application followed by preemergence				
Alfalfa sod **Quackgrass** **Annual broadleaves** **Annual grasses**	glyphosate *(Roundup Ultra,* others)	1½	2 qt 3L a.e.	• Apply glyphosate in fall. • Best timing for treatment is 4 to 6 weeks after last alfalfa harvest. • Alfalfa should be at least 4 in. tall and actively growing. • Quackgrass, if present, should be at least 8 in. tall actively growing. • Air temperature should be at least 60°F.
	FOLLOWED BY:			
	atrazine (commercial product) + Burndown (See Table 1H)	2	2 qt 4L	• Postemergence *Banvel, Clarity* or 2,4-D may be needed to control alfalfa escapes. • *Lasso, Micro-Tech, Partner, Frontier, Harness, Surpass, TopNotch, Dual, Dual II, Dual Magnum, Dual II Magnum,* or *Axiom* may be included if annual grasses are expected to be a serious problem. • If weeds are small, the rate of *Gramoxone Extra/ Gramoxone Max* or glyphosate may be reduced. See label for details. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details.

NO-TILL — LEGUME SOD (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
FALL application followed by preemergence				
Alfalfa sod **Annual broadleaves** **Annual grasses**	2,4-D ester FOLLOWED BY:	1¼	1¼ qt	• Apply 2,4-D in fall. • Alfalfa should be at least 4 in. tall and actively growing at treatment time. • Air temperature should be at least 60°F.
	atrazine (commercial product) + Burndown (See Table 1H)	2	2 qt 4L OR 2⅛ lb 90% DG	• Apply atrazine + *Gramoxone Extra/Gramoxone Max* or glyphosate at planting time. • Postemergence *Banvel* or 2,4-D may be needed to control alfalfa escapes. • Quackgrass is usually not at the proper state of growth (8 in. tall) for maximum effectiveness from glyphosate treatment at corn planting. (See "Quackgrass" section for notes on glyphosate use.) • *Lasso, Micro-Tech, Partner, Frontier, Harness, Surpass, TopNotch, Dual, Dual II, Dual II Magnum, Dual Magnum,* or *Axiom* may be included if annual grasses are expected to be a serious problem. • If weeds are small, the rate of *Gramoxone Extra/Gramoxone Max* or glyphosate may be reduced. See label for details. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details.
SPRING application followed by preemergence				
Alfalfa sod **Annual broadleaves** **Annual grasses**	2,4-D ester FOLLOWED BY:	1¼	1¼ qt	• Apply 2,4-D 7 to 10 days before planting. • Alfalfa should be at least 4 in. tall at treatment time. • Apply atrazine and *Gramoxone Extra/Gramoxone Max* or glyphosate at planting time.
	atrazine (commercial product) + Burndown (See Table 1H)	2	2 qt 4L OR 2⅛ lb 90% DG	• Postemergence *Banvel/Clarity* or 2,4-D may be needed to control alfalfa escapes. • Quackgrass is usually not at the proper stage of growth (8 in. tall) for maximum effectiveness from glyphosate treatment at corn planting. (See "Quackgrass" section for notes on glyphosate use.) • *Lasso, Micro-Tech, Partner, Frontier, Harness, Surpass, TopNotch, Dual, Dual II, Dual Magnum, Dual II Magnum,* or *Axiom* may be included if annual grasses are expected to be a serious problem. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details.

NO-TILL — QUACKGRASS SOD

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
FALL application followed by preemergence				
Alfalfa **Quackgrass** **Annual broadleaves** **Annual grasses**	glyphosate *(Roundup Ultra,* others*)* FOLLOWED BY:	1½	2 qt 3L a.e.	• Apply glyphosate in fall. • Quackgrass should be at least 8 in. tall and actively growing. • Air temperature should be at least 60°F.
	atrazine (commercial product) + Burndown (See Table 1H)	2	2 qt 4L OR 2½ lb 90% DG	• *Lasso, Micro-Tech, Partner, Frontier, Harness,* 30 gal of water/A with *Roundup Ultra. Surpass, TopNotch, Dual Dual II, Dual Magnum, Dual II Magnum, or Axiom* may be included if annual grasses are expected to be a serious problem. • Mixing, loading, and application setbacks are required for atrazine and cyanazine. See label and pg. 12–13 for details.

TABLE 1G – PLANT RESPONSE TO BURNDOWN HERBICIDES IN SOD

	Alfalfa	Red Clover	Hairy Vetch	Dandelion	Curled Dock	Bromegrass	Timothy	Bluegrass	Orchardgrass	Quackgrass
Fall Application[a]										
Roundup Ultra (1 qt/A)[cd] or Touchdown 5 (.87 qt/A)[c]	**F-G**	**F-G**	**F-G**	F	–	**G**	**G**	**G**	**G**	**G-E**
Roundup Ultra (2 qt/A)[cd] or Touchdown 5 (1.74 qt/A)[c]	**G-E**	**G-E**	**G-E**	**G**	–	**E**	**E**	**E**	**E**	**E**
2,4-D Ester (1 qt/A)	**F-G**	F	F	**G**	–	N	N	N	N	N
Roundup Ultra + 2,4-D Ester (1 qt/A + 1 qt/A)[cd]	**G**	**G**	**G**	**G**	–	**G**	**G**	**G**	**G**	**G-E**
Touchdown 5 + 2,4-D Ester (.87 qt/A + 1 qt/A)[c]	**G**	**G**	**G**	**G**	–	**G**	**G**	**G**	**G**	**G-E**
Roundup Ultra + 2,4-D Ester (2 qt/A + 1 qt/A)[cd]	**G-E**	**G-E**	**G-E**	**G**	–	**E**	**E**	**E**	**E**	**E**
Touchdown 5 + 2,4-D Ester (1.74 qt/A + 1 qt/A)[c]	**G-E**	**G-E**	**G-E**	**G**	–	**E**	**E**	**E**	**E**	**E**
Spring Application[b]										
Roundup Ultra (1 qt/A)[cd] or Touchdown 5 (.87 qt/A)[c]	F	F	F	P	P	F	F	**G**	P	**G**
Roundup Ultra (2 qt/A)[cd] or Touchdown 5 (1.74 qt/A)[c]	**F-G**	**F-G**	**F-G**	P	F	**G**	**G**	**G**	F	**E**
2,4-D Ester (1 qt/A)	**F-G**	**F-G**	**F-G**	**G**	P	N	N	N	N	N
Roundup Ultra + 2,4-D Ester (1 qt/A + 1 qt/A)[cd]	**F-G**	**F-G**	**F-G**	**G**	P-F	F	F	**G**	P	**G**
Touchdown 5 + 2,4-D Ester (.87 qt/A + 1 qt/A)[c]	**F-G**	**F-G**	**F-G**	**G**	P-F	F	F	**G**	P	**G**
Roundup Ultra + 2,4-D Ester (2 qt/A + 1 qt/A)[cd]	**G**	**G**	**G**	**G**	F	**G**	**G**	**G**	F	**E**
Touchdown 5 + 2,4-D Ester (1.74 qt/A + 1 qt/A)[c]	**G**	**G**	**G**	**G**	F	**G**	**G**	**G**	F	**E**

P = Poor; F = Fair; G = Good; E = Excellent; N = None; – = Not enough information to rank

a. Ideal timing is 4 to 6 weeks after mowing. Mow in late August–early September and treat in early–mid October in central or southern Michigan.
b. Treat when plants reach at least 6 inches tall.
c. Addition of ammonium sulfate (AMS) at 17 lbs/100 gal of water often improves control.
d. Other glyphosate products can be substituted for *Roundup Ultra*. Always check the herbicide label for instructions on the addition of non-ionic surfactant. See Table 2C.

TABLE 1H – EFFECTIVENESS OF HERBICIDES FOR BURNDOWN IN CORN*,**

	ANNUAL BROADLEAVES										ANNUAL GRASSES								WINTER ANNUALS/PERENNIALS							COVER CROPS			
	Cocklebur	Jimsonweed	Lambsquarters	Nightshade	Pigweed	Ragweed (Common)	Ragweed (Giant)	Smartweed	Velvetleaf	Wild Mustard	Barnyardgrass	Crabgrass	Giant Foxtail	Green Foxtail	Yellow Foxtail	Fall Panicum	Witchgrass	Sandbur	Chickweed (common)	Yellow Rocket	Shepards' purse	Pennycress	Marestail (Horseweed)	Dandelion	Quackgrass	Rye	Wheat	Clover	Hairy Vetch
	Maximum Weed Height (inches)																		Herbicide Effectiveness										
Atrazine (1 lb ai/A)[ad]	2	2	2	2	2	2	2	2	2	2	NR	NR	NR	NR	NR	NR	NR	NR	–	G	E	G	G	P	P	P	P	P	P
Atrazine (2 lb ai/A)[ad]	3	3	3	3	3	3	3	3	3	3	NR	NR	NR	1½	1½	NR	NR	NR	–	E	E	E	E	F	F	F	F	F	F
2,4-D Ester (1 pt/A)	3	NR	3	3	3	3	3	NR	2	3	NR	NR	NR	NR	NR	NR	NR	NR	P	F	G	F	E	F	N	N	N	F	F
2,4-D Ester (1 qt/A)	6	3	6	6	6	6	6	3	5	6	NR	NR	NR	NR	NR	NR	NR	NR	F	G	E	G	E	G	N	N	N	G	G
Roundup Ultra (1 pt/A)[be]	5	2	2	2	5	2	NR	NR	NR	5	NR	–	5	5	5	–	–	–	E	G	E	G	G	P	P	G	G	P	P
Touchdown 5 (.87 pt/A)[b]	5	2	2	2	5	2	NR	NR	NR	5	NR	–	5	5	5	–	–	–	E	G	E	G	G	P	P	G	G	P	P
Roundup Ultra (1 qt/A)[be]	16	10	10	10	16	10	5	5	5	16	5	–	16	16	16	–	–	–	E	E	E	E	E	P	F	E	E	F	F
Touchdown 5 (.87 qt/A)[b]	16	10	10	10	16	10	5	5	5	16	5	–	16	16	16	–	–	–	E	E	E	E	E	P	F	E	E	F	F
Gramoxone Extra (1½ pt/A)[c] Gramoxone Max (1¼ pt/A)[c]	3	3	3	3	3	3	3	NR	3	3	3	3	3	3	3	3	3	3	E	G	G	G	P	P	P	F	F	P	P
Gramoxone Extra (2½ pt/A)[c] Gramoxone Max (2.1 pt/A)[c]	6	6	6	6	6	6	6	NR	6	6	6	6	6	6	6	6	6	6	E	E	E	E	P	P	P	G	G	F	F

P = Poor; F = Fair; G = Good; E = Excellent; N = None; NR = Not Recommended; – = Not enough information to rank

*Burndown effectiveness varies depending on several factors. This table is intended as a guide to relative effectiveness of burndown herbicide options. This table assumes tank mix applications with residual herbicides.

**To avoid excessive cover crop growth, 2,4-D, *Gramoxone Extra*, or *Roundup Ultra, Touchdown* or other glyphosate products (Table 2C) may be applied prior to planting.

a. Always add crop oil concentrate at 1 qt/A to maximize foliar activity.

b. Addition of ammonium sulfate at 17 lbs/100 gal of water often improves control.

c. Always add surfactant with *Gramoxone Extra* or *Gramoxone Max*. Use 1/2 pt/100 gal of water. Double surfactant in liquid nitrogen fertilizer. Regrowth of rye or wheat may occur if plants are not fully tillered when treated.

d. Use of liquid nitrogen fertilizer as the herbicide carrier will improve burndown.

e. Other glyphosate products can be substituted for *Roundup Ultra*. Always check the herbicide label for instructions on the addition of non-ionic surfactant. See Table 2C.

TABLE 1I –
HERBICIDE PREMIXES IN CORN

TRADE NAME	COMPANY	FORMULATION	TYPICAL USE RATE	=	EQUIVALENT RATES
Accent Gold	DuPont	83.8% DG	2.9 oz/A	=	.25 oz Accent + .188 oz ai rimsulfuron + 2.4 oz Hornet
Axiom AT	Bayer	75%	2.75 lb/A	=	15.8 oz Axiom + 1.5 lb Atrazine 90 DG
Basis	DuPont	75% DG	.33 oz/A	=	.165 oz a.i. rimsulfuron + .33 oz Pinnacle
Basis Gold	DuPont	89.5% DG	14 oz/A	=	0.25 oz Accent + .188 oz a.i. rimsulfuron + .84 lb Atrazine 90 DF
Bicep Lite II	Novartis	4.9L	2.4 qt/A	=	2 pt Dual II + 1 qt Atrazine 4L
Bicep II	Novartis	5.9L	2.4 qt/A	=	2 pt Dual II + 1.6 qt Atrazine 4L
Bicep Lite II Magnum	Novartis	6L	1.5 qt/A	=	1.33 pt Dual II Magnum + 1 qt Atrazine 4L
Bicep II Magnum	Novartis	5.5L	2.1 qt/A	=	1.33 pt Dual II Magnum + 1.6 qt Atrazine 4L
Bicep Magnum TR	Novartis	4.59L	2 qt/A	=	1.33 pt Dual II Magnum + 1 lb ai Atrazine + 0.9 oz Python
Broadstrike + Dual	Novartis	7.67L	2.25 pt/A	=	1.14 oz Python + 2.1 pt Dual
Bronco	Monsanto	4L	4 qt/A	=	2.6 qt Lasso + 1.4 qt Roundup
Buctril + Atrazine	Rhone-Poulenc	3L	3 pt/A	=	0.75 qt Buctril 2E + 0.75 qt Atrazine 4L
Bullet	Monsanto	4L	3 qt/A	=	1.88 qt Micro-Tech + 1.13 qt Atrazine 4L
Celebrity	BASF	Co-pack	6.67 oz/A	=	.67 oz Accent (Celebrity G) + .53 pt Banvel (Celebrity B)
Celebrity Plus	BASF	70% DG	4.7 oz/A	=	4.0 oz Distinct + .67 oz Accent
Degree Xtra	Monsanto	4L	3 qt/A	=	4.3 pt Degree + 1.0 Atrazine 4L
Double Play	Zeneca	7L	5.7 pt/A	=	4.75 pt Eradicane + 1.25 pt Surpass
Extrazine II DF	DuPont	90% DF	1.5 lb/A	=	1.125 lb Bladex 90 DF + 0.38 lb Atrazine 90
Field Master	Monsanto	4.06L	1 gal/A	=	2.3 pt Harness + 1.5 qt Atrazine 4L + 1.5 pt Roundup Ultra
Fultime	Zeneca	4L	2.7 qt/A	=	2 qt TopNotch + 1 qt Atrazine 4L
Guardsman	BASF	5L	4.5 pt/A	=	28 fl. oz. Frontier + 1.5 qt Atrazine 4L
Harness Xtra	Monsanto	6L	2 qt/A	=	2.5 pt Harness + 0.8 qt Atrazine 4L
Harness Xtra 5.6L	Monsanto	5.6L	2 qt/A	=	1.8 pt Harness + 1.25 qt Atrazine 4L
Hornet	Dow AgroSciences	85.6%	2.4 oz/A	=	0.68 oz Python + 0.25 pt Stinger

TABLE 1I –

HERBICIDE PREMIXES IN CORN

TRADE NAME	COMPANY	FORMULATION	TYPICAL USE RATE	=	EQUIVALENT RATES
Hornet WDG	Dow AgroSciences	68.5%	3.0 oz/A	=	0.7 oz Python + 0.25 pt Stinger
Laddok	BASF	5L	2.4 pt/A	=	0.75 qt Basagran + 0.75 qt Atrazine 4L
Lariat	Monsanto	4L	3 qt/A	=	1.88 qt Lasso + 1.13 qt Atrazine 4L
LeadOff	DuPont	5L	2 qt/A	=	25 fl oz Frontier + 1.34 qt Atrazine 4L
Liberty ATZ	Aventis	4.3 L	40 fl oz/A	=	24 fl oz Liberty + 1 qt Atrazine 4L
Lightning	BASF	70% DG	1.28 oz/A	=	1 oz Pursuit 70% DG + imazapyr
Marksman	BASF	3.2L	3.5 pt/A	=	1 pt Banvel + 1 qt Atrazine 4L
Northstar	Novartis	43.8% DG	5 oz/A	=	0.5 oz Beacon + 3.6 fl oz Banvel
Ready Master ATZ	Monsanto	3.5L	2 qt/A	=	1 qt Roundup Ultra + 1 qt Atrazine 4L
Scorpion III	Dow AgroSciences	84% DG	.25 lb/A	=	0.47 oz Python + .17 pt Stinger + .25 pt 2,4-D
Shotgun	United Agri Products	3.25L	1 qt/A	=	0.56 qt Atrazine 4L + 0.5 pt 2,4-D Ester
Surpass 100	Zeneca	4.9L	2.2 qt/A	=	2 pt Surpass + 1.1 qt Atrazine 4L

TABLE 1J–WEED RESPONSE TO HERBICIDES IN CORN*

	MODE OF ACTION	CORN TOLERANCE**	ANNUAL BROADLEAVES												ANNUAL GRASSES								PERENNIALS				
			COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	T-R LAMBSQUARTERS[a]	NIGHTSHADE (BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	RAGWEED (GIANT)	SMARTWEED	VELVETLEAF	WILD MUSTARD	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	SANDBUR	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE	JOHNSONGRASS (seedling)	JOHNSONGRASS (Rhizome)
Preplant Incorporated																											
ATRAZINE	C	1	F	F	E	N	E	G	E	G	G	F	E	G	P	F	F	G	P	P	P	F	F	F	N	N
AXIOM	O/C	3	P	P	G	–	F	G	F	P	F	F	P	E	E	E	E	E	E	E	F	N	N	F	P	N
BLADEX	C	2	P	N	F	N	F	P	F	P	F	N	F	F	F	F	F	F	F	F	P	N	N	N	N	N
BROADSTRIKE + DUAL	B/O	3	F	F	E	E	G	E	F	P	G	G	E	E	E	E	E	E	E	E	F	N	N	G	P	N
DUAL II MAGNUM	O	1	N	N	P	P	F	G	P	N	P	N	P	E	E	E	E	E	E	E	F	N	N	G	P	N
ERADICANE	O	2	P	P	F	F	P	F	F	P	F	F	F	E	E	E	E	E	E	E	G	N	F	G	F	P
FRONTIER/OUTLOOK	O	2	N	N	P	P	G	G	P	N	P	N	P	E	E	E	E	E	E	E	F	N	N	F	P	N
HARNESS/SURPASS/TOPNOTCH/DEGREE	O	2	P	N	F	F	G	G	F	N	P	P	P	E	E	E	E	E	E	E	F	N	N	G	P	N
HORNET/HORNET WDG	B/O	3	G	F	E	E	G	E	E	G	G	G	E	N	N	N	N	N	N	N	N	F	N	N	N	N
LASSO/PARTNER/MICRO-TECH	O	2	N	N	P	P	G	G	P	N	P	N	P	E	E	E	E	E	E	E	F	N	N	F	P	N
PRINCEP	C	1	F	F	E	N	E	G	E	F	G	F	E	G	F	F	F	G	P	P	P	P	F	F	N	N
PYTHON	B	3	F	F	E	E	G	E	F	P	G	G	E	P	P	F	P	P	P	P	P	N	N	N	N	N
Preemergence																											
ATRAZINE	C	1	F	F	E	N	E	G	E	G	G	F	E	G	P	F	F	G	P	P	P	F	F	F	N	N
AXIOM	O/C	3	P	P	G	–	F	G	F	P	F	F	P	E	E	E	E	E	E	E	F	N	N	P	P	N
BLADEX	C	2	P	N	F	N	F	P	F	P	F	N	F	F	F	F	F	F	F	F	P	N	N	N	N	N
BROADSTRIKE + DUAL	B/O	3	F	F	E	E	E	E	F	P	G	G	E	E	E	E	E	E	E	E	F	N	N	F	P	N
DUAL II MAGNUM	O	1	N	N	P	P	F	G	P	N	P	N	P	E	E	E	E	E	E	E	F	N	N	F	P	N
FRONTIER/OUTLOOK	O	2	N	N	P	P	G	G	P	N	P	N	P	E	E	E	E	E	E	E	F	N	N	F	P	N
HARNESS/SURPASS/TOPNOTCH/DEGREE	O	2	P	N	F	F	G	G	F	N	P	P	P	E	E	E	E	E	E	E	F	N	N	F	P	N
HORNET/HORNET WDG	B/O	3	G	F	E	E	G	E	E	G	G	G	E	N	N	N	N	N	N	N	N	F	N	N	N	N
LASSO/PARTNER/MICRO-TECH	O	2	N	N	P	P	G	G	P	N	P	N	P	E	E	E	E	E	E	E	F	N	N	P	P	N
PRINCEP	C	1	F	F	E	N	E	G	E	F	G	F	E	G	F	F	F	G	P	P	P	P	F	F	N	N
PROWL	O	3	N	N	E	E	P	F	P	N	P	F	P	G	G	G	G	G	G	G	G	N	N	N	P	N
PYTHON	B	3	F	F	E	E	G	E	F	P	G	G	E	P	P	F	P	P	P	P	P	N	N	N	N	N
RAMROD	O	2	N	P	P	P	N	F	P	–	P	P	P	G	E	E	E	E	G	G	F	N	N	N	P	N

Herbicide Mode of Action: A = ACCase Inhibitor; B = ALS Inhibitor; C = Photosynthesis Inhibitor; O = Other

Herbicide Effectiveness: P = Poor; F = Fair; G = Good; E = Excellent; N = None; – = Not enough information to rank

**The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.*

***Crop Tolerance: 1=Minimal risk of crop injury; 2=Crop injury can occur under certain conditions (soil applied—cold, wet: foliar applied—hot, humid); 3=Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4=Risk of severe crop injury is high. Recommended only in rescue situations.

[a] Triazine-resistant lambsquarters

TABLE 1J–WEED RESPONSE TO HERBICIDES IN CORN*

			ANNUAL BROADLEAVES											ANNUAL GRASSES								PERENNIALS				
	MODE OF ACTION	CORN TOLERANCE**	COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	T-R LAMBSQUARTERS[a]	NIGHTSHADE (BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	RAGWEED (GIANT)	SMARTWEED	VELVETLEAF	WILD MUSTARD	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	SANDBUR	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE	JOHNSONGRASS (seedling)	JOHNSONGRASS (Rhizome)
Postemergence																										
ACCENT	**B**	2	F	**G**	F	F	P	**E**	P	N	**G**	F	–	**E**	P	**E**	**E**	**E**	**E**	**E**	**G**	F	**G**	F	**E**	**G**
ACCENT GOLD	**B**/O	3	**E**	**G**	F	F	F	**E**	**E**	**E**	**E**	**G**	**G**	**G**	P[d]	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	P	**G**	F
AIM	O	3	P	–	F	F	**G**	**G**	P	P	P	**E**	–	N	N	N	N	N	N	N	N	N	N	N	N	N
ATRAZINE	**C**	1	**G**	**G**	**E**	N	**G**	**E**	**E**	**G**	**G**	F	**E**	F	P	F	**G**	**G**	P	P	P	F	F	F	N	N
BANVEL/CLARITY	O	3	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**E**	**E**	F	**G**	N	N	N	N	N	N	N	N	F	N	N	N	N
BANVEL + ATRAZINE (MARKSMAN)	O/**C**	3	**G**	**G**	**E**	**G**	**G**	**E**	**E**	**E**	**E**	**G**	**E**	P	P	P	F	F	P	P	P	F	P	F	N	N
BASAGRAN	O	1	**E**	**G**	F	F	P	P	F	P	**G**	F	**E**	N	N	N	N	N	N	N	N	**G**	N	**G**	N	N
BASAGRAN + ATRAZINE (LADDOK)	O/**C**	1	**E**	**G**	**G**	F	F	**G**	**E**	**G**	**G**	**G**	**E**	P	P	P	F	F	P	P	P	F	P	**G**	N	N
BASIS	**B**	3	F	–	**G**	**G**	P	**E**	P	P	**E**	**G**	**G**	**G**	P	F	F	F	F	F	P	P	P	N	F	P
BASIS GOLD	**B**/**C**	3	F	**G**	**G**	F	**G**	**E**	**G**	**G**	**E**	**G**	**G**	**G**	P[d]	**G**	**G**	**G**	**G**	**G**	**G**	F	**G**	F	**G**	F
BEACON	**B**	2	**E**	**G**	F	F	**G**	**E**	**E**	**E**	**G**	**G**	F	P	P	F	F	F	**G**	**G**	F	F	**G**	F	**G**	F
BUCTRIL/MOXY	O	2	**G**	**G**	**E**	**E**	**G**	F	**G**	**G**	**G**	**G**	F	N	N	N	N	N	N	N	N	P	N	N	N	N
BUCTRIL + ATRAZINE	O/**C**	2	**G**	**G**	**E**	**E**	**G**	**G**	**E**	**E**	**G**	**G**	**G**	P	P	P	F	F	P	P	P	P	P	F	N	N
DISTINCT	O	3	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**E**	**E**	**G**	**G**	P	P	P	P	P	P	P	P	**G**	N	N	N	N
HORNET/HORNET WDG	**B**/O	2	**E**	F	F	F	F	P	**G**	**E**	**G**	**G**	**G**	N	N	N	N	N	N	N	N	**G**	N	N	N	N
LIBERTY (Liberty Resistant Corn only)[c]	O	1	**E**	**G**	F	F	**G**	**G**	**E**	**G**	**G**	**G**	**E**	F	F	**G**	**G**	F	F	F	P	P	P	P	**G**	F
LIGHTNING (Clearfield Corn only)[b]	**B**	2	**E**	**G**	**G**	**G**	**G**	**E**	F	F	**G**	**G**	**G**	F	F	**G**	F	F	F	F	F	F	P	F	**G**	**G**
PERMIT	**B**	1	**E**	**G**	N	N	P	**E**	**G**	**G**	F	**G**	–	N	N	N	N	N	N	N	N	P	N	**E**	N	N
RESOURCE	O	2	P	P	F	F	P	P	P	P	P	**E**	P	N	N	N	N	N	N	N	N	N	N	N	N	N
ROUNDUP ULTRA (RR Corn only)[ce]	O	1	**E**	**E**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**E**	**E**	**E**	**G**	**G**	**G**	**G**	**E**	F	**E**	**E**
SCORPION III	**B**/O	3	**E**	F	**G**	**G**	F	**G**	**G**	**G**	**G**	**G**	**G**	N	N	N	N	N	N	N	N	F	N	N	N	N
SENCOR + 2,4-D AMINE	C/O	3	**G**	**G**	**G**	F	F	**E**	F	F	**G**	**G**	**G**	N	N	N	N	N	N	N	N	P	N	N	N	N
STINGER	O	1	**E**	**G**	P	P	F	P	**G**	**E**	F	P	P	N	N	N	N	N	N	N	N	**G**	P	N	N	N
2, 4-D AMINE	O	3	**G**	F	**G**	**G**	**G**	**G**	**G**	**G**	P	F	**G**	N	N	N	N	N	N	N	N	F	N	N	N	N
Postemergence Directed																										
EVIK	**C**	4	**G**	**G**	**G**	N	**G**	**G**	**G**	F	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	F	P	F	P	P
GRAMOXONE EXTRA/GRAMOXONE MAX	O	4	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	F	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	P	P	P	P	P
LINEX/LOROX	**C**	4	F	F	**G**	**G**	**G**	**G**	**G**	F	**G**	**G**	**G**	F	F	F	F	F	F	F	F	N	N	N	P	P

Herbicide Mode of Action: A = ACCase Inhibitor; B = ALS Inhibitor; C = Photosynthesis Inhibitor; O = Other

Herbicide Effectiveness: P = Poor; F = Fair; G = Good; E = Excellent; N = None; – = Not enough information to rank

**The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.*

**Crop Tolerance: 1=Minimal risk of crop injury; 2=Crop injury can occur under certain conditions (soil applied—cold, wet: foliar applied—hot, humid); 3=Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4=Risk of severe crop injury is high. Recommended only in rescue situations.

[a] Triazine-resistant lambsquarters

[b] Apply to Clearfield Corn only.

[c] Must add nitrogen fertilizer for velvetleaf control.

[d] Basis Gold and Accent Gold are more effective (F) on large crabgrass up to 1".

[e] For consistent velvetleaf control, treat before plants exceed 4".

TABLE 1K – WEED AND CROP HEIGHTS FOR POSTEMERGENCE HERBICIDE APPLICATIONS IN CORN*

Herbicide[b]		ANNUAL BROADLEAVES											ANNUAL GRASSES								CORN	
		COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	T-R LAMBSQUARTERS[c]	NIGHTSHADE (BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	RAGWEED (GIANT)	SMARTWEED	VELVETLEAF	WILD MUSTARD	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	SANDBUR		
	RATE/A	MAXIMUM HEIGHT[a]											MAXIMUM HEIGHT[a]								MINIMUM[a] HEIGHT	MAXIMUM[a] HEIGHT
Broadcast																						
Accent	⅔ oz	NR	3″	NR	NR	NR	4″	NR	NR	4″	NR	–	4″	NR	4″	4″	4″	4″	4″	3″	None	20″ or 6 collars
Accent Gold	2.9 oz	6″	4″	NR	NR	NR	4″	6″	6″	6″	6″	6″	3″	NR	3″	3″	3″	3″	3″	2″	None	12″ or 6 collars
Aim	½ oz	NR	–	NR	NR	4″	4″	NR	NR	NR	36″	–	NR	NR	NR	NR	NR	NR	NR	NR	None	8 collars
Atrazine 4L	2 qt	4″	4″	6″	NR	4″	6″	4″	4″	4″	NR	4″	NR	NR	NR	1½″	1½″	NR	NR	NR	None	12″
Banvel/Clarity	1 pt	4″	4″	4″	4″	4″	4″	4″	4″	6″	NR	2″	NR	NR	NR	NR	NR	NR	NR	NR	None	8″ or 5 lf
Banvel + Atrazine 4L	1 pt + 2 pt	6″	6″	6″	4″	6″	6″	6″	6″	8″	6″	6″	NR	NR	NR	NR	NR	NR	NR	NR	None	8″ or 5 lf
Basagran	2 pt	10″	10″	NR	NR	NR	NR	NR	NR	10″	NR	8″	NR	NR	NR	NR	NR	NR	NR	NR	None	None
Basagran + Atrazine 4L	1.4 pt + 1.4 pt	8″	8″	8″	NR	NR	6″	5″	6″	12″	10″	8″	NR	NR	NR	NR	NR	NR	NR	NR	None	12″
Basis	½ oz	NR	NR	3″	3″	NR	3″	NR	NR	3″	3″	3″	2″	NR	2″	2″	2″	2″	2″	NR	None	2 collars or 6″
Basis Gold	14 oz	NR	4″	3″	NR	3″	4″	3″	3″	4″	3″	3″	3″	NR	3″	3″	2″	3″	3″	2″	None	12″ or 6 collars
Beacon	.76 oz	4″	4″	NR	NR	4″	4″	9″	9″	4″	4″	NR	NR	NR	NR	NR	NR	2″	2″	NR	4″	20″
Buctril, Moxy	1½ pt	10″	6″	8″	8″	6″	NR	6″	6″	6″	5″	NR	NR	NR	NR	NR	NR	NR	NR	NR	None	d
Buctril + Atrazine	1½ pt + 1½ pt	12″	6″	12″	8″	6″	6″	6″	10″	8″	6″	4″	NR	NR	NR	NR	NR	NR	NR	NR	None	12″
Distinct	6 oz	4″	4″	4″	4″	4″	4″	4″	4″	6″	4″	2″	NR	NR	NR	NR	NR	NR	NR	NR	4″	10″
Hornet/Hornet WDG	2.4 oz/3.0 oz	6″	NR	NR	NR	NR	NR	6″	6″	6″	4″	4″	NR	NR	NR	NR	NR	NR	NR	NR	None	20″ or 6 collars
Liberty (Liberty Link only)	24 oz	4″	4″	NR	NR	2″	3″	4″	4″	4″	3″	4″	2″	2″	4″	4″	2″	2″	2″	NR	None	24″ or 7 collars
Lightning (Clearfield Corn only)	1.28 oz	4″	3″	3″	3″	3″	6″	NR	NR	3″	3″	–	2″	2″	4″	2″	2″	2″	2″	2″	None	12″
Permit	⅔ oz	9″	6″	NR	NR	NR	3″	9″	3″	NR	6″	–	NR	NR	NR	NR	NR	NR	NR	NR	None	canopy closure
Resource	4 oz	NR	NR	NR	NR	NR	NR	NR	NR	NR	5 lf	NR	NR	NR	NR	NR	NR	NR	NR	NR	2 lf	10 collars or canopy closure
Roundup Ultra (RR Corn only)	24 oz	6″	6″	3″	3″	4″	4″	4″	6″	4″	4″	6″	6″	4″	6″	6″	6″	6″	6″	6″	None	30″ or 8 collars
Scorpion III	.25 lb	4″	NR	4″	4″	NR	4″	4″	4″	4″	4″	4″	NR	NR	NR	NR	NR	NR	NR	NR	None	8″ or 5 collars
Sencor + 2,4-D amine	2 oz + ½ pt	8″	5″	6″	NR	NR	6″	NR	NR	4″	4″	4″	NR	NR	NR	NR	NR	NR	NR	NR	None	8″
Stinger	¼ pt	5 lf	5 lf	NR	NR	NR	NR	5 lf	5 lf	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	None	24″
2,4-D amine	1 pt	4″	NR	4″	4″	4″	4″	4″	4″	NR	NR	4″	NR	NR	NR	NR	NR	NR	NR	NR	None	8″
Directed																						
Evik	2 lb	3″	3″	3″	NR	3″	3″	3″	NR	3″	3″	3″	3″	3″	3″	3″	3″	3″	3″	4″	12″	3 wk before tasseling
Gramoxone Extra	1.2 pt	3″	3″	3″	3″	3″	3″	3″	3″	NR	3″	3″	3″	3″	3″	3″	3″	3″	3″	3″	10″	3 wk before tasseling
Gramoxone Max	1.0 pt	3″	3″	3″	3″	3″	3″	3″	3″	NR	3″	3″	3″	3″	3″	3″	3″	3″	3″	3″	10″	3 wk before tasseling
Lorox/Linex (50% DF)	3 lb	NR	NR	3″	3″	3″	3″	3″	NR	3″	3″	3″	NR	NR	NR	NR	NR	NR	NR	NR	15″	3 wk before

[a] NR = not recommended; – = not enough information to rank; lf = leaf stage.
[b] Consult label for recommended additives.
[c] Triazine-resistant lambsquarters.
[d] Before tassel emergence
*The weed heights and growth stages listed in this table are estimates of the maximum size where consistent control is expected. The maximum height for effective control in any specific situation is dependent on environment conditions including soil moisture, temperature, and relative humidity.

TABLE 1L – TANK-MIX COMBINATIONS, ADDITIVES AND APPLICATION TIMING FOR SELECTED HERBICIDES

Herbicides	Additives					Maximum Corn Height
	None	Surfactant[a]	COC[b]	Surfactant + 28% N[c]	COC + 28%N	
Accent						
Alone	no	¼%	1%	¼% + 4 qt/A[f]	1% + 2–4 qt/A[f]	20 in. or 6 collar
+ Atrazine	no	no	1%	no	1% + 2–4 qt/A[f]	12 in.
+ Banvel/Clarity	no	¼%	no	¼% + 4 qt/A[f]	no	8 in. or 5 leaf
+ Buctril[d]	no	¼%	no	¼% + 4 qt/A[f]	no	20 in. or 6 collar
+ Buctril + atrazine[d]	no	¼%	no	¼% + 4 qt/A[f]	no	12 in.
+ Marksman	no	¼%	no	¼% + 4 qt/A[f]	no	8 in. or 5 leaf
+ Scorpion III	no	¼%	no	¼% + 2 qt/A[f]	no	8 in. or 5 collar
+ Northstar	no	no	no	no	1% + 2–4 qt[f]	20 in. or 6 collar
Beacon						
Alone	no	¼%	1%	¼% + 4 qt/A[f]	1% + 2–4 qt/A[f]	20 in.
+ Buctril[d]	no	¼%	no	¼% + 4 qt/A[f]	no	20 in.
+ Banvel/Clarity	no	¼%	no	¼% + 4 qt/A[f]	no	8 in. or 5 leaf
+ 2,4-D	no	¼%	no	¼% + 4 qt/A[f]	no	8 in.
+ Atrazine	no	no	1%	no	1% + 2–4 qt/A[f]	12 in.
+ Buctril + atrazine[d]	no	¼%	no	¼% + 4 qt/A[f]	no	12 in.
+ Marksman	no	¼%	no	¼% + 4 qt/A[f]	no	8 in. or 5 leaf
+ Accent	no	¼%	1%	¼% + 4 qt/A[f]	1% + 2–4 qt/A[f]	20 in.
Hornet/Hornet WDG						
Alone	no	¼%	1%	¼% + 2.5%	1% + 2.5%[f]	20 in. or 6 collar
+ Accent	no	¼%	1%	¼% + 4 qt/A[f]	1% + 2–4 qt/A[f]	20 in. or 6 collar
+ Basis Gold	no	no	1%	no	1% + 2 qt/A[f]	12 in. or 6 collar
+ Atrazine	no	no	1%	no	no	12 in.
+ Banvel/Clarity	no	¼%	no	¼% + 2.5%	no	8 in. or 5 leaf
+ 2,4-D Amine	no	¼%	no	¼% + 2.5%	no	8 in.
+ Buctril	no	¼%	no	¼% + 2.5%	no	20 in. or 6 collar
Permit						
Alone	no	¼%	1%	¼% + 4 qt/A[f]	1% + 2–4 qt/A[f]	canopy closure
+ Banvel/Clarity	no	¼%	no	no	no	8 in. or 5 leaf
+ 2,4-D	no	¼%	no	no	no	8 in.
+ Buctril[d]	no	¼%	no	no	no	before tassel emergence
+ Buctril + atrazine[d]	no	¼%	no	no	no	12 in.
+ Atrazine[e]	no	no	1%	no	no	12 in.
+ Accent	no	¼%	1%	¼% + 4 qt/A[f]	1% + 2–4 qt/A[f]	20 in. or 6 collar
+ Beacon	no	¼%	1%	¼% + 4 qt/A[f]	1% + 2–4 qt/A[f]	20 in.
+ Marksman	no	¼%	no	no	no	8 in. or 5 leaf
Resource						
Alone	no	no	1 pt/A	no	1 pt/A + 2%	10 collar or canopy closure
+ Atrazine	no	no	1 pt/A	no	no	12 in.
+ Accent	no	no	1 pt/A	no	1% + 2–4 qt/A[f]	20 in. or 6 collar
+ Banvel	yes	no	no	no	no	8 in. or 5 leaf
+ 2,4-D Ester	yes	no	no	no	no	8 in.
+ 2,4-D Amine	no	¼%	no	no	no	8 in.

[a] Non-ionic surfactant
[b] Crop oil concentrate
[c] 28% liquid nitrogen fertilizer (urea-ammonium nitrate)
[d] Severe leaf burn can occur if application is made under high temperature/high humidity conditions or if treatment follows several days of cool, cloudy weather.
[e] Atrazine may cause antagonism (reduced control) on large broadleaved weeds.
[f] Or spray grade ammonium sulfate (AMS) at 2–4 lbs/A. See labels for details.

TABLE 1M – HERBICIDE: ORGANOPHOSPHATE INSECTICIDE COMPATIBILITY CHART FOR CONVENTIONAL AND IT CORN*

Herbicide	Soil applied OPs[1]						Foliar applied OPs[4]	
	Counter 15G	Counter 20CR (in furrow)	Counter 20CR (banded)	Thimet/ phorate	Dyfonate, Lorsban	Other[2]	Days before herbicide[5]	Days after herbicide[6]
Accent	Do not use	Do not use	NR	T	T	T	7	3
Accent Gold	Do not use	Do not use	Do not use	Do not use	NR	T	7	3
Beacon	Do not use	Do not use	NR	T	T	T	10	7
Basis	Do not use	Do not use	NR	NR	NR	T	7	3
Basis Gold	Do not use	Do not use	NR	NR	NR	T	7	3
Broadstrike/Dual	Do not use	Do not use	Do not use	Do not use	T[3]	T[3]	NA	NA
Hornet/Hornet WDG soil applied	Do not use	Do not use	Do not use	Do not use	T[3]	T[3]	NA	NA
Hornet/Hornet WDG foliar applied	Do not use	Do not use	Do not use	Do not use	T[3]	T[3]	10	10
Lightning (IT Corn only)	Do not use	Do not use	T[3]	T[3]	T[3]	T[3]	—	—

[1] Do not use=do not apply herbicide to corn previously treated with soil applied OP insecticide, as severe injury may result; NR=application of herbicide to corn previously treated with soil applied OP is not recommended; T=application of herbicide to corn previously treated with soil applied OP may result in temporary injury; —=no information or not applicable; NA=not applicable.

[2] Includes diazinon and *Mocap. Aztec* and *Fortress* do not appear to interact with the herbicides listed and can be used without risk of injury.

[3] OP insecticides should be applied in a band treatment to reduce risk of crop injury.

[4] Includes dimethoate *(Cygon),* diazinon, *Disyston, Imidan, Lorsban,* malathion, and *Penncap-2FM.* Also includes the herbicides *Basagran* and *Laddok.*

[5] Foliar applied OP may be safely applied this many days *before* herbicide treatment.

[6] Foliar applied OP may be safely applied this many days *after* herbicide treatment.

Note: Non-OP insecticides do not interact with the herbicides listed and can be used without the risk of injury from an OP insecticide-herbicide interaction. These insecticides include *Furadan, Dipel, Condor, Javelin, Biobit, MVP, M-Peril, Sevin, Asana, Warrier, Lannate,* metaldehyde, *Ambush, Pounce, Comite, Omite,* and *Force.*

TABLE 2A–CHEMICAL WEED CONTROL IN SOYBEANS

PREPLANT INCORPORATED

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses	trifluralin *(Treflan)*	¾	1½ pt	• Incorporate in top 2 or 3 in. of soil within 24 hr. after application. • On sandy and sandy loam soils low in organic matter, use ½ lb a.i./A (1 pt/A). • Most effective control if application is made 10 days to 2 weeks ahead of planting and field is reworked just prior to planting.
	pendimethalin *(Prowl)*	1	2.4 pt 3.3 EC OR 1.6 lb 60 DG	• Incorporate in top 2 to 3 in. of soil. • Incorporate within 7 days of application unless rainfall occurs.
	ethalfluralin *(Sonalan)*	0.9	2½ pt	• Incorporate in top 2 to 3 in. of soil. • Incorporate within 2 days of application.
Annual grasses Yellow Nutsedge	alachlor *(Lasso, Micro-Tech,* or *Partner)*	2.5	2.5 qt OR 3.8 lb 65% DG	• Alachlor is a **restricted use** pesticide. • Incorporate in top 2 to 3 in. of soil. • Alachlor rate should be increased to 3 qt/A (4.5 lb 65% DG) for effective nutsedge control.
	s-metolachlor *(Dual Magnum, Dual II Magnum)*	1.27	1.33 pt	• Incorporate in top 2 to 3 in. of soil. • *Dual II Magnum* rate should be increased to 1.66 pt/A (*Dual II* to 2.5 pt/A) for effective nutsedge control.
	dimethenamid *(Frontier)* OR *(Outlook)*	1.31 OR 0.75	28 oz 6.0 L OR 16 oz 6.0 L	• Incorporate in top 2 to 3 in. of soil. • *Frontier* rate should be increased to 30 oz/A for effective nutsedge control. • *Outlook* rate should be increased to 21 oz/A for effective nutsedge control. • *Frontier* and *Outlook* rates are determined by soil texture or CEC.
Annual broadleaves (EXCEPT nightshade)	metribuzin *(Sencor)*	⅜	¾ pt 4L OR ½ lb 75% DF OR ½ lb *Sencor Solupak*	• See *Sencor* label or Table 11 for crop rotation restrictions. • Good control of velvetleaf. Fair control of jimsonweed and cocklebur. Additional velvetleaf and other broadleaf weed control if preplant incorporated metribuzin is followed with a preemergence metribuzin application. See metribuzin label. • DO NOT use on sands or soils with less than ½% organic matter. DO NOT use on loamy sand or sandy loam soils with less than 1% organic matter. • Reduce metribuzin rate if soil pH is above 7.0. See label. • If soil pH is above 7.4, DO NOT apply metribuzin. • Some soybean varieties have low tolerance to metribuzin and should not be planted. Consult MSUE or agribusiness for a listing of these varieties. • Alachlor, *Dual Magnum*, or *Frontier* are needed for black nightshade control. • See Table 2F for prepackaged herbicide mixes.

(Continued on next page)

SOYBEANS — PREPLANT INCORPORATED (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves (EXCEPT nightshade)	metribuzin + chlorimuron-ethyl *(Canopy)* + metribuzin *(Sencor)*	0.19 + 0.1	4 oz 75% DG + 2 oz 75% DG	• SEE *CANOPY* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • DO NOT USE IF SOIL pH IS GREATER THAN 6.8. Soil pH may be quite variable in a field. Soybean stunting and INJURY TO LABELED ROTATION CROPS CAN OCCUR IF SOIL pH EXCEEDS 6.8. • APPLICATION RATES OF *CANOPY* GREATER THAN 4 oz/A MAY CAUSE UNACCEPTABLE SOYBEAN INJURY. • Use caution to avoid misapplication or spray overlap as carryover may occur to labeled rotation crops. • DO NOT use on sands. DO NOT use on soils with less than ½% organic matter. • Use on soils with organic matter from ½ to 5%. • Some soybean varieties have low tolerance to metribuzin and should not be planted. Consult MSUE or agribusiness for a listing of these varieties. • Better control of velvetleaf, cocklebur, ragweed, and jimsonweed than metribuzin alone. • Alachlor, *Dual Magnum*, or *Frontier* are needed for black nightshade control. • **Special precaution:** A special sprayer clean-out procedure is required for *Canopy*. See label for specific instructions.
	cloransulam-methyl *(FirstRate)*	0.031	0.6 oz 84% WDG	• SEE LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • ADJUST APPLICATION RATE ACCORDING TO SOIL TYPE AND % ORGANIC MATTER. DO NOT overlap as soybean stunting may occur. • This product has a **groundwater advisory** statement. • Excellent common and giant ragweed control. Good control of cocklebur and jimsonweed. • Alachlor, *Dual II Magnum*, or *Frontier* are needed for black nightshade control.
Annual broadleaves (including nightshade)	sulfentrazone + chlorimuron-ethyl *(Canopy XL)*	0.13	3.8 oz 56% DG	• SEE *CANOPY XL* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • 2.5 oz may be used on soils up to pH 7.6. • For rates higher than 2.5 oz, DO NOT USE IF SOIL pH IS GREATER THAN 6.8. Soil pH may be quite variable in a field. Soybean stunting and INJURY TO LABELED ROTATION CROPS CAN OCCUR IF SOIL pH EXCEEDS 6.8. • APPLICATION RATES OF *CANOPY XL* GREATER THAN 4.2 oz/A MAY CAUSE UNACCEPTABLE SOYBEAN INJURY. • Soybean stunting may occur if excessive rainfall occurs after application but before soybeans emerge. • Use on soils with organic matter from ½ to 4%. • *Lexone* at 2–6 oz/A can be added for improved cocklebur or jimsonweed control. A postemergence application of *Basagran* or *Classic* would control these weeds if needed.

(Continued on next page)

SOYBEANS — PREPLANT INCORPORATED (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued) **Annual broadleaves** (including nightshade)	flumetsulam *(Python)*	0.062	1.25 oz 80% DG	• SEE LABELS OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • ADJUST APPLICATION RATE ACCORDING TO SOIL TYPE AND % ORGANIC MATTER. See label for details. • Flumetsulam sold as *Python* or available in prepackaged mixes as *Broadstrike.* • DO NOT USE IF SOIL pH EXCEEDS 7.8 AS INCREASED CROP INJURY MAY OCCUR. • DO NOT USE IF ORGANIC MATTER IS >5% AND SOIL pH IS < 5.9 AS POOR WEED CONTROL MAY RESULT. • DO NOT use on peat or muck soils. • This product has a **groundwater advisory** statement. • Incorporate *Broadstrike/Treflan* within 24 hours of application to the top 2 to 3 inches of soil. • Control of only light to moderate common ragweed, cocklebur, and jimsonweed infestation with *Python* at 1.25 oz/A or *Broadstrike*. Increase application rate of *Python* to 1.33 oz/A OR preferably tankmix with *Canopy* at 3 oz/A or *FirstRate* at 0.3 oz/A. See labels.
	OR	OR	OR	
	flumetsulam + trifluralin *(Broadstrike/ Treflan)*	0.062 + 0.88	2 pt	
	OR	OR	OR	
	flumetsulam + metolachlor *(Broadstrike/ Dual)*	0.056 + 2.1	2¼ pt	
	imazaquin *(Scepter)*	0.125	⅝ pt OR 2.8 oz 70% DG	• CORN CANNOT BE PLANTED THE YEAR FOLLOWING *SCEPTER* APPLICATION EXCEPT IN THE SOUTHERN TWO TIERS OF COUNTIES IN MICHIGAN AND IF 15" OF RAIN FALLS AFTER APPLICATION. SEE *SCEPTER* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • Imidazolinone resistant (IR or IMR) and imidazolinone tolerant (IT) corn hybrids can be planted the year following *Scepter* application. • Use caution to avoid misapplication or spray overlap or carryover may occur to labeled rotation crops. • Soybean stunting (shortening of internodes) may occur on sandy soils. • *Scepter* will suppress yellow nutsedge. • Velvetleaf and black nightshade control are best when *Scepter* is incorporated. Common ragweed control is better when *Scepter* is applied preemergence. • See Table 2F for prepackaged herbicide mixes.
	imazethapyr *(Pursuit)*	0.063	4 oz 2L OR 1.4 oz 70% DG	• SEE *PURSUIT* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • Use caution to avoid misapplication or spray overlap or carryover may occur to labeled rotation crops. • Two pass incorporation is suggested for weed control. • COMMON RAGWEED may only be suppressed, and an additional preplant-incorporated herbicide such as metribuzin or *Scepter* or a postemergence herbicide application for common ragweed control may be necessary. • Velvetleaf and black nightshade control are best when *Pursuit* is incorporated. • The prepackaged mixture *Steel* contains *Prowl* + *Pursuit* + *Scepter.* See Table 2F.

(Continued on next page)

SOYBEANS — PREEMERGENCE ALL TILLAGE SYSTEMS

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves (including nightshade)	sulfentrazone + cloransulam-methyl *(Gauntlet)*	0.25 + 0.031	5.33 oz + 0.6 oz	• Co-pack of sulfentrazone + *FirstRate*. The individual components must be used together. (Sulfentrazone is the active ingredient in *Authority*). • SEE *GAUNTLET* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • DO NOT apply after soybean emergence or severe death or injury may occur. • DO NOT overlap as soybean injury may occur. • Soybean stunting may occur if an excessive rainfall occurs after application but before soybean emergence. • Some soybean varieties are sensitive to sulfentrazone. Consult MSUE or agribusiness for a listing of these varieties.
Annual grasses **Annual broadleaves** (EXCEPT jimsonweed)	s-metolachlor + metribuzin *(Boundary)*	1.22	1.25 pt	• SEE *BOUNDARY* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • *Boundary* is a premix of *Dual II Magnum* and metribuzin. See Table 2F for equivalent rates. • Some soybean varieties have low tolerance to the metribuzin found in *Boundary* and should not be planted. Consult product label, MSUE, or agribusiness for a listing of varieties. • Incorporate in top 2 in. of soil. • Product rate ranges depending on soil texture,organic matter, and pH. • DO NOT use on sands or soils with less than ½% organic matter. Do not use on sandy loam or loamy sand soils with less than 1% organic matter. • On soils with pH above 7.0, use the 1.25 pt/A rate only.
Annual grasses **Annual broadleaves** (EXCEPT cocklebur, jimsonweed)	imazethapyr + pendimethalin *(Pursuit Plus)*	0.9	2½ pt	• SEE *PURSUIT PLUS* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • Use caution to avoid misapplications and spray overlaps or carryover may occur to rotational crops. • COMMON RAGWEED may only be suppressed. • Incorporate into the top 2 to 3 in. of soil. • Incorporate within 7 days of application unless rainfall occurs. • *Pursuit Plus* is a premix of *Pursuit* and *Prowl*. See Table 2F for equivalent rates.
Annual grasses **Yellow nutsedge**	alachlor *(Lasso, Micro-Tech,* or *Partner)*	2	2 qt OR 3 lb 65% DG	• Alachlor is a **restricted use** pesticide. • Alachlor rate should be increased to 2.5 qt/A (3.8 lb 65% DG) for effective nutsedge control. • Nutsedge control is improved when alachlor is incorporated.
	s-metolachlor *(Dual Magnum, Dual II Magnum)*	1.27	1.33 pt	• *Dual II Magnum* rate should be increased to 1.66 pt/A (*Dual II* to 2.5 pt/A) for effective nutsedge control. Nutsedge control is improved when *Dual* is incorporated.
	dimethenamid *(Frontier)* OR *(Outlook)*	1.31 OR 0.75	28 oz 6.0 L OR 16 oz 6.0 L	• *Frontier* rate should be increased to 30 oz/A for effective nutsedge dontrol. • Nutsedge control is improved when *Frontier* or *Outlook* is incorporated. • *Frontier* and *Outlook* rates are determined by soil texture or CEC.

SOYBEANS — PREEMERGENCE ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses	flufenacet + metribuzin *(Axiom)*	0.44 + 0.11	13 oz	• Maximum rate of *Axiom* allowed in soybeans is 13 oz/A. • *Axiom* at 13 oz/A contains 2.3 oz/A of *Sencor DF*. • *Axiom* at 13 oz/A will ONLY provide early season grass control on medium and fine-textured soils. • *Axiom* will not control yellow nutsedge. • Do not apply *Axiom* to permeable coarse-textured soils where the water table is shallow as this may result in ground water contamination. • Do not apply *Axiom* to sites that are vulnerable to runoff and surface water contamination.
	pendimethalin *(Prowl)*	1	2.4 pt 3.3 EC OR 1.6 lb 60% DG	• Preemergence following up until 2 days after soybean planting. DO NOT apply after soybean cracking or emergence. • NOT RECOMMENDED on sandy loam soils. Brittleness of soybean stems at the soil line may occur.
	clomazone *(Command 3 ME)*	3/4	2 pt 3 ME	• ONLY APPLY *COMMAND 3 ME* PREEMERGENCE. Poor weed control will result if *Command 3 ME* is incorporated. • SEE *COMMAND* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • Avoid spray drift. Use drift reduction nozzles which produce larger droplets. • Leave an adequate buffer zone between the area to be treated and desirable plants. DO NOT apply within 1200 feet of housing, greenhouses, fruit, and vegetable production. • DO NOT apply in winds above 10 miles per hour. • DO NOT exceed 30 psi spray pressure. • **Special precaution:** A special sprayer clean-out procedure is required for *Command 3 ME*. See label for specific instructions.
Annual broadleaves (EXCEPT nightshade)	flufenacet + metribuzin *(Domain)*	0.56–1	10 oz 60 DF	• 10 oz/A of *Domain* contains 4.8 oz of *Sencor DF*. • *Domain* may be applied at broadcast use rates of 9 to 16 oz/A on most soils which contain 0.5% organic matter or greater. • DO NOT use if soil pH is greater than 7.4. • DO NOT use if soil organic matter is less than ½%, or sands with less than 1% organic matter. • Metribuzin and flufenacet have properties that may result in ground water contamination. DO NOT apply *Domain* to permeable, coarse-textured soils where the water table is shallow as this may result in ground water contamination. • DO NOT apply *Domain* to sites that are vulnerable to runoff and surface water contamination. • Some soybean varieties have low tolerance to metribuzin and should not be planted. Consult MSUE or agribusiness for a list of these varieties. • *Domain* will provide 3 to 6 weeks of weed control. Increase application rate to increase length of control OR use tank mixtures or other sequential herbicides.

(Continued on next page)

SOYBEANS — PREEMERGENCE ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued) **Annual broadleaves** (EXCEPT nightshade)	metribuzin *(Sencor)*	¾	¾ pt 4L OR ½ lb 75% DF OR ½ lb Sencor Solupak	• SEE *SENCOR* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • Good control of velvetleaf. Fair control of jimsonweed and cocklebur. Additional velvetleaf and other broadleaf weed control if metribuzin is preplant incorporated, followed by a preemergence metribuzin application. See metribuzin label. • Reduce metribuzin rate if soil pH is above 7.0. See label. • If soil pH is above 7.4, DO NOT apply metribuzin. • DO NOT use on sands or soils with less than ½% organic matter. DO NOT use on loamy sand or sandy loam soils with less than 1% organic matter. • Some soybean varieties have low tolerance to metribuzin and should not be planted. Consult MSUE or agribusiness for a listing of these varieties. • Alachlor, *Dual Magnum,* or *Frontier/Outlook* are needed for black nightshade control. • See Table 2F for prepackaged herbicide mixes.
	metribuzin + chlorimuron-ethyl *(Canopy)* + metribuzin *(Sencor)*	0.19 + 0.1	4 oz 75% DG + 2 oz 75% DF	• SEE *CANOPY* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS • DO NOT USE 4 oz/A IF SOIL pH IS GREATER THAN 6.8. Soil pH may be quite variable in a field. Soybean stunting and INJURY TO LABELED ROTATION CROPS CAN OCCUR IF SOIL pH EXCEEDS 6.8. • *Canopy* at 2 oz/A can be applied if soil pH is 7.6 or less. Residual weed control will be limited, and control of velvetleaf, lambsquarters, and cocklebur will be reduced. • 8 to 10 oz/A of *Lorox* can be substituted for 2 oz/A of metribuzin. • APPLICATION RATES OF *CANOPY* GREATER THAN 4 oz/A MAY CAUSE UNACCEPTABLE SOYBEAN INJURY. • Use caution to avoid misapplication or spray overlap or carryover may occur to labeled rotation crops. • DO NOT use on sands. DO NOT use on soils with less than ½% organic matter. • Use on soils with organic matter from ½ to 5%. • Some soybean varieties have low tolerance to metribuzin and should not be planted. Consult MSUE or agribusiness for a listing of these varieties. • Better control of velvetleaf, cocklebur, and jimsonweed than metribuzin. • Alachlor, *Dual Magnum,* or *Frontier/Outlook* are needed for black nightshade control. • **Special precaution:** A special sprayer clean-out procedure is required for *Canopy.* See label.
	cloransulam-methyl *(FirstRate)*	0.031	0.6 oz 84% WDG	• SEE LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • ADJUST APPLICATION RATE ACCORDING TO SOIL TYPE AND % ORGANIC MATTER. DO NOT overlap as soybean stunting may occur. • This product has a **groundwater advisory** statement. • Excellent common and giant ragweed control. Good control of cocklebur and jimsonweed. • Alachlor, *Dual, Magnum,* or *Frontier/Outlook* are needed for black nightshade control.

SOYBEANS — PREEMERGENCE ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (FAIR on nightshade)	linuron *(Lorox, Linex)*	¾	¾ qt 4L OR 1½ lb 50% DF	• If heavy rainfall occurs soon after application, injury to the crop may result. • DO NOT use on coarse-textured sandy or loamy sand soils or on soils with less than 1% organic matter. • Plant soybeans at least 1¾ in. deep. • Fair control of velvetleaf. Poor control of jimsonweed and cocklebur. • For black nightshade control, apply with alachlor, *Dual Magnum* or *Frontier/Outlook*.
Annual broadleaves (including nightshade)	sulfentrazone + chlorimuron-ethyl *(Canopy XL)*	0.13	3.8 oz 56% DG	• SEE *CANOPY XL* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • 2.5 oz may be used in soils up to pH 7.6. • For rates higher than 2.5 oz, DO NOT USE IF SOIL pH IS GREATER THAN 6.8. Soil pH may be quite variable in a field. Soybean stunting and INJURY TO LABELED ROTATION CROPS CAN OCCUR IF SOIL pH EXCEEDS 6.8. • APPLICATION RATES OF *CANOPY XL* GREATER THAN 4.2 OZ/A MAY CAUSE UNACCEPTABLE SOYBEAN INJURY. • Soybean stunting may occur if excessive rainfall occurs after application but before soybeans emerge. • Use on soils with organic matter from ½ to 4%. • *Lexone* at 2–6 oz/A can be added for improved cocklebur or jimsonweed control. A postemergence application of *Basagran* or *Classic* would control these weeds if needed. • DO NOT APPLY AFTER SOYBEAN CRACKING or emergence as severe injury or death will occur.
	flumetsulam *(Python)* OR flumetsulam + metolachlor *(Broadstrike/Dual)*	0.057 OR 0.056 + 2.1	1.14 oz 80% DG OR 2¼ pt	• SEE LABELS OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • ADJUST APPLICATION RATE ACCORDING TO SOIL TYPE AND % ORGANIC MATTER. See label for details. • Flumetsulam sold as *Python* or available in a prepackaged mix as *Broadstrike*. • DO NOT USE IF SOIL pH EXCEEDS 7.8 AS INCREASED CROP INJURY MAY OCCUR. • DO NOT USE IF ORGANIC MATTER IS >5% *AND* SOIL pH IS < 5.9 AS POOR WEED CONTROL MAY RESULT. • DO NOT use on peat or muck soils. • This product has a **groundwater advisory** statement. • *Canopy* can be added at 3 oz/A or *FirstRate* at 0.3 oz/A to improve control of common ragweed, cocklebur, and jimsonweed. See supplemental labels. • Rotary hoe and cultivate if dry weather follows preemergence application.

(Continued on next page)

SOYBEANS — PREEMERGENCE ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves (including nightshade)	imazaquin *(Scepter)*	0.125	⅔ pt 1.5L OR 2.8 oz 70% DG	• CORN CANNOT BE PLANTED THE YEAR FOLLOWING *SCEPTER* APPLICATION EXCEPT IN THE SOUTHERN TWO TIERS OF COUNTIES IN MICHIGAN AND IF 15" OF RAIN FALLS AFTER APPLICATION. SEE *SCEPTER* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • Imidazolinone resistant (IR or IMR) and imidazolinone tolerant (IT) corn hybrids can be planted the year following *Scepter* application. • Good control of cocklebur and jimsonweed. Fair control of velvetleaf. • Use caution to avoid misapplication or spray overlap or carryover may occur to labeled rotation crops. • Soybean stunting (shortening of internodes) may occur on sandy soils. • Common ragweed control is best when *Scepter* is applied preemergence. However, black nightshade and velvetleaf control are better when *Scepter* is preplant incorporated. • See Table 2F for prepackaged herbicide mixes.
	imazethapyr *(Pursuit)*	0.063	4 oz 2L OR 1.4 oz 70% DG	• SEE *PURSUIT* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • Fair control of cocklebur, jimsonweed, and velvetleaf. • COMMON RAGWEED MAY ONLY BE SUPPRESSED, and an additional preemergence herbicide or a postemergence herbicide application for common ragweed control may be necessary. • Rotary hoe if no rainfall occurs within 7 days. • Use caution to avoid misapplication or spray overlap or carryover may occur to labeled rotation crops. • The prepackaged mixture *Steel* contains *Prowl* + *Pursuit* + *Scepter.* See Table 2F for prepackaged herbicide mixes.
	sulfentrazone + cloransulam-methyl *(Gauntlet)*	0.25 + 0.031	5.33 oz + 0.6 oz	• Co-pack of sulfentrazone + *FirstRate.* The individual components must be used together. (Sulfentrazone is the active ingredient in *Authority*). • SEE *GAUNTLET* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • DO NOT apply after soybean emergence or severe death or injury may occur. • DO NOT overlap as soybean injury may occur. • Soybean stunting may occur if an excessive rainfall occurs after application but before soybeans emergence. • Some soybean varieties are sensitive to sulfentrazone. Consult MSUE or agribusiness for a listing of these varieties.
Black nightshade and Redroot pigweed only	sulfentrazone *(Authority)*	0.188	4 oz 75% DG	• DO NOT apply after soybean cracking or emergence as severe injury or death will occur. • Soybean stunting may occur if excessive rainfall occurs after application but before soybeans emerge. • Some soybean varieties are sensitive to sulfentrazone. Consult your local seed dealer for information. • Reduce *Authority* to 3 oz/A if a glyphosate postemergence program is planned in glyphosate-resistant soybeans.

SOYBEANS — PREEMERGENCE ALL TILLAGE SYSTEMS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses **Annual broadleaves** (EXCEPT cocklebur, jimsonweed)	sulfentrazone + clomazone *(Command Xtra)*	0.3 + 0.6	9.6 oz + 25.6 oz	• Co-pack of sulfentrazone + *Command.* The individual components must be used together. (Sulfentrazone is the active ingredient in *Authority.*) • SEE *COMMAND XTRA* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • ONLY APPLY *COMMAND XTRA* PREEMERGENCE. Poor weed control will result if *Command Xtra* is incorporated. • Avoid spray drift. Use drift reduction nozzles that produce larger droplets. • Leave an adequate buffer zone between area to be sprayed and desirable plants. DO NOT apply within 1,200 feet of housing, greenhouses, and vegetable production. • DO NOT apply in winds above 10 mph. • **Special precaution:** A special sprayer clean-out procedure is required for *Command Xtra.* See label for specific instructions. • DO NOT apply after soybean cracking or emergence as severe injury may occur. • Soybean stunting may occur if an excessive rainfall occurs after application but before soybeans emergence. • Some soybean varieties are sensitive to sulfentrazone. Consult MSUE or agribusiness for a listing of these varieties. • Good control of nightshade. • Consult Table 2F for equivalent rates.
	imazethapyr + pendimethalin *(Pursuit Plus)*	0.9	2½ pt	• SEE *PURSUIT PLUS* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • Use caution to avoid misapplications and spray overlaps or carryover may occur to rotational crops. • COMMON RAGWEED may only be suppressed. • Preemergence timing is allowed up to 2 days after soybean planting. DO NOT apply after soybean cracking or emergence. • NOT RECOMMENDED ON SANDY LOAM SOILS. Brittleness of the stem at the soil line may occur. • *Pursuit Plus* is a premix of *Pursuit* and *Prowl.* See Table 2F for equivalent rates.
Annual grasses **Annual broadleaves** (EXCEPT jimsonweed	s-metolachlor + metribuzin *(Boundary)*	1.22	1.25 pt	• SEE *BOUNDARY* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • *Boundary* is a premix of *Dual II Magnum* and metribuzin. See Table 2F for equivalent rates. • Some soybean varieties have low tolerance to the metribuzin found in *Boundary* and should not be planted. Consult product label, MSUE, or agribusiness for a listing of varieties. • Product rate ranges depending on soil texture, organic matter, and pH. • DO NOT use on sands or soils with less than ½% organic matter. Do not use on sandy loam or loamy sand soils with less than 1% organic matter. • On soils with pH above 7.0, use the 1.25 pt/A rate only.

SOYBEANS — POSTEMERGENCE FOR BROADLEAF WEEDS

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (EXCEPT pigweed and nightshade) **Yellow Nutsedge**	bentazon *(Basagran)* + crop oil concentrate	1 + 1 qt	2 pt + 1 qt	• Most effective on small weeds. Apply 1½ pt/A if weeds are smaller than maximum growth stage on the label. See Table 2H and label. • Use a minimum of 40 psi and 20 gal of water/A. Do not use flood nozzles. • Do not apply if soybeans are under stress from herbicide injury, cold or dry weather, or hail damage. • Use 1 gal/A of 28% liquid nitrogen (urea ammonium nitrate) *INSTEAD OF* crop oil concentrate for improved velvetleaf control. DO NOT use 28% liquid nitrogen if common lambsquarters is present. • Apply both 28% liquid nitrogen and crop oil concentrate if velvetleaf and lambsquarters are present. See Table 2I. • Poor control of pigweed and black nightshade. Fair to good control of common ragweed and lambsquarters. • *Basagran* can be tank mixed with *Ultra Blazer, Cobra, Flexstar, Reflex, Pursuit, Pinnacle,* and *Scepter* for redroot pigweed control. *Basagran* can be tank mixed with *Ultra Blazer, Cobra, Pursuit, Flexstar,* or *Reflex* for black nightshade control. See Tables 2G and 2J. • A prepackaged mix of *Basagran* plus *Blazer (Galaxy* or *Storm)* is available. See remarks for *Galaxy* or *Storm* and Table 2F. • *Rezult* is a co-pac of *Basagran* and *Poast Plus. Rezult* can be tank-mixed with *Ultra Blazer, FirstRate, Classic,* or *Pursuit* for additional broadleaf weed control. See label. • *Basagran* can be tank mixed for postemergence grass control. See Table 2L.
Annual broadleaves (EXCEPT velvetleaf and lambsquarters)	acifluorfen *(Ultra Blazer)* + surfactant OR 28% liquid nitrogen	0.38 + 1/8% OR 2–4 qt	1.5 pt + 1/8% OR 2–4 qt	• Most effective on small weeds. See label and Table 2H. • Use a minimum of 40 psi and 20 gal of water/A. Do not use flood nozzles. • Do not apply if soybeans are under stress from herbicide injury, cold or dry weather, or hail damage. • ½ to 1 gal/A of 28% liquid nitrogen may be added INSTEAD OF surfactant for improved weed control. • Allow 50 days between *Ultra Blazer* application and soybean harvest. • *Ultra Blazer* can be tank mixed with *Scepter* or *Pursuit* for additional cocklebur control, with *Basagran* for additional cocklebur, velvetleaf, and lambsquarters control, and with *Pinnacle* for additional lambsquarters and pigweed control. See Tables 2G and 2J. • A prepackaged mix of *Basagran* plus *Ultra Blazer (Galaxy* or *Storm)* is available. See remarks for *Galaxy* or *Storm.* • *Ultra Blazer* can be tank mixed for postemergence grass control. See Table 2L.

SOYBEANS — POSTEMERGENCE FOR BROADLEAF WEEDS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	bentazon + acifluorfen *(Storm)* + crop oil concentrate	0.75 + 1 qt	1½ pt + 1 qt	• *Storm* is a prepackaged mix of *Basagran* plus *Ultra Blazer.* • 1½ pt/A of *Storm* is equal to 1 pt/A of *Basagran* + 1 pt/A of *Ultra Blazer.* • Most effective on small weeds. See Table 2H and label. • Common lambsquarters and velvetleaf control may be inconsistent. • Use a minimum of 40 psi and 20 gal of water/A. Do not use flood nozzles. • Replace COC with ½-1 gal/A of 28% liquid nitrogen for improved pigweed and velvetleaf control. • *Storm* can be tank mixed with *Classic* for improved velvetleaf control. See Tables 2G and 2J. • *Storm* can be tank mixed with *Pinnacle* for improved lambsquarters and velvetleaf control. See Tables 2G and 2J. • *Rezult* is a co-pac of *Basagran* and *Poast Plus. Rezult* can be tank-mixed with *Ultra Blazer, FirstRate, Classic,* or *Pursuit* for additional broadleaf weed control. See label. • *Storm* can be tank mixed with postemergence grass herbicides. See Table 2L.
Annual broadleaves **Yellow Nutsedge**	bentazon + acifluorfen *(Galaxy)* + crop oil concentrate	0.92 + 1 qt	2 pt + 1 qt	• *Galaxy* is a prepackaged mix of *Basagran* plus *Ultra Blazer.* • 2 pt/A of *Galaxy* is equal to 1.5 pt/A of *Basagran* + 0.66 pt/A of *Ultra Blazer.* • Most effective on small weeds. See Table 2H and label. • A later application of *Basagran* may be needed for yellow nutsedge control. • Use a minimum of 40 psi and 20 gal of water/A. Do not use flood nozzles. • Do not apply if soybeans are under stress from herbicide injury, cold or dry weather, or hail damage. • Replace COC with ½-1 gal/A of 28% liquid nitrogen OR 2.5 lb ammonium sulfate if velvetleaf is the target weed and NOT common ragweed or lambsquarters. • *Galaxy* can be tankmixed with *Pinnacle* for improved lambsquarters control OR *Classic* for improved nutsedge and pigweed control OR *Pursuit* for improved pigweed control. See Tables 2G and 2J. • *Rezult* is a co-pac of *Basagran* and *Poast Plus. Rezult* can be tank-mixed with *Ultra Blazer, FirstRate, Classic,* or *Pursuit* for additional broadleaf weed control. See label. • *Galaxy* can be tankmixed with postemergence grass herbicides. See Table 2L.

SOYBEANS — POSTEMERGENCE FOR BROADLEAF WEEDS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (EXCEPT black nightshade and lambsquarters) **Yellow Nutsedge** **Jerusalem Artichoke**	chlorimuron-ethyl *(Classic)* + surfactant OR + crop oil concentrate	0.0106 + 1/4% + 1%	2/3 oz. 25% DF + 1/4% + 1%	• DO NOT APPLY TO SOILS WITH A pH GREATER THAN 7.0 IF *CLASSIC* IS APPLIED AT 1/2 oz/A OR GREATER. • Classic can be applied at 1/4 oz/A or 1/3 oz/A when tank mixed with *Pinnacle.* This tank mix is not limited by soil pH. HOWEVER, CROP ROTATION RESTRICTIONS remain the same. • SEE LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • Most effective on small weeds. Labeled rates of 1/2 to 3/4 oz/A, depending on weed size. See Table 2H and label. • 3/4 oz/A required for Jerusalem artichoke. • Apply after the first trifoliate leaf of soybeans has fully expanded. • DO NOT apply to soybeans or weeds under stress from herbicide injury or cold or dry weather—crop injury or poor weed control may result. • Under hot, dry conditions, surfactant may be replaced with crop oil concentrate at 1%. However, increased crop injury may result. See Table 2I. • Addition of 1 gal/A of 28% liquid nitrogen (urea ammonium nitrate) or 1 qt/A of 10-34-0 (diammonium phosphate) IN ADDITION TO crop oil concentrate OR surfactant IS REQUIRED for control of velvetleaf. • Use a minimum of 25 psi and 10 gal of water/A. For heavy weed pressure, increase volume to 15 gal/A. Do not use flood nozzles. • Cultivation 14 days after treatment will improve weed control. • Allow 60 days between *Classic* application and soybean harvest. • *Classic* can be tank mixed with *Pinnacle* for lambsquarters control. *Classic* can be tank mixed with *Galaxy, Ultra Blazer, Resource, Flexstar, Reflex* or *Cobra.* See labels and Tables 2G and 2J. • *Classic* can be tank mixed with some postemergence herbicides for control of some grasses. See Table 2L.
Annual broadleaves (ONLY lambsquarters, smartweed, pigweed, wild mustard and velvetleaf)	thifensulfuron methyl *(Pinnacle)* + surfactant	0.004 + 1/8%	1/4 oz 25% DF + 1/8%	• No soil pH or crop rotation restrictions. • For velvetleaf control, add 2-4 qt/A of 28% liquid nitrogen/A or 2-4 lb of ammonium sulfate in addition to surfactant. See Table 2I. • Use a minimum of 25 psi and 10 gal of water/A. For heavy weed pressure, increase volume to 15 gal/A. Do not use flood nozzles. • Apply after the first trifoliate leaf of soybeans has fully expanded. • Allow a minimum of 60 days between *Pinnacle* application and soybean harvest. • DO NOT tank mix with the surfactant *Dash.* • DO NOT exceed 1/8% of nonionic surfactant. • *Pinnacle* can be tank mixed with *Ultra Blazer, Cobra, Reflex, Flexstar, FirstRate, Galaxy, Basagran, Pursuit* or *Classic* for additional weed control. See Tables 2G and 2J. • *Pinnacle* can be tank mixed with *Assure II* for annual grass control. See Table 2L. • **Special precaution:** A special sprayer clean-out procedure is required. See label.

SOYBEANS — POSTEMERGENCE FOR BROADLEAF WEEDS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (EXCEPT black nightshade and common ragweed)	chlorimuron-ethyl *(Classic)*	0.004	¼ oz 25% DF	• *Classic* can be applied to soils with a pH greater than 7.0 if the *Classic* rate is ¼ to ⅓ oz/A. • SEE LABEL OR TABLE 11 FOR CROP ROTATION • *CLASSIC* MUST BE APPLIED AT ⅓ OZ/A for common ragweed control. • Black nightshade will NOT BE controlled. • For black nightshade control add 4 to 6 oz/A of *Cobra* OR 1 pt/A of *Reflex* OR *Ultra Blazer* OR 2 oz/A of *Pursuit.* • Addition of 1 gal/A of 28% liquid nitrogen (urea ammonium nitrate) or 1 qt/A of 10-34-0 (diammonium phosphate) IN ADDITION TO crop oil concentrate OR surfactant IS REQUIRED for control of velvetleaf. • Apply after the first trifoliate leaf of soybeans has fully expanded. • DO NOT apply to soybeans or weeds under stress from herbicide injury or cold or dry weather—crop injury or poor weed control may result. • Under hot, dry conditions, surfactant may be replaced with crop oil concentrate at 1%. However, increased crop injury may result. Do not use crop oil concentrate if *Pursuit* is tank-mixed for black nightshade control. See Table 21. • Use a minimum of 25 psi and 10 gal of water/A. For heavy weed pressure, increase volume to 15 gal/A. Do not use flood nozzles. • Cultivation 14 days after treatment will improve weed control. • An additional ¼ oz/A of *Classic* must be added for yellow nutsedge control. DO NOT APPLY TO SOILS WITH A pH GREATER THAN 7.0 • An additional ½ oz/A of *Classic* must be added for Jerusalem Artichoke control. DO NOT APPLY TO SOILS WITH A pH GREATER THAN 7.0.
	+	+	+	
	thifensulfuron methyl *(Pinnacle)*	0.004	¼ oz 25% DF	
	+	+	+	
	surfactant	⅛%	⅛%	

SOYBEANS — POSTEMERGENCE FOR BROADLEAF WEEDS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations

Annual broadleaves (EXCEPT black nightshade)
Yellow Nutsedge
Jerusalem Artichoke
Common Milkweed
	chlorimuron-ethyl + thifensulfuron methyl *(Synchrony STS)*
	+
	28% liquid nitrogen
	OR
	ammonium sulfate
	+
	crop oil concentrate
		0.0136
		+
		2 qt
		OR
		2 lb
		+
		1%
			½ oz 42% DF
			+
			2 qt
			OR
			2 lb
			+
			1%
				• ONLY APPLY *SYNCHRONY STS* TO STS SOYBEANS.
				• One 2 oz soluble pack of *Synchrony* treats 4 acres.
				• DO NOT APPLY TO SOILS WITH A pH GREATER THAN 7.0 IF FIELD IS NORTH OF I-96.
				• SEE LABELS OR TABLE 11 FOR CROP ROTATION RESTRICTIONS.
				• FOR BLACK NIGHTSHADE CONTROL:
				  • Apply *Authority* preemergence at 4 oz/A for black nightshade control.
				  • *Synchrony STS* can be tank mixed with 4 to 6 oz/A of *Cobra* or 1 pt/A of *Flexstar* for control of black nightshade. Reduce crop oil concentrate to ½% if tank mixed with *Cobra*.
				  • *Synchrony STS* can be tank mixed with 1 pt/A of *Reflex* for black nightshade control. Keep crop oil concentrate at 1%.
				  • *Synchrony STS* can be tank mixed with 1 pt/A of *Blazer* for black nightshade control. Use ¼% nonionic surfactant INSTEAD of crop oil concentrate.
				  • *Synchrony STS* can be tank mixed with 2 oz/A of *Pursuit* for black nightshade control. Use nonionic surfactant INSTEAD OF crop oil concentrate when *Pursuit* is applied.
				• Apply after the first trifoliate leaf of soybeans has fully expanded.
				• Use a minimum of 25 psi and 15 gpa. Do not use flood nozzles.
				• Cultivation 14 days after treatment will improve weed control.
				• *Synchrony STS* will suppress pokeweed, perennial sowthistle, and dandelion. See supplemental label.
				• Allow 60 days between application and harvest.
				• *Synchrony STS* can be tank mixed with *Assure II* or *Select* for control of some grasses. See label.

Annual broadleaves (EXCEPT lambsquarters and common ragweed) **Jerusalem artichoke**	imazethapyr *(Pursuit)* + 28% liquid nitrogen OR ammonium sulfate + surfactant	0.063 + 1 qt OR 2.5 lb + ¼%	4 oz 2L OR 1.4 oz 70% DG + 1 qt OR 2.5 lb + ¼%	• SEE *PURSUIT* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • DO NOT apply without both surfactant AND fertilizer or control will be reduced. See Table 21. • Will control yellow and green foxtails, barnyardgrass, and crabgrass up to 3 inches tall, and giant foxtail up to 6 inches tall. • Use a minimum of 20 psi and 10 gal of water/A. • Apply after the first trifoliate leaf of soybeans has fully expanded. • For maximum effectiveness, cultivate 7-10 days following postemergence herbicide application. • Allow a minimum of 85 days between *Pursuit* application and soybean harvest. • *Pursuit* can be tank mixed with *Basagran, Ultra Blazer, Reflex, FirstRate, Resource, Cobra, Pinnacle* and *Galaxy* for additional weed control. See Tables 2G and 2J. • *Pursuit* may be tank mixed with postemergence grass herbicides for volunteer corn control only. See Table 2L.

SOYBEANS — POSTEMERGENCE FOR BROADLEAF WEEDS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (EXCEPT common ragweed) **Annual grasses**	imazamox *(Raptor)* + 28% liquid nitrogen OR ammonium sulfate + surfactant	0.04 + 1 qt OR 2.5 lb + ¼%	5 oz 1L + 1 qt OR 2.5 lb + ¼%	• SEE *RAPTOR* LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • DO NOT apply without both surfactant AND fertilizer or control will be reduced. See Table 2I. • Apply after 1st trifoliate is expanded but before soybean bloom. • Apply in a minimum of 10 gal/A of water (20 gal/A minimum for reduced tillage systems) at 20 to 40 psi (spray coupe 40 to 60 psi). • Will control barnyardgrass, foxtails, and panicum but ONLY SUPPRESS crabgrass. • APPLICATION RATE MUST BE AT 5 OZ/A for annual grass and common lambsquarters control OR apply *Prowl* preemergence for control of these weeds. • Common ragweed (less than 3") will be suppressed. • To increase common ragweed control, *Raptor* can be tank-mixed with 2–3 oz/A of *Cobra*, 8 oz/A of *Ultra Blazer* or 6–8 oz/A of *Flexstar*. Higher rates can cause grass antagonism. See Table 2J. • DO NOT tank mix with postemergence grass herbicides as antagonism will occur and grass control will equal that of *Raptor* alone.
Annual broadleaves (EXCEPT velvetleaf, smartweed, lambsquarters and cocklebur)	fomesafen *(Reflex)* + surfactant OR crop oil concentrate	0.25 + ¼% OR 1%	1 pt 2L + ¼% OR 1%	• *REFLEX* MAY BE APPLIED IN COUNTIES SOUTH OF HWY 55. • *REFLEX* CANNOT BE APPLIED TO THE SAME FIELD TWO CONSECUTIVE YEARS. • Small grains can be planted 4 months following application; corn, and dry beans 10 months. DO NOT PLANT SUGAR BEETS OR ALFALFA FOR 18 MONTHS FOLLOWING APPLICATION. • *Reflex* can be reduced to ¾ pt/A for smaller jimsonweed, mustard, nightshade, pigweed, and ragweed. See label and Table 2H. • Apply before soybeans bloom. • *Reflex* can be tank mixed with *Basagran* or *Pinnacle* for velvetleaf, smartweed, lambsquarters and cocklebur control. *Reflex* can be tank mixed with *Scepter* or *Pursuit* for cocklebur control, and with *Classic* for cocklebur and smartweed control. See Tables 2G and 2J. • *Reflex* can be tank mixed for postemergence grass control. See Table 2L.
Annual broadleaves (EXCEPT velvetleaf, lambsquarters and cocklebur)	fomesafen *(Flexstar)* + 28% liquid nitrogen OR ammonium sulfate + surfactant OR crop oil concentrate	0.25 + 2.5% OR 10 lb/100 gal + ¼% OR ½%	1 pt 1.88L + 2.5% OR 10 lb/100 gal + ¼% OR ½%	• *FLEXSTAR* MAY BE APPLIED IN COUNTIES SOUTH OF HWY 55. • *FLEXSTAR* CANNOT BE APPLIED TO THE SAME FIELD TWO CONSECUTIVE YEARS. • Small grains can be planted 4 months following application; corn, and dry beans 10 months. DO NOT PLANT SUGAR BEETS OR ALFALFA FOR 18 MONTHS FOLLOWING APPLICATION. • *Flexstar* is *Reflex* formulated with additional surfactants. • Apply before soybeans bloom. • Apply at 10 to 20 gpa and 30 to 60 psi. • *Flexstar* can be tank mixed with *Scepter, Basagran*, or *Classic* to improve cocklebur control; *Basagran* or *Pinnacle* to improve lambsquarters and velvetleaf control. See Tables 2G and 2J. • *Flexstar* can be tank mixed for postemergence grass control. See Table 2L.

SOYBEANS — POSTEMERGENCE FOR BROADLEAF WEEDS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (EXCEPT velvetleaf, smartweed, and lambsquarters)	lactofen *(Cobra)* + crop oil concentrate OR surfactant	0.195 + 1 pt OR 1/4%	12.5 oz + 1 pt OR 1/4%	• Poor on smartweed and lambsquarters. Fair on velvetleaf. • *Cobra* can be tank mixed with *Resource* to control velvetleaf. This prepackaged mixture is *Stellar. Stellar* should be tank-mixed with *Basagran* or *Pinnacle* for smartweed and lambsquarters control. • *Cobra* can be applied at 6 to 10 oz/A when tank mixed with other herbicides or when applied alone. 6 oz/A of *Cobra* will control 3 leaf nightshade, 4 leaf pigweed, and 6 leaf common ragweed. 8 to 10 oz/A will control 4 leaf nightshade and cocklebur, and 6 leaf pigweed and common ragweed. • Most effective on small weeds. See label and Table 2H. • DO NOT apply to soybeans in the cotyledon stage. • DO NOT apply if soybeans are under stress from herbicide injury, cold or dry weather, or hail damage. • When weather conditions are good and weeds growing vigorously, a surfactant at 1/4% or 28% liquid nitrogen at 1 gal/A may be substituted for crop oil concentrate. See Table 2I. • Use a minimum of 40 psi and 20 gal of water/A. Do not use flood nozzles. • A timely cultivation one week following application will assist in weed control. • Allow 45 days between *Cobra* application and soybean harvest. • *Cobra* can be tank mixed with *Pinnacle* or *Basagran* to control velvetleaf, smartweed, and lambsquarters. *Cobra* can be tank mixed with *Classic* or *Pursuit* for control of smartweed and cocklebur or with *Scepter* for cocklebur control. See Tables 2G and 2J. • *Cobra* can be tank mixed for postemergence grass control. See Table 2L.
Annual broadleaves (EXCEPT lambsquarters, pigweed, nightshade)	cloransulam-methyl *(FirstRate)* + 28% liquid nitrogen OR ammonium sulfate + surfactant OR COC OR MSO	0.016 + 2.5% OR 2 lb + 1/4% OR 1.2% OR 1.2%	0.3 oz 84% WDG + 2.5% OR 2 lb + 1/4% OR 1.2% OR 1.2%	• SEE LABLE OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • Apply prior to 50% flowering stage. Application prior to first trifoliate stage may cause temporary yellowing. • Reduce surfactant to 1/8% if hot and humid OR with some tank mixtures. See Tables 2I and 2J. • Must add 28% N or AMS for velvetleaf control. • Apply in 10 to 40 gpa and 20 to 40 psi. • Excellent ragweed control. • For tank mixture information see Tables 2G, 2J and 2L.

SOYBEANS — POSTEMERGENCE FOR BROADLEAF WEEDS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (ONLY redroot pigweed and cocklebur)	imazaquin *(Scepter)*	0.063	⅛ pt OR 1.4 oz 70% DG	• SEE LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. • For redroot pigweed and cocklebur control ONLY. See Table 2H.
	+	+	+	
	crop oil concentrate OR surfactant	1 qt OR ¼%	1 qt OR ¼%	• Apply ⅔ pt/A (2.8 oz/A 70% DG) if soil activity to stop germinating weed seeds is desired or to control redroot pigweed from 4 to 12 in. tall. CORN CANNOT BE PLANTED THE YEAR FOLLOWING A ⅔ PT/A APPLICATION EXCEPT IN THE SOUTHERN TWO TIERS OF COUNTIES IN MICHIGAN. • Imidazolinone resistant (IR or IMR) and imidazolinone tolerant (IT) corn hybrids can be planted the year following *Scepter* application. • Avoid misapplication or spray overlap or carryover may occur to labeled rotation crops. • Use a minimum of 40 psi and 20 gal of water/A. Do not use flood nozzles. • Allow 90 days between *Scepter* application and soybean harvest. • *Scepter* can be tank mixed with *Basagran, Ultra Blazer, Resource, Flexstar, Reflex,* or *Cobra* for control of additional broadleaf weeds. See Tables 2G and 2J. • Scepter cannot be tank mixed with postemergence grass herbicides. See Table 2L.
Annual broadleaves (ONLY velvetleaf)	flumiclorac *(Resource)*	0.041	6 oz 0.86L	• Very effective on velvetleaf up to 10 leaf. • Some pigweed, lambsquarters, and common ragweed suppression.
	+	+	+	
	crop oil concentrate	1 qt	1 qt	• *Resource* at 4 oz/A may be tank mixed with *Select* for annual grass control and *Basagran, Classic, Cobra, Flexstar* or *Pursuit* for broadleaf control. See Table 2J. • A prepackaged mix of *Resource* plus *Cobra* is available as *Stellar.* See Table 2F. • There are no crop rotation restrictions. • Apply in a minimum of 15 gpa at a minimum of 40 psi. • Allow 60 days between *Resource* application and soybean harvest.
Canada thistle **Yellow nutsedge**	bentazon *(Basagran)*	¾ + ¾	1½ pt + 1½ pt	• Increase *Basagran* rate to 1 qt/A for each application for more effective Canada thistle control. • Treat when nutsedge is 4 to 6 in. and again 10 days later. • See nutsedge remarks under "Special Weed Problems." • Use a minimum of 40 psi and 20 gal of water/A. Do not use flood nozzles. • Delay 7 days between *Basagran* application and *Assure II, Fusilade DX, Fusion, Poast, Poast Plus, Select,* or *Option* treatments.
	+	+	+	
	crop oil concentrate	1 qt + 1 qt	1 qt + 1 qt	

SOYBEANS — POSTEMERGENCE GRASS CONTROL

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses	sethoxydim *(Poast)*	0.19	16 oz	• No soil activity. Controls only grasses present when sprayed.
	OR	OR	OR	• Treat actively growing grasses. See Table 2K.
	sethoxydim *(Poast Plus)*	0.19	24 oz	• *Poast* can be reduced to 12 oz/A and *Poast Plus* can be reduced to 16 oz/A for 1- to 4-in. barnyardgrass, green and giant foxtail, and fall panicum.
	+	+	+	
	crop oil concentrate	1 qt	1 qt	• Use 5 to 20 gal of water/A and a minimum of 40 psi.
	OR	OR	OR	• Addition of 2.5 lb ammonium sulfate/A in *Poast* or *Poast Plus* applications increases large crabgrass control.
	Dash	1 qt	1 qt	• *Poast Plus* can be tank mixed with *Basagran* or *FirstRate*. *Poast* can be mixed with *Basagran* and/or *Ultra Blazer*. Increase *Poast* to 24 oz/A for yellow foxtail, barnyardgrass, and crabgrass when tank mixing. See *Poast* or *Poast Plus* label for additional information and Table 2L.
				• Wait 1 day after *Poast* or *Poast Plus* application before applying *Basagran* or *Ultra Blazer*. Wait 7 days after *Basagran* or *Ultra Blazer* application before applying *Poast* or *Poast Plus*.
				• Avoid drift onto corn, small grains, and turf.
	fluazifop-P-butyl *(Fusilade DX)*	0.188	12 oz	• No soil activity. Controls only grasses present when sprayed.
	+	+	+	• Treat actively growing grasses. See Table 2K.
	crop oil concentrate	1 qt	1 qt	• Use 5 to 40 gal of water/A and 40 to 60 psi.
				• *Fusilade DX* can be reduced to 10 oz/A for certain conditions. See label.
				• *Fusilade* can be tank mixed with *Basagran, Reflex, Flexstar, Cobra,* and *Ultra Blazer*. However, the minimum rate for *Fusilade DX* would be 12 oz/A. See label and Table 2L.
				• Wait 3 days after *Fusilade* application before applying *Basagran* or *Blazer*. Wait 7 days after *Basagran* or *Blazer* application before applying *Fusilade DX*.
				• Avoid drift onto corn, small grains, and turf.
	fluazifop-P-butyl + fenoxaprop *(Fusion)*	0.166	8 oz	• No soil activity. Controls only grasses present when sprayed.
				• Treat actively growing grasses. See Table 2K.
	+	+	+	• Use 5 to 40 gal of water/A and 40 to 60 psi.
	crop oil concentrate	½-1%	½-1%	• *Fusion* can be tank mixed with *Basagran, Reflex, Flexstar, Ultra Blazer, Classic, Pinnacle,* and *Pursuit*. See Table 2L.
	OR	OR	OR	
	surfactant	¼-½%	¼-½%	• Avoid drift onto corn, small grains, and turf.
	clethodim *(Select)*	0.094	6 oz	• No soil activity. Controls only grasses present when sprayed.
	+	+	+	• Treat actively growing grasses. See Table 2K.
	crop oil concentrate	1%	1%	• Use 10 to 40 gal of water/A and 20 to 60 psi.
				• *Select* can be applied at 6 oz/A under favorable soil moisture and humidity and when grasses are not at maximum height. *Select* can be applied at 4 to 5 oz/A when some grass species are small. See label and Table 2K.
				• DO NOT cultivate for 7 days before or 7 days after treatment.
				• Avoid drift onto corn, small grains, or turf.
				• Allow 60 days between *Select* application and soybean harvest.
				• *Select* can be tank mixed with *Basagran, Ultra Blazer, Stellar, FirstRate, Resource, Reflex, Cobra,* or *Classic*. See Table 2L.

(Continued on next page)

SOYBEANS — POSTEMERGENCE GRASS CONTROL (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(Continued)				
Annual grasses	quizalofop-P-ethyl *(Assure II)*	0.044	7 oz	• No soil activity. Controls only grasses present when sprayed. • Treat actively growing grasses. See Table 2K. • Use 10 to 40 gal of water/A and a minimum of 40 psi. • 8 oz/A required for barnyardgrass and crabgrass control. • DO NOT cultivate for 7 days before or 7 days after treatment. • Wait 1 day after *Assure II* application before applying *Basagran* or *Ultra Blazer.* Wait 7 days after *Basagran* or *Ultra Blazer* before applying *Assure II.* • Avoid drift onto corn, small grains, or turf. • Allow 80 days between *Assure II* application and soybean harvest. • *Assure II* can be tank mixed with *Basagran, Pinnacle* or *Classic,* but should NOT be tank mixed when the target grass is barnyardgrass, crabgrass, or quackgrass. If tank mixing for other grasses except giant foxtail and broadleaf weeds, increase the rate of *Assure II* by 2 oz/A and reduce the surfactant rate to 1/8%. See Table 2L.
	\+	\+	\+	
	crop oil concentrate	1%	1%	
	OR	OR	OR	
	surfactant	1/4%	1/4%	
Volunteer corn	fluazifop-P-butyl *(Fusilade DX)*	0.094	6 oz	• Refer to above remarks on annual grass control. • Treat volunteer corn up to 24 in. See Table 2K.
	\+	\+	\+	
	crop oil concentrate	1 qt	1 qt	
	sethoxydim *(Poast)*	0.19	16 oz	• Refer to remarks on annual grass control. • Treat volunteer corn up to 20 in. See Table 2K. • *Poast* can be reduced to 12 oz/A or *Poast Plus* to 18 oz/A if volunteer corn is less than 12 in. tall. • *Poast* is **not as effective** on volunteer corn as *Select, Fusilade DX, Fusion, Option II* or *Assure II.*
	OR	OR	OR	
	sethoxydim *(Poast Plus)*	0.19	24 oz	
	\+	\+	\+	
	crop oil concentrate	1 qt	1 qt	
	OR	OR	OR	
	Dash	1 qt	1 qt	
	\+	\+	\+	
	28% liquid nitrogen	1 gal	1 gal	
	OR	OR	OR	
	ammonium sulfate	2 1/2 lb	2 1/2 lb	
	clethodim *(Select)*	0.063	4 oz	• Refer to remarks on annual grass control. • Treat volunteer corn up to 12 in. See Table 2K. • Increase rate to 6 oz/A on 12–24 in. corn.
	\+	\+	\+	
	crop oil concentrate	1%	1%	
	quizalofop-P-ethyl *(Assure II)*	0.031	5 oz	• Refer to remarks on annual grass control. • Treat volunteer corn up to 18 in. See Table 2K.
	\+	\+	\+	
	crop oil concentrate	1%	1%	
	OR	OR	OR	
	surfactant	1/4%	1/4%	
	fluazifop-P-butyl + fenoxaprop *(Fusion)*	0.126	6 oz	• Refer to remarks on annual grass control. • Treat volunteer corn from 12-24 in. See Table 2K.
	\+	\+	\+	
	crop oil concentrate	1/2-1%	1/2-1%	
	OR	OR	OR	
	surfactant	1/4-1/2%	1/4-1/2%	
Volunteer corn Weed escapes Perennials	glyphosate *(Roundup Ultra,* others—See Table 2C	Rate varies	See label	• Use with ropewick applicator, wipe-on applicator, or recirculating sprayer. • See Table 2C for a list of glyphosate products.

SOYBEANS — POSTEMERGENCE GRASS CONTROL (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Quackgrass	quizalofop-P-ethyl *(Assure II)*	0.0625	10 oz	• Make application when quackgrass is 6 to 10 in. tall. See Table 2K.
	+	+	+	• Two applications may be needed for best quackgrass control. Make second application of 7 oz/A 14 to 21 days later when quackgrass has reached 4 to 8 in. Cultivation may replace second application.
	crop oil concentrate	1%	1%	
	OR	OR	OR	
	surfactant	¼%	¼%	
				• Use 10 to 40 gal of water/A and a minimum of 40 psi.
	fluazifop-P-butyl *(Fusilade DX)*	0.188	12 oz	• Make application when quackgrass is 6 to 10 in. tall. See Table 2K.
	+	+	+	• Two applications may be needed for best quackgrass control. Make a second application of 8 oz/A 14 to 21 days later before quackgrass reaches 10 in. Cultivation may replace second application.
	crop oil concentrate	1 qt	1 qt	
				• Use 5 to 40 gal of water/A and 40 to 60 psi.
	sethoxydim *(Poast)*	0.29 + 0.19	24 oz + 16 oz	• Make application when quackgrass is 6 to 8 in. tall. See Table 2K.
	OR	OR	OR	• Two applications will be needed for best quackgrass control. Make the second application 14 to 21 days later when quackgrass has regrown. Cultivation may replace second application.
	sethoxydim *(Poast Plus)*	0.29 + 0.19	36 oz + 24 oz	
	+	+	+	
	crop oil concentrate	1 qt + 1 qt	1 qt + 1 qt	• Use 5 to 20 gal of water/A and a minimum of 40 psi.
	OR	OR	OR	
	Dash	1 qt + 1 qt	1 qt + 1 qt	
	+	+	+	
	28% liquid nitrogen	1 gal + 1 gal	1 gal + 1 gal	
	OR	OR	OR	
	ammonium sulfate	2½ lb +2½ lb	2½ lb +2½ lb	
	fluazifop-P-butyl + fenoxaprop *(Fusion)*	0.25	12 oz	• Make application when quackgrass is 6 to 10 in. tall. See Table 2K.
	+	+	+	• Two applications may be needed for best quackgrass control. Make a second application of 8 oz/A 14 to 21 days later before quackgrass reaches 10 in. Cultivation may replace second application.
	crop oil concentrate	1%	1%	
				• Use 5 to 40 gal of water/A and 40 to 60 psi.
	clethodim *(Select)*	0.125–0.25	8–16 oz	• Make application when quackgrass is 4 to 12 in. tall See Table 2K. Use high rate when grasses are stressed or at the maximum height.
	+	+	+	
	crop oil concentrate	1%	1%	• Two applications may be needed for best quackgrass control. Make a second application of 8 oz/A 14 to 21 days later when quackgrass has regrown. Cultivation may replace second application.
	+	+	+	
	ammonium sulfate	2½ lb	2½ lb	
	OR	OR	OR	
	28% liquid nitrogen	2.5%	2.5%	• Use 10 to 40 gal of water/A and 20 to 60 psi.
Postemergence **Johnsongrass**	quizalofop *(Assure II)*	0.0625	10 oz	• Reduce rate to 5 oz/A for seedling johnsongrass up to 8 in. tall.
	+	+	+	• Apply 10 oz/A to rhizome johnsongrass up to 24 in. tall.
	crop oil concentrate	1%	1%	• A second application at 6 oz/A to 6 to 10 in. johnsongrass may be needed.
	OR	OR	OR	
	surfactant	¼%	¼%	• DO NOT tank mix.
	fluazifop-P-butyl *(Fusilade DX)*	0.188	12 oz	• Reduce rate to 8 oz/A for seedling johnsongrass up to 8 in. tall.
	+	+	+	• Apply 12 oz/A to rhizome johnsongrass up to 18 in. tall.
	crop oil concentrate	1 qt	1 qt	• A second application at 8 oz/A to 6 to 12 in. johnsongrass may be needed.
				• DO NOT tank mix.
	clethodim *(Select)*	0.25	16 oz	• Reduce rate to 8 oz/A for seedling johnsongrass up to 10 in. tall.
	+	+	+	• Apply 16 oz to rhizome johnsongrass up to 18 in. tall.
	crop oil concentrate	1%	1%	• A second application at 8 oz/A to 6 to 18 in. johnsongrass may be needed.
				• DO NOT tank mix.

TABLE 2B–WEED CONTROL IN GLYPHOSATE RESISTANT SOYBEANS

Soybeans that are resistant to glyphosate are designated *Roundup Ready* soybeans. Glyphosate products labeled for postemergence use on *Roundup Ready* soybeans can be broadcast applied postemergence on *Roundup Ready* soybeans only. Read carefully all remarks and limitations written below and on the labels for each of the glyphosate products registered for use in *Roundup Ready* soybeans. See Table 2C for a list of glyphosate products registered for use in *Roundup Ready* soybeans.

WEED CONTROL IN ROUNDUP READY SOYBEANS

Weed Controlled	Herbicide	Rate lb/A a.e.	Formulation/A	Remarks and Limitations
Annual grasses **Annual broadleaves** **Suppression of:** **Yellow nutsedge** **Other perennials**	glyphosate *(Roundup Ultra,* others—see Table 2C) OR glyphosate *(Touchdown 5)* + 28% liquid nitrogen OR ammonium sulfate	0.75 OR 0.75 + 4% OR 2.5 lb	32 oz 3 L a.e. OR 1.74 pt 3.4 L a.e. + 4% OR 2.5 lb	• APPLY TO *ROUNDUP READY* SOYBEANS ONLY. • Many glyphosate products are registered for application to *Roundup Ready* soybeans. Read the label and see Table 2C to determine application rates and additives needed. • All glyphosate rates apply to glyphosate formulations containing 3 lb ae/gal (or *Touchdown 5* at 3.45 ae/gal). See labels for use rates of *Roundup UltraMAX, Roundup Ultra Dry,* and *Roundup Custom.* • *Touchdown 5* can cause leaf speckling (yellowing and bronzing) following application. This leaf injury is from the trimethylsulfonium salt of glyphosate in the *Touchdown 5.* • USE EXTREME CAUTION TO AVOID SPRAY DRIFT. CORN IS VERY SENSITIVE TO GLYPHOSATE. • APPLY WHEN WIND SPEEDS ARE LOW (BELOW 5 MPH). • AVOID EXCESSIVE SPRAY PRESSURE. • Apply to annual weeds up to 5 in. in height. DO NOT let weeds compete in soybeans for longer than 6 weeks after planting or soybean yield may be reduced. • Velvetleaf, common lambsquarters, and giant ragweed control will be inconsistent if the *Roundup Ultra* application rate is reduced to 24 oz/A (*Touchdown 5* to 1.3 pt/A). • DO NOT let barnyardgrass, crabgrass, or nightshade exceed 4 in. in height. • Adding 28% liquid nitrogen or ammonium sulfate will improve weed control if weeds are larger or drought stressed or if water source is 'hard.' • ADD SURFACTANT to *Glyfos* and *Glyphomax.* See labels. • The *Roundup Ultra* application rate can be increased to 2 qt/A (*Touchdown 5* to 3.2 pt/A) if weeds are large (10 to 12 in.) in height. See labels. These weeds may be competitive with soybean and reduce yield. • These herbicides do not have soil activity. MAKE A SECOND APPLICATION IF NEW WEEDS EMERGE. Drilled soybeans will reduce the chance of later weed emergence. • DO NOT EXCEED 3 QT/A TOTAL OF *ROUNDUP ULTRA* (or 3.2 pt/A of *Touchdown 5*) FROM SOYBEAN CRACKING THROUGH FULL FLOWER. • FOR QUACKGRASS CONTROL, treat when quackgrass is 6 to 8 in. tall.

(Continued on next page)

WEED CONTROL IN ROUNDUP READY SOYBEANS (continued)

Weed Controlled	Herbicide	Rate lb/A a.e.	Formulation/A	Remarks and Limitations
(continued) **Annual grasses** **Annual broadleaves** **Suppression of:** **Yellow nutsedge** **Other perennials**				• FOR YELLOW NUTSEDGE SUPPRESSION, apply 32 oz/A (*Touchdown 5* at 1.74 pt/A) when nutsedge is 3 to 4 in. tall. Adding *Classic* at ¾ oz/A will improve suppression OR make a second application of glyphosate 2 to 3 weeks later. • FOR PERENNIAL BROADLEAF WEED CONTROL, apply 32 oz/A (*Touchdown 5* at 1.74 pt/A) for control of annual weeds before they exceed 5 in. in height. MAKE A SECOND APPLICATION for perennial weed control before soybeans reach full flower. • Michigan State University does NOT recommend tank mixing glyphosate with other postemergence herbicides for annual weed control. Reduced weed control can result, depending on the application rate of glyphosate, the other herbicide, and the conditions and weed sizes at the time of application.
	glyphosate + imazaquin *(Backdraft)* + surfactant + 28% liquid nitrogen OR ammonium sulfate	0.56 a.i. + 1/4% + 4% OR 2.5 lb	3 pt + 1/4% + 4% OR 2.5 lb	• APPLY TO *ROUNDUP READY* SOYBEANS ONLY. • APPLY WHEN WINDS ARE BELOW 10 MPH. • USE EXTREME CAUTION TO AVOID SPRAY DRIFT. CORN IS VERY SENSITIVE TO *Backdraft.* • AVOID EXCESSIVE SPRAY PRESSURE. • Apply to weeds up to 4 in. in height. • Adding ammonium sulfate or liquid nitrogen will improve weed control if weeds are larger or drought stressed or water source is "hard." • *Backdraft* is a premix of *Scepter* + glyphosate. See Table 2F for equivalent rates.
	glyphosate + imazaquin *(Extreme)* + surfactant + 28% liquid nitrogen OR ammonium sulfate	0.81 a.i. + 1/4% + 4% OR 2.5 lb	3 pt + 1/4% + 4% OR 2.5 lb	• APPLY TO *ROUNDUP READY* SOYBEANS ONLY. • APPLY WHEN WINDS ARE BELOW 10 MPH. • USE EXTREME CAUTION TO AVOID SPRAY DRIFT. CORN IS VERY SENSITIVE TO *Extreme.* • AVOID EXCESSIVE SPRAY PRESSURE. • Apply to weeds up to 4 in. in height. • Adding ammonium sulfate or liquid nitrogen will improve weed control if weeds are larger or drought stressed or water source is "hard." • *Extreme* is a premix of *Pursuit* + glyphosate. See Table 2F for equivalent rates.

TABLE 2C – GLYPHOSATE PRODUCTS REGISTERED FOR POSTEMERGENCE APPLICATION IN *ROUNDUP READY* SOYBEANS

BRAND NAME CONTAINING GLYPHOSATE	MANUFACTURER	GLYPHOSATE FORMULATION (lb/gal) a.e.[a]	GLYPHOSATE ACID (a.e./Acre)	TYPICAL FORMULATION RATE/A	SURFACTANT NEEDED?[b]	ADD AMS?
Acquire	BASF	3	0.75	32 fl oz/A	Yes	Yes
Backdraft	BASF	0.92	0.35[d]	3 pt/A	Yes	Yes
Credit	Nufarm	3	0.75	32 fl oz/A	Yes	Yes
Extreme	BASF	1.47	0.55[d]	3 pt/A	Yes	Yes
Gly-Flo	Micro Flo	3	0.75	32 fl oz/A	Yes	Yes
Glyfos X-tra	Cheminova	3	0.75	32 fl oz/A	No	Yes
Glyphomax	Dow AgroSciences	3	0.75	32 fl oz/A	Yes	Yes
Glyphomax Plus	Dow AgroSciences	3	0.75	32 fl oz/A	No	Yes
Mirage	UAP	3	0.75	32 fl oz/A	Yes	Yes
Rattler	Helena	3	0.75	32 fl oz/A	Yes	Yes
Roundup Original	Monsanto	3	0.75	32 fl oz/A	Yes	Yes
Roundup Ultra	Monsanto	3	0.75	32 fl oz/A	No	Yes
Roundup UltraDry	Monsanto	65%	0.75	18.5 oz/A	No	Yes
Roundup UltraMAX	Monsanto	3.7	0.75	26 fl oz/A	No	Yes
Silhouette	Agriliance	3	0.75	32 fl oz/A	Yes	Yes
Touchdown 5	Zeneca	3.45	0.75	28 fl oz/A	No[c]	Yes

[a] a.e. acid equivalent, lbs of active glyphosate herbicide per gallon.

[b] For products that need a surfactant, a nonionic surfactant at 1/4% v/v is the typical recommendation. Consult the herbicide label to verify the type and rate of surfactant to include.

[c] Surfactant not required but a nonionic surfactant containing at least 75% active ingredient can be used up to 1/4% v/v with *Touchdown 5*.

[d] The glyphosate rates/A are lower for *Backdraft* and *Extreme* premixes, because rates are based on label recommendations.

TABLE 2D–CHEMICAL WEED CONTROL IN NO-TILL SOYBEANS

Effective weed control in no-tillage soybean production requires complete control of all weeds and cover crops present at the time of planting. This can be accomplished with an early preplant application of residual herbicides and/or with a burndown herbicide such as paraquat *(Gramoxone Extra)* or glyphosate (*Roundup Ultra, Touchdown,* or other glyphosate products) added to the tank mix for control of existing vegetation at planting. *Gramoxone Extra* provides a faster kill. *Roundup Ultra, Touchdown,* or other glyphosate products may provide better control if weed or cover crop growth is dense and is preferred for perennial weeds or seedling grasses prior to completion of tillering. Use ½ pt non-ionic surfactant/100 gal of water with paraquat. Double the surfactant rate if liquid fertilizer is used as the carrier. Do not use suspension fertilizers as carriers for *Gramoxone Extra.* The best carrier for *Roundup Ultra, Touchdown,* or other glyphosate products is water. Reduced control may occur if *Roundup Ultra, Touchdown* or other glyphosate products are used in tank mixtures containing fluid fertilizer. Carefully follow the mixing instructions for *Gramoxone Extra* and *Roundup Ultra, Touchdown,* or other glyphosate products.

Many situations may require little or no adjustment in application rates. However, dense plant residue and the total reliance on herbicides for weed control may require that herbicides be used at the high end of the labelled rate range for the soil type. Postemergence herbicides listed in the "Soybean—Postemergence" section (p. 63) may be needed in no-till soybeans to provide season long control.

EFFECTIVENESS OF HERBICIDES FOR BURNDOWN IN SOYBEANS*,**

	ANNUAL BROADLEAVES										ANNUAL GRASSES								WINTER ANNUALS/PERENNIALS							COVER CROPS			
	Cocklebur	Jimsonweed	Lambsquarters	Nightshade (E. Black)	Pigweed	Ragweed (Common)	Ragweed (Giant)	Smartweed	Velvetleaf	Wild Mustard	Barnyardgrass	Crabgrass	Giant Foxtail	Green Foxtail	Yellow Foxtail	Fall Panicum	Witchgrass	Wild Proso Millet/Sandbur	Chickweed (common)	Yellow Rocket	Shepards' purse	Pennycress	Marestail (Horseweed)	Dandelion[g]	Quackgrass	Rye	Wheat	Clover	Hairy Vetch
	Maximum Weed Height (inches)																		Herbicide Effectiveness										
Sencor (¾ pt/A)[ab]	2	2	2	NR	2	2	NR	2	2	2	–	–	–	–	–	–	–	–	G	–	–	–	F	P	P	P	P	P	P
Lorox (¾ qt/A)[ab]	NR	NR	2	–	2	2	NR	2	2	2	–	–	–	–	–	–	–	–	G	–	–	–	P	P	P	P	P	P	P
Canopy (4 oz/A)+ Sencor (2 oz/A)[ab]	2	2	2	–	2	2	2	2	2	2	–	–	–	–	–	–	–	–	G	G	G	G	F	F	P	P	P	P	P
Backdraft (3 pt/A)	8	2	2	2	5	2	2	3	3	12	3	3	8	8	8	4	–	–	E	G	E	G	G	P	P	G	G	P	P
Extreme (3 pt/A)	8	5	2	2	5	2	2	3	2	5	3	3	8	8	8	2	–	–	E	G	E	G	G	P	P	G	G	P	P
Steel (3 pt/A)[ad]	8	3	NR	2	6	NR	NR	3	2	3	3	3	6	3	3	NR	NR	NR	G	G	G	–	P	P	N	P	P	P	P
FirstRate[a] (0.3–0.6 oz/A)	10	4	NR	NR	NR	10	10	6	6	–	NR	NR	NR	NR	NR	NR	NR	NR	P	–	F	G	E	P	N	N	N	–	–
Python[a] (1.14 oz/A)	–	–	–	–	–	–	–	–	–	–	NR	NR	NR	NR	NR	NR	NR	NR	G	–	F	G	E	P	N	N	N	–	–
Canopy[ab] (2 oz/A)	2	2	–	–	2	2	2	2	2	2	–	–	–	–	–	–	–	–	G	G	G	G	F	F	P	P	P	P	P
Canopy XL[abc] (2.5 oz/A)	NR	NR	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1	F	G	G	G	F	G	P	P	P	P	P
2,4-D Ester (1 pt/A)[e]	3	NR	3	3	3	3	3	NR	2	3	NR	NR	NR	NR	NR	NR	NR	NR	P	F	G	F	E	F	N	N	N	F	F
2,4-D Ester (1 qt/A)[e]	6	3	6	6	6	6	6	3	5	6	NR	NR	NR	NR	NR	NR	NR	NR	F	G	E	G	E	G	N	N	N	G	G
Roundup Ultra (1 pt/A)[fi]	5	2	2	2	5	2	NR	NR	NR	5	NR	–	5	5	5	–	–	–	E	G	E	G	G	P	P	G	G	P	P
Roundup Ultra (1 qt/A)[fi]	16	10	10	10	16	10	5	5	5	16	5	–	16	16	16	–	–	–	E	E	E	E	E	P	F	E	E	F	F

P = Poor; F = Fair; G = Good; E = Excellent; N = None; NR = Not Recommended; – = Not enough information to rank

(Continued on next page)

EFFECTIVENESS OF HERBICIDES FOR BURNDOWN IN SOYBEANS*,**

	ANNUAL BROADLEAVES										ANNUAL GRASSES								WINTER ANNUALS/PERENNIALS							COVER CROPS			
	Cocklebur	Jimsonweed	Lambsquarters	Nightshade (E. Black)	Pigweed	Ragweed (Common)	Ragweed (Giant)	Smartweed	Velvetleaf	Wild Mustard	Barnyardgrass	Crabgrass	Giant Foxtail	Green Foxtail	Yellow Foxtail	Fall Panicum	Witchgrass	Wild Proso Millet/Sandbur	Chickweed (common)	Yellow Rocket	Shepards' purse	Pennycress	Marestail (Horseweed)	Dandelion[h]	Quackgrass	Rye	Wheat	Clover	Hairy Vetch
	Maximum Weed Height (inches)																		Herbicide Effectiveness										
Touchdown 5 (.87 pt/A)[f]	5	2	2	2	5	2	NR	NR	NR	5	NR	–	5	5	5	–	–	–	E	G	E	G	G	P	P	G	G	P	P
Touchdown 5 (.87 qt/A)[f]	16	10	10	10	16	10	5	5	5	16	5	–	16	16	16	–	–	–	E	E	E	E	E	P	F	E	E	F	F
Gramoxone Extra (1½ pt/A)[g] Gramoxone Max (1.25 pt/A)	3	3	3	3	3	3	3	NR	3	3	3	3	3	3	3	3	3	3	E	G	G	G	P	P	P	F	F	P	P
Gramoxone Extra (2½ pt/A)[g] Gramoxone Max (2.1 pt/A)	6	6	6	6	6	6	6	NR	6	6	6	6	6	6	6	6	6	6	E	E	E	E	P	P	P	G	G	F	F

P = Poor; F = Fair; G = Good; E = Excellent; N = None; NR = Not Recommended; – = Not enough information to rank

*Burndown effectiveness varies depending on several factors. This table is intended as a guide to relative effectiveness of burndown herbicide options. This table assumes tank mix application with residual herbicides.

**To avoid excessive cover crop growth, *Gramoxone Extra* or *Roundup Ultra, Touchdown,* or other glyphosate products (Table 2C) may be applied prior to planting.

a. Burndown effectiveness of these herbicides is highly dependent on environment. Maximum effectiveness will occur under high temperature, high humidity conditions. Under cool, cloudy conditions burndown effectiveness will be inadequate.

b. Always add crop oil concentrate at 1 qt/A to maximize foliar activity.

c. To improve common chickweed control, add *Express, Lexone, Sencor* or glyphosate. To improve marestail control, add 2,4-D ester.

d. Always add either 28% liquid nitrogen at 1 qt/A or ammonium sulfate at 2.5 lb/A PLUS crop oil concentrate at 1 qt/A to maximize foliar activity.

e. Delay planting at least 7 and 30 days following 2,4-D ester application at 1 pt/A and 1 qt/A, respectively. Do not apply 2,4-D amine before planting soybeans. Refer to 2,4-D label for approval for preplant application in soybeans.

f. Addition of ammonium sulfate at 17 lbs/100 gal of water often improves control.

g. Always add surfactant (1/2 pt/100 gal of water) with *Gramoxone Extra* and *Gramoxone Max.* Regrowth of rye or wheat may occur if plants are not fully tillered when treated.

h. Dandelion control with *Gramoxone Extra* will be improved when treatment is tank mixed with *Canopy.*

i. Other glyphosate products can be substituted for *Roundup Ultra.* Always check the herbicide label for instructions on the addition of non-ionic surfactant. See Table 2C.

MARESTAIL (HORSEWEED) CONTROL IN NO-TILL SOYBEANS

(Following corn, soybeans, or small grains without a cover crop)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Early preplant				
Annual grasses	2,4-D ester	0.5	1 pt	• Apply 10 to 14 days before planting.
Annual broadleaves	OR	OR	OR	• Delay planting at least 7 days following 2,4-D ester
Marestail	glyphosate *(Roundup Ultra,* others)	0.56	1½ pt 3L a.e.	application at 1 pt/A. Do not apply 2,4-D amine before planting soybeans. • If marestail plants exceed 2 in., increase *Roundup Ultra* rate to 1 qt/A. • Must be followed by a sequential application pre-emergence. • Do not treat when plants are under stress. • Apply when air temperature is at least 60°F. • Control will be maximized with spray volume of 5 to 10 gal/A. • Use flat fan nozzles.
FOLLOWED BY:	metribuzin	⅜	¾ pt 4L	• Apply preemergence.
Preemergence	*(Sencor)*		OR	• Refer to herbicide labels for approved burndown
			½ lb 75% DF	herbicides.
			OR	• Add alachlor, *Dual Magnum,* or *Frontier* for annual
			½ lb Sencor Solupak	grass control.
	OR	OR	OR	
	metribuzin + chlorimuron ethyl *(Canopy)*	0.19	4 oz 75% DG	
	+	+	+	
	metribuzin *(Sencor)*	0.10	2 oz 75% DG	
	OR	OR	OR	
	linuron *(Lorox or Linex)*	¾	¾ qt 4L	
			OR	
			1½ lb 50% DF	
	OR	OR	OR	
	flumetsulam *(Python)*	0.057	1.14 oz 80% DG	
	OR	OR	OR	
	cloransulam-methyl *(FirstRate)*	0.031	0.6 oz 84% WDG	
			+	
	Burndown (See Table 2D)			
Early preplant				
Annual grasses	metribuzin	¼	½ pt 4L	• Apply 10 to 14 days before planting.
Annual broadleaves	*(Sencor)*		OR	• Apply before marestail plants exceed 3 in.
Marestail			⅜ lb 75% DF	• Must be followed by a sequential application
			OR	preemergence.
			⅜ lb *Sencor Solupak*	
FOLLOWED BY:	metribuzin	⅛	¼ pt 4L	• Apply preemergence.
Preemergence	*(Sencor)*		OR	• Refer to herbicide labels for approved burndown
			⅜ lb 75% DF	herbicides.
			OR	• Add alachlor, *Dual Magnum,* or *Frontier* for annual
			⅜ lb *Sencor Solupak*	grass control.
	+			
	Burndown (See Table 2D)			

(Continued on next page)

MARESTAIL (HORSEWEED) CONTROL IN NO-TILL SOYBEANS (continued)

(Following corn, soybeans, or small grains without a cover crop)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Early preplant				
Annual grasses **Annual broadleaves** **Marestail**	metribuzin + chlorimuron-ethyl *(Canopy)*	0.14	3 oz 75% DG	• Apply 10 to 14 days before planting. • Apply before marestail plants exceed 3 in. • Must be followed by a sequential application preemergence.
	+	+	+	
	metribuzin *(Sencor)*	0.08	1.5 oz 75% DG	
FOLLOWED BY: ***Preemergence***	metribuzin + chlorimuron-ethyl *(Canopy)*	0.05	1 oz 75% DG	• Apply preemergence. • Refer to herbicide labels for approved burndown herbicides.
	+	+	+	• Add alachlor, *Dual Magnum,* or *Frontier* for annual grass control.
	metribuzin *(Sencor)*	0.03	0.5 oz 75% DG	
	+ Burndown (See Table 2D)			
Preemergence	glyphosate *(Roundup Ultra,* others)	¾	2 pt 3L a.e.	• Apply preemergence. • Apply before marestail plants exceed 3 in.
	+	+	+	• *Roundup Ultra* (and other glyphosates) rate must be at least 2 pt/A for effective control of marestail.
	metribuzin *(Sencor)*	⅜	¾ pt 4L OR ½ lb 75% DF OR ½ lb *Sencor Solupak*	• Do not treat when plants are under stress. • Apply when air temperature is at least 60°F. • Use a maximum of 40 gal of water/A. • Requires rainfall following application for adequate control.
	OR	OR	OR	
	metribuzin + chlorimuron ethyl *(Canopy)*	0.19	4 oz 75% DG	• Add alachlor, *Dual Magnum,* or *Frontier* for annual grass control.
	+	+	+	
	metribuzin *(Sencor)*	0.10	2 oz 75% DG	
	OR	OR	OR	
	flumetsulam *(Python)*	0.057	1.14 oz 80% DG	
	OR	OR	OR	
	cloransulam-methyl *(FirstRate)*	0.031	0.6 oz 84% WDG	

TABLE 2E–SOYBEANS– PREHARVEST APPLICATION

SOYBEANS — PREHARVEST APPLICATION

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses **Annual broadleaves** **Perennial Weeds**	glyphosate *(Roundup Ultra, Touchdown 5, Glyphomax Plus, Glyphomax)*	¾-3	1-4 qt	• **Apply a maximum of 1.6 pt/A of *Touchdown 5*.** • DO NOT apply to soybeans grown for seed. • Apply up until 7 days before harvest. • Pods must NOT be green. • DO NOT graze or harvest the treated crop for livestock feed within 25 days of application. • Apply in 10-40 gal of water. • Apply 1 qt/A for all products except *Touchdown 5* for annual weeds. • Apply rate needed for perennial weeds with all products except *Touchdown 5*.
Annual grasses **Annual broadleaves**	paraquat *(Gramoxone Extra)* OR *(Gramoxone Max)* + surfactant	0.25 + ⅛%	12.8 oz OR 7.7 oz + ⅛%	• *Gramoxone Extra* and *Gramoxone Max* are **restricted use** pesticides. • Indeterminate varieties: Apply when at least 65% of pods are mature brown (seed moisture less than 30%) • Determinate varieties: Apply when ½ of leaves have • Determinate varieties: Apply when ½ of leaves have dropped. • Immature soybeans will be injured. • Do not pasture for 15 days. • Apply *Gramaxone Extra* in 10 gal. of water (ground); 5 gal. of water (air). • Apply *Gramoxone Max* in 20 gal. water (ground); 5 gal. water (air).

TABLE 2F–
HERBICIDE PREMIXES IN SOYBEANS

TRADE NAME	COMPANY	FORMULATION	TYPICAL USE RATE	=	EQUIVALENT RATES
Axiom	Bayer	68% DF	13 oz/Acre	=	.36 lb ai flufenacet + 2.3 oz Sencor DF
Backdraft	BASF	1.5	3 pt/A	=	0.93 pt glyphosate + 2.14 oz Scepter
Boundary	Novartis	7.8	1.25 pt/A	=	1 pt of Dual II Magnum 5 oz of Sencor DF
Bronco	Monsanto	4L	4 qt/Acre	=	2.6 qt Lasso + 1.4 qt Roundup
Broadstrike/Dual	Novartis	7.67	2¼ pt/Acre	=	1.12 oz Python + 2.1 pt Dual
Broadstrike + Treflan	Dow AgroSciences	3.65	2 pt/Acre	=	1.24 oz Python + 1¾ pt Treflan
Canopy	DuPont	75% DG	4 oz/Acre	=	1.7 oz Classic + 3.5 oz Lexone/Sencor
Canopy XL	DuPont	56.3% DG	3.8 oz/Acre	=	1.4 oz Classic + 2.5 oz Authority
Command Xtra	FMC	co-pack	9.6 oz/A 25.6 oz/A	of of	Sulfentrazone 75 DF (B) Command (G)
Conclude	BASF	co-pack	1.5 pt/Acre 1.5 pt/Acre	of of	Storm (Conclude B) + Poast (Conclude G)
Domain	Bayer	60% DF	13 oz/Acre	=	.195 lb ai flufenacet + 6.2 oz Sencor DF
Extreme	BASF	2.17	3 pt/A	=	1.5 pt glyphosate + 4 fl oz Pursuit
Fusion	Zeneca	2.66	½ pt/Acre	=	1 pt Fusilade 2000 + 0.4 pt Option II
Galaxy	BASF	3.67	2 pt/Acre	=	1½ pt Basagran + 2/3 pt Blazer
Gauntlet	FMC	co-pack	5.33 oz/A 0.6 oz/A	of of	Sulfentrazone 75 DF FirstRate
Rezult B:G	BASF	co-pack	1.6 pt/Acre 1.6 pt/Acre		of Basagran (B) of Poast Plus (G)
Steel	BASF	2.59	3 pt/Acre	=	2.1 pt Prowl 3.3 EC + 1/4 pt Pursuit + 0.33 pt Scepter
Stellar	Valent	3.1	5 oz/Acre	=	6 oz Cobra + 4 oz Resource
Storm	BASF	4.0	1½ pt/Acre	=	1 pt Basagran + 1 pt Blazer
Squadron	BASF	2.33	3 pt/Acre	=	1.8 pt Prowl 3.3EC + ⅔ pt Scepter
Synchrony STS	DuPont	42% DF	1/2 oz/Acre	=	0.64 oz Classic + 0.20 oz Pinnacle
Pursuit Plus	BASF	3.0	2½ pt/Acre	=	2.1 pt Prowl 3.3EC + ¼ pt Pursuit

TABLE 2G–WEED RESPONSE TO HERBICIDES IN SOYBEANS*

			ANNUAL BROADLEAVES											ANNUAL GRASSES								PERENNIALS				
	MODE OF ACTION	CROP RESPONSE	COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (E. BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	RAGWEED (GIANT)	SMARTWEED	VELVETLEAF	WILD MUSTARD	HORSEWEED (MARESTAIL)	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	SANDBUR	BINDWEED (FIELD)	BINDWEED (HEDGE)	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE
Preplant Incorporated																										
DUAL MAGNUM/DUAL II MAGNUM	O	1	N	N	P	F	**G**	P	N	P	N	P	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
LASSO/PARTNER/MICROTECH	O	1	N	N	P	**G**	**G**	P	N	P	N	P	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
FRONTIER/OUTLOOK	O	1	N	N	P	**G**	**G**	P	N	P	N	P	N	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
SENCOR	C	2	**G**	F	**E**	N	**E**	**G**	F	**E**	**G**	**E**	–	P	F	**G**	**G**	**G**	F	F	P	N	N	N	N	N
CANOPY+SENCOR	C/B	3	**E**	**G**	**E**	P	**E**	**G**	**G**	**E**	**G**	**E**	–	F	F	F	**G**	**G**	F	F	P	N	N	N	N	F
CANOPY XL	B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	F	F	**G**	F	F	–	–	–	P	P	–	–	F
AUTHORITY	O	3	P	P	**G**	**G**	**G**	F	P	P	F	P	–	F	–	F	F	–	–	–	–	N	N	–	–	F
PYTHON	B	1	F	F	**E**	**G**	**E**	F	F	**G**	**G**	**E**	–	P	P	F	P	P	P	P	P	N	N	N	N	N
FIRSTRATE	B	2	**G**	**G**	**G**	P	**E**	**E**	**G**	**E**	**G**	**E**	–	F	F	F	F	F	F	–	–	N	N	N	N	P
PROWL, PENDIMAX	O	1	N	N	**G**	P	**G**	P	N	P	F	P	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	N
PURSUIT	B	1	F	F	**G**	**E**	**E**	F	F	**G**	**G**	**E**	–	F	F	**G**	**G**	**G**	P	P	P	P	P	N	N	F
SCEPTER	B	1	**E**	**G**	**G**	**G**	**E**	F	**G**	**G**	**G**	**G**	–	F	P	**G**	**G**	**G**	P	P	P	N	N	N	N	F
SONALAN	O	1	N	N	**G**	F	**G**	P	N	P	N	P	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	N
TREFLAN	O	1	N	N	**G**	N	**G**	N	N	P	N	P	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	N
BROADSTRIKE/DUAL	B/O	1	F	F	**E**	**G**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
BROADSTRIKE/TREFLAN	B/O	1	F	F	**E**	**G**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	F
DUAL+SENCOR[a]	O/C	2	**G**	F	**E**	F	**E**	**G**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
LASSO+SENCOR[a]	O/C	2	**G**	F	**E**	**G**	**E**	**G**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
FRONTIER+SENCOR	O/C	2	**G**	F	**E**	**G**	**E**	**G**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
TREFLAN+SENCOR[a]	O/C	2	**G**	F	**E**	N	**E**	**G**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	N
SONALAN+SENCOR[a]	O/C	2	**G**	F	**E**	F	**E**	**G**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	N
PROWL+SENCOR[a]	O/C	2	**G**	F	**E**	P	**E**	**G**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	N
DUAL+CANOPY+SENCOR	O/C/B	3	**E**	**G**	**E**	F	**E**	**G**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
LASSO+CANOPY+SENCOR	O/C/B	3	**E**	**G**	**E**	**G**	**E**	**G**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
FRONTIER+CANOPY+SENCOR	O/C/B	3	**E**	**G**	**E**	**G**	**E**	**G**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
TREFLAN+CANOPY+SENCOR	O/C/B	3	**E**	**G**	**E**	P	**E**	**G**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	F
SONALAN+CANOPY+SENCOR	O/C/B	3	**E**	**G**	**E**	F	**E**	**G**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	F
PROWL+CANOPY+SENCOR	O/C/B	3	**E**	**G**	**E**	P	**E**	**G**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	F
DUAL+CANOPY XL	O/B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	P	P	–	–	**G**
LASSO+CANOPY XL	O/B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	P	P	–	–	**G**
FRONTIER+CANOPY XL	O/B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	P	P	–	–	**G**
TREFLAN+CANOPY XL	O/B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	P	P	P	–	–	F
SONALAN+CANOPY XL	O/B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	P	P	P	–	–	F
PROWL+CANOPY XL	O/B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	P	P	P	–	–	F
LASSO+PYTHON	O/B	1	F	F	**E**	**G**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
FRONTIER+PYTHON	O/B	1	F	F	**E**	**G**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
SONALAN+PYTHON	O/B	1	F	F	**E**	**G**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	N	N	N	N	N
PROWL+PYTHON	O/B	1	F	F	**E**	**G**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	N	N	N	N	N
DUAL+FIRSTRATE	O/B	2	**G**	**G**	**G**	**G**	**E**	**E**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
LASSO+FIRSTRATE	O/B	2	**G**	**G**	**G**	**G**	**E**	**E**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
FRONTIER+FIRSTRATE	O/B	2	**G**	**G**	**G**	**G**	**E**	**E**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
TREFLAN+FIRSTRATE	O/B	2	**G**	**G**	**G**	P	**E**	**E**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	P
SONALAN+FIRSTRATE	O/B	2	**G**	**G**	**G**	P	**E**	**E**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	P

P = Poor; F = Fair; **G** = Good; **E** = Excellent; N = None; – = Not enough information to rank
Herbicide mode of Action: A = ACCase inhibitor; B = ALS inhibitor; C = Photosynthesis inhibitor; O = Other.
Crop Response: 1=Minimal risk of crop injury; 2=Crop injury can occur under certain conditions (soil applied—cold, wet: foliar applied—hot, humid); 3=Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4=Risk of severe crop injury is high. Recommended only in rescue situations.

[a] Add 2 oz/A of Pursuit to improve black nightshade control.

* The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.

TABLE 2G–WEED RESPONSE TO HERBICIDES IN SOYBEANS*

			ANNUAL BROADLEAVES												ANNUAL GRASSES								PERENNIALS				
	MODE OF ACTION	CROP RESPONSE	COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (E. BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	RAGWEED (GIANT)	SMARTWEED	VELVETLEAF	WILD MUSTARD	HORSEWEED (MARESTAIL)	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	SANDBUR	BINDWEED (FIELD)	BINDWEED (HEDGE)	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE
Preplant Incorporated continued																											
PROWL+FIRSTRATE	O/B	2	**G**	**G**	**G**	P	**E**	**E**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	P
DUAL+SCEPTER	O/B	1	**E**	**G**	**G**	**G**	**E**	F	**G**	**G**	**G**	**G**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
LASSO+SCEPTER	O/B	1	**E**	**G**	**G**	**G**	**E**	F	**G**	**G**	**G**	**G**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
FRONTIER+SCEPTER	O/B	1	**E**	**G**	**G**	**G**	**E**	F	**G**	**G**	**G**	**G**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
TREFLAN+SCEPTER	O/B	1	**E**	**G**	**G**	**G**	**E**	F	**G**	**G**	**G**	**G**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	F
SONALAN+SCEPTER	O/B	1	**E**	**G**	**G**	**G**	**E**	F	**G**	**G**	**G**	**G**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	F
PROWL+SCEPTER	O/B	1	**E**	**G**	**G**	**G**	**E**	F	**G**	**G**	**G**	**G**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	F
DUAL+PURSUIT	O/B	1	F	F	**G**	**E**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	P	P	N	N	**G**
LASSO+PURSUIT	O/B	1	F	F	**G**	**E**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	P	P	N	N	F
FRONTIER+PURSUIT	O/B	1	F	F	**G**	**E**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	P	P	N	N	**G**
TREFLAN+PURSUIT	O/B	1	F	F	**G**	**E**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	P	P	N	N	F
SONALAN+PURSUIT	O/B	1	F	F	**G**	**E**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	P	P	N	N	F
PURSUIT PLUS	O/B	1	F	F	**G**	**E**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	P	P	N	N	F
STEEL	O/B/B	1	**G**	F	**G**	**E**	**E**	**G**	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	F
BOUNDARY	C/O	2	**G**	F	**E**	F	**E**	**G**	F	**E**	**G**	**E**	**G**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
CANOPY XL + AUTHORITY	B/O/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	F	F	**G**	F	F	–	–	–	P	P	–	–	F
GAUNTLET	B/0	3	**G**	**G**	**G**	**G**	**E**	**E**	**G**	**E**	**G**	**E**	–	F	F	F	F	F	F	–	–	N	N	N	N	F

P = Poor; F = Fair; **G** = Good; **E** = Excellent; N = None; – = Not enough information to rank
Herbicide mode of Action: A = ACCase inhibitor; B = ALS inhibitor; C = Photosynthesis inhibitor; O = Other.
Crop Response: 1=Minimal risk of crop injury; 2=Crop injury can occur under certain conditions (soil applied—cold, wet: foliar applied—hot, humid); 3=Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4=Risk of severe crop injury is high. Recommended only in rescue situations.

[a] Add 2 oz/A of Pursuit to improve black nightshade control.

* The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.

TABLE 2G–WEED RESPONSE TO HERBICIDES IN SOYBEANS*

			ANNUAL BROADLEAVES											ANNUAL GRASSES								PERENNIALS				
	MODE OF ACTION	CROP RESPONSE	COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (E. BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	RAGWEED (GIANT)	SMARTWEED	VELVETLEAF	WILD MUSTARD	HORSEWEED (MARESTAIL)	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	SANDBUR	BINDWEED (FIELD)	BINDWEED (HEDGE)	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE
Preemergence																										
COMMAND 3ME	O	1	F	F	**G**	P	P	**G**	P	**G**	**E**	P	—	**G**	**E**	**E**	**E**	**G**	**G**	**G**	F	N	N	N	N	N
DUAL MAGNUM/DUAL II MAGNUM	O	1	N	N	P	F	**G**	P	N	P	N	P	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
LASSO/PARTNER/MICROTECH	O	1	N	N	P	**G**	**G**	P	N	P	N	P	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	P
AXIOM	O/C	1	P	P	F	P	F	P	P	P	P	P	–	F	F	F	F	F	F	F	P	N	N	N	N	P
DOMAIN	O/C	2	F	F	**G**	P	**E**	**G**	F	**E**	**G**	**E**	**G**	F	F	**G**	**G**	**G**	F	F	P	N	N	N	N	N
FRONTIER/OUTLOOK	O	1	N	N	P	**G**	**G**	P	N	P	N	P	N	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
SENCOR	C	2	F	F	**E**	N	**E**	**G**	F	**E**	**G**	**E**	**G**	P	F	**G**	**G**	**G**	F	F	P	N	N	N	N	N
LINEX/LOROX	C	2	P	P	**G**	F	**G**	**G**	F	**G**	F	**G**	P	F	F	F	F	F	F	F	P	N	N	N	N	N
CANOPY+SENCOR	C/B	3	**G**	**G**	**E**	P	**E**	**G**	**G**	**E**	**G**	**E**	**E**	F	F	F	**G**	**G**	F	F	P	N	N	N	N	F
CANOPY XL	B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	F	F	**G**	F	F	F	–	–	P	P	–	–	F
AUTHORITY	O	3	P	P	**G**	**G**	**G**	F	P	P	F	P	–	F	–	F	F	–	–	–	–	N	N	–	–	F
PYTHON	B	1	F	F	**E**	**E**	**E**	F	F	**G**	**G**	**E**	–	P	P	F	P	P	P	P	P	N	N	N	N	N
FIRSTRATE	B	2	**G**	**G**	**G**	P	**E**	**E**	**G**	**E**	**G**	**E**	–	F	F	F	F	F	F	–	–	N	N	N	N	P
PROWL, PENDIMAX	O	2	N	N	**G**	P	F	P	N	P	F	P	P	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	N	N	N	N	N
PURSUIT	B	1	F	F	F	**E**	**E**	F	F	**G**	F	**G**	P	F	F	F	F	F	P	P	P	N	N	N	N	F
SCEPTER	B	1	**G**	**G**	**G**	F	**E**	**G**	**G**	**G**	F	**G**	P	F	P	**G**	**G**	**G**	P	P	P	N	N	N	N	P
BROADSTRIKE/DUAL	B/O	1	F	F	**E**	**E**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
DUAL+LOROX	O/C	2	P	P	**G**	**G**	**G**	**G**	F	**G**	F	**G**	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
LASSO+LOROX	O/C	2	P	P	**G**	**G**	**G**	**G**	F	**G**	F	**G**	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	P
FRONTIER+LOROX	O/C	2	P	P	**G**	**G**	**G**	**G**	F	**G**	F	**G**	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
AXIOM+LOROX	O/C/C	2	P	P	**G**	F	**G**	**G**	F	**G**	F	**G**	P	F	F	F	F	F	F	F	P	N	N	N	N	P
PROWL+LOROX	O/C	3	P	P	**G**	F	**G**	**G**	F	**G**	F	**G**	P	**G**	**G**	**G**	**G**	**G**	**G**	**G**	F	N	N	N	N	N
DUAL+SENCOR[a]	O/C	2	F	F	**E**	F	**E**	**G**	F	**E**	**G**	**E**	**G**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
LASSO+SENCOR[a]	O/C	2	F	F	**E**	**G**	**E**	**G**	F	**E**	**G**	**E**	**G**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	P
FRONTIER+SENCOR[a]	O/C	2	F	F	**E**	**G**	**E**	**G**	F	**E**	**G**	**E**	**G**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
PROWL+SENCOR[a]	O/C	3	F	F	**E**	P	**E**	**G**	F	**E**	**G**	**E**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	F	N	N	N	N	N
AXIOM+SENCOR[a]	O/C/C	2	F	F	**E**	N	**E**	**G**	F	**E**	**G**	**E**	**G**	P	F	**G**	**G**	**G**	F	F	P	N	N	N	N	P
DUAL+SCEPTER	O/B	1	**G**	**G**	**G**	**G**	**E**	**G**	**G**	**G**	F	**G**	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
LASSO+SCEPTER	O/B	1	**G**	**G**	**G**	**G**	**E**	**G**	**G**	**G**	F	**G**	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	P
FRONTIER+SCEPTER	O/B	1	**G**	**G**	**G**	**G**	**E**	**G**	**G**	**G**	F	**G**	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
PROWL+SCEPTER	O/B	2	**G**	**G**	**G**	F	**E**	**G**	**G**	**G**	F	**G**	P	**G**	**G**	**G**	**G**	**G**	**G**	**G**	F	N	N	N	N	P
AXIOM+SCEPTER	O/C/B	1	**G**	**G**	**G**	F	**E**	**G**	**G**	**G**	F	**G**	P	F	P	**G**	**G**	**G**	P	P	P	N	N	N	N	P
DUAL+PURSUIT	O/B	1	F	F	F	**E**	**E**	F	F	**G**	F	**G**	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
LASSO+PURSUIT	O/B	1	F	F	F	**E**	**E**	F	F	**G**	F	**G**	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
FRONTIER+PURSUIT	O/B	1	F	F	F	**E**	**E**	F	F	**G**	F	**G**	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
AXIOM+PURSUIT	O/C/B	1	F	F	F	**E**	**E**	F	F	**G**	F	**G**	P	F	F	F	F	F	P	P	P	N	N	N	N	F
PURSUIT PLUS	O/B	2	F	F	**G**	**E**	**E**	F	F	**G**	**G**	**G**	P	**G**	**G**	**E**	**G**	**G**	**G**	**G**	**G**	N	N	N	N	F
STEEL	O/B/B	2	**G**	F	**G**	**E**	**E**	**G**	F	**G**	**G**	**E**	P	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	N	N	N	N	F
DUAL+CANOPY+SENCOR	O/C/B	3	**G**	**G**	**E**	F	**E**	**G**	**G**	**E**	**G**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
LASSO+CANOPY+SENCOR	O/C/B	3	**G**	**G**	**E**	**G**	**E**	**G**	**G**	**E**	**G**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
FRONTIER+CANOPY+SENCOR	O/C/B	3	**G**	**G**	**E**	**G**	**E**	**G**	**G**	**E**	**G**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	P	P	N	N	F
AXIOM+CANOPY+SENCOR	O/C/C/B	3	**G**	**G**	**E**	P	**E**	**G**	**G**	**E**	**G**	**E**	**E**	F	F	F	**G**	**G**	F	F	P	N	N	N	N	F

P = Poor; F = Fair; **G** = Good; **E** = Excellent; N = None; – = Not enough information to rank
Herbicide mode of Action: A = ACCase inhibitor; B = ALS inhibitor; C = Photosynthesis inhibitor; O = Other.
Crop Response: 1=Minimal risk of crop injury; 2=Crop injury can occur under certain conditions (soil applied—cold, wet: foliar applied—hot, humid); 3=Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4=Risk of severe crop injury is high. Recommended only in rescue situations.

[a] Add 2 oz/A of Pursuit to improve black nightshade control.

* The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.

TABLE 2G–WEED RESPONSE TO HERBICIDES IN SOYBEANS*

			ANNUAL BROADLEAVES											ANNUAL GRASSES								PERENNIALS				
	MODE OF ACTION	CROP RESPONSE	COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (E. BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	RAGWEED (GIANT)	SMARTWEED	VELVETLEAF	WILD MUSTARD	HORSEWEED (MARESTAIL)	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	SANDBUR	BINDWEED (FIELD)	BINDWEED (HEDGE)	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE
Preemergence continued																										
DUAL+CANOPY XL	O/B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	P	P	–	–	**G**
LASSO+CANOPY XL	O/B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	P	P	–	–	F
FRONTIER+CANOPY XL	O/B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	P	P	–	–	**G**
PROWL+CANOPY XL	O/B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**E**	**E**	–	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	P	P	–	–	F
AXIOM+CANOPY XL	O/C/B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	F	F	**G**	F	F	F	P	P	P	P	–	–	F
LASSO+PYTHON[b]	O/B	1	F	F	**E**	**E**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
FRONTIER+PYTHON[b]	O/B	1	F	F	**E**	**E**	**E**	F	F	**G**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
AXIOM+PYTHON[b]	O/C/B	1	F	F	**E**	**E**	**E**	F	F	**G**	**G**	**E**	–	F	F	F	F	F	F	F	P	N	N	N	N	F
DUAL+FIRSTRATE	O/B	2	**G**	**G**	**G**	F	**E**	**E**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
LASSO+FIRSTRATE	O/B	2	**G**	**G**	**G**	**G**	**E**	**E**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	P
FRONTIER+FIRSTRATE	O/B	2	**G**	**G**	**G**	**G**	**E**	**E**	**G**	**E**	**G**	**E**	–	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
AXIOM+FIRSTRATE	O/C/B	2	**G**	**G**	**G**	P	**E**	**E**	**G**	**E**	**G**	**E**	–	F	F	F	F	F	F	F	P	N	N	N	N	P
COMMAND 3ME+CANOPY+SENCOR	O/C/B	3	**G**	**G**	**E**	P	**E**	**G**	**G**	**E**	**E**	**E**	**E**	**G**	**E**	**E**	**E**	**G**	**G**	**G**	F	N	N	N	N	F
COMMAND 3ME+LASSO	O/O	1	F	F	**G**	**G**	**G**	**G**	P	**G**	**E**	P	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	F	N	N	N	N	P
COMMAND 3ME+DUAL	O/O	1	F	F	**G**	F	**G**	**G**	P	**G**	**E**	P	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	F	N	N	N	N	F
COMMAND 3ME+SCEPTER	O/B	1	**G**	**G**	**G**	F	**E**	**G**	**G**	**G**	**E**	**G**	P	**G**	**E**	**E**	**E**	**G**	**G**	**G**	F	N	N	N	N	P
COMMAND 3ME+LOROX	O/C	2	F	F	**G**	F	**G**	**G**	F	**G**	**E**	**G**	P	**G**	**E**	**E**	**E**	**G**	**G**	**G**	F	N	N	N	N	N
COMMAND 3ME+SENCOR	O/C	2	F	F	**E**	P	**E**	**G**	F	**E**	**E**	**E**	**G**	**G**	**E**	**E**	**E**	**G**	**G**	**G**	F	N	N	N	N	N
COMMAND 3ME+CANOPY XL	O/B/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**E**	**E**	–	**G**	**E**	**E**	**E**	**G**	**G**	**G**	F	P	P	–	–	F
BOUNDARY	C/O	2	**G**	F	**E**	F	**E**	**G**	F	**E**	**G**	**E**	**G**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	**G**
CANOPY XL + AUTHORITY	B/O/O	3	F	F	**E**	**G**	**E**	**E**	F	**E**	**G**	**E**	–	F	F	**G**	F	F	F	–	–	P	P	–	–	F
COMMAND XTRA	O/O	3	P	P	**G**	**G**	**G**	**G**	P	**G**	**E**	P	–	**G**	**E**	**E**	**E**	**G**	**G**	**G**	F	N	N	N	N	F
GAUNTLET	B/O	3	**G**	**G**	**G**	**G**	**E**	**E**	**G**	**E**	**G**	**E**	–	F	F	F	F	F	F	–	–	N	N	N	N	F

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[a] Add 2 oz/A of Pursuit to improve black nightshade control.
[b] Add 2 oz/A of Canopy or 0.3 oz/A of FirstRate to improve cocklebur, jimsonweed, and ragweed control.
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TABLE 2G–WEED RESPONSE TO HERBICIDES IN SOYBEANS*

			ANNUAL BROADLEAVES											ANNUAL GRASSES								PERENNIALS				
	MODE OF ACTION	CROP RESPONSE	COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (E. BLACK)***	PIGWEED (REDROOT)	RAGWEED (COMMON)	RAGWEED (GIANT)	SMARTWEED	VELVETLEAF	WILD MUSTARD	HORSEWEED (MARESTAIL)	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	SANDBUR	BINDWEED (FIELD)	BINDWEED (HEDGE)	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE
Postemergence																										
ASSURE II	A	1	N	N	N	N	N	N	N	N	N	N	N	G	G	E	E	E	E	E	E	N	N	N	E	N
FUSILADE DX	A	1	N	N	N	N	N	N	N	N	N	N	N	E	G	E	E	E	E	E	E	N	N	N	G	N
FUSION	A	1	N	N	N	N	N	N	N	N	N	N	N	G	G	E	E	E	G	G	E	N	N	N	G	N
POAST or POAST PLUS	A	1	N	N	N	N	N	N	N	N	N	N	N	E	G	E	E	E	E	E	E	N	N	N	F	N
SELECT	A	1	N	N	N	N	N	N	N	N	N	N	N	E	G	E	E	E	E	E	E	N	N	N	G	N
BASAGRAN	O	2	E	G	G	P	P	F	F	E	G	E	F	N	N	N	N	N	N	N	N	N	N	G	N	F
CLASSIC	B	2	E	G	N	N	E	G	G	E	G	E	G	N	N	P	P	P	N	N	N	N	N	F	N	E
PINNACLE	B	3	F	F	G	N	E	P	P	E	G	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SYNCHRONY STS[a]	B	1	E	G	G	N	E	G	G	E	E	E	G	N	N	N	N	N	N	N	N	N	N	F	N	E
ROUNDUP ULTRA-ROUNDUP READY[b e]	O	1	E	E	G	G	G	G	G	G	G	G	E	G	G	E	E	E	G	G	G	G	G	G	E	F
LIBERTY-LIBERTY LINK[e]	O	1	E	G	F	G	G	E	G	G	G	E	E	F	F	G	G	F	F	F	P	P	P	P	P	P
PURSUIT	B	2	E	F	P	E	E	F	G	G	G	G	P	F	F	G	G	G	F	F	P	P	P	P	N	F
ULTRA BLAZER	O	3	F	G	P	G	E	E	F	G	P	E	P	N	N	F	F	F	P	P	N	P	P	P	N	N
REFLEX	O	1	P	F	P	F	E	G	G	P	P	E	P	P	P	P	P	P	P	N	N	P	P	P	N	N
FLEXSTAR	O	3	F	G	F	G	E	E	E	G	F	E	P	P	P	F	F	F	P	P	N	P	P	P	N	N
COBRA	O	3	G	G	P	G	E	E	E	P	F	E	P	N	N	N	N	N	N	N	N	P	P	P	N	N
SCEPTER	B	2	E	P	N	P	E	P	P	P	P	P	P	N	N	F	F	F	N	N	N	N	N	N	N	N
RESOURCE	O	2	P	P	F	P	P	P	P	P	E	P	P	N	N	N	N	N	N	N	N	N	N	N	N	N
RAPTOR[d]	B	2	G	G	G	E	E	F	G	G	G	E	–	F	F	E	G	G	F	F	–	P	P	F	P	P
FIRSTRATE	B	1	E	E	N	N	P	E	E	E	G	G	G	N	N	N	N	N	N	N	N	P	P	F	N	F
GALAXY	O/O	3	E	G	G	F	G	G	F	E	G	E	F	N	N	P	P	P	P	N	N	P	P	F	N	F
STORM	O/O	3	G	G	F	G	E	E	F	G	F	E	P	N	N	P	P	P	P	N	N	P	P	P	N	P
BASAGRAN+PINNACLE	O/B	3	E	G	E	P	E	P	F	E	G	E	F	N	N	N	N	N	N	N	N	N	N	F	N	F
BASAGRAN+PURSUIT	O/B	2	E	G	F	E	E	F	F	E	G	E	F	F	F	G	G	G	F	F	P	P	P	F	N	F
BASAGRAN+ULTRA BLAZER	O/O	3	E	G	G	G	E	G	F	E	G	E	F	N	N	P	P	P	P	N	N	P	P	F	N	F
BASAGRAN+REFLEX	O/O	2	E	G	G	F	E	G	G	E	G	E	F	P	P	F	F	F	P	P	N	P	P	F	N	F
BASAGRAN+FLEXSTAR	O/O	3	E	G	G	G	E	E	E	E	G	E	F	P	P	F	F	F	P	P	N	P	P	F	N	F
BASAGRAN+COBRA	O/O	3	E	G	G	G	E	G	G	E	G	E	F	N	N	N	N	N	N	N	N	P	P	F	N	F
BASAGRAN+SCEPTER	O/B	2	E	G	G	P	E	F	F	E	G	E	F	N	N	F	F	F	N	N	N	N	N	F	N	F
BASAGRAN+RESOURCE	O/O	2	G	G	F	P	F	F	P	G	E	G	P	N	N	N	N	N	N	N	N	N	N	F	N	F
CLASSIC+PINNACLE[c]	B/B	3	E	G	G	N	E	F	G	E	G	E	G	N	N	N	N	N	N	N	N	N	N	N	N	E
CLASSIC+ULTRA BLAZER	B/O	3	E	G	P	G	E	E	G	E	G	E	F	N	N	P	P	P	P	N	N	P	P	P	N	G
CLASSIC+REFLEX	B/O	2	E	G	P	F	E	G	G	E	G	E	F	P	P	P	P	P	P	P	N	P	P	P	N	G
CLASSIC+FLEXSTAR	B/O	3	E	G	F	G	E	E	E	E	G	E	F	P	P	F	F	F	P	P	N	P	P	P	N	G
CLASSIC+COBRA	B/O	3	E	G	P	G	E	G	G	E	G	E	F	N	N	N	N	N	N	N	N	P	P	P	N	G
CLASSIC+RESOURCE	B/O	2	E	G	F	P	E	G	G	E	E	E	G	N	N	P	P	P	N	N	N	N	N	F	N	G
CLASSIC+GALAXY	B/O	3	E	G	F	F	E	G	G	E	G	E	F	N	N	P	P	P	P	N	N	P	P	F	N	G
CLASSIC+FIRSTRATE	B/B	2	E	G	N	N	E	E	E	E	G	E	G	N	N	P	P	P	N	N	N	P	P	F	N	E

P = Poor; F = Fair; **G** = Good; **E** = Excellent; N = None; – = Not enough information to rank
Herbicide mode of Action: A = ACCase inhibitor; B = ALS inhibitor; C = Photosynthesis inhibitor; O = Other.
Crop Response: 1=Minimal risk of crop injury; 2=Crop injury can occur under certain conditions (soil applied—cold, wet: foliar applied—hot, humid); 3=Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4=Risk of severe crop injury is high. Recommended only in rescue situations.

[a] Add 2 oz/A of *Pursuit* to improve E. black nightshade control OR add 1 pt/A of *Reflex* or *Flexstar* for black nightshade control OR apply *Authority* preemergence.
[b] For more consistent velvetleaf control do not exceed 5 in. in height.
[c] Add 4 to 6 oz of *Cobra*, 1 pt of *Reflex*, 1 pt of *Blazer* or 2 oz/A of *Pursuit* for **E. black nightshade** control.
[d] Use a methylated seed oil instead of nonionic surfactant to improve common ragweed control.
[e] Must add ammonium sulfate for velvetleaf control.
* The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.
****Weed response to postemergence broadleaf herbicide combinations may vary due to a change in application rate, a change in spray additive, or herbicide antagonism. See Table 2H for the proper additive(s) and see labels for proper herbicide rates. Rates may vary dependent on weed species, weed size, and tank mix.**
***If application rates are reduced, control of **E. black nightshade** is Good with 2 oz/A of *Pursuit*, Fair with 6 oz/A of *Cobra* and Poor with ½ pt/A of *Blazer*.

TABLE 2G–WEED RESPONSE TO HERBICIDES IN SOYBEANS*

	MODE OF ACTION	CROP RESPONSE	ANNUAL BROADLEAVES											ANNUAL GRASSES								PERENNIALS				
			COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (E. BLACK)***	PIGWEED (REDROOT)	RAGWEED (COMMON)	RAGWEED (GIANT)	SMARTWEED	VELVETLEAF	WILD MUSTARD	HORSEWEED (MARESTAIL)	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	SANDBUR	BINDWEED (FIELD)	BINDWEED (HEDGE)	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE
Postemergence continued*																					N	P	P	P	N	N
PINNACLE+ULTRA BLAZER	B/O	3	F	**G**	**G**	**G**	**E**	**G**	F	**E**	**G**	**E**	P	N	N	P	P	P	P	N	N	P	P	P	N	N
PINNACLE+COBRA	B/O	3	F	F	**G**	**G**	**E**	**G**	**G**	**E**	**G**	**E**	P	N	N	N	N	N	N	N	N	P	P	P	N	N
PINNACLE+REFLEX	B/O	3	F	F	**G**	F	**E**	**G**	**G**	**E**	**G**	**E**	N	P	P	F	F	F	P	P	N	P	P	P	N	N
PINNACLE+FLEXSTAR	B/O	3	**G**	**G**	**G**	**G**	**E**	**E**	**E**	**E**	**G**	**E**	P	P	P	F	F	F	P	P	N	P	P	F	N	F
PINNACLE+GALAXY	B/O	3	**E**	**G**	**E**	F	**E**	**G**	F	**E**	**G**	**E**	F	N	N	P	P	P	N	N	N	P	P	P	N	P
PINNACLE+STORM	B/O	3	**G**	**G**	**G**	**G**	**E**	**E**	**G**	**E**	**G**	**E**	P	N	N	P	P	P	N	N	P	P	P	P	N	P
PURSUIT+ULTRA BLAZER	B/O	3	**E**	**G**	P	**E**	**E**	**G**	F	**G**	**G**	**E**	P	F	F	F	F	F	F	F	P	P	P	P	N	P
PURSUIT+REFLEX	B/O	2	**E**	F	P	**E**	**E**	**G**	**G**	**G**	**G**	**G**	P	F	F	F	F	F	F	F	P	P	P	P	N	P
PURSUIT+FLEXSTAR	B/O	3	**E**	F	P	**E**	**E**	**E**	**G**	**G**	**G**	**G**	P	F	F	F	F	F	F	F	P	P	P	P	N	P
PURSUIT+RESOURCE	B/O	2	**E**	F	F	**E**	**E**	F	**G**	**G**	**E**	**G**	P	F	F	F	F	F	F	F	P	P	P	P	N	P
PURSUIT+COBRA	B/O	3	**E**	F	P	**E**	**E**	**G**	**G**	**G**	**G**	**G**	P	F	F	F	F	F	F	F	P	P	P	F	N	F
PURSUIT+GALAXY	B/O	3	**E**	**G**	**G**	**E**	**E**	**G**	F	**E**	**G**	**E**	F	F	F	F	F	F	F	F	P	P	P	P	N	F
PURSUIT+PINNACLE	B/B	3	**E**	F	**G**	**E**	**E**	F	F	**E**	**G**	**E**	P	F	F	**G**	**G**	**G**	F	F	N	P	P	P	N	N
SCEPTER+ULTRA BLAZER	B/O	3	**E**	**G**	P	**G**	**E**	**E**	F	**G**	P	**E**	P	P	P	F	F	F	P	P	N	P	P	P	N	N
SCEPTER+REFLEX	B/O	2	**E**	F	P	F	**E**	**G**	**G**	P	P	**E**	P	P	P	F	F	F	P	P	N	P	P	P	N	N
SCEPTER+FLEXSTAR	B/O	3	**E**	**G**	F	**G**	**E**	**E**	**E**	**G**	F	**E**	P	P	P	F	F	F	P	P	N	N	N	N	N	N
SCEPTER+RESOURCE	B/O	2	**E**	P	F	P	**E**	F	F	P	**E**	P	P	N	N	P	P	P	N	N	N	P	P	P	N	N
SCEPTER+COBRA	B/O	3	**E**	**G**	P	**G**	**E**	**E**	**E**	P	F	**E**	P	N	N	F	F	F	N	N	N	P	P	F	N	**G**
STORM+CLASSIC	O/B	3	**E**	**G**	F	**G**	**E**	**E**	**G**	**E**	**G**	**E**	F	N	N	P	P	P	P	N	N	P	P	P	N	N
COBRA+RESOURCE	O/O	3	**G**	**G**	F	**G**	**E**	**E**	**E**	P	**E**	**E**	P	N	N	N	N	N	N	N	P	P	P	P	P	P
RAPTOR+ULTRA BLAZER	B/O	3	**G**	–	F	**E**	**E**	**E**	**G**	**G**	**G**	**E**	–	P	P	F	F	F	P	P	P	P	P	P	P	P
RAPTOR+REFLEX	B/O	2	**G**	**G**	F	**E**	**E**	**G**	**G**	**G**	**G**	**E**	P	P	P	F	F	F	P	P	–	P	P	F	P	P
RAPTOR+FIRSTRATE	B/B	2	**E**	**E**	**G**	**E**	**E**	**E**	**E**	**E**	**G**	**E**	**G**	F	F	**E**	**G**	**G**	F	F	N	P	P	P	N	P
FIRSTRATE+ULTRA BLAZER	B/O	3	**E**	**E**	F	**G**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	P	P	P	P	N	N	N	N	P	N	P
FIRSTRATE+PINNACLE	B/B	3	**E**	**E**	**G**	N	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	N	N	N	N	P	P	F	N	F
FIRSTRATE+REFLEX	B/O	1	**E**	**E**	P	F	**E**	**E**	**E**	**E**	**E**	**E**	**G**	P	P	P	P	P	P	N	N	P	P	F	N	F
FIRSTRATE+COBRA	B/O	3	**E**	**E**	P	**G**	**E**	**E**	**E**	**G**	**G**	**E**	**G**	N	N	N	N	N	N	N	N	P	P	**G**	N	F
FIRSTRATE+BASAGRAN	B/O	2	**E**	**E**	**G**	P	P	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	N	N	N	P	P	P	F	N	F
FIRSTRATE+PURSUIT	B/B	2	**E**	**E**	P	**E**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	F	F	F	F	F	F	F	N	P	P	P	N	P
FIRSTRATE+FLEXSTAR	B/O	3	**E**	**E**	F	**G**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	P	P	P	P	N						

P = Poor; F = Fair; **G** = Good; **E** = Excellent; N = None; – = Not enough information to rank
Herbicide mode of Action: A = ACCase inhibitor; B = ALS inhibitor; C = Photosynthesis inhibitor; O = Other.
Crop Response: 1=Minimal risk of crop injury; 2=Crop injury can occur under certain conditions (soil applied—cold, wet: foliar applied—hot, humid); 3=Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4=Risk of severe crop injury is high. Recommended only in rescue situations.

[a] Add 2 oz/A of *Pursuit* to improve E. black nightshade control OR add 1 pt/A of *Reflex* or *Flexstar* for black nightshade control OR apply *Authority* preemergence.
[b] For more consistent velvetleaf control do not exceed 5 in. in height.
[c] Add 4 to 6 oz of *Cobra*, 1 pt of *Reflex*, 1 pt of *Blazer* or 2 oz/A of *Pursuit* for **E. black nightshade** control.
[d] Use a methylated seed oil instead of nonionic surfactant to improve common ragweed control.
[e] Must add ammonium sulfate for velvetleaf control.

* The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.

****Weed response to postemergence broadleaf herbicide combinations may vary due to a change in application rate, a change in spray additive, or herbicide antagonism. See Table 2H for the proper additive(s) and see labels for proper herbicide rates. Rates may vary dependent on weed species, weed size, and tank mix.**

*** If application rates are reduced, control of **E. black nightshade** is Good with 2 oz/A of *Pursuit*, Fair with 6 oz/A of *Cobra* and Poor with ½ pt/A of *Blazer*.

TABLE 2H – MAXIMUM BROADLEAF WEED HEIGHTS FOR POSTEMERGENCE CONTROL IN SOYBEANS*

Herbicide	RATE/A	COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (E. BLACK)**	PIGWEED (REDROOT)	RAGWEED (COMMON)	RAGWEED (GIANT)	SMARTWEED	VELVETLEAF	WILD MUSTARD (DIAMETER OF ROSETTE)	HORSEWEED (MARESTAIL)
		WEED HEIGHT[a] (Inches)										
Basagran	2 pt	10[e]	10	2	NO	NO	3	6	10	6[b,e]	8	6
Classic	¾ oz	12	6	NO	NO	4	4	6	4	6[c]	6	6
Cobra	12.5 oz	6	4	NO	2	4	4	6	SUP	2	4	4
FirstRate	0.3 oz	10	4	NO	NO	NO	8	10	6	6	4	6
Galaxy	2 pt	6	6	2	<2	2	3	6	6	5	4	5
Pinnacle	¼ oz	SUP	SUP	4	NO	12	NO	NO	6	6[d]	4	NO
Pursuit	¼ pt	8	3	<1	2	6	2	3	3	2	3	NO
Reflex	1 pt	NO	4	SUP	2	2	4	SUP	4	NO	4	NO
Flexstar	1 pt	4	6	SUP	4	4	4	4	4	SUP	6	NO
Resource	6 oz	NO	NO	SUP	NO	SUP	SUP	SUP	NO	10	NO	NO
Raptor[f]	5 oz	8	6	3	3	6	3	4	4	4	3	NO
Roundup Ultra–Roundup Ready	32 oz	6	6	5	4	6	6	8	4	5	6	6
Scepter	⅓ pt	8	NO	NO	NO	4	NO	NO	NO	NO	NO	NO
Storm	1½ pt	6	6	INC	2	2	3	3	6	INC	4	NO
Synchrony STS	½ oz	8	5	4	NO	8	4	4	8	8	5	5
Ultra Blazer	1.5 pt	2	6	<1	2	4	3	3	6	NO	4	4

[a] NO = no control; SUP = suppression only; INC = inconsistent

[b] Add 1 gal/A of 28% liquid ammonium nitrate for velvetleaf control with *Basagran.*

[c] Add 28% liquid urea ammonium nitrate (UAN) to *Classic* + nonionic surfactant for velvetleaf control.

[d] Add 28% liquid urea ammonium nitrate (UAN) to *Pinnacle* + nonionic surfactant for velvetleaf control.

[e] Cocklebur up to 24 in. and velvetleaf up to 12 in. can be suppressed by 3 pt/A *Basagran* or 1.5 pt/A applied twice.

[f] Use a methylated seed oil instead of nonionic surfactant for improved common ragweed control.

***The weed heights listed in this table are estimates of the maximum size where consistent control is expected. The maximum height for effective control in any specific situation is dependent on environment conditions including soil moisture, temperature, and relative humidity.**

If application rates are reduced, control of **E. black nightshade is Good with 2 oz/A of *Pursuit,* Fair with 6 oz/A of *Cobra* and Poor with ½ pt/A of *Ultra Blazer.*

TABLE 2I – SUGGESTED ADDITIVES FOR POSTEMERGENCE HERBICIDE APPLICATIONS IN SOYBEANS*

Herbicide	Crop Oil Concentrate (COC)	OR	Nonionic Surfactant (NIS)	AND/OR	28% N or AMS or 10-34-0[a]
Assure II	1% (2% if drought stress)		¼%		No
Fusilade DX	½ – 1%		¼ – ½%		28% N at 1 gal/A may be added
Fusion	½ – 1%		¼ – ½%		28% N may be added up to 4%
Poast[b] or Poast Plus	1 qt/A (or DASH 1 qt/A)		No		28% N at ½ – 1 gal/A or AMS at 2.5 lb/A + COC or DASH
Select	1 qt/A		No		28% N at 1 to 2 qt/A or AMS at 2.5 to 4 lb/A
Basagran[c]	1 qt/A		No		28% N at 1 gal/A + COC
Classic[e]	1% if hot, dry only		¼%		28% N at 1 gal/A or 10-34-0 at 1 qt/A + NIS
Cobra[f]	0.125–0.25%		¼% if high RH		28% N at 4% or AMS at 2 to 4 lb/A + NIS or COC
FirstRate[g]	1.2% if dry only		⅛–¼%		Always add 28% N at 2.5% when applying NIS
Flexstar	½%		¼%		NO
Galaxy[h]	2 pt/A		No		28% N at ½ – 1 gal/A OR AMS at 2.5 lb/A INSTEAD OF COC
Pinnacle[i]	½% if hot, dry only		⅛%		28% N at 2 – 4 qt/A + NIS
Pursuit[j]	1.25%		¼%		Always add 28% N or 10-34-0 at 1-2 qt/A or AMS at 2.5 lb/A
Raptor[k]	1%[k]		¼%[k]		Always add 28% N at 1–2 qt/A or AMS at 2.5 lb/A
Reflex	½–1%		¼–½%		NO
Resource	1 qt/A		No		28% N at 1 gal/A may be added
Roundup Ultra–Roundup Ready	No		No		Add 28% N at 4% v/v or AMS at 2.5 lb/A
Scepter	1 qt/A		¼%		No
Storm	1-2 pt/A		¼%		28% N at ½-1 gal/A instead of COC or NIS
Synchrony STS	1%		No		Always add 28% N at 2 qt or AMS at 2 lb/A
Ultra Blazer[d]	No		⅛%		Replace NIS w/2 – 4 qt/A of 28% N

*** ⅛% = 1 pt in 100 gal of spray solution; ¼% = 1 qt in 100 gal; 1% = 1 gal in 100 gal; 4% = 4 gal in 100 gal.**

[a] 28% N = 28% urea ammonium nitrate; AMS = ammonium sulfate; 10-34-0 = diammonium phosphate.

[b] AMS improves control of large crabgrass, quackgrass, and volunteer corn and cereals.

[c] 28% N *may* be added for improved velvetleaf control. Leave COC in for consistent common ragweed and lambsquarters control. *DASH* at 1 qt/A may be applied instead of 1 qt/A of COC.

[d] Increase NIS to ¼% for lambsquarters.

[e] 28% N or 10-34-0 *must* be added for velvetleaf control.

[f] RH = relative humidity. See Table 1s on the *Cobra* label for adjuvant recommendations based on relative humidity.

[g] 28% N or AMS must be added for velvetleaf control.

[h] Replace COC with 28% N or AMS for velvetleaf control when common ragweed and lambsquarters are not target weeds.

[i] 28% N *must* be added for velvetleaf control. *Only* under hot, dry conditions should NIS be increased to ¼% or NIS replaced by COC at ½%.

[j] Pursuit can be applied with *Sun-it II* at 1 qt/A instead of NIS. Do not tank mix. MSU does *not* recommend use of COC at 1.5 pt/A with *Pursuit* instead of NIS *except* under hot, dry conditions.

[k] Use Sun-it II or methylated seed oil (MSO) for improved common ragweed control.

TABLE 2J – ADDITIVES FOR POSTEMERGENCE BROADLEAF WEED CONTROL IN SOYBEANS*

Additives are listed for each herbicide tank mixture based on the label of the herbicide in the Primary Herbicide column. Sometimes, a tank mixture may occur on only one label. For example, *Basagran + Classic* is listed as a tank mixture on the *Basagran* label but is not listed as a tank mixture on the *Classic* label. To find the correct additives for a tank mixture, find the first herbicide in the Primary Herbicide column and then move across the column to the box that corresponds with the tank mix partner.

PRIMARY HERBICIDE	TANK MIX PARTNER: BASAGRAN	CLASSIC	PINNACLE	PURSUIT	ULTRA BLAZER	REFLEX	COBRA	SCEPTER	GALAXY[g]	STORM[g]	SYNCHRONY STS	FLEXSTAR	RESOURCE[i]	FIRSTRATE	RAPTOR
Basagran	–	¼% NIS + 1 qt UAN	⅛% NIS[a,b]	¼% NIS + 1 qt UAN	¼% NIS or 1 pt COC[c]	1 qt COC	1 pt COC[d]	1 qt COC	NL	NL	NL	2 qt UAN + ½% COC	1 qt COC	1.2% COC + 2.5% UAN	NL
Classic	NL	–	⅛% NIS[b] + 4 qt UAN	NL	¼% NIS	¼% NIS	½% NIS[e]	NL	NL	NL	NL	¼% NIS	NL	1% COC + 2.5% UAN	NL
Pinnacle	⅛% NIS[a,b]	NL	–	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL
Pursuit	¼% NIS + 1 qt UAN	NL	¼% NIS[h] + 2.5% UAN	–	¼% NIS[f] + 1 qt UAN	¼% NIS[f] + 1 qt UAN	¼% NIS[f] + 1 qt UAN	NL	¼% NIS[f] + 1 qt UAN	NL	NL	¼% NIS[f] + 1 qt UAN	1 qt COC + 1 qt UAN	¼% NIS + 1 qt UAN	NL
Ultra Blazer	¼% NIS or 1 pt COC[c]	¼% NIS	⅛% NIS[e]	¼% NIS[f] + 1 qt UAN	–	NL	NL	¼% NIS	NL	NL	1 pt COC + 2 qt UAN	NL	1 pt COC	⅛% NIS + 2.5% UAN	¼% NIS[k] + 1 qt UAN
Reflex	¼% NIS	¼% NIS	¼% NIS[h]	¼% NIS[f]	NL	–	NL	½% NIS	NL	NL	¼% NIS + 2 qt UAN	¼% NIS	¼% NIS	¼% NIS	¼% NIS
Cobra	1 pt COC[d]	1 pt COC	⅛% NIS[e]	¼% NIS[f] + 1% UAN	NL	NL	–	⅛% NIS	NL	NL	⅛% COC	NL	1 qt COC	1% COC + 2.5% UAN	NL
Scepter	NL	NL	NL	NL	NL	NL	NL	–	NL	NL	NL	NL	NL	NL	NL
Galaxy[g]	NL	¼% NIS + 2 qt UAN	⅛% NIS + 2 qt UAN	¼% NIS + 1 qt UAN	NL	NL	NL	¼% NIS + 2 qt UAN	–	NL	1 pt COC + 2 qt UAN	NL	1 pt COC	1 pt COC + 2 qt UAN	1 pt NIS + 2 qt UAN
Storm[g]	¼% NIS	¼% NIS + 2 qt UAN	⅛% NIS + 2 qt UAN	¼% NIS + 2 qt UAN	NL	NL	NL	¼% NIS + 2 qt UAN	NL	–	1 pt COC + 2 qt UAN	NL	1 pt COC	1 pt COC	¼% NIS + 2 qt UAN
Synchrony STS	NL	NL	NL	NL	NL	NL	½% COC + 2 qt UAN	NL	NL	NL	–	NL	NL	NL	NL
Flexstar	¼% NIS	¼% NIS	¼% NIS[h]	¼% NIS[f]	NL	NL	NL	¼% NIS	NL	NL	¼% NIS	–	¼% NIS	¼% NIS	¼% NIS
Resource[j]	1 qt COC + 1 qt UAN	1 qt COC + 1 qt UAN	¼% NIS[h] + 2.5 lb AMS	1 qt COC + 1 qt UAN	NL	NL	1 qt COC + 2 qt UAN	1 qt COC	1 pt COC + 2.0 lb AMS	1 pt COC	NL	1 pt COC + 2.5 lb AMS	–	1 pt COC + 2.5 lb AMS	NL
FirstRate	¼% NIS + 2.5% UAN	¼% NIS + 2.5% UAN	¼% NIS + 2.5% UAN	¼% NIS + 2.5% UAN	¼% NIS + 2.5% UAN	¼% NIS + 2.5% UAN	¼% NIS + 2.5% UAN	NL	NL	NL	¼% NIS + 2.5 qt UAN	¼% NIS + 2.5% UAN	¼% NIS + 2.5% UAN	–	¼% NIS + 2.5% UAN
Raptor	NL	¼% NIS	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	–

* **Based on primary herbicide label. NL – not labeled;** NIS – nonionic surfactant; COC – crop oil concentrate; UAN – 28% urea ammonium nitrate; AMS – ammonium sulfate; ⅛% = 1 pt in 100 gal of spray solution; ¼% = 1 qt in 100 gal. *DASH* is NOT RECOMMENDED with ANY TANK MIXTURES.

[a] Increase NIS to ¼% OR use COC at ½% if dry conditions exist.

[b] Add UAN at 2-4 qt/A, 10-34-0 at 1-2 qt/A, or 2-4 lb/A of AMS IN ADDITION TO NIS for velvetleaf control.

[c] *Blazer* applied at 1 pt/A. Substitute UAN for COC only if velvetleaf is the target weed and lambsquarters and common ragweed are not.

[d] *Cobra* applied at 6 to 8 oz/A.

[e] Add 4 qt/A of UAN for velvetleaf control. Crop injury will increase.

[f] Tank mix either *Blazer* at 1 pt/A, *Reflex* at 1 pt/A, Flexstar at 1 pt, or *Cobra* at ¼ pt/A with *Pursuit* for common ragweed control.

[g] *Galaxy* is a prepackaged mix of *Basagran + Blazer,* 2 pt/A of *Galaxy* = 1½ pt/A of *Basagran* and ⅔ pt/A of *Blazer. Storm* is a prepackaged mix of *Basagran + Blazer;* 1½ pt/A of *Storm* = 1 pt of *Basagran* + 1 pt of *Blazer.*

[h] Reduce *Pinnacle* to ⅛ oz/A to avoid crop injury. Lambsquarters control may be reduced. (For *Pinnacle* at ⅛ oz/A, include 1 pt/A COC + 2 qt/A UAN.)

[i] Reduce *Resource* to 4 oz/A. Reduce *Basagran* to 1 to 1.5 pt/A; *Classic* to ½ oz/A. when tank-mixed with *Resource.*

[j] *Cobra* applied at 4 to 6 oz/A for nightshade.

[k] *Blazer/Status* added at 12 oz/A for common ragweed control. Grass antagonism will occur. See label.

TABLE 2K – APPLICATION RATES OF POSTEMERGENCE GRASS HERBICIDES FOR CONTROL OF GRASS SPECIES AT VARIOUS HEIGHTS

	Poast	Poast Plus	Select	Assure II	Fusilade DX	Fusion[a]
	oz/A					
Barnyardgrass						
1–2″	12	18	4	–	10	–
2–3″	12	18	4	8	12	8
3–4″	12	18	4	8	–	8
4–6″	16	24	6	8	–	–
6–8″	16	24	6	–	–	–
Crabgrass						
<1″	–	–	–	–	10	–
1–2″	16	24	6	8	12	8
2–6″	16	24	6	8	–	–
Giant Foxtail						
1–2″	12	18	4	–	10	–
2–4″	12	18	4	7	12	8
4–6″	16	24	6	7	12	8
6–8″	16	24	6	7	–	8
8–12″	–	–	6	–	–	–
Green Foxtail						
1–2″	12	18	–	–	10	–
2–4″	12	18	6	7	12	8
4–6″	16	24	6	–	–	–
6–8″	16	24	6	–	–	–
Yellow Foxtail						
1–2″	16	24	–	–	10	–
2–4″	16	24	6	7	12	8
4–6″	16	24	6	–	–	–
6–8″	16	24	6	–	–	–
Fall Panicum						
1–2″	12	18	4	–	10	–
2–4″	12	18	4	7	12	8
4–6″	16	24	6	7	12	8
6–8″	16	24	6	–	–	–
Witchgrass						
1–2″	16	24	–	–	10	–
2–4″	16	24	6	7	12	8
4–6″	16	24	6	7	–	8
6–8″	16	24	6	–	–	–
V. Corn						
1–4″	12	18	–	–	–	–
4–6″	12	18	4	–	–	–
6–12″	12	18	4	5	–	–
12–18″	16	24	6	5	6	6
18–20″	16	24	6	–	6	6
20–24″	–	–	6	–	6	6
Quackgrass						
4–6″	–	–	8–16+8	–	10	–
6–8″	24+16	36+24	8–16+8	10+7	12+8	12+8
8–10″	–	–	–	10+7	12+8	12+8

[a] If grasses are small and not drought stressed, the *Fusion* rate can be reduced to 6 oz/A on barnyardgrass and all foxtails and 4 oz on volunteer corn.
– Not labeled.

TABLE 2L – LABELED TANK MIXES WITH POSTEMERGENCE GRASS HERBICIDES IN SOYBEANS*

BROADLEAF HERBICIDES	GRASS HERBICIDES											
	Assure II		Fusilade DX		Fusion		Poast		Poast Plus		Select	
Basagran	–	Y[1]	–	Y	–	Y	Y	Y[2,9]	Y	Y[3,9]	–	Y[4]
Classic	–	Y[1]	–	Y[7]	–	Y[10]	–	Y	–	Y	–	Y[4]
Cobra	Y	Y	Y	Y	–	Y	–	Y	–	Y	Y	Y
FirstRate	Y	Y[4,11,13]	–	–	Y	Y[4,10,11]	–	Y	Y	Y	Y	–
Flexstar	Y	–	Y	–	Y	Y	Y	Y	Y	Y	Y	Y
Galaxy	Y	–[11]	Y	–	Y	Y[11]	Y	Y[11]	Y	Y[11]	Y	Y
Pinnacle	Y	Y[1,5]	–	–	–	Y[10]	–	–	N	–	–	–
Pursuit	–	Y[6]	–	Y[6,7]	–	Y[7]	–	Y[6,9]	–	Y[6,9]	–	Y[6]
Raptor	Y	–[6]	Y	–[6]	Y	Y[6]	–	Y[6,9]	Y	Y[6,9]	Y	Y[6]
Reflex	Y	–	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Resource	Y	–	Y	–	Y	–	Y	Y	Y	Y	Y	Y
Scepter	–	–	–	–	–	Y[10]	–	–	–	–	–	–
Storm	Y	–[11]	Y	–[11]	Y	Y[11]	Y	Y[11]	Y	Y[11]	Y	Y[11]
Synchrony STS	Y	Y[1,5]	–	–	Y	Y[7]	–	Y	Y	Y	Y	Y[4]
Ultra Blazer[8]	Y	–[11,12]	Y	Y	Y	Y[11]	Y	Y[2,11]	Y	Y[11]	Y	Y

*** Y = yes, can be mixed; N = no, cannot be mixed; – = not listed on label.** In the columns, the first letter is based on the broadleaf herbicide label, while the second letter is based on the grass herbicide label. (For example "Y –" means that the tank mix is listed on the broadleaf herbicide label but is not listed on the grass herbicide label.)

TANK MIXES: Tank mixing saves time and application cost but is only labeled for some herbicides and for a limited number of grass species. Consult pesticide labels for further information and always read and follow label directions.

SEQUENTIAL HERBICIDE APPLICATIONS: If a decision is made to make a sequential application (two trips across the field) the basic rule is that a postemergence grass herbicide should be applied 1 day prior to postemergence broadleaf herbicide(s) application. If a broadleaf herbicide is applied first, delay the application of *Assure II, Fusilade DX, Fusion, Poast, Poast Plus,* or *Select* until the grasses are actively growing again, which may be 7 days or more. Sequential applications require additional time and application costs.

1 Do not tank mix if target grass is barnyardgrass, yellow foxtail, or quackgrass.
2 Apply *Poast* at 24 oz/A when tank mixing with *Basagran*. Do not tank mix if target species is quackgrass. Do not tank mix with *Blazer* if target grass is volunteer corn.
3 Apply *Poast Plus* at 36 oz/A when target grass is barnyardgrass or yellow foxtail. Do not tank mix if target grass is quackgrass. Available as a prepackaged mixture of *Rezult* (*Basagran* + *Poast Plus*).
14 Grass antagonism may occur.
15 Increase *Assure II* rate to 8 oz/A if target grass is fall panicum, green foxtail, or volunteer cereals. Reduce *Assure II* rate to 5 oz/A if target grasses are 4 in. giant foxtail and 6 in. volunteer corn.
16 GRASS ANTAGONISM WILL OCCUR. NOT RECOMMENDED.
17 Tank mix only if volunteer corn or shattercane are target species.
18 For *Ultra Blazer* tank mixes, grass herbicide labels refer to *Blazer* and not *Ultra Blazer.*
19 Do not use MSO with any tank mix combinations except *Basagran, Pursuit,* or *Raptor*.
10 If the grass population consists mainly of yellow foxtail and barnyardgrass and conditions are less than optimal, a sequential application is recommended to provide satisfactory control.
11 Sequential application is recommended.
12 If tank mixed with *Assure II*, include 1/4% NIS; if tank mixed with other grass herbicides, include 1 pt COC.
13 Do not tank mix if target species is fall panicum.

TABLE 2M – FEED AND FORAGE RESTRICTIONS FOR SOYBEAN HERBICIDES[a]

Herbicide	Mode of Action[b]	For Use in Feed/Forage?	Pre-Harvest Interval
Herbicides Applied PPI or PRE			
Python	B	No	
FirstRate	B	**Yes**	none listed
Pursuit	B	No	
Scepter	B	No	
Canopy XL	B/O	No	
Lorox	C	No	
Sencor/Lexone	C	**Yes**	none listed
Authority	O	No	
Command 3ME	O	No	
Dual II Magnum	O	**Yes**	none listed
Frontier	O	No	
Lasso/Partner/Microtech	O	**Yes**	none listed
Prowl	O	**Yes**	none listed
Sonalan	O	No	
Treflan	O	**Yes**	none listed
Herbicides Applied POST			
Assure II	A	No	
Fusilade DX	A	No	
Fusion	A	No	
Poast/Poast Plus	A	**Yes**	75 days
Select	A	No	
Classic	B	No	
FirstRate	B	**Yes**	14 days
Pinnacle	B	No	
Pursuit	B	No	
Scepter	B	No	
Basagran	O	**Yes**	30 days
Blazer/Status	O	No	
Cobra	O	No	
Reflex/Flexstar	O	No	
Resource	O	No	
Roundup Ultra	O	No	

[a] Restrictions based on herbicide labels. Always read and follow herbicide labels.

[b] Mode of Action: A = ACCase inhibitor; B = ALS inhibitor; C = Photosynthesis inhibitor; O = Other

TABLE 3A–CHEMICAL WEED CONTROL IN SMALL GRAINS

DIRECT-DRILLED SMALL GRAINS (NO-TILL)

(fall or spring seedings following soybeans, corn or dry edible beans)

In general, complete control of all plants present at the time of planting is required for successful weed control. With direct drilling (no-till), vegetation control is accomplished before planting with burndown herbicides such as paraquat *(Gramoxone Extra/Gramoxone Max)* or glyphosate *(Roundup Ultra, Touchdown,* or other glyphosate products). The required application rate varies depending on weed species and size. Refer to the product labels for details. *Gramoxone Extra/Gramoxone Max* provides faster kill. *Roundup Ultra, Touchdown,* or other glyphosate products are preferred if perennial weeds are present, but fields with serious perennial weed problems should not be direct drilled with a small grain until the perennial weeds have been controlled.

The need for a burndown herbicide depends on the species of weeds present. If no weeds are present, a burndown herbicide is not needed. For fall-seeded small grains, fields with small seedlings of species that do not overwinter (summer annuals only) and are present at low densities do not need a burndown herbicide. If the weeds are large, however, or capable of overwintering (winter annuals, biennials, or perennials) or if identification of the weeds cannot be confirmed, a burndown herbicide should be used. For spring-seeded small grains, a burndown herbicide should be used if any weeds are present at planting time, regardless of species or size.

Herbicides applied after small grain emergence are not affected by the tillage system used. All of the herbicides listed below can be used in all tillage systems including direct drilling. No weed problems are unique to no-till small grain production. Therefore, no-till small grain production does not present any special weed control concerns.

BARLEY AND WHEAT WITHOUT LEGUME SEEDINGS — ALL TILLAGE SYSTEMS

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	2,4-D amine	½	1 pt	• Apply in the spring to actively growing grain following tillering (usually about 6- to 8-in. high) but prior to jointing (between 3 and 6 on Feeke's scale). DO NOT TREAT GRAIN IN BOOT TO DOUGH STAGE. The boot stage is when the upper sheath is beginning to swell with the enlarging head. • Do not apply in the fall. • Most effective when weeds are small (less than 4 in.). • Not effective on smartweed and wild buckwheat. • If 2,4-D ester is used, an application rate no higher than 0.38 lbs ai/A is advised. 2,4-D ester mixes easier with 28% liquid nitrogen.
	bromoxynil *(Buctril, Moxy)*	⅜	1½ pt 2L	• May be applied from emergence up to boot stage (between 1 and 9 on Feeke's scale). • Good coverage is essential. • Bromoxynil must be applied to small weeds for effective control (see label). • Redroot pigweed and mustard must be controlled when very small (refer to label for details). • Very good crop safety.

(Continued on next page)

BARLEY AND WHEAT WITHOUT LEGUME SEEDINGS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued) **Annual broadleaves**	dicamba *(Banvel, Clarity)*	⅛	¼ pt	• Apply in spring to actively growing grain with a well established secondary root system or following tillering but prior to jointing (between 3 and 6 on Feeke's scale). • Some wheat varieties are sensitive to *Banvel/Clarity.* • DO NOT APPLY *BANVEL/CLARITY* TO WHEAT VARIETIES WAKEFIELD OR MADISON AS SEVERE INJURY AND YIELD LOSS WILL LIKELY OCCUR. • Do not apply to spring-seeded barley. • Most effective when weeds are small (less than 4 in.) • See remarks and limitations for dicamba *(Banvel/Clarity)* in "Corn—Postemergence" section. • More effective than 2,4-D on smartweed, wild buckwheat, and perennials.
	thifensulfuron methyl + tribenuron methyl *(Harmony Extra)*	0.023	½ oz.	• Apply to winter wheat and barley after the crop is in the 2-leaf stage but before the flag leaf is visible (between 1.2 and 7.9). • Most effective if weeds are small (4 in. or less). • Addition of surfactant is essential for adequate results. • *Harmony Extra* may be tank mixed with 2,4-D Amine, MCPA, or *Buctril* for more rapid weed kill and improved control of ragweed. Tank mixes with 2,4-D may improve thistle control but also carry a greater risk of crop injury. To reduce this risk apply 2,4-D at no more than ½ pt/A (¼ lb ai/A) and reduce surfactant concentration to ⅛%. The lower surfactant concentration may reduce velvetleaf control. Observe the timing restrictions for 2,4-D, MCPA, and *Buctril* when tank mixing with *Harmony Extra*. Do not tank mix with *Banvel/Clarity,* as reduced control (antagonism) may occur. • Tank mixes with *Buctril* may reduce Canada thistle control. • For severe infestation, increase *Harmony Extra* rate to 0.6 oz. per acre. • For mayweed (dogfennel) control, *Harmony Extra* rate may be reduced to 0.3 oz. per acre. • Control of common ragweed is inconsistent. • Do not exceed 1 oz. product per acre to any one crop during one growing season. • Do not graze or feed forage or hay from treated areas to livestock. (Dry-harvested straw may be used for bedding and/or feed.) • Do not plant treated area to any crop other than wheat, barley or oats for 60 days after application. • Do not apply to wheat or barley underseeded with another crop. • Injury symptoms will appear on weeds in 1 to 3 weeks after application. • Very good crop safety. • Special sprayer clean-out procedure required (see *Harmony Extra* label). • **Caution:** If liquid nitrogen fertilizer is used as the herbicide carrier, leaf burn, yellowing, and stunting are likely. With favorable growing conditions the symptoms are temporary, but this practice is not recommended.
	+ surfactant	+ ¼%	+ ¼%	

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BARLEY AND WHEAT WITHOUT LEGUME SEEDINGS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued) **Annual broadleaves**	clopyralid + 2,4-D amine *(Curtail)*	0.094 + 0.5	2 pt	• For control of annual broadleaves and suppression of Canada thistle. • Apply to wheat and barley following tillering but prior to jointing (between 3 and 6 on Feeke's scale). DO NOT APPLY AFTER THE BOOT STAGE. The boot stage is when the upper sheath is beginning to swell with the enlarging head. • Do not treat a field with *Curtail* that has been treated previously with 2,4-D or *Banvel/Clarity.* • See Table 3B for harvest restrictions. • See Table 11 for crop rotation restrictions.
ONLY ragweed, cocklebur, jimsonweed, and mayweed	clopyralid *(Stinger)*	0.094	¼ pt	• Apply to wheat or barley from the 3-leaf stage to boot stage (between 1.3 and 9 on Feeke's scale). See label for details. • Do not graze dairy or meat animals within 1 week after treatment. • Do not harvest hay from treated grain fields. • Do not apply to small grains underseeded with a legume. • May be tank mixed with 2,4-D, *Banvel/Clarity, Buctril, Harmony Extra*, or *Express* for control of additional weeds. See label for details on rates. • See Table 11 for crop rotation restrictions.
Perennials (bindweed, thistles)	2,4-D ester	¾	1½ pt	• Apply in the spring to actively growing grain following tillering (usually about 6- to 8-in. high) but prior to jointing (between 3 and 6 on Feeke's scale). DO NOT TREAT GRAIN IN BOOT TO DOUGH STAGE. The boot stage is when the upper sheath is beginning to swell with the enlarging head. • Will provide suppression only. • Injury may occur. • Some control of wild onion and wild garlic.
	dicamba *(Banvel, Clarity)*	⅛	¼ pt	• Apply in spring to actively growing grain with a well established secondary root system or following tillering but prior to jointing (between 3 and 6 on Feeke's scale). • Some wheat varieties are sensitive to *Banvel/Clarity.* • DO NOT APPLY *BANVEL/CLARITY* TO WHEAT VARIETIES WAKEFIELD OR MADISON AS SEVERE INJURY AND YIELD LOSS WILL LIKELY OCCUR. • Do not apply to spring-seeded barley. • Will provide suppression only. • See remarks and limitations for *Banvel/Clarity* in "Corn — Postemergence" section. • Some control of wild onion and wild garlic.

BARLEY AND WHEAT WITHOUT LEGUME SEEDINGS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Perennials (Canada thistle, sowthistle)	tribenuron methyl *(Express)*	0.016	⅓ oz.	• Apply after the crop has reached the 2-leaf stage but before the flag leaf is visible (between 1.2 and 7.9 on Feeke's scale). • Apply when thistles are actively growing and 4 to 8 in. tall with 2 to 6 in. of new growth. • Addition of surfactant is essential for adequate results. • *Express* may be tank mixed with 2,4-D Amine, MCPA, or *Buctril* for more rapid weed kill and improved control of ragweed. Tank mixes with 2,4-D may improve thistle control but also carry a greater risk of crop injury. To reduce this risk apply 2,4-D at no more than ½ pt/A (¼ lb ai/A) and reduce surfactant concentration to ⅛%. The lower surfactant concentration may reduce velvetleaf control. Observe the timing restrictions for 2,4-D, MCPA, and *Buctril* when tank mixing with *Express.* Do not tank mix with *Banvel/Clarity* as reduced control (antagonism) may occur. • Tank mixes with *Buctril* may reduce Canada thistle control. • Spectrum of annual weeds controlled is narrower than with *Harmony Extra.* • Do not harvest sooner than 45 days after application. • Do not graze or feed forage or hay from treated areas to livestock (dry-harvested straw may be used for bedding and/or feed). • Do not exceed ⅓ oz. product per acre to any one crop during one growing season. • Do not plant treated area to any crop other than wheat or barley for 60 days after application. • Do not apply to wheat or barley underseeded with another crop. • Injury symptoms will appear on weeds in 1 to 3 weeks after application. • Very good crop safety. • Special sprayer clean-out procedure required (see *Express* label). • **Caution:** If liquid nitrogen fertilizer is used as the herbicide carrier, leaf burn, yellowing, and stunting are likely. With favorable growing conditions the symptoms are temporary, but this practice is not recommended.
	+ surfactant	+ ¼%	+ ¼%	

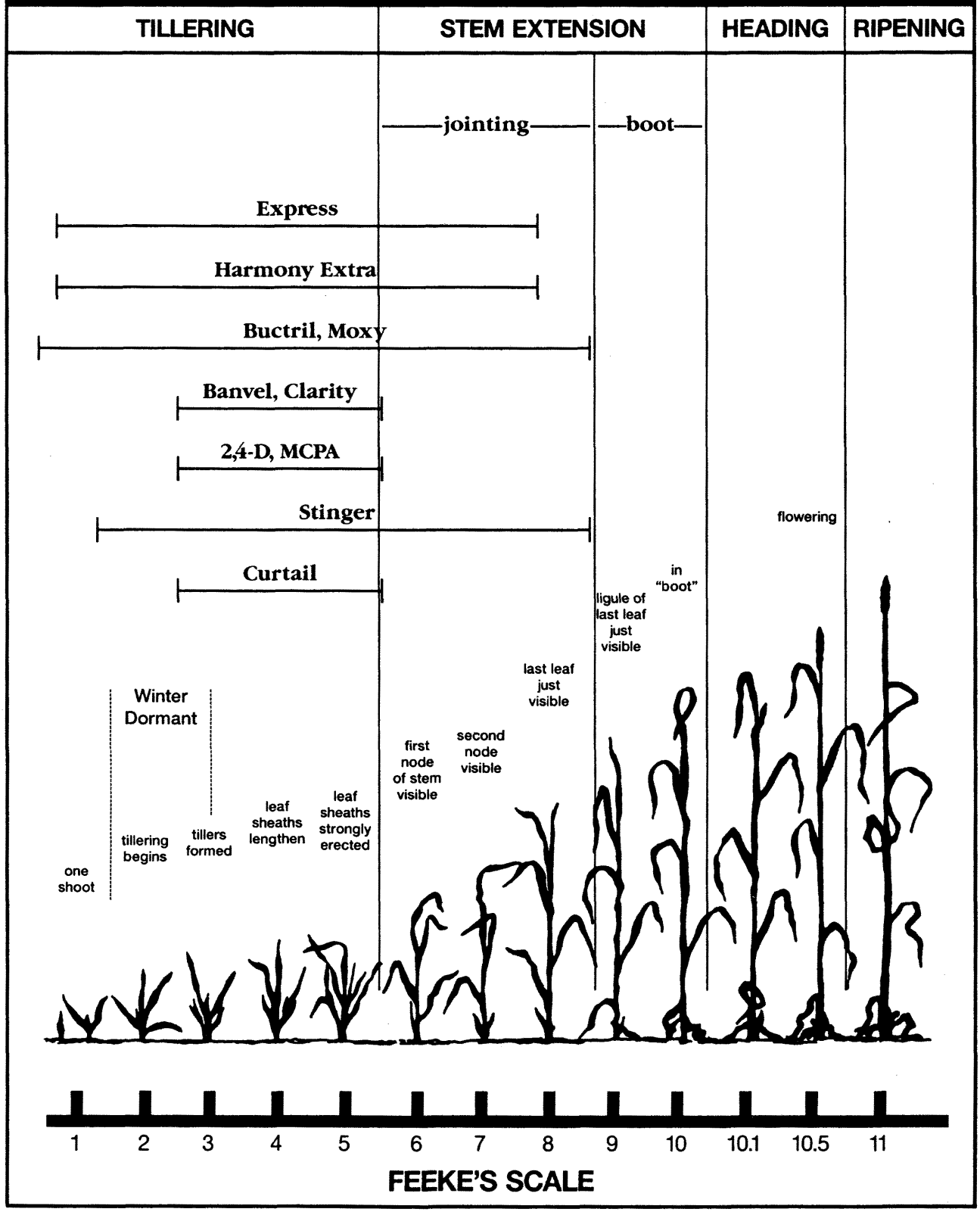
(Continued on next page)

BARLEY AND WHEAT WITHOUT LEGUME SEEDINGS (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued) **Perennials** (Canada thistle, sowthistle)	thifensulfuron methyl + tribenuron methyl *(Harmony Extra)* + surfactant	0.028 + ¼%	0.6 oz. + ¼%	• See remarks and limitations on *Harmony Extra* for control of annual broadleaves. • Apply when thistles are actively growing and 4 to 8 in. tall with 2 to 6 in. of new growth. • *Harmony Extra* controls a wider spectrum of annual weeds than *Express.* • *Harmony Extra* may be tank mixed with 2,4-D Amine, MCPA, or *Buctril* for more rapid weed kill and improved control of ragweed. Tank mixes with 2,4-D may improve thistle control but also carry a greater risk of crop injury. To reduce this risk apply 2,4-D at no more than ½ pt. per acre and reduce surfactant concentration to ⅛%. The lower surfactant concentration may reduce velvetleaf control. Observe the timing restrictions for 2,4-D, MCPA, and *Buctril* when tank mixing with *Harmony Extra*. Do not tank mix with *Banvel/Clarity* as reduced control (antagonism) may occur. • Tank mixes with *Buctril* may reduce Canada thistle control.
	clopyralid *(Stinger)*	0.125	⅓ pt	• Treat thistle plants between rosette stage and bud stage for suppression. • Apply to wheat and barley from the 3-leaf stage to boot stage (between 1.3 and 9 on Feeke's scale). See label for details. • See remarks and limitations for *Stinger* for annual broadleaves. • See Table 11 for crop rotation restrictions.
Wild garlic **Wild onion**	thifensulfuron methyl + tribenuron methyl *(Harmony Extra)* + surfactant	0.028 + ¼%	0.6 oz + ¼%	• See remarks and limitations of *Harmony Extra* for control of annual broadleaves. • Apply when wild garlic plants are less than 12 in. tall with 2 to 4 in. of new growth. • For best results, treat actively growing wild garlic when air temperature is at least 60°F. • Less effective for wild onion control.
	dicamba *(Banvel, Clarity)* + 2,4-D	⅛ + ½	¼ pt + 1 pt	• Apply in the spring to actively growing grain following tillering (usually about 6- to 8-in. high) but prior to jointing. DO NOT TREAT GRAIN IN BOOT TO DOUGH STAGE. The boot stage is when the upper sheath is beginning to swell with the enlarging head. • Some wheat varieties are sensitive to *Banvel/Clarity.* • DO NOT APPLY *BANVEL/CLARITY* TO WHEAT VARIETIES WAKEFIELD OR MADISON AS SEVERE INJURY AND YIELD LOSS WILL LIKELY OCCUR. • Do not apply to spring-seeded barley. • May use either ester or amine 2,4-D. • Provides suppression only. • See remarks and limitations for *Banvel/Clarity* in "Corn — Postemergence" section.

FIGURE 1

Wheat growth stages according to Zadoks' decimal code and Feeke's scale. Management inputs are indicated.



OATS WITHOUT LEGUME SEEDINGS — ALL TILLAGE SYSTEMS

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	2,4-D amine	⅜	¾ pt	• Apply in the spring to actively growing grain following tillering (usually about 6- to 8-in. high) but prior to jointing. DO NOT TREAT GRAIN IN BOOT TO DOUGH STAGE. The boot stage is when the upper sheath is beginning to swell with the enlarging head. • Most effective when weeds are small (less than 4 in.). • Some yield reduction may occur but generally less than that caused by weeds.
	MCPA	⅜	¾ pt 4L	• Less injurious and less effective than 2,4-D. • Most effective when weeds are small (less than 4 in.). • Apply at or after full tillering but before the boot stage (the first node is detectable and the grain is usually 6 to 8 in. tall at full tillering; the boot stage is when the upper sheath is beginning to swell with the enlarging head).
	bromoxynil *(Buctril, Moxy)*	⅜	1½ pt	• May be applied from emergence up to boot stage. • Good coverage essential. • Bromoxynil must be applied to small weeds for effective control (see label). • Redroot pigweed and mustard must be controlled when very small (refer to label for details). • Very good crop safety.
	thifensulfuron methyl + tribenuron methyl *(Harmony Extra)* + surfactant	0.018 + ¼%	0.4 oz. + ¼%	• Apply to oats in the 3–5 leaf stage, but before jointing. • Do not exceed 0.4 oz. product per acre to any one crop during one growing season. • Do not apply to Ogle, Porter, or Premer varieties. • Most effective if weeds are small (4 in. or less). • Addition of surfactant is essential for adequate results. • Control of common ragweed is inconsistent. • Do not graze or feed forage or hay from treated areas to livestock. (Dry-harvested straw may be used for bedding and/or feed.) • Do not plant treated area to any crop other than wheat, barley or oats for 60 days after application. • Do not apply to oats underseeded with another crop. • Injury symptoms will appear on weeds in 1 to 3 weeks after application. • Special sprayer clean-out procedure required (see *Harmony Extra* label).

OATS WITHOUT LEGUME SEEDINGS — ALL TILLAGE SYSTEMS

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
ONLY ragweed, cocklebur, and jimsonweed	clopyralid *(Stinger)*	0.094	¼ pt	• Apply to oats from the 3-leaf stage to boot stage. See label for details. • Do not graze dairy or meat animals within 1 week after treatment. • Do not harvest hay from treated grain fields. • Do not apply to oats underseeded with a legume. • May be tank mixed with *Buctril* for control of additional weeds.

SMALL GRAINS SEEDED TO LEGUMES — ALL TILLAGE SYSTEMS

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	MCPA	3/16	⅜ pt 4L	• Apply in the spring to actively growing grain following tillering (usually about 6- to 8-in. high) but prior to jointing. DO NOT TREAT GRAIN IN BOOT TO DOUGH STAGE. The boot stage is when the upper sheath is beginning to swell with the enlarging head. • A canopy of grain and weeds over the seeding will reduce the possibility of injury to the legume. • Apply in 5 to 6 gal of water/A to minimize crop injury. • Sweet clover is very sensitive to MCPA.
	bromoxynil *(Buctril, Moxy)*	⅜	1½ pt 2L	• SMALL GRAINS SEEDED WITH ALFALFA ONLY. • Apply after alfalfa has reached at least the 4 trifoliate • stage and between emergence and boot stage of wheat or barley. • Do not treat when air temperatures exceed 70°F at and for 3 days following application or unacceptable alfalfa injury may occur. • Do not use any spray additives or increased injury may occur. • Alfalfa leaf burn following application is likely, but plants recover rapidly in favorable growing conditions. • Warm, humid conditions enhance leaf burn. • Less injurious than MCPA. • Do not treat when plants are under stress. • Rate may be reduced to1 pt per acre for greater crop safety (see label for weed sizes). • With ground application, use a minimum of 20 gal of water/A and 30 psi. • For best results, weeds must be small (see label for details). • Redroot pigweed and wild mustard must be controlled when very small (refer to label for details). • Weak on common chickweed. • Do not graze or cut for feed for 30 days after application.

TABLE 3B–
HARVEST RESTRICTIONS FOR SMALL GRAIN HERBICIDES
(as indicated on the product labels)

Herbicide	Restrictions
Banvel/Clarity	A waiting interval of 7 days is required before harvest. Do not use preharvest-treated wheat for seed unless a germination test is performed on the seed with an acceptable result of 95% germination or better.
Buctril	Do not graze treated fields for 30 days following application.
Curtail	Do not cut treated grass for hay within 30 days after application. Remove meat animals from freshly treated areas 7 days before slaughter. Withdrawal is not needed if 2 weeks have elapsed since application. Do not graze dairy animals in treated areas for 14 days after application. Do not use hay or straw from treated areas for composting or mulching on susceptible broadleaf crops. Do not transfer livestock from treated grazing areas onto sensitive broadleaf crop areas without first allowing 7 days of grazing on an untreated pasture. Otherwise, urine may contain enough clopyralid to cause injury to sensitive broadleaf plants.
Express	Do not graze or feed forage or hay from treated areas to livestock (dry-harvested straw may be used for bedding and/or feed).
Harmony Extra	Do not graze or feed forage or hay from treated areas to livestock (dry-harvested straw may be used for bedding and/or feed).
MCPA	Do not allow livestock to forage or graze treated areas within 7 days of slaughter.
Stinger	Do not permit dairy animals or meat animals being finished for slaughter to forage or graze treated grain fields within 1 week after treatment. Do not harvest hay from treated fields.
2,4-D	Do not permit dairy animals or meat animals being finished for slaughter to forage treated grain fields within 2 weeks after treatment. Do not feed treated straw to livestock if a preharvest or emergency treatment is used. See label.

TABLE 3C–WEED RESPONSE TO HERBICIDES IN SMALL GRAINS*

			ANNUAL BROADLEAVES														PERENNIALS						
	MODE OF ACTION	CROP TOLERANCE**	COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (BLACK)	PIGWEED (REDROOT)	RAGWEED	SMARTWEED	VELVETLEAF	WILD MUSTARD	HOARY ALYSSUM	YELLOW ROCKET	CHICKWEED (COMMON)	MAYWEED (DOGFENNEL)	ANNUAL GRASSES	BINDWEED (FIELD)	CANADA THISTLE	SOWTHISTLE	QUACKGRASS	YELLOW NUTSEDGE	WILD GARLIC	WILD ONION
BANVEL/CLARITY	O	3	**G**	**G**	**G**	**G**	**G**	**G**	**G**	F	**G**	F	**G**	**G**	F	F	F	F	F	P	N	F	F
BUCTRIL/MOXY	O	1	**G**	**G**	**E**	**G**	F	**G**	**G**	**G**	F	F	F	P	F	N	P	P	N	N	N	N	N
CURTAIL	O	3	**E**	**G**	**G**	**G**	**G**	**G**	F	F	**G**	**G**	**G**	P	**G**	N	P	F	P	N	N	P	P
EXPRESS	B	1	F	–	**E**	P	F	P	F	P	**E**	–	**G**	**G**	**E**	N	P	F	F	N	N	F	P
HARMONY EXTRA	B	1	**G**	–	**E**	P	**E**	F	**E**	**G**	**E**	–	**G**	**G**	**E**	N	P	F	F	N	N	**G**	F
MCPA	O	2	F	F	**G**	**G**	**G**	**G**	P	F	**G**	**G**	**G**	P	P	N	P	P	P	N	N	P	P
STINGER	O	2	**E**	**G**	P	P	P	**G**	F	P	P	P	P	P	**G**	N	P	F	F	N	N	N	N
2,4-D AMINE	O	3	F	F	**G**	**G**	**G**	**G**	P	F	**G**	**G**	**G**	P	P	N	P	P	P	N	N	P	P
2,4-D ESTER	O	3	F	F	**G**	**G**	**G**	**G**	P	**G**	**G**	**G**	**G**	P	P	N	F	F	P	N	N	F	F

Herbicide Mode of Action: A = ACCase Inhibitor; B = ALS Inhibitor; C = Photosynthesis Inhibitor; O = Other

Herbicide Effectiveness: P = Poor; F = Fair; G = Good; E = Excellent; N = None; – = Not enough information to rank

*The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.

**Crop Tolerance: 1=Minimal risk of crop injury; 2=Crop injury can occur under certain conditions (soil applied—cold, wet: foliar applied—hot, humid); 3=Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4=Risk of severe crop injury is high. Recommended only in rescue situations.

TABLE 4A–CHEMICAL WEED CONTROL IN FORAGE ESTABLISHMENT

DIRECT-DRILLED FORAGE LEGUMES (NO-TILL)
(spring seedings following soybeans, corn or dry edible beans)

In general, the major benefits of weed control in new alfalfa seedings are improved forage quality in the first harvest and insurance against stand loss from intense weed competition. In conventional tillage, weeds present at planting are killed by tillage during final seedbed preparation. With direct seeding (no-till), vegetation control is accomplished before planting with burndown herbicides such as paraquat *(Gramoxone Extra/Gramoxone Max)* or glyphosate (*Roundup Ultra, Touchdown,* or other glyphosate products). The required application rate varies depending on weed species and size. Refer to the product labels for details. *Gramoxone Extra/Gramoxone Max* provides faster kill. *Roundup Ultra, Touchdown,* or other glyphosate products are preferred if perennial weeds are present, however, fields with serious perennial weed problems should not be direct drilled with a forage legume. Perennial weeds should be controlled in the previous crop or in the fall prior to a spring seeding. Herbicide options in the fall include *Roundup Ultra, Touchdown,* other glyphosate products, 2,4-D ester, or a combination of a glyphosate product plus 2,4-D amine. Do not apply 2,4-D in the spring prior to spring planting.

The need for a burndown herbicide depends on the presence of weeds at planting time. If no weeds are present, a burndown herbicide is not needed. However, a burndown herbicide will improve first-harvest forage quality if weeds are present at planting time, regardless of species or size.

Herbicides applied after crop emergence are not affected by the tillage system used. All of the herbicides listed for postemergence application can be used in all tillage systems including direct drilling.

ALFALFA, TREFOIL AND CLOVER SEEDINGS
(clear seedings without small grain companion crops)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Preplant Incorporated				
Annual broadleaves **Annual grasses**	EPTC *(Eptam)*	3	3½ pt	• Incorporate into soil immediately after application. • Seed may be planted immediately after this operation. • Do not use when grass is seeded with legumes.
Postemergence— all tillage systems				
Annual broadleaves	2,4-DB amine *(Butoxone 200* or *Butyrac 200)*	1	2 qt	• Apply postemergence when legume seedlings are at or beyond the 1 to 2 trifoliate leaf stage. • Can be used if an annual broadleaf problem develops after using Eptam. • This treatment is not labeled for use with small grain companion crops. • Do not apply to sweet clover or established clovers grown for seed. • Do not graze or feed hay from forage for 60 days after application. • Do not apply when crop is under stress. • Do not apply when the daytime temperature is expected to exceed 90°F within the next 3 days. Do not apply if temperature is expected to fall below 40°F shortly after treatment.
Postemergence — all tillage systems				
Common Chickweed **Volunteer Cereals**	Pronamide *(Kerb)*	¾	1½ lb 50W	• Apply in the fall following spring or summer seeding. • Apply after soil temperature has dropped below 55°F. • Do not graze for 120 days after application.

BIRDSFOOT TREFOIL (Only) – POSTEMERGENCE – ALL TILLAGE SYSTEMS
(clear seedings without small grain companion crops)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses	sethoxydim *(Poast)* OR sethoxydim *(Poast Plus)* + crop oil concentrate	0.19 OR 0.19 + 1 qt	1 pt OR 1.5 pt + 1 qt	• Apply postemergence prior to first cutting. • Treat small, actively growing grasses (crabgrass up to 4 in.; foxtail, fall panicum, witchgrass, barnyardgrass up to 8 in.). • Use 5 to 20 gal of water/A and 40 to 60 psi. • Avoid spray drift onto corn, sorghum, small grains, and turf. • Rainfall within 1 hr of application will reduce control. • Does not control nutsedge or broadleaved weeds. • Do not apply within 7 days of feeding, grazing, or harvesting for (undried) forage, or within 14 days of feeding or harvesting for (dry) hay. • Do not apply more than 5 pt/A in one season. • *Poast* rate can be reduced to ¾ pt/A for 1- to 4-in. barnyardgrass, green and giant foxtail, and fall panicum. • Addition of liquid nitrogen fertilizer (28% N) at 1 gal/A or ammonium sulfate at 2½ lb/A will improve large crabgrass control.
	clethodim *(Select)* + crop oil concentrate	0.094 + 1%	6 oz + 1%	• Use on spring seedings. • Apply postemergence prior to first cutting. • Treat small, actively growing grass. • Do not apply within 15 days of grazing, feeding, or harvesting (cutting) trefoil for forage or hay. • Do not plant rotational crops until 30 days after application.
Volunteer corn	sethoxydim *(Poast)* OR sethoxydim *(Poast Plus)* + crop oil concentrate + 28% liquid nitrogen OR ammonium sulfate	0.19 OR 0.19 + 1 qt + 1 gal OR 2½ lb	1 pt OR 1.5 pt + 1 qt + 1 gal OR 2½ lb	• Apply postemergence prior to first cutting. • Treat actively growing corn up to a maximum of 20 in. tall. • Use 5 to 20 gal of water/A and 40 to 60 psi. • Avoid spray drift onto corn, sorghum, small grains, and turf. • Rainfall within 1 hr of application will reduce control. • Does not control nutsedge or broadleaved weeds. • Do not apply within 7 days of feeding, grazing, or harvesting for (undried) forage, or within 14 days of feeding or harvesting for (dry) hay. • Do not apply more than 5 pt/A in one season.
	clethodim *(Select)* + crop oil concentrate	0.063 + 1%	4 oz + 1%	• Use on spring seedings. • Apply postemergence prior to first cutting. • Treat actively growing volunteer corn up to 12 inches. Increase rate to 6 oz/A for 12–24 in. corn. • Do not apply within 15 days of grazing, feeding, or harvesting (cutting) trefoil for forage or hay. • Do not plant rotational crops until 30 days after application.

BIRDSFOOT TREFOIL (Only) – POSTEMERGENCE – ALL TILLAGE SYSTEMS
(clear seedings without small grain companion crops)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Volunteer cereals (wheat, barley, oats, rye)	sethoxydim *(Poast)*	0.29	1½ pt	• Apply postemergence prior to first cutting. • Treat actively growing grass up to a maximum of 4 in. tall. • Use 5 to 20 gal of water/A and 40 to 60 psi. • Avoid spray drift onto corn, sorghum, small grains, and turf. • Rainfall within 1 hr of application will reduce control. • Does not control nutsedge or broadleaved weeds. • Do not apply within 7 days of feeding, grazing, or harvesting for (undried) forage, or within 14 days of feeding or harvesting for (dry) hay. • Do not apply more than 5 pt/A in one season.
	OR	OR	OR	
	sethoxydim *(Poast Plus)*	0.29	2.3 pt	
	+	+	+	
	crop oil concentrate	1 qt	1 qt	
	+	+	+	
	28% liquid nitrogen	1 gal	1 gal	
	OR	OR	OR	
	ammonium sulfate	2½ lb	2½ lb	
	clethodim *(Select)*	0.125	8 oz	• Use on spring or summer seedings. • Apply postemergence prior to first cutting. • Treat actively growing volunteer cereals. • Do not apply within 15 days of grazing, feeding, or harvesting (cutting) trefoil for forage or hay. • Do not plant rotational crops until 30 days after application.
	+	+	+	
	crop oil concentrate	1%	1%	

ALFALFA (Only) – POSTEMERGENCE – ALL TILLAGE SYSTEMS
(clear seedings without small grain companion crops)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses	sethoxydim *(Poast)*	0.19	1 pt	• Use on spring seedings. • Apply postemergence prior to first cutting. • Treat small, actively growing grasses (crabgrass up to 4 in.; foxtail, fall panicum, witchgrass, barnyardgrass up to 8 in.). • Use 5 to 20 gal of water/A and 40 to 60 psi. • Avoid spray drift onto corn, sorghum, small grains, and turf. • Rainfall within 1 hr of application will reduce control. • Does not control nutsedge or broadleaved weeds. • 2,4-DB amine may be tank mixed with *Poast* or *Poast Plus* for broadleaf weed control. Temporary leaf burning may occur. Do not apply more than 0.5 lb a.i./A (1 qt/A) of 2,4-DB. Do not add fertilizer to this tank mix. See Remarks and Limitations for 2,4-DB. • Do not apply within 7 days of feeding, grazing, or harvesting for (undried) forage, or within 14 days of feeding or harvesting for (dry) hay. • Do not apply more than 5 pt/A in one season. • *Poast* rate can be reduced to ¾ pt/A for 1- to 4-in. barnyardgrass, green and giant foxtail, and fall panicum. • Addition of liquid nitrogen fertilizer (28% N) at 1 gal/A or ammonium sulfate at 2½ lb/A will improve large crabgrass control.
	OR	OR	OR	
	sethoxydim *(Poast Plus)*	0.19	1.5 pt	
	+	+	+	
	crop oil concentrate	1 qt	1 qt	
	clethodim *(Select)*	0.094	6 oz	• Use on spring seedings. • Apply postemergence prior to first cutting. • Treat small, actively growing grass. • Do not apply within 15 days of grazing, feeding, or harvesting (cutting) alfalfa for forage or hay. • Do not plant rotational crops until 30 days after application.
	+	+	+	
	crop oil concentrate	1%	1%	

ALFALFA (Only) – POSTEMERGENCE – ALL TILLAGE SYSTEMS *(continued)*

(clear seedings without small grain companion crops)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Volunteer corn	sethoxydim *(Poast)*	0.19	1 pt	• Use on spring seedings. • Apply postemergence prior to first cutting. • Treat actively growing corn up to a maximum of 20 in. tall. • Use 5 to 20 gal of water/A and 40 to 60 psi. • Avoid spray drift onto corn, sorghum, small grains, and turf. • Rainfall within 1 hr of application will reduce control. • Does not control nutsedge or broadleaved weeds. • Do not apply within 7 days of feeding, grazing, or harvesting for (undried) forage, or within 14 days of feeding or harvesting for (dry) hay. • Do not apply more than 5 pt/A in one season.
	OR	OR	OR	
	sethoxydim *(Poast Plus)*	0.19	1.5 pt	
	+	+	+	
	crop oil concentrate	1 qt	1 qt	
	+	+	+	
	28% liquid nitrogen	1 gal	1 gal	
	OR	OR	OR	
	ammonium sulfate	2½ lb	2½ lb	
	clethodim *(Select)*	0.063	4 oz	• Use on spring seedings. • Apply postemergence prior to first cutting. • Treat actively growing volunteer corn up to 12 inches. Increase rate to 6 oz/A for 12–24 in. corn. • Do not apply within 15 days of grazing, feeding, or harvesting (cutting) alfalfa for forage or hay. • Do not plant rotational crops until 30 days after application.
	+	+	+	
	crop oil concentrate	1%	1%	
Volunteer cereals (wheat, barley, oats, rye)	sethoxydim *(Poast)*	0.29	1½ pt	• Use on spring or summer seedings. • Apply postemergence prior to first cutting. • Treat actively growing grass up to a maximum of 4 in. tall. • Use 5 to 20 gal of water/A and 40 to 60 psi. • Avoid spray drift onto corn, sorghum, small grains, and turf. • Rainfall within 1 hr of application will reduce control. • Does not control nutsedge or broadleaved weeds. • Do not apply within 7 days of feeding, grazing, or harvesting for (undried) forage, or within 14 days of feeding or harvesting for (dry) hay. • Do not apply more than 5 pt/A in one season.
	OR	OR	OR	
	sethoxydim *(Poast Plus)*	0.25	2 pt	
	+	+	+	
	crop oil concentrate	1 qt	1 qt	
	+	+	+	
	28% liquid nitrogen	1 gal	1 gal	
	OR	OR	OR	
	ammonium sulfate	2½ lb	2½ lb	
	clethodim *(Select)*	0.125	8 oz	• Use on spring or summer seedings. • Apply postemergence prior to first cutting. • Treat actively growing volunteer cereals. • Do not apply within 15 days of grazing, feeding, or harvesting (cutting) alfalfa for forage or hay. • Do not plant rotational crops until 30 days after application.
	+	+	+	
	crop oil concentrate	1%	1%	
Annual broadleaves	imazethapyr *(Pursuit)*	0.063	4 oz 2L OR 1.4 oz 70% DG	• Apply after alfalfa has 2 fully expanded trifoliate leaves. • May be applied to spring or summer seedings. • May be applied in spring or fall. • Always add surfactant plus either 28% liquid nitrogen or spray grade ammonium sulfate (AMS). • Treat when weeds are less than 3 in. in height. • Will control several broadleaved weeds in new alfalfa seedings, including common chickweed. See Table 4E for details. • Will suppress volunteer cereals. • *Pursuit* is labeled for tank mixing with *2,4-DB, Poast Plus,* or *Buctril.* • Tank mixing *Pursuit* with *Buctril* or *2,4-DB* is not recommended due to increased risk of crop injury. • Tank mixing *Pursuit* with *Poast Plus* may result in reduced grass control (grass antagonism).
	+	+	+	
	28% liquid nitrogen	1 qt	1 qt	
	OR	OR	OR	
	ammonium sulfate	2.5 lb	2.5 lb	
	+	+	+	
	surfactant	¼%	¼%	

(Continued on next page)

ALFALFA (Only) – POSTEMERGENCE – ALL TILLAGE SYSTEMS *(continued)*
(clear seedings without small grain companion crops)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(Continued)				
Annual broadleaves	bromoxynil *(Buctril, Moxy)*	¼	1 pt 2L	• Apply postemergence to spring or summer seedings. • Apply after alfalfa has reached at least the 4 trifoliate leaf stage. • Do not treat when air temperatures exceed 70°F at the time of application or for 3 days following application or unacceptable crop injury may occur. • Do not use any spray additives or increased injury will occur. • Leaf burn following application is likely, but plants recover rapidly in favorable growing conditions. • Warm, humid conditions enhance leaf burn. • Do not treat when plants are under stress. • Rate may be reduced to 1 pt per acre for greater crop safety (see label for weed sizes). • With ground application, use a minimum of 20 gal of water/A and 30 psi. • For best results, weeds must be small; see label for details. • Redroot pigweed and wild mustard must be controlled when very small (refer to label for details). • Weak on common chickweed. • Do not graze or cut for feed for 30 days after application.

TABLE 4B – CHEMICAL WEED CONTROL IN ESTABLISHED FORAGES

ALFALFA (ESTABLISHED STAND – AT LEAST 1 YEAR OLD)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Yellow rocket and broadleaved winter annuals	metribuzin *(Sencor)*	½	1 pt 4L OR ⅔ lb 75% DF	• Apply to alfalfa established for one year or more. • Apply to *dormant* alfalfa in late fall or early spring. • Non-dormant alfalfa may be severely injured. • Application rate varies, depending on soil type (see label). • Sencor rate may be reduced to ½ pt per acre for common chickweed control.
	terbacil *(Sinbar)*	1	1¼ 80W	• Apply to alfalfa established for one year or more. • Apply to *dormant* alfalfa in late fall or early spring. • See label for crop rotation restrictions. • Early spring applications will control other broadleaf weeds and suppress quackgrass infestations. • Application rate varies, depending on soil type (see label).
	hexazinone *(Velpar)*	½	0.55 lb 90% SP OR 1 qt 2L OR 0.66 lb 75% DF	• Apply to alfalfa established for one year or more. • Alfalfa plants should be healthy, vigorous, and not under stress by weather, insects, diseases, or extreme weed competition. The crop root system should be well established. • Apply in late fall or early spring before alfalfa growth exceeds 2 in. Applications to *dormant* alfalfa provide the greatest crop safety. • Application can be made between cuttings before regrowth exceeds 2 in. in height, but alfalfa injury may result if plants are under stress. Do not make more than one application in one growing season. • Do not apply to seedling alfalfa or alfalfa-forage grass mixtures. • Do not apply to snow-covered or frozen ground. • Use at least 20 gal water/A for ground application. • Do not graze or feed treated forage to livestock for 30 days following application. • **Rotational restriction:** Corn may be planted 12 mo. following the last application, provided the soil is moldboard plowed prior to planting. Do not plant any other crop for 2 years after application. • Application rate varies, depending on soil type (see label).
Dandelions	metribuzin *(Sencor)*	1	1 qt 4L OR 1⅓ lb 75% DF	• Apply to alfalfa established for one year or more. • Apply in spring before alfalfa breaks dormancy. • Non-dormant alfalfa may be severely injured. • Perennial grasses may also be suppressed. • Early spring applications will control other broadleaf weeds and suppress quackgrass infestations. • Application rate varies, depending on soil type (see label).

(Continued on next page)

ALFALFA (ESTABLISHED STAND – AT LEAST 1 YEAR OLD) (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Dandelions	hexazinone *(Velpar)*	1	1.1 lb 90% SP OR 2 qt 2L OR 1.33 lb 75% DF	• Apply to alfalfa established for one year or more. • Alfalfa plants should be healthy, vigorous, and not under stress by weather, insects, diseases, or extreme weed competition. The crop root system should be well established. • Apply in spring before alfalfa growth exceeds 2 in. Spring applications to *dormant* alfalfa provide the greatest crop safety. • Application can be made between cuttings before regrowth exceeds 2 in. in height, but alfalfa injury may result if plants are under stress. Do not make more than one application in one growing season. • Do not apply to seedling alfalfa or alfalfa-forage grass mixtures. • Do not apply to snow-covered or frozen ground. • Use at least 20 gal of water/A for ground application. • Do not graze or feed treated forage to livestock for 30 days following application. • **Rotational restriction:** Corn may be planted 12 mo. following the last application, provided the soil is moldboard plowed prior to planting. Do not plant any other crop for 2 years after application. • Will also provide partial control of quackgrass. • Application rate varies, depending on soil type (see label).
Hoary alyssum **Annual broadleaves**	2,4-DB amine *(Butoxone 200* or *(Butyrac 200)*	1	2 qt	• Apply in early April. • Spray when hoary alyssum seedlings are in the 2- to 4-leaf stage. • Do not graze or feed hay from forage for 30 days after application. • Do not apply when crop is under stress. • Do not apply when the daytime temperature is expected to exceed 90°F within the next 3 days. Do not apply if the temperature is expected to fall below 40°F shortly after treatment.
Quackgrass	pronamide *(Kerb)*	1½	3 lb	• Apply in late fall when soil temperatures are below 55°F. • For light to moderate quackgrass infestations, rate can be reduced to 1 lb a.i./A (2 lb/A of formulated product).

BIRDSFOOT TREFOIL (ESTABLISHED STAND)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Quackgrass	pronamide *(Kerb)*	1½	3 lb	• Apply in late fall when soil temperatures are below 55°F. • For light to moderate quackgrass infestations, rate can be reduced to 1 lb a.i./A (2 lb/A of formulated product).

GRASS PASTURE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Perennial broadleaves	2,4-D ester	1	1 qt	• Apply in fall or spring to actively growing weeds. • Legumes will be injured or killed. • See Table 4D for harvest and grazing restrictions.
	dicamba *(Banvel/Clarity)*	1	1 qt	• Legumes will be injured or killed. • Apply in fall or spring to actively growing weeds. • Treat when biennials are in the rosette stage. • See Table 4D for harvest and grazing restrictions.
	2,4-D ester + dicamba *(Banvel/Clarity)*	¾ + ¼	1½ pt + ½ pt	• Legumes will be injured or killed. • Apply in fall or spring to actively growing weeds. • See Table 4D for harvest and grazing restrictions.
	clopyralid *(Stinger)*	0.188	½ pt	• Apply only to established forage grasses. • Legumes will be injured or killed. • See Table 4D for harvest and grazing restrictions. • See Table 11 for crop rotation restrictions. • A premix of clopyralid + 2,4-D amine *(Curtail)* is available.

PREHARVEST APPLICATION — ALFALFA

Weed Controlled	Herbicide	Rate lb/A a.e.	Formulation/A	Remarks and Limitations
Quackgrass	glyphosate *(Roundup Ultra)* OR (others—see label) + ammonium sulfate	0.75 + 17 lb/100 gal	 1 qt 3L a.e. OR (see label) + 17 lb/100 gal	• May be applied prior to the last harvest before reestablishment of the site. • Fits fall application best. • Alfalfa will be injured but not killed. • Deep tillage following harvest will be required for complete kill of alfalfa and quackgrass. • Does not fit no-tillage systems. • Treat actively growing quackgrass at least 8 inches tall. • Addition of ammonium sulfate (AMS) at 17 lbs/100 gal of water often improves control. • Allow a minimum of 36 hours between application and harvest. • A time interval of 3 days between application and harvest is recommended to allow maximum quackgrass control. • Treated crop and weeds can be fed to livestock. • Do not use on alfalfa grown for seed. • See supplemental label for further details.

TABLE 4C –
HARVEST RESTRICTIONS FOR FORAGE LEGUME HERBICIDES
(as indicated on the product labels)

Herbicide	Restrictions
Buctril, Moxy	Do not cut for feed or graze spring-treated alfalfa within 30 days following treatment.
Eptam	None for preplant application.
Kerb	Do not graze or harvest for forage or dehydration within 120 days of application.
Sencor	Do not graze or harvest within 28 days after application.
MCPA	Do not allow livestock to forage or graze treated areas within 7 days of slaughter.
Poast, Poast Plus	Do not apply within 7 days of feeding, grazing, or harvesting for (undried) forage, or within 14 days of feeding or harvesting for (dry) hay.
Pursuit	Do not feed, graze or harvest alfalfa for 30 days following application.
Select	Do not apply within 15 days of grazing, feeding, or harvesting (cutting) alfalfa for hay or forage.
Sinbar	None.
2,4-DB	Do not graze established alfalfa or feed straw or hay from treated crops to livestock within 30 days after application. Do not graze or feed seedling alfalfa, clover or birdsfoot trefoil within 60 days after application.
Velpar	Do not graze or feed forage or hay to livestock within 30 days after application.
Roundup Ultra	Allow a minimum of 36 hours between application and harvest (alfalfa only).

TABLE 4D –
HARVEST RESTRICTIONS FOR FORAGE GRASS HERBICIDES
(as indicated on the product labels)

Herbicide	Restrictions
Banvel/Clarity	Animals cannot be removed from treated area for slaughter prior to 30 days after last application. There is no waiting period between treatment and grazing for non-lactating animals. Timing Restriction for Lactating Dairy Animals Following Treatment: Up to 1 pt/A—7 days before grazing, 37 days before hay harvest. Up to 1 qt/A—21 days before grazing, 51 days before hay harvest. See label for details.
2,4-D	Do not graze animals on treated areas within 7 days after treatment. Do not permit dairy animals or meat animals being finished for slaughter to forage treated fields within 3 days of slaughter. Do not cut grass for hay within 30 days after application.
Stinger	Do not use hay or straw from treated areas for composting or mulching on susceptible broadleaf crops. Do not transfer livestock from treated grazing areas onto sensitive broadleaf crop areas without first allowing 7 days of grazing on an untreated pasture. Otherwise, urine may contain enough clopyralid to cause injury to sensitive broadleaf plants.
Curtail	Do not cut treated grass for hay within 30 days after application. Remove meat animals from freshly treated areas 7 days before slaughter. Withdrawal is not needed if 2 weeks have elapsed since application. Do not graze dairy animals in treated areas for 14 days after application. Do not use hay or straw from treated areas for composting or mulching on susceptible broadleaf crops. Do not transfer livestock from treated grazing areas onto sensitive broadleaf crop areas without first allowing 7 days of grazing on an untreated pasture. Otherwise, urine may contain enough clopyralid to cause injury to sensitive broadleaf plants.

TABLE 4E–WEED RESPONSE TO HERBICIDES IN FORAGE LEGUMES*

	MODE OF ACTION	CROP TOLERANCE**	ANNUAL BROADLEAVES												ANNUAL GRASSES							PERENNIALS					
			COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	SMARTWEED	VELVETLEAF	WILD MUSTARD	HOARY ALYSSUM	YELLOW ROCKET	CHICKWEED (COMMON)	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	BINDWEED (FIELD)	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE	DANDELION	CURLED DOCK
Seedling Legumes																										
BUCTRIL/MOXY	O	3	**G**	**G**	**E**	**G**	F	**G**	**G**	**G**	F	F	F	P	N	N	N	N	N	N	N	P	P	N	N	P	P
EPTAM	O	2	P	P	**G**	P	F	F	F	F	F	F	F	F	**E**	**E**	**E**	**E**	**E**	**E**	**E**	N	N	F	P	N	P
KERB	O	1	P	P	P	P	P	P	P	P	P	P	P	**G**	F	F	P	F	F	P	P	N	N	**G**	N	N	P
MCPA	O	4	F	F	**G**	**G**	**G**	**G**	**G**	F	**G**	**G**	F	P	N	N	N	N	N	N	N	P	P	N	N	P	P
POAST or POAST PLUS	**A**	1	N	N	N	N	N	N	N	N	N	N	N	N	**E**	**G**	**E**	**E**	**E**	**E**	**E**	N	N	F	N	N	N
PURSUIT	**B**	2	**E**	F	P	**G**	**E**	F	**G**	**G**	**G**	–	**G**	**G**	F	F	**G**	**G**	**G**	F	F	P	P	N	F	P	P
2,4-DB	O	2	P	P	**G**	F	**G**	F	P	F	F	F	F	P	N	N	N	N	N	N	N	P	P	N	N	N	F
Established Alfalfa																											
SENCOR	**C**	3	**E**	**G**	**E**	N	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	**G**	**E**	**E**	**G**	**G**	N	N	P	P	**G**	P
SINBAR	**C**	3	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**E**	**E**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	P	F	F	P	F	P
VELPAR	**C**	3	**G**	**G**	**E**	F	**E**	**E**	**E**	**G**	**E**	**E**	**E**	**E**	**G**	**G**	**E**	**E**	**E**	**E**	**E**	F	F	F	F	**E**	P

Herbicide Mode of Action: A = ACCase Inhibitor; B = ALS Inhibitor; C = Photosynthesis Inhibitor; O = Other

Herbicide Effectiveness: P = Poor; F = Fair; G = Good; E = Excellent; N = None; – = Not enough information to rank

*The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.

**Crop Tolerance: 1=Minimal risk of crop injury; 2=Crop injury can occur under certain conditions (soil applied—cold, wet: foliar applied—hot, humid); 3=Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4=Risk of severe crop injury is high. Recommended only in rescue situations.

TABLE 4F–WEED RESPONSE TO HERBICIDES IN ESTABLISHED FORAGE GRASSES*

	MODE OF ACTION	CROP TOLERANCE**	ANNUAL BROADLEAVES												ANNUAL GRASSES							PERENNIALS					
			COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	SMARTWEED	VELVETLEAF	WILD MUSTARD	HOARY ALYSSUM	YELLOW ROCKET	CHICKWEED (COMMON)	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	BINDWEED (FIELD)	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE	DANDELION	CURLED DOCK
2,4-D ESTER	O	2	**E**	**G**	**E**	**E**	**E**	**E**	F	**G**	**G**	**G**	**G**	P	N	N	N	N	N	N	N	F	F	N	N	**G**	P
BANVEL/CLARITY	O	2	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	**E**	**G**	**E**	**E**	N	N	N	N	N	N	N	**G**	**G**	N	N	**G**	F
STINGER	O	2	**E**	**G**	P	F	P	**E**	F	P	P	P	P	P	N	N	N	N	N	N	N	P	**G**	N	N	**G**	P

Herbicide Mode of Action: A = ACCase Inhibitor; B = ALS Inhibitor; C = Photosynthesis Inhibitor; O = Other

Herbicide Effectiveness: P = Poor; F = Fair; G = Good; E = Excellent; N = None; – = Not enough information to rank

*The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.

**Crop Tolerance: 1=Minimal risk of crop injury; 2=Crop injury can occur under certain conditions (soil applied—cold, wet: foliar applied—hot, humid); 3=Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4=Risk of severe crop injury is high. Recommended only in rescue situations.

TABLE 5A–CHEMICAL WEED CONTROL IN DRY EDIBLE BEANS

DRY EDIBLE BEANS – PREPLANT

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses **Yellow nutsedge** **Redroot pigweed** **Black nightshade**	alachlor *(Lasso, Micro-Tech,* or *Partner)* OR s-metolachlor *(Dual Magnum,)* *Dual II Magnum)* OR dimethenamid *(Frontier)* OR dimethenamid-P *(Outlook)*	2 OR 1.27 OR 1.17 OR 0.64	2 qt OR 3 lb 65% DG OR 1.33 pt OR 25 oz 6.0 L OR 14 oz 6.0 L	• Alachlor is a **restricted use** pesticide. • Incorporate to 2-in. depth. • DO NOT use alachlor on sands or loamy sands — injury can occur. • *Dual Magnum* or *Dual II* Magnum at 1.33 pt/A is equal to *Dual* or *Dual II* at 2 pt/A. • REDUCE *Dual Magnum* rate to 1 pt/A, *Frontier* rate to 20 oz/A, and *Outlook* to 12 oz/A on coarse-textured soils low in organic matter (see labels). • Navy and black beans have greater tolerance to *Dual Magnum* than to *Frontier (Outlook).* • This treatment is used for black nightshade control. • Alachlor, *Dual Magnum,* and *Frontier (Outlook)* should be preplant incorporated to minimize danger of bean injury. • Alachlor and *Frontier (Outlook)* will provide better nightshade and pigweed control than *Dual Magnum.* • *Dual Magnum* will provide better yellow nutsedge control than alachlor, *Frontier,* or *Outlook.* • *Prowl, Treflan,* or *Sonalan* can be tankmixed for lambsquarters control. • A postemergence application of *Basagran* or an application of *Pursuit* may be necessary for broadleaf weed control. See remarks for these herbicides.
Annual grasses **Annual broadleaves** (EXCEPT nightshade, cocklebur, jimsonweed)	EPTC *(Eptam)* + trifluralin *(Treflan)* OR pendimethalin *(Prowl)* OR ethalfluralin *(Sonalan)*	2¼ + ½ OR ¾ OR ¾	1¼ qt + 1 pt OR 1.8 pt 3.3 EC OR 2 pt	• Incorporate immediately after application. • *Eptam* suppresses common ragweed and wild mustard. • *Prowl* provides better velvetleaf control than *Treflan* or *Sonalan.* • *Treflan* provides better pigweed control than *Prowl* or *Sonalan.* • A postemergence application of *Basagran* or an application of *Pursuit* may be necessary for broadleaf weed control. See remarks for these herbicides.

DRY EDIBLE BEANS – PREPLANT (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (EXCEPT common ragweed, lambsquarters, smartweed, cocklebur, jimsonweed, and velvetleaf) **Annual grasses**	alachlor *(Lasso, Micro-Tech,* or *Partner)*	2	2 qt	• Alachlor is a **restricted use** pesticide. • SEE PURSUIT SUPPLEMENTAL LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. DO NOT USE IF SUGAR BEETS ARE PLANNED IN THE CROP ROTATION. • DO NOT apply *Pursuit* preplant in the Upper Peninsula of Michigan. • DO NOT use on sands or loamy sands—injury can occur. • Increase Pursuit to 3 oz/A (1.08 oz/A 70 DG) on heavy soils if organic matter is greater than 2% and weed pressure is high. • DO NOT apply *Pursuit* if cold and/or wet conditions are present or predicted to occur within one week of application. • Delayed maturity may result from *Pursuit* application. • DO NOT apply if planting is delayed and chance of frost prior to maturity is likely to occur. • Incorporate to a 2-in. depth. • *Dual Magnum* or *Dual II Magnum* at 1.33 pt/A is equal to *Dual* or *Dual II* at 2 pt/A. • Reduce *Dual Magnum* rate to 1 pt/A, *Frontier* rate to 20 oz/A, and *Outlook* rate to 12 oz/A on coarse-textured soils low in organic matter (see labels). • Navy and black beans have greater tolerance to *Dual Magnum* than to *Frontier (Outlook).* • For use on navy, black turtle,pinto, kidney, and cranberry beans ONLY. DO NOT apply to Domino black turtle beans. Olathe pinto bean is sensitive to *Pursuit.* • Bean varieties vary in sensitivity to *Pursuit.* • DO NOT apply within 60 days of harvest. • AVOID DRIFT AND SPRAY OVERLAP. • This treatment is used for black nightshade control. • *Dual Magnum* will provide better yellow nutsedge suppression than alachlor, *Frontier*, or *Outlook.*
	OR	OR	OR	
	s-metolachlor *(Dual Magnum, Dual II Magnum)*	1.27	1.33 pt	
	OR	OR	OR	
	dimethenamid *(Frontier)*	1.17	25 oz 6.0 L	
	OR	OR	OR	
	dimethenamid-P *(Outlook)*	0.64	14 oz 6.0 L	
	+	+	+	
	imazethapyr *(Pursuit)*	0.031	2 oz 2 L OR 0.72 oz 70 DG	
Annual broadleaves (including nightshade) (EXCEPT common ragweed) **Annual grasses**	imazethapyr+ pendimethalin *(Pursuit Plus)*	0.47	20 oz	• SEE *PURSUIT PLUS* SUPPLEMENTAL LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. DO NOT USE IF SUGARBEETS ARE PLANNED IN THE CROP ROTATION. • DO NOT apply *Pursuit* preplant in the Upper Peninsula of Michigan. • DO NOT use on sands or loamy sands. • 20 oz of *Pursuit Plus* contains 1.1 pt of *Prowl* 3.3 EC. Under heavy annual grass pressure, control may not be adequate. • Use 30 oz/A of *Pursuit Plus* on heavy soils if organic matter is greater than 2% and weed pressure is heavy. • DO NOT apply *Pursuit Plus* if cold and/or wet conditions are present or predicted to occur within one week of application. • Delayed maturity may result from *Pursuit Plus* application. • DO NOT apply if planting is delayed and chance of frost prior to maturity is likely to occur. • Incorporate immediately after application. • For use on navy, black turtle, pinto, kidney, and cranberry beans ONLY. DO NOT apply to Domino black turtle beans. Olathe pinto bean is sensitive to *Pursuit.* • Bean varieties vary in sensitivity to *Pursuit Plus.* • DO NOT apply within 60 days of harvest. • Avoid DRIFT AND SPRAY OVERLAP. • Yellow nutsedge will be suppressed by this treatment. • **Common ragweed** will **not** be controlled by this treatment.

(Continued on next page)

DRY EDIBLE BEANS – PREPLANT (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves (including nightshade) **Annual grasses**	EPTC *(Eptam)*	2¼	1¼ qt	• SEE *PURSUIT* SUPPLEMENTAL LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. DO NOT USE IF SUGARBEETS ARE PLANNED IN THE CROP ROTATION. • DO NOT apply *Pursuit* preplant in the Upper Peninsula of Michigan. • DO NOT use on sands or loamy sands. • Increase *Pursuit* to 3 oz/A (1.08 oz/A 70 DG) on heavy soils if organic matter is greater than 2% and weed pressure is high. • DO NOT apply *Pursuit* if cold and/or wet conditions are present or predicted to occur within one week of application. • Delayed maturity may result from *Pursuit* application. • DO NOT apply if planting is delayed and chance of frost prior to maturity is likely to occur. • Incorporate immediately after application. • For use on navy, black turtle, pinto, kidney, and cranberry beans ONLY. DO NOT apply to Domino black turtle beans. Olathe pinto bean is sensitive to *Pursuit*. • Bean varieties vary in sensitivity to *Pursuit*. • DO NOT apply within 60 days of harvest. • Avoid DRIFT AND SPRAY OVERLAP. • If *Eptam* is NOT applied, common ragweed control will be reduced. • If *Treflan, Sonalan,* or *Prowl* are NOT applied, lambsquarters control will be reduced. • Yellow nutsedge will be suppressed by this treatment. • A prepackaged mix of *Prowl* plus *Pursuit* is registered for use in dry beans *(Pursuit Plus)*. See supplemental label.
	+	+	+	
	imazethapyr *(Pursuit)*	0.031	2 oz 2 L OR 0.72 oz 70 DG	
	+	+	+	
	trifluralin *(Treflan)*	½	1 pt	
	OR	OR	OR	
	pendimethalin *(Prowl)*	¾	1.8 pt 3.3 EC	
	OR	OR	OR	
	ethalfluralin *(Sonalan)*	¾	2 pt	

DRY EDIBLE BEANS – PREPLANT FOLLOWED BY PREEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Preplant incorporated				
Annual broadleaves (including nightshade) **Annual grasses**	EPTC *(Eptam)*	2¼	1¼ qt	• Incorporate immediately after application. • Follow with preemergence *Pursuit* for additional broadleaf weed control IF CROP ROTATION PERMITS. • Follow with *Basagran* for additional broadleaf weed control.
	+	+	+	
	trifluralin *(Treflan)*	½	1 pt	
	OR	OR	OR	
	pendimethalin *(Prowl)*	¾	1.8 pt 3.3 EC	
	OR	OR	OR	
	ethalfluralin *(Sonalan)*	¾	2 pt	

FOLLOWED BY
(See next page)

DRY EDIBLE BEANS – PREPLANT FOLLOWED BY PREEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
FOLLOWED BY ***Preemergence***	imazethapyr *(Pursuit)*	0.031	2 oz 2 L OR 0.72 OZ 70 DG	• SEE *PURSUIT* SUPPLEMENTAL LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. DO NOT USE IF SUGARBEETS ARE PLANNED IN THE CROP ROTATION. • DO NOT apply *Pursuit* preemergence in the Upper Peninsula of Michigan. • Increase *Pursuit* to 3 oz/A (1.08 oz/A 70 DG) on heavy soils if organic matter is greater than 2% and weed pressure is high. • DO NOT apply *Pursuit* if cold and/or wet conditions are present or predicted to occur within one week of application. • Delayed maturity may result from *Pursuit* application. • DO NOT apply if planting is delayed and chance of frost prior to maturity is likely to occur. • Requires rainfall for activation. Rotary hoe if no rainfall occurs within 7 days. • DO NOT use on sands or loamy sands. • For use on navy, black turtle, pinto, kidney, and cranberry beans ONLY. DO NOT apply to Domino black turtle beans. Olathe pinto is sensitive to *Pursuit*. • Bean varieties vary in sensitivity to *Pursuit*. • DO NOT apply within 60 days of harvest. • Avoid DRIFT AND SPRAY OVERLAP. • Yellow nutsedge will be suppressed by this treatment.

DRY EDIBLE BEANS – PREEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses **Yellow Nutsedge** **Redroot Pigweed** **Black Nightshade**	s-metolachlor *(Dual Magnum, Dual II Magnum)* OR dimethenamid *(Frontier)* OR dimethenamid-P *(Outlook)*	1.27 OR 1.17 OR 0.64	1.33 pt OR 25 oz 6.0 L OR 14 oz 6.0 L	• DO NOT apply if soil is cracking and beans are at the crook stage. • *Dual Magnum* or *Dual II Magnum* at 1.33 pt/A is equal to *Dual* or *Dual II* at 2 pt/A. • Reduce *Dual Magnum* rate to 1 pt/A, *Frontier* rate to 20 oz/A, and *Outlook* rate to 12 oz/A on coarse textured soils low in organic matter (see labels). • Navy and black beans have greater tolerance to *Dual Magnum* than to *Frontier (Outlook)*. • Danger of bean injury is greater when *Frontier (Outlook)* or *Dual Magnum* is applied preemergence. • *Frontier (Outlook)* will provide better black nightshade control than *Dual Magnum*. *Dual Magnum* will provide better yellow nutsedge control than *Frontier, Outlook*. • Requires rainfall for activation. Rotary hoe if no rainfall occurs within 7 days. • A postemergence application of *Basagran* or *Pursuit* may be necessary for broadleaf weed control. See remarks for these herbicides.

DRY EDIBLE BEANS – PREEMERGENCE (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (except common ragweed, lambsquarters, smartweed, cocklebur, jimsonweed, and velvetleaf) **Annual grasses**	s-metolachlor *(Dual Magnum, Dual II Magnum)* OR dimethenamid *(Frontier)* OR dimethenamid-P *(Outlook)* + imazethapyr *(Pursuit)*	1.27 OR 1.17 OR 0.64 + 0.031	1.33 pt OR 25 oz 6.0 L OR 14 oz 6.0 L + 2 oz 2 L OR 0.72 oz 70 DG	• SEE *PURSUIT* SUPPLEMENTAL LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. DO NOT USE IF SUGARBEETS ARE PLANNED IN THE CROP ROTATION. • DO NOT apply if soil is cracking and beans are at the crook stage. • DO NOT apply *Pursuit* preemergence in the Upper Peninsula of Michigan. • DO NOT USE on sands and loamy sands. • Increase *Pursuit* to 3 oz/A (1.08 oz/A of 70 DG) on heavy soils if soil organic matter is greater than 2% and weed pressure is high. • DO NOT apply *Pursuit* if cold and/or wet conditions are present or predicted to occur within one week of application. • Delayed maturity may result from *Pursuit* application. • DO NOT apply if planting is delayed and chance of frost prior to maturity is likely to occur. • *Dual Magnum* or *Dual II Magnum* at 1.33 pt/A is equal to *Dual* or *Dual II* at 2 pt/A. • Reduce *Frontier* rate to 20 oz/A, *Outlook* to 12 oz/A, and *Dual Magnum* rate to 1 pt/A on sandy loam soils low in organic matter (see labels). • Navy and black beans have greater tolerance to *Dual Magnum* than to *Frontier (Outlook).* • Danger of bean injury is greater when *Frontier, Outlook* or *Dual Magnum* is applied preemergence. • Requires rainfall for activation. Rotary hoe if no rainfall occurs within 7 days. • For use on navy, black turtle, pinto, kidney, and cranberry beans ONLY. DO NOT apply to Domino black turtle beans. Olathe pinto bean is sensitive to *Pursuit.* • Bean varieties vary in sensitivity to *Pursuit.* • AVOID DRIFT, AVOID SPRAY OVERLAP. Sensitive crops may be injured. • DO NOT apply with 70 days of harvest if *Outlook* is applied; 60 days for *Dual Magnum.*

DRY EDIBLE BEANS – POSTEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (including cocklebur, velvetleaf, and jimsonweed)	bentazon *(Basagran)* + crop oil concentrate	¾ + 1 qt	1½ pt + 1 qt	• Controls only certain broadleaves. POOR CONTROL OF REDROOT PIGWEED AND BLACK NIGHTSHADE. Fair control of common ragweed and common lambsquarters. • Check the *Basagran* dry bean label for specific rate and proper weed growth stage. • Beans MUST HAVE 1 to 2 trifoliate leaves before application. • Use a minimum of 40 psi and 20 gal of water/A. Do not use flood nozzles. • Use 1 gal of 28% liquid nitrogen (urea ammonium nitrate)/A INSTEAD OF crop oil concentrate for improved velvetleaf control. Do not use 28% liquid nitrogen if lambsquarters is present. • Do not apply if dry beans are under stress from herbicide injury, cold or dry weather, or hail damage.

(Continued on next page)

DRY EDIBLE BEANS — POSTEMERGENCE (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves (including cocklebur, velvetleaf, and jimsonweed)	bentazon *(Basagran)* + crop oil concentrate	0.5 + 0.5 + 1 pt + 1 pt	1 pt + 1 pt + 1 pt + 1 pt	• Split applications of *Basagran* provide more consistent control of common ragweed and lambsquarters than a single application. Redroot pigweed control will be fair; black nightshade control poor. • Time application for weed size. Make the first application when weeds are less than 1 in. tall (pigweed less than ½ in. tall). Make a second application 10 to 14 days later. • Use a minimum of 40 psi and 20 gal of water/A. Do not use flood nozzles. • For application to navy, black turtle, pinto, kidney, cranberry, and great Northern beans.
Redroot Pigweed **Black Nightshade** **Wild Mustard**	imazethapyr *(Pursuit)* + surfactant	0.031 + ¼%	2 oz 2 L OR 0.72 oz 70 DG + ¼%	• SEE *PURSUIT* SUPPLEMENTAL LABEL OR TABLE 11 FOR CROP ROTATION RESTRICTIONS. DO NOT USE IF SUGARBEETS ARE PLANNED IN THE CROP ROTATION. • Dry beans MUST HAVE one fully expanded trifoliate leaf. • DO NOT apply postemergence if dry beans have begun to flower. • DO NOT apply to Domino black turtle beans. • Pinto variety Olathe is sensitive to *Pursuit*. • DO NOT add 28% liquid nitrogen or ammonium sulfate. • DO NOT apply if chance of frost prior to maturity is likely. • DO NOT apply within 60 days of harvest. • Apply when broadleaf weeds are less than 2 inches tall.
Annual grasses	sethoxydim *(Poast)* + crop oil concentrate	0.19 + 1 qt	1 pt + 1 qt	• Apply to annual grasses up to 8 in. (crabgrass up to 6 in.) • *Poast* can be reduced to ¾ pt/A for 1- to 4-in. barnyard grass, green and giant foxtails, and fall panicum. • Do not apply to grasses under stress or poor weed control may result. • Use a minimum of 5 gal of water/A and a maximum of 20 gal of water/A, and 40 to 60 psi. • No soil activity. • Do not cultivate within 5 days prior to and 7 days following application. • Do not apply within 30 days of harvest. • DO NOT tank mix with *Pursuit* as poor grass control will result.
	clethodim *(Select)* + crop oil concentrate	0.094 + 1%	6 oz + 1%	• Apply to annual grasses up to 6 in. • *Select* rate can be reduced to 4-5 oz/A when some grass species are small. • Use 10 to 40 gal of water/A and 20 to 60 psi. • No soil activity. • DO NOT cultivate for 7 days before or 7 days after treatment. • Allow 30 days between *Select* application and dry bean harvest. • *Select* can be tank mixed with *Basagran*. Increase the *Select* rate to 8–10 oz/A. • DO NOT tank mix with *Pursuit* as poor grass control will result.

(Continued on next page)

DRY EDIBLE BEANS — POSTEMERGENCE (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual grasses	quizalofop-P-ethyl *(Assure II)*	0.044	7 oz	• Apply to annual grasses up to 4 in. • DO NOT apply to grasses under stress or poor weed control may result. • Apply in 10 to 20 gal. of water/A using standard flat fan or hollow cone nozzle. • No soil activity. • DO NOT cultivate within 5 days prior to and 7 days following application. • Allow 30 days between *Assure II* application and dry bean harvest. • *Assure II* can be tank mixed with *Basagran* for control of foxtails and barnyardgrass only. Increase the recommended rate of *Assure II* by 2 oz. • DO NOT tank mix with *Pursuit* as poor grass control will result.
	+	+	+	
	crop oil concentrate	1%	1%	
	OR	OR	OR	
	surfactant	¼%	¼%	
Quackgrass	quizalofop-P-ethyl *(Assure II)*	0.0625	10 oz	• Make application when quackgrass is 6 to 10 in. tall. • Two applications may be needed for best quackgrass control. Make second application of 7 oz/A 14 to 21 days later when quackgrass has reached 4 to 8 in. Cultivation may replace second application. • Use 10 to 20 gal. of water /A and standard flat fan or hollow cone nozzles. • DO NOT apply to quackgrass under stress or poor control may result. • DO NOT apply within 30 days of harvest.
	+	+	+	
	crop oil concentrate	1%	1%	
	OR	OR	OR	
	surfactant	¼%	¼%	
	clethodim *(Select)*	0.125–0.25	8–16 oz	• Make application when quackgrass is 4 to 12 in. tall. • Use the higher rate when quackgrass is at maximum size or under stress. • Two applications may be needed. Make second application of 8 oz/A 14 to 21 days later. Cultivation may replace second application. • Use 10 to 40 gal of water/A and 20 to 60 psi. • DO NOT apply within 30 days of harvest.
	+	+	+	
	crop oil concentrate	1%	1%	
	+	+	+	
	AMS	2½ lb	2½ lb	
	OR	OR	OR	
	28% liquid nitrogen	2.5%	2.5%	
	sethoxydim *(Poast)*	0.29 + 0.19	1½ pt + 1 pt	• Treat actively growing quackgrass 6- to 8-in. tall. • Two applications may be necessary for quackgrass control. Make a second application of 1 pt/A 14 to 21 days following initial treatment. Cultivation may replace second application. • Do not cultivate within 5 days prior to and 14 to 21 days following application. • Use a minimum of 5 gal of water/A and a maximum of 20 gal of water/A, and 40 to 60 psi. • Do not apply to quackgrass under stress or poor control may result. • DO NOT apply within 30 days of harvest.
	+	+	+	
	crop oil concentrate	1 qt + 1 qt	1 qt + 1 qt	
	+	+	+	
	28% liquid nitrogen	1 gal + 1 gal	1 gal + 1 gal	
	OR	OR	OR	
	ammonium sulfate	2½ lb+2½ lb	2½ lb+2½ lb	
Nutsedge **Canada thistle**	bentazon *(Basagran)*	¾ + ¾	1½ pt + 1½ pt	• Beans must have 1 to 2 trifoliate leaves before application. • For Canada thistle control, treat when plants are 6 to 8 in. tall. Repeat 7–10 days later if needed. • For yellow nutsedge control, treat when plants are 4 to 6 in. tall. Repeat 7–10 days later if needed.
	+	+	+	
	crop oil concentrate	1 qt + 1 qt	1 qt + 1 qt	

TABLE 5B–VINE DESICCATION IN DRY EDIBLE BEANS

Dry Bean Vine Desiccation	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
	sodium chlorate *(Defol 6)*	6	1 gal 6L	• Crop should be fully mature at the time of application. • Add non-ionic surfactant (½%) or crop oil concentrate (1%) to enhance results. • DO NOT add any other chemicals to the spray tank – a fire or explosion may result. • Apply 1 gal/A by air in 5 to 10 gal of water/A or 1 gal/A by ground in 10 to 20 gal of water/A. • Apply on a clear, sunny day with high temperatures and humidity for best results. • Harvest 7 to 10 days following application or regrowth may occur.
	paraquat *(Gramoxone Extra)* OR *(Gramoxone Max)* + non-ionic surfactant	0.31-0.47 + ¼%	1-1½ pt OR 0.75–1.3 pt + ¼%	• *Gramoxone Extra* and *Gramoxone Max* are restricted use pesticides. • Apply when crop is mature and at least 80% of the pods are yellowing and mostly ripe. No more than 40% (bush-type beans) or 30% (vine-type beans) of the leaves still green in color. • Apply by air in 5 gal of water/A or by ground in 20 to 40 gal of water/A. • If growth is lush and vigorous, make either a single application of 1½ pt/A (1.3 pt/A of *Gramoxone Max*) or a split application of ¾ pt/A followed by ¾ pt/A (0.65 pt/A followed by 0.65 pt/A of *Gramoxone Max*). Do not exceed 1½ pt/A (1.3 pt/A of *Gramoxone Max).* • Do not harvest within 7 days of application.
	urea sulfuric acid *(Enquik)* + non-ionic surfactant	– + ⅛%	5 to 10 gal + ⅛%	• **DANGER – CORROSIVE. Protective clothing and eyewear required.** • **Special spray equipment required. SEE LABEL.** • Apply at 50 to 60 psi in 5 to 20 gal of water/A with ground equipment ONLY. • Application effect will be evident within 24 hours. • Make a second application two days later, if necessary. Do not exceed a total of 10 gal of *Enquik* per season. • Will desiccate some broadleaf weeds.

TABLE 5C–WEED RESPONSE TO HERBICIDES IN DRY EDIBLE BEANS*

			ANNUAL BROADLEAVES									ANNUAL GRASSES								PERENNIALS				
	MODE OF ACTION	CROP TOLERANCE	COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	SMARTWEED	VELVETLEAF	WILD MUSTARD	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	SANDBUR	BINDWEED (FIELD)	BINDWEED (HEDGE)	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE
Preplant Incorporated																								
DUAL MAGNUM, DUAL II MAGNUM	O	2	N	N	P	F	**G**	P	P	N	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	F	N	N	N	N	**G**
EPTAM	O	2	P	P	**G**	F	F	F	F	F	F	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	F	F
FRONTIER, OUTLOOK	O	3[a]	N	N	P	**G**	**G**	P	P	N	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
LASSO	O	3	N	N	P	**G**	**G**	P	P	N	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	F	N	N	N	N	F
PROWL	O	1	N	N	**G**	P	F	P	P	F	P	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	N
PURSUIT	B	3	F	F	P	**E**	**E**	P	F	F	**G**	P	P	F	F	F	P	P	P	N	N	N	N	F
SONALAN	O	1	N	N	**G**	F	**G**	P	P	N	P	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	N
TREFLAN	O	1	N	N	**G**	N	**G**	N	P	N	P	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	N
PURSUIT PLUS	O/B	3	F	F	**G**	**E**	**E**	P	F	**G**	**G**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	F
Preemergence																								
FRONTIER, OUTLOOK	O	3[a]	N	N	P	**G**	**G**	P	P	N	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	P	N	N	N	N	F
DUAL MAGNUM, DUAL II MAGNUM	O	2	N	N	P	F	**G**	P	P	N	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	F	N	N	N	N	F
PURSUIT	B	3	P	P	P	**E**	**E**	P	F	P	**G**	P	P	F	F	F	P	P	P	N	N	P	N	F
Postemergence																								
BASAGRAN	O	2	**E**	**G**	F	P	P	F	**G**	**G**	**E**	N	N	N	N	N	N	N	N	N	N	**G**	N	**G**
POAST	A	1	N	N	N	N	N	N	N	N	N	**E**	**G**	**E**	**E**	**E**	**E**	**E**	**E**	N	N	N	F	N
SELECT	A	1	N	N	N	N	N	N	N	N	N	**E**	**G**	**E**	**E**	**E**	**E**	**E**	**E**	N	N	N	**G**	N
ASSURE II	A	1	N	N	N	N	N	N	N	N	N	**G**	**G**	**E**	**E**	**E**	**E**	**E**	**E**	N	N	N	**E**	N
PURSUIT**	B	3	F	P	P	**E**	**E**	P	P	P	**E**	P	P	F	P	P	P	P	P	N	N	P	N	P
BASAGRAN+PURSUIT**	O/B	2	**E**	**G**	F	**E**	**E**	F	**G**	**G**	**E**	P	P	F	P	P	P	P	P	N	N	**G**	N	**G**

Herbicide mode of Action: A = ACCase inhibitor; B = ALS inhibitor; C = Photosynthesis inhibitor; O = Other.
P = Poor; F = Fair; **G** = Good; **E** = Excellent; N = None

Crop Tolerance: 1 = Minimal risk of crop injury; 2 = Crop injury can occur under certain conditions (soil applied — cold, wet; foliar applied — hot, humid); 3 = Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4 = Risk of severe crop injury is high. Recommended only in rescue situations.

*The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.

**See Supplemental Label that expires December 31, 2001.

[a] Crop tolerance for navy and black beans = 3. For other bean classes crop tolerance = 2. Preplant incorporation will increase tolerance of navy and black beans to *Frontier (Outlook).*

TABLE 6A–CHEMICAL WEED CONTROL IN POTATOES

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Quackgrass	glyphosate *(Roundup Ultra,* others)	1½	2 qt 3L a.e.	• Apply to actively growing quackgrass at least 8 in. tall. • Use 15 to 20 gal of water/A. • No soil residue. • Can plow or till and plant crop 3 days after application. • Do not plow or till prior to treatment. • *Emerged* potatoes are very sensitive to *Roundup Ultra* and other glyphosate products damage. Do not use near growing potato plants. • Heavy stand of rye cover may reduce quackgrass control. • *Roundup Ultra at 1 qt/A* and other glyphosate products (see labels) may be used for *single season* quackgrass control. Apply 1 qt in 5 to 10 gal of water/A.

POTATO – PREPLANT FOLLOWED BY DELAYED PREEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses **Annual broadleaves** ***Preplant incorporated***	EPTC *(Eptam)*	4	4½ pt	• Work into soil immediately after application. • Use 6¾ pt/A if nutsedge is a problem. • Preplant incorporated.
FOLLOWED BY: ***Delayed preemergence***				
	linuron *(Lorox* or *Linex)*	1	1 qt 4L OR 2 lb 50% DF	• Delayed preemergence. • Treatment should be made prior to potato emergence and to germinating weeds or weeds that have emerged but are very small.
	OR metribuzin *(Sencor)*	OR ½	OR 1 pt 4L OR ⅔ lb 75% DF OR ⅔ lb *Sencor Solupak*	• If small weeds have emerged, add nonionic surfactant at ⅛% (1 pt/100 gal. water). • A preemergence application of metribuzin to Atlantic and and Shepody varieties is not recommended because injury can occur, especially under adverse weather conditions and when high metribuzin rates are used. • DO NOT use *Matrix* preemergence on soils with greater than 6% organic matter. • Adding *Matrix* will provide additional annual grass and redroot pigweed control and will suppress cocklebur.
	+ rimsulfuron *(Matrix)*	+ 0.024	+ 1.5 oz	

POTATOES – EARLY PREEMERGENCE FOLLOWED BY DELAYED PREEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses (especially barnyard grass) Annual broadleaves ***Early preemergence***	s-metolachlor *(Dual Magnum, Dual II Magnum)*	1.27	1.33 pt	• If field leveling is necessary, it should be done soon after planting. • Apply ***early preemergence*** – make application soon after planting. • Most effective on germinating grasses that have **not** emerged. • *Dual Magnum* and *Dual II Magnum* at 1.33 pt/A is equal to *Dual* or *Dual II* at 2 pt/A. • Do not use *Prowl* on muck soils or loamy sands with less than 1½% organic matter. • Follow with *Sencor,* or *Lorox* or *Linex,* or *Sencor* plus *Matrix*.
	OR pendimethalin *(Prowl)*	OR ¾	OR 1.8 pt 3.3 EC	

(Continued on next page)

POTATOES – EARLY PREEMERGENCE FOLLOWED BY DELAYED PREEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
FOLLOWED BY: ***Delayed Preemergence***				
	linuron *(Lorox or Linex)*	1	1 qt 4L OR 2 lb 50% DF	• These treatments follow *Prowl* or *Dual Magnum* preemergence. • Delayed preemergence. • Apply before potato emergence. • Most effective on germinating and small emerged weeds. • If small weeds have emerged, add nonionic surfactant at ⅛% (1 pt/100 gal. water). • A preemergence application of metribuzin to Atlantic or Shepody varieties is not recommended because injury can occur, especially under adverse weather conditions and where high metribuzin rates are used. • DO NOT use *Matrix* preemergence on soils with greater than 6% organic matter. • Adding *Matrix* will provide additional annual grass and redroot pigweed control and will suppress cocklebur.
	OR	OR	OR	
	metribuzin *(Sencor)*	½	1 pt 4 L OR ⅔ lb 75% DF OR ⅔ lb *Sencor Solupak*	
	+	+	+	
	rimsulfuron *(Matrix)*	0.024	1.5 oz	

POTATOES – DELAYED PREEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves **Annual grasses** **Yellow nutsedge**	linuron *(Lorox or Linex)*	1½	1½ qt 4L OR 3 lb 50% DF	• If field leveling is necessary, it should be done soon after planting to allow weed emergence before spraying. • Apply delayed preemergence before grasses are 2 in. and broadleaves are 4 in., but BEFORE POTATOES EMERGE. • *Dual Magnum* and *Dual II Magnum* at 1.33 pt/A is equal to *Dual* or *Dual II* at 2 pt/A. • On soils with greater than 5% organic matter, apply 2 lb a.i./A of linuron to emerged weeds.
	+	+	+	
	s-metolachlor *(Dual Magnum, Dual II Magnum)*	1.27	1.33 pt	
	metribuzin *(Sencor)*	½	1 pt 4L OR ⅔ lb 75% DF OR ⅔ lb *Sencor Solupak*	• If field leveling is necessary, it should be done soon after planting to allow weed emergence before spraying. • Apply delayed preemergence before weeds are 1 in. and before potatoes emerge. • *Dual Magnum* and *Dual II Magnum* at 1.33 pt/A is equal to *Dual* or *Dual II* at 2 pt/A. • Use up to 1 lb a.i. of metribuzin/A on high organic (muck) soil. • A preemergence application of metribuzin to Atlantic or Shepody varieties is not recommended because injury can occur, especially under adverse weather conditions and where high metribuzin rates are used. • The prepackaged mixture *Turbo* at 2.5 pt/A = 2.1 pt/A of *Dual* (1.4 pt/A of *Dual Magnum*) + 0.94 pt/A of *Sencor.*
	+	+	+	
	s-metolachlor *(Dual Magnum, Dual II Magnum)*	1.27	1.33 pt	
	metribuzin *(Sencor)*	½	1 pt 4 L OR ⅔ lb 75% DF OR ⅔ lb *Sencor Solupak*	• If field leveling is necessary, it should be done soon after planting to allow weed emergence before spraying. • Apply delayed preemergence before weeds are 1 in. and before potatoes emerge. • *Dual Magnum* and *Dual II Magnum* at 1.33 pt/A is equal to *Dual* or *Dual II* at 2 pt/A. • A preemergence application of metribuzin to Atlantic or Shepody varieties is not recommended because injury can occur, especially under adverse weather conditions and where high metribuzin rates are used. • DO NOT use *Matrix* preemergence on soils with greater than 6% organic matter. • Adding *Matrix* will provide additional annual grass and redroot pigweed control and will suppress cocklebur. • The prepackaged mixture *Turbo* at 2.5 pt/A = 2.1 pt/A of *Dual* (1.4 pt/A of *Dual Magnum*) + 0.94 pt/A of *Sencor.*
	+	+	+	
	rimsulfuron *(Matrix)*	0.024	1.5 oz	
	+	+	+	
	s-metolachlor *(Dual Magnum, Dual II Magnum)*	1.27	1.33 pt	

POTATOES – POSTEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves **Annual grasses**	metribuzin *(Sencor)*	¼	½ pt 4L OR ⅓ lb 75% DF OR ⅓ lb *Sencor Solupak*	• Do not apply postemergence within 3 days after periods of cool, wet or cloudy weather or crop injury may occur. • Treat when weeds are less than 1 in. tall. • Greater possibility of injury to potatoes when sprayed at 12- to 15-in. stages. • Not recommended on Atlantic, Shepody, Chip Belle, Bell Chip, or Centennial varieties. • Not recommended for early-maturing varieties such as Superior. • Not recommended for red skinned varieties. • Do not apply postemergence within 60 days of harvest. • Metribuzin at ⅓ lb DF/A can be tank mixed with *Poast* for annual grass and broadleaf weed control on russet or white-skinned potatoes that are NOT early maturing. See *Poast* remarks for the recommended rate. Crop injury may occur.
Redroot pigweed **Wild mustard** **Annual grasses**	rimsulfuron *(Matrix)* + nonionic surfactant	0.0156 + ¼%	1 oz + ¼%	• DO NOT apply postemergence within 60 days of harvest. • DO NOT apply by air. • Apply to small weeds less than 1 inch in height (quackgrass 4–6") that are actively growing. • For control of redroot pigweed, mustard, and annual grasses. • Suppression of wild buckwheat, yellow nutsedge, quackgrass, and volunteer cereals.
Annual broadleaves **Annual grasses**	metribuzin *(Sencor)* + rimsulfuron *(Matrix)* + nonionic surfactant	¼ + 0.0156 + ⅛%	1/3 lb 75% DF OR ⅓ lb *Sencor Solupak* + 1 oz + ⅛%	• Do not apply postemergence within 3 days after periods of cool, wet or cloudy weather or crop injury may occur. • Treat when weeds are less than 1 in. tall. • Greater possibility of injury to potatoes when sprayed at 12 to 15-in stages. • Not recommended on Atlantic, Shepody, Chip Belle, Bell Chip, or Centennial varieties. • Not recommended for early maturing varieties such as Superior. • Not recommended for red skinned varieties. • Do not apply postemergence within 60 days of harvest. • Add nonionic surfactant at ⅛% (1 pint per 100 gal. water). • *Matrix* will improve control of annual grasses, redroot pigweed, triazine resistant lambsquarters, wild buckwheat, and yellow nutsedge and quackgrass.
Annual grasses **Redroot pigweed**	s-metolachlor *(Dual Magnum, Dual II Magnum)*	1.27	1.33 pt	• *Dual Magnum* and *Dual II Magnum* at 1.33 pt/A is equal to *Dual* or *Dual II* at 2 pt/A. • Will not control emerged weeds. • Do not apply within 40 days of harvest. • Do not apply to potatoes at green tip (cracking).
Annual broadleaves **Annual grasses**	s-metolachlor *(Dual Magnum, Dual II Magnum)* + metribuzin *(Sencor)*	1.27 + ¼	1.33 pt + ½ pt 4L OR ⅓ lb 75% DF OR ⅓ lb *Sencor Solupak*	• *Dual Magnum* and *Dual II Magnum* at 1.33 pt/A is equal to *Dual* or *Dual II* at 2 pt/A. • Refer to remarks for metribuzin postemergence. • APPLICATION should be made ONLY as a directed or semi-DIRECTED spray to avoid chlorosis, minor necrosis, and leaf distortion.

POTATOES – POSTEMERGENCE (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses	sethoxydim *(Poast)*	0.19	1 pt	• Apply to annual grasses up to 8 in. (crabgrass up to 6 in.). • *Poast* can be reduced to ¾ pt/A for 1- to 4-in. barnyardgrass, green and giant foxtails, and fall panicum. • Do not apply to grasses under stress or poor weed control may result. • Use a minimum of 5 gal of water/A and a maximum of 20 gal of water/A, and 40 to 60 psi. • No soil activity. • Do not cultivate within 5 days prior to and 7 days following application. • Metribuzin at ½ lb DF/A can be tank mixed with *Poast* for annual grass and broadleaf weed control on russet or white-skinned potatoes that are NOT early maturing. • Add crop oil concentrate at 2 pt/A. Crop injury may occur. • If applied separately, wait 1 day after *Poast* application before applying metribuzin. Wait a minimum of 7 days after metribuzin before applying *Poast*. • Do not apply within 30 days of harvest.
	+	+	+	
	crop oil concentrate	1 qt	1 qt	
Quackgrass	sethoxydim *(Poast)*	0.29 + 0.19	1½ pt + 1 pt	• TWO APPLICATIONS MAY BE NECESSARY FOR QUACKGRASS CONTROL. Make a second application of 1 pt/A 14 to 21 days following initial treatment. Cultivation may replace second application. • Do not cultivate within 5 days prior to and 14 to 21 days following application. • Use a minimum of 5 gal of water/A and a maximum of 20 gal of water/A, and 40 to 60 psi. • Treat actively growing quackgrass 6 to 8 in. tall. • Do not apply to quackgrass under stress or poor control may result. • Wait 1 day after *Poast* application before applying metribuzin. Wait a minimum of 7 days after metribuzin before applying *Poast*. • Do not apply within 30 days of harvest.
	+	+	+	
	crop oil concentrate	1 qt + 1 qt	1 qt + 1 qt	
	+	+	+	
	28% liquid nitrogen	1 gal + 1 gal	1 gal + 1 gal	
	OR	OR	OR	
	ammonium sulfate	2.5 lb+2.5 lb	2.5 lb+2.5 lb	
	rimsulfuron *(Matrix)*	0.0156	1 oz	• Application rate can be increased to 1.5 oz/A. • Apply to quackgrass that is 4 to 8 in. tall. • Do not apply to quackgrass under stress or poor control may result. • Do not apply within 60 days of harvest. • Do not cultivate for 14 days following application.
	+	+	+	
	nonionic surfactant	¼%	¼%	
Volunteer cereals	sethoxydim *(Poast)*	0.29	1½ pt	• Apply before tillering (up to 4 in.). • See remarks for annual grass control with *Poast*. • *Poast* is NOT recommended for spring control of cereals that emerged the previous fall.
	+	+	+	
	crop oil concentrate	1 qt	1 qt	

TABLE 6B–VINE DESICCATION IN POTATOES

Potato Vine Dessication	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
	diquat *(Diquat)* + surfactant	¼–½ + ¼%	1–2 pt + ¼%	• Add a non-ionic surfactant (1/4%). • Make a second application of 1 to 2 pt/A a minimum of 5 days later if vine growth is dense. • A total of 4 pt/A may be applied, with not more than 2 pt/A at a single application. Allow 5 days between applications. • Apply at 50 psi or less in 20 to 100 gal of clean water/A. Greater water volumes will provide more thorough coverage of heavy vine growth. • Apply at least 7 days before harvest. • Do **not** apply to drought-stressed potatoes. • No soil persistence. A cover crop can be planted immediately.
	endothall *(DESICATE II)* + ammonium sulfate + LI 700	0.75 + 5 lb + 1 pt	3 pt + 5 lb + 1 pt	• **DO NOT** add LI 700 if temperatures are high and/or the field is moisture stressed. • Increase application rate to 4 pt/A if vine growth is lush and dense, or if weather conditions are cool and cloudy. • Apply at 50 psi or less in 5 to 40 gal of water/A. • Apply at least 10 days before harvest.
	glufosinate *(Rely)* + ammonium sulfate	0.375 + 17 lb/100 gal	3 pt/A + 17 lb/100 gal	• DO NOT use to dessicate potato vines when potatoes are being used for seed. • Apply at a total volume of 20 to 100 gal. per acre with ground equipment. • Requires a rainfree period for 4 hours after application. • Apply *Rely* from two hours after sunlight until two hours before sunset. • Apply at least 9 days before harvest.
	paraquat *(Gramoxone Extra)* + surfactant	0.25–0.47 + ⅛%	13–24 oz + ⅛%	• *Gramoxone Extra* is a **restricted use** pesticide. • DO NOT USE to dessicate potato vines when potatoes are to be stored or used for seed. • DO NOT USE on muck soils. • Apply at 50 psi or less in 50 gal of clean water/A. • Split applications of 13 oz/A for the first application and repeated 5 to 7 days later is suggested for dense vine canopies.
	urea sulfuric acid *(Enquik)*	–	20 gal	• **DANGER – CORROSIVE. Protective clothing and eyewear required.** • **Special spray equipment required. SEE LABEL.** • Apply in 20 gal of water/A (total spray volume of 40 gal/A) at 50 psi. • Split applications of 15 gal of *Enquik*/A in 25 gal of water/A for the first application and repeated 2 days later is suggested for dense vine canopies.

TABLE 6C–WEED RESPONSE TO HERBICIDES IN POTATOES*

			ANNUAL BROADLEAVES										ANNUAL GRASSES								PERENNIALS				
	MODE OF ACTION	CROP TOLERANCE	COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (E. BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	SMARTWEED	VELVETLEAF	WILD MUSTARD	WILD BUCKWHEAT	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	SANDBUR	BINDWEED (FIELD)	BINDWEED (HEDGE)	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE
Preplant Incorporated																									
EPTAM	O	1	P	P	**G**	F	F	F	F	F	F	P	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	F	F
Preemergence																									
DUAL MAGNUM	O	2	N	N	P	F	**G**	P	P	N	P	P	**E**	**E**	**E**	**E**	**E**	**G**	**G**	F	N	N	N	N	**G**
SENCOR	C	2	F	F	**E**	N	**E**	**G**	**E**	**G**	**E**	**G**	P	F	**G**	**G**	**G**	F	F	P	N	N	N	N	N
LINEX/LOROX	C	1	P	P	**G**	F	**G**	**G**	**G**	F	**G**	F	F	F	F	F	F	F	F	P	N	N	N	N	N
PROWL	O	1	N	N	**G**	P	F	P	P	F	P	P	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	N	N	N	N	N
Delayed Preemergence																									
SENCOR	C	2	F	F	**E**	N	**E**	**E**	**E**	**G**	**E**	**G**	P	F	**G**	**G**	**G**	F	F	P	N	N	N	N	N
LINEX/LOROX	C	1	P	P	**G**	F	**E**	**G**	**G**	F	**G**	F**	F	F	F	F	F	F	F	P	N	N	N	N	N
MATRIX + SENCOR@	B/C	2	**G**	F	**E**	P	**E**	**E**	**E**	**G**	**E**	**G**	**G**	F	**G**	**G**	**G**	F	F	–	N	N	P	P	P
MATRIX@	B	1	**G**	F	F	P	**E**	F	F	F	**E**	F	**G**	F	**G**	**G**	**G**	F	F	–	N	N	P	P	P
Postemergence																									
SENCOR	C	2	**G**	F	**E**	N	**G**	**E**	**E**	**G**	**E**	F	P	P	F	F	F	F	F	P	N	N	N	N	N
MATRIX + SENCOR@	B/C	2	**G**	F	**E**	F	**E**	**E**	**E**	**G**	**E**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	P	N	N	F	F	F
MATRIX@	B	1	**G**	P	F	F	**E**	F	F	F	**E**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	P	N	N	F	**G**	F
POAST	A	1	N	N	N	N	N	N	N	N	N	N	**E**	**G**	**E**	**E**	**E**	**E**	**E**	**E**	N	N	N	**G**	N

Herbicide mode of Action: A = ACCase inhibitor; B = ALS inhibitor; C = Photosynthesis inhibitor; O = Other.
P = Poor; F = Fair; **G** = Good; **E** = Excellent; N = None

Crop Tolerance: 1 = Minimal risk of crop injury; 2 = Crop injury can occur under certain conditions (soil applied — cold, wet; foliar applied — hot, humid); 3 = Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4 = Risk of severe crop injury is high. Recommended only in rescue situations.

* The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.

** *Lorox/Linex* provides good control of emerged wild buckwheat.

@ will suppress triazine resistant lambsquarters. Hairy nightshade is more susceptible to *Matrix* applications than eastern black nightshade.

TABLE 7A–CHEMICAL WEED CONTROL IN SUGAR BEETS

SUGAR BEETS – PREPLANT

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses	cycloate *(Ro-Neet)*	3	2 qt	• Incorporate immediately to 2 to 3 in. • May be followed preemergence by *Pyramin.* • DO NOT apply *Nortron* preemergence. • Injury may occur when *Betamix* or *Betanex* or *Progress* is applied postemergence before the 6 true leaf stage. • Use reduced rates of postemergence herbicides in split or micro-rate applications to reduce the risk of injury. • *Ro-Neet* provides good velvetleaf suppression.

SUGAR BEETS – PREEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	pyrazon *(Pyramin)*	4	6.2 lb DF	• DO NOT use *Pyramin* on sands or loamy sands or crop injury may occur. • Reduce the *Pyramin* rate to 4.65 lb/A of DF on a sandy loam soil and/or if soil organic matter is less than 3%. • If soils are high in clay and/or organic matter and velvetleaf is a problem, apply 7.8 lb/A of *Pyramin* DF. • To control annual grasses, preplant incorporate *Ro-Neet* OR apply *Poast, Assure II,* or *Select* postemergence. *Nortron* preemergence will suppress grasses. • *Pyramin* plus *Nortron* provides better velvetleaf suppression than either herbicide alone. These herbicides are not as effective as *Ro-Neet* preplant incorporated followed by *Pyramin* preemergence or *UpBeet* postemergence. • To approach 100% weed control, it will in most cases be necessary to follow with a postemergence application.
	pyrazon *(Pyramin)* + ethofumesate *(Nortron)*	3 + 1.5	4.7 lb DF + 3 pt SC	• See all remarks for *Pyramin.* • *Nortron* will provide some suppression of annual grasses, such as foxtail. • *Pyramin* plus *Nortron* provides better velvetleaf suppression than either herbicide alone. These herbicides are not as effective as *Ro-Neet* preplant incorporated followed by *Pyramin* preemergence or *UpBeet* postemergence. • Increase *Nortron* rate to 4 pt/A of SC on clay soils if weed pressure is heavy.

SUGAR BEETS – MICRO-RATE POSTEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	desmedipham + phenmedipham *(Betamix)*	0.08	8 oz	• Micro-rate applications may be applied to sugar beets at any growth stage. TIME THE FIRST MICRO-RATE application when weeds are less than 1/8 in. tall. This can be as early as 14 days after sugar beet planting.
	+	+	+	
	triflusulfuron methyl *(UpBeet)*	0.0039	1/8 oz	• Make the second micro-rate application when emerging weeds are less than 1/8 in. tall. This will be 5 to 14 days later, depending on temperature and moisture.
	+	+	+	
	clopyralid *(Stinger)*	0.0235	1 oz	• Continue TIMELY micro-rate applications (usually every 7 days) as needed until beet canopy closure.
	+	+	+	• The *Betamix* rate can be increased to 1 pt/A if the smallest sugar beet plants in the field are in the 4-true leaf stage.
	methylated seed oil	1.5%	1.5%	• IF WEEDS EXCEED 1/4 in. — return to standard herbicide application rates.
		AND REPEAT		• *Select* at 2 oz/A, *Assure II* at 4 oz/A, or *Poast* at 5.3 oz/A can be *added to each* micro-rate application OR wait until grasses reach 2–3 in. tall and add one of these herbicides *at standard rates to one* of the micro-rate applications.
				• Apply micro-rates in 10–12 gal. of water/A. The methylated seed oil concentration must be a minimum of 1 pt/A in spray volumes of 4–8 gal. of water/A.
				• Micro-rates can be applied at any time of day.
				• DO NOT tank mix micro-rates with BOTH fungicides and insecticides.
	desmedipham + phenmedipham ethofumesame *(Progress)*	0.08	5.7 oz	• SEE ALL REMARKS IN THE *BETAMIX* MICRO-RATE SECTION.
	+	+	+	• Redroot pigweed will not be controlled by *Progress* micro-rate applications if pigweed exceeds 1/4 in. at the time of application. *Betamix* micro-rate applications will provide more consistent pigweed control.
	triflusulfuron methyl *(UpBeet)*	0.0039	1/8 oz	• The *Progress* rate can be increased to 11.7 oz/A if the smallest sugar beet plants in the field are in the 4-true leaf stage.
	+	+	+	
	clopyralid *(Stinger)*	0.0235	1 oz	
	+	+	+	
	methylated seed oil	1.5%	1.5%	
		AND REPEAT		

SUGAR BEETS – EARLY POSTEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	desmedipham + phenmedipham *(Betamix)*	0.5	3 pt	• Split low rate applications of *Betamix* + *UpBeet* may be applied to sugarbeets at early growth stages (less than 4 true leaf stage) to control weed seedlings at the cotyledon stage. Weeds not completely controlled by the first treatment will be checked and controlled by the second application. • The second application MUST BE MADE AT LEAST 7 days but not more than 10 days AFTER the first application. • The rate of *Betamix* in the second application can be increased to 4.6 pt/A. • ONLY add surfactant at 1/4% v/v (2 pt in 100 gal. of water) to the SECOND APPLICATION. • DISPERSE *UpBeet* thoroughly in the tank before adding other herbicides. • Apply in 10 gal. of water/A at 20 to 40 psi. • The maximum amount of *UpBeet* that can be applied in one year is 2.5 oz/A. • Rainfall within 6 hours of application may reduce control. • Adding *UpBeet* to *Betamix* results in velvetleaf control, and more consistent lambsquarter, pigweed, smartweed, and buckwheat control.
	+	+	+	
	triflusulfuron methyl *(UpBeet)*	0.0156	½ oz	
	FOLLOWED BY:			
	desmedipham + phenmedipham *(Betamix)*	0.5	3 pt	
	+	+	+	
	triflusulfuron methyl *(UpBeet)*	0.0156	½ oz	
	desmedipham phenmedipham *(Betamix)*	0.5	3 pt	• Split low rates of *Betamix* + *UpBeet* followed by *Betamix* + *UpBeet* + *Stinger* may be applied to sugarbeets at early growth stages (less than 4 true leaf stage) to control weed seedlings at the cotyledon stage. Weeds not completely controlled by the first treatment will be checked and controlled by the second application. • The second application MUST BE MADE AT LEAST 7 days but not more than 10 days AFTER the first application. • The rate of *Betamix* in the second application can be increased to 4.6 pt/A. • Adding *Stinger* to the second application will control cocklebur, and common and giant ragweed and improve lambsquarters control. • ONLY add surfactant at ¼% v/v (2 pt in 100 gal. of water) to the SECOND APPLICATION. • DISPERSE *UpBeet* thoroughly in the tank before adding other herbicides. • Apply in 10 gal. of water/A at 20 to 40 psi. • DO NOT apply *Stinger* on sandy soils where water tables are shallow. • DO NOT plant dry beans for 18 months if organic matter is less than 2%. • The maximum amount of *UpBeet* that can be applied in one year is 2.5 oz/Acre. • Rainfall within 6 hours of application may reduce control.
	+	+	+	
	triflusulfuron methyl *(UpBeet)*	0.0156	½ oz	
	FOLLOWED BY:			
	desmedipham + phenmedipham *(Betamix)*	0.5	3 pt	
	+	+	+	
	triflusulfuron methyl *(UpBeet)*	0.0156	½ oz	
	+	+	+	
	clopyralid *(Stinger)*	0.094	¼ pt	

(Continued on next page)

SUGAR BEETS – EARLY POSTEMERGENCE (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves	desmedipham + phenmedipham + ethofumesate *(Progress)*	0.25	1.13 pt	• DISPERSE *UpBeet* thoroughly in the tank before adding other herbicides. • DO NOT add crop oil concentrate or surfactant. • Split (low rate) applications of *Progress* plus *UpBeet* may be applied to sugarbeets at early growth stages (cotyledon to 4 true leaf stage) to control weed seedlings at the cotyledon stage. • The second application MUST BE MADE AT LEAST 7 days but not more than 10 days AFTER the first application. • The rate of *Progress* in the second application can be increased to 2 pt/A if sugarbeets are 2-leaf pair or larger. • Adding *UpBeet* to *Progress* results in velvetleaf control and provides more consistent control of pigweed, mustard, smartweed, and wild buckwheat. • *Stinger* can be added to the second application for control of cocklebur and common and giant ragweed. • Apply in a minimum of 10 gal. of water/A at 20 to 40 psi. • The maximum amount of *UpBeet* that can be applied in 1 year is 2.5 oz/Acre. • Allow at least 60 days between *UpBeet* application and sugarbeet harvest. • Rainfall within 6 hours of application may reduce control.
	+	+	+	
	triflusulfuron methyl *(UpBeet)*	0.0156	½ oz	
	FOLLOWED BY:			
	desmedipham + phenmedipham + ethofumesate *(Progress)*	0.33	1.5 pt	
	+	+	+	
	triflusulfuron methyl *(UpBeet)*	0.0156	½ oz	

SUGAR BEETS – POSTEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (including smartweed)	desmedipham + phenmedipham *(Betamix)*	1	6.2 pt	• Apply when the beets are in the 2 to 4 true leaf stage, (6 true leaf stage if *Ro-Neet* was applied) and weeds have 4 leaves or less. • When temperature is 75°F or greater, apply in late afternoon or early evening. • DO NOT apply when plants are under stress, such as from temperatures above 85°F, or when climate changes rapidly from cool, overcast days to hot, sunny days, or crop injury can occur. • Add 1 qt/A crop oil concentrate for hard to control large weeds or if plants are not vigorously growing. *Betamix* RATE SHOULD BE REDUCED 25% to reduce injury. • REDUCE *Betamix* rate 25% and DO NOT add crop oil if high temperature and/or high humidity conditions have been prevalent. • *Pyramin* DF can be added at 3.1 lb/A to provide residual weed control (stop weeds from emerging).
	+	+	+	
	endothall *(H-273)*	½	1½ pt	
	desmedipham *(Betanex)*	1	6.2 pt	• Refer to remarks under *Betamix* plus *H-273*. • More effective pigweed control than *Betamix*. • Does not control green or yellow foxtail. • Less effective than *Betamix* on lambsquarters and common ragweed, and wild buckwheat.
	+	+	+	
	endothall *(H-273)*	½	1½ pt	

SUGAR BEETS – POSTEMERGENCE (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Smartweed and buckwheat	endothall *(H-273)*	1	2⅔ pt	• Apply when beets are at least at the 4-leaf stage.. • Will control large smartweed and buckwheat. • There are some smartweeds in Mich. that are difficult to control. These smartweeds are perennials and/or have hairy leaves.
Velvetleaf	triflusulfuron methyl *(UpBeet)* + surfactant	0.0156 + ¼% AND REPEAT	½ oz + ¼%	• *UpBeet* provides better velvetleaf control than *Pyramin* postemergence. • DISPERSE *UpBeet* thoroughly in the tank before adding surfactant. • A MINIMUM OF TWO APPLICATIONS ARE NEEDED FOR VELVETLEAF CONTROL. • Apply to velvetleaf at the 1st true leaf. REPEAT application 7 to 10 days later. • SEE TABLE 7C "Guidelines for Velvetleaf Control with UpBeet" • Add 2 qt/A 28% liquid nitrogen in addition to surfactant, if velvetleaf are 1 to 2 true leaves and beets are at 2 leaf pair. • A third application of ½ oz/A of *UpBeet* + surfactant can be made. • The maximum amount of *UpBeet* that can be applied in 1 year is 2.5 oz/Acre. • *UpBeet* can be tank mixed with *Betamix* or *Progress*. Never add surfactant with *Progress* unless you are applying micro-rates. Add surfactant with *UpBeet* + *Betamix* if beets are at 2 leaf pair or larger for improved velvetleaf control. • Apply *UpBeet* in a minimum of 10 gal. of water/A at 20 to 40 psi. • Rainfall within 6 hours of application may reduce control. • Allow at least 60 days between *UpBeet* application and sugarbeet harvest.
	pyrazon *(Pyramin)* + methylated seed oil	1 + 24 oz AND REPEAT	1.55 lb DF + 24 oz	• TWO APPLICATIONS ARE NEEDED FOR BEST VELVETLEAF CONTROL. MAKE SECOND APPLICATION 5 TO 7 DAYS FOLLOWING INITIAL TREATMENT. • Make first application when velvetleaf has cotyledonary leaves and one true leaf. • Application to velvetleaf at two true leaves will NOT provide consistent control. • DO NOT TANK MIX with *Betamix* or *Progress* as crop injury may occur. • *UpBeet* will provide better control than *Pyramin DF*.

SUGAR BEETS – POSTEMERGENCE (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Cocklebur **Giant ragweed** **Common ragweed** **Jimsonweed** **Volunteer sweetclover** **Volunteer alfalfa**	clopyralid *(Stinger)* + crop oil concentrate	0.094 + 1 qt	¼ pt + 1 qt	• DO NOT use on sands or loamy sands, or permeable soils where water tables are shallow because of potential groundwater contamination. • Increase rate to ½ pt under drought conditions or dense weed infestations. • Controls cocklebur, giant ragweed and volunteer alfalfa and sweet clover up to 6-leaf, common ragweed up to 5-leaf. • ¼ pt/A will suppress smartweed, wild buckwheat and nightshade if less than 3-leaf. • DO NOT cultivate for 7 days following application. • Tank mix with other postemergence herbicides such as *Betamix* or *Progress* to control other broadleaf weeds. • DO NOT plant dry beans for 18 months if organic matter is less than 2%. • Allow 105 days between application and sugar beet harvest.
Perennial sowthistle	clopyralid *(Stinger)* + crop oil concentrate OR ammonium sulfate	0.188 + 1 qt OR 2½ lb	½ pt + 1 qt OR 2½ lb	• DO NOT use on sands or loamy sands or permeable soils where water tables are shallow because of potential groundwater contamination. • Increase rate to ⅔ pt under drought conditions. • Apply after sugar beets have reached the third leaf pair AND before thistles have reached the flowering stage. • DO NOT cultivate before OR for a minimum of 14 days after application. • DO NOT tank mix with other herbicides when applying for perennial sowthistle control. • Banded applications are NOT recommended. Instead make a broadcast application over the thistle-infested area. • DO NOT plant dry beans for 18 months if soil organic matter is less than 2%. • Allow 105 days between application and sugar beet harvest.
Canada thistle	clopyralid *(Stinger)* + crop oil concentrate OR ammonium sulfate	0.125 + 1 qt OR 2½ lb	½ pt + 1 qt OR 2½ lb	• DO NOT use on sands or loamy sands or permeable soils where water tables are shallow because of potential groundwater contamination. • Increase rate to ½ pt under drought conditions. • Apply after sugar beets have reached the third leaf pair AND before thistles have reached the flowering stage. • DO NOT cultivate before OR for a minimum of 14 days after application. • Add COC when tankmixing ⅓ pt of *Stinger* with *Betamix*. COC is not necessary when ½ pt/A of *Stinger* is applied. • Banded applications are NOT recommended. Instead make a broadcast application over the thistle-infested area. • DO NOT plant dry beans for 18 months if soil organic matter is less than 2%. • Allow 105 days between application and sugar beet harvest.

SUGAR BEETS – POSTEMERGENCE (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses	sethoxydim *(Poast)* + crop oil concentrate OR methylated seed oil	0.19 + 1 qt OR 24 oz	1 pt + 1 qt OR 24 oz	• Treat actively growing foxtails, fall panicum, and barnyardgrass up to 8 in. and crabgrass up to 4 in. • *Poast* can be reduced to ¾ pt/A for 1- to 4-in. barnyardgrass, green and giant foxtails, and fall panicum. • Ammonium sulfate or 28% liquid nitrogen (urea ammonium nitrate) can be added at 2½ lb/A to enhance crabgrass control. • DO NOT apply *Betamix* or *Progress* or *UpBeet* within five days prior to applying *Poast* or reduced grass control may occur. • No soil activity from *Poast*. Controls only grasses present when sprayed. • Use a minimum of 5 gal of water/A and 40 psi. • Does not control yellow nutsedge. • Rainfall within 1 hour of application will reduce control. • DO NOT apply *Poast* within 60 days of beet harvest.
	clethodim *(Select)* + crop oil concentrate	0.094 + 1%	6 oz + 1%	• Treat actively growing foxtails, fall panicum, and barnyardgrass up to 8 in. and crabgrass up to 4 in. • *Select* can be reduced to 4 to 5 oz/A for 1- to 4-in grasses of some species. • DO NOT apply *Betamix* or *Progress* or *UpBeet* within five days prior to applying *Select* or reduced grass control may occur. • No soil activity from *Select*. Controls only grasses present when sprayed. • Apply in 5 to 40 gal of water/A and 30 to 60 psi. • Does not control yellow nutsedge. • Rainfall within 1 hour of application will reduce control. • DO NOT apply *Select* within 100 days of beet harvest.
	quizalofop-P-methyl *(Assure II)* + crop oil concentrate OR surfactant	0.044 + 1% OR ¼%	7 oz + 1% OR ¼%	• Treat actively growing grasses up to 4 in. tall. • 8 oz/A required for barnyardgrass and crabgrass control. • DO NOT apply *Betamix* or *Progress* or *UpBeet* within 5 days prior to applying *Assure II* or reduced grass control may occur. • DO NOT cultivate for 7 days before or 7 days after treatment. • No soil activity from *Assure II*. Controls only grasses present when sprayed. • Apply in 10 to 20 gal. of water/A with standard flat fan or hollow cone nozzles. • Does not control yellow nutsedge. • Rainfall within 1 hour of application will reduce control. • Avoid drift onto corn, small grains, turf. • DO NOT apply *Assure II* within 45 days of beet harvest.
Annual grasses **Annual broadleaves**	sethoxydim *(Poast)* + desmedipham + phenmedipham desmedipham + *(Betamix)*	0.29 + ½-1	1.5 pt + 3-6 pt	• Treat actively growing barnyardgrass or foxtails up to 2 in. • DO NOT ADD CROP OIL CONCENTRATE OR OTHER ADDITIVES. • Adjust *Betamix* rate to size of broadleaf weeds. • No soil activity. Controls only grasses present when sprayed.

SUGAR BEETS – POSTEMERGENCE (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Volunteer corn	quizalofop-P-ethyl *(Assure II)*	0.031	5 oz	• For volunteer corn up to 18 in. tall. • Rainfall within 1 hour of application will reduce control. • *Assure II* is more effective than *Poast.*
	+	+	+	
	crop oil concentrate	1%	1%	
	OR	OR	OR	
	surfactant	¼%	¼%	
	sethoxydim *(Poast)*	0.19	1 pt	• For volunteer corn up to 20 in. tall. • If the volunteer corn is less than 12 in., the application rate may be reduced. • Rainfall within 1 hour of application will reduce control.
	+	+	+	
	crop oil concentrate	1 qt	1 qt	
	OR	OR	OR	
	methylated seed oil	24 oz	24 oz	
	+	+	+	
	ammonium sulfate	2½ lb	2½ lb	
	OR	OR	OR	
	28% liquid nitrogen	1 gal	1 gal	
	clethodim *(Select)*	0.096	6 oz	• For volunteer corn up to 18 in. tall. • Use 4 oz/A if volunteer corn is 4–12 in. tall. • Rainfall within 1 hour of application will reduce control. • *Select* is more effective than *Poast.*
	+	+	+	
	crop oil concentrate	1%	1%	
Small grains	quizalofop-P-ethyl *(Assure II)*	0.0625	10 oz	• Apply at 8 oz/A if cereals are less than 4 in. in height. • Spring seeded cereals only. • *Assure II* is more effective than *Poast.*
	+	+	+	
	crop oil concentrate	1%	1%	
	OR	OR	OR	
	surfactant	¼%	¼%	
	sethoxydim *(Poast)*	0.29	1½ pt	• Apply before tillering (up to 4 in. tall). • Spring-seeded cereals only.
	+	+	+	
	crop oil concentrate	1 qt	1 qt	
	OR	OR	OR	
	methylated seed oil	24 oz	24 oz	
	+	+	+	
	ammonium sulfate	2½ lb	2½ lb	
	OR	OR	OR	
	28% liquid nitrogen	1 gal	1 gal	
	clethodim *(Select)*	0.125–0.25	8–16 oz	• Oats can be controlled with 8 oz/A. • Spring seeded cereals are labeled for control at 8 oz/A. However, 16 oz/A will provide better control. • Apply before cereals exceed 6 in. • *Select* is more effective than *Poast.*
	+	+	+	
	ammonium sulfate	2½ lb	2½ lb	
	OR	OR	OR	
	28% liquid nitrogen	2.5%	2.5%	
	+	+	+	
	crop oil concentrate	1%	1%	

SUGAR BEETS – POSTEMERGENCE (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Quackgrass	quizalofop-P-ethyl *(Assure II)* + crop oil concentrate OR surfactant	0.0625 + 1% OR ¼%	10 oz + 1% OR ¼%	• Make application when quackgrass is 6 to 8 in. tall. • Two applications may be needed for best quackgrass control. Make a second application of 7 oz/A 14 to 21 days later when quackgrass has reached 4 to 8 in. Cultivation may replace second application. • DO NOT TANK MIX. Reduced quackgrass control and/or crop injury may occur. • Use 10 to 20 gal/A of water using standard flat fan or hollow cone nozzles. • Avoid drift onto corn, small grains, or turf. • DO NOT apply *Assure II* within 45 days of beet harvest.
	sethoxydim *(Poast)* + ammonium sulfate OR 28% liquid nitrogen + crop oil concentrate OR methylated seed oil	0.29 + 0.19 0.3 + 0.2 + 2½ lb+2½ lb OR 1 gal + 1 gal + 1 qt + 1 qt OR 24 oz+24 oz	1½ pt + 1 pt + 2½ lb+2½ lb OR 1 gal + 1 gal + 1 qt + 1 qt OR 24 oz+24 oz	• Two applications are needed for best quackgrass control. Make second application 14 to 21 days following initial treatment. Cultivation may replace second application. • DO NOT TANK MIX. Crop injury or reduced quackgrass control may occur, especially with nitrogen additives. • Addition of ammonium sulfate or liquid nitrogen is required. • Treat actively growing quackgrass 6- to 8-in. tall. • Use a minimum of 5 gal of water/A and 40 psi. • Avoid drift onto corn, small grains or turf. • Rainfall within 1 hr of application will reduce control. • DO NOT apply *Poast* within 60 days of beet harvest.
	clethodim *(Select)* + ammonium sulfate OR 28% liquid nitrogen + crop oil concentrate	0.125-0.25+0.125 + 2½ lb+2½ lb OR 2.5%+2.5% + 1% + 1%	8-16 oz+8 oz + 2½ lb+2½ lb OR 2.5%+2.5% + 1% + 1%	• Make application when quackgrass is 4- to 12-in. tall. Use high rate when grasses are stressed or at maximum height. • Two applications may be needed for control. Make a second application of 17 oz/A 14 to 21 days later. • Cultivation may replace the second application. • DO NOT TANK MIX. Crop injury or reduced quackgrass control may occur. • Use 5 to 40 gal of water/A and 30 to 60 psi. • Avoid drift onto corn, small grains or turf. • DO NOT apply *Select* within 100 days of beet harvest.

TABLE 7B–WEED RESPONSE TO HERBICIDES IN SUGAR BEETS*

			ANNUAL BROADLEAVES										ANNUAL GRASSES							PERENNIALS					
	MODE OF ACTION	CROP TOLERANCE	COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	SMARTWEED	VELVETLEAF	WILD MUSTARD	WILD BUCKWHEAT	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	BINDWEED (FIELD)	BINDWEED (HEDGE)	CANADA THISTLE	PERENNIAL SOWTHISTLE	QUACKGRASS	YELLOW NUTSEDGE
Preplant Incorporated																									
RO-NEET	O	2	P	P	F	F	**G**	F	P	**G**	P	F	**G**	**G**	**G**	**G**	**G**	**G**	**G**	N	N	N	N	F	**G**
Preemergence																									
NORTRON	O	2	F	F	**G**	**G**	**G**	P	**G**	F	**G**	**G**	P	F	**G**	F	F	P	P	N	N	N	N	N	P
PYRAMIN	O	2	P	P	**E**	**G**	**G**	**G**	**G**	F	**G**	**G**	P	P	P	P	P	P	P	N	N	N	N	N	N
Postemergence																									
BETAMIX	O	2	F	F	**E**	F	**G**	**G**	F	P	**G**	F	P	P	F	F	F	P	P	N	N	N	N	N	N
BETANEX	O	2	F	F	**G**	F	**E**	F	F	P	**G**	P	P	P	P	P	P	P	P	N	N	N	N	N	N
H-273**	O	3	P	P	P	P	P	P	**E**	P	P	**E**	N	N	N	N	N	N	N	N	N	P	N	N	N
NORTRON	O	2	P	P	F	**G**	F	P	**G**	P	**G**	**G**	P	P	F	F	F	P	P	N	N	N	N	N	P
UPBEET	B	2	F	–	P	F	F	F	F	**G**	**E**	F	P	P	F	F	F	P	P	N	N	P	N	N	P
PROGRESS	O/O	2	F	F	**E**	**G**	**G**	**G**	**G**	P	**G**	**G**	P	P	F	F	F	P	P	N	N	N	N	N	P
BETAMIX + H-273**	O/O	3	F	F	**E**	F	**G**	**G**	**E**	P	**G**	**E**	P	P	F	F	F	P	P	N	N	N	N	N	N
BETAMIX + UPBEET	O/B	2	F	F	**E**	F	**E**	**G**	**G**	**G**	**E**	**G**	P	P	**G**	F	F	P	P	N	N	P	P	N	P
BETAMIX + STINGER	O/O	2	**E**	**G**	**E**	F	**G**	**E**	**G**	P	**G**	**G**	P	P	F	F	F	P	P	N	N	F	F	N	N
BETAMIX + UPBEET + STINGER	O/B/O	2	**E**	**G**	**E**	**E**	**E**	**E**	**G**	**G**	**E**	**G**	P	P	**G**	F	F	P	P	N	N	F	F	N	P
PROGRESS + UPBEET	O/B	3	F	F	**E**	**G**	**E**	**G**	**G**	**G**	**E**	**G**	P	P	**G**	F	F	P	P	N	N	P	P	N	P
PROGRESS + STINGER	O/O/O	3	**E**	**G**	**E**	**G**	**E**	**E**	**G**	P	**G**	**G**	P	P	F	F	F	P	P	N	N	F	F	N	P
PROGRESS + UPBEET + STINGER	O/B/O	3	**E**	**G**	**E**	**E**	**E**	**E**	**G**	**G**	**E**	**E**	P	P	**G**	F	F	P	P	N	N	F	F	N	P
POAST	A	1	N	N	N	N	N	N	N	N	N	N	**E**	**G**	**E**	**E**	**E**	**E**	**E**	N	N	N	N	F	N
SELECT	A	1	N	N	N	N	N	N	N	N	N	N	**E**	**G**	**E**	**E**	**E**	**E**	**E**	N	N	N	N	**G**	N
ASSURE II	A	1	N	N	N	N	N	N	N	N	N	N	**G**	**G**	**E**	**E**	**E**	**E**	**E**	N	N	N	N	**E**	N
PYRAMIN	O	1	P	P	F	P	F	F	F	F	F	F	P	P	P	P	P	P	P	N	N	N	N	N	N
STINGER	O	1	**E**	**G**	P	F	P	**E**	F	P	P	F	N	N	N	N	N	N	N	P	P	**G**	**G**	N	N

Herbicide mode of Action: A = ACCase inhibitor; B = ALS inhibitor; C = Photosynthesis inhibitor; O = Other.
P = Poor; F = Fair; **G** = Good; **E** = Excellent; N = None

Crop Tolerance: 1 = Minimal risk of crop injury; 2 = Crop injury can occur under certain conditions (soil applied — cold, wet; foliar applied — hot, humid); 3 = Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4 = Risk of severe crop injury is high. Recommended only in rescue situations.

*The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.

***H-273* is better than *Betamix + Stinger, Betamix + UpBeet,* and *Progress + UpBeet* on larger (greater than 1.5 inch) smartweed and buckwheat.

TABLE 7C–GUIDELINES FOR VELVETLEAF CONTROL WITH UPBEET

Beet Size	Velvetleaf Size	Other Weeds?	UpBeet Application*
cotyledon	coty — 1st true leaf	No	UpBeet + NIS
> cotyledon	coty — 2nd true leaf	No	UpBeet + 28% N + NIS
coty — 1st leaf pair	coty — 1st true leaf	Yes	UpBeet + Betamix
coty — 1st leaf pair	coty — 1st true leaf	Yes	UpBeet + Progress[a]
≥ 2nd leaf pair	coty — 1st true leaf	Yes	UpBeet + Betamix + NIS
≥ 2nd leaf pair	coty — 1st true leaf	Yes	UpBeet + Progress

*UpBeet at ½ oz/A. NIS—nonionic surfactant.
[a] DO NOT use IF RoNeet was applied.

TABLE 8–CHEMICAL WEED CONTROL IN FORAGE SORGHUM

FORAGE SORGHUM, SORGHUM/SUDANGRASS HYBRIDS – PREEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves **Annual grasses** (EXCEPT fall panicum, green foxtail, giant foxtail, witchgrass, and crabgrass)	atrazine (commercial product)	2	2 qt 4L OR 2.2 lb 50% DG	• Do not use on sands, loamy sands, sandy clay loams, or any soil with less than 1% organic matter. • Heavy rains following application may cause injury. • May be applied preplant incorporated. • Do not apply to sudangrass. • See label for details.

FORAGE SORGHUM – PREEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves **Annual grasses**	atrazine (commercial product)	1	1 qt 4L OR 1.1 lb 90% DG	• CAUTION; Seed must be treated with CGA-92194 *(Concept II)* herbicide antidote. • See label for additional restrictions.
	+	+	+	• Commercial prepackaged mix *(Bicep)* is available. See Table 1F.
	metolachlor *(Dual)*	1½	1½ pt	• May be applied preplant incorporated. • Do not apply to sudangrass or sorghum-sudangrass hybrids.

FORAGE SORGHUM, SORGHUM/SUDANGRASS HYBRIDS – POSTEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	atrazine (commercial product)	1.2	1.2 qt 4L OR 1.3 lb 90% DG	• Apply after sorghum has reached the 3-leaf stage but before it exceeds 12 in. in height. • Apply before common lambsquarters and redroot pigweed reach 6 in. and other broadleaf weeds 4 in.
	+	+	+	• Heavy rainfall following application may cause injury.
	crop oil concentrate	1 qt	1 qt	• Do not apply on sands or loamy sands. • Do not graze or cut for feed for 21 days following application. • Do not apply to sudangrass.

FORAGE SORGHUM – POSTEMERGENCE

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	2,4-D amine	½	1 pt	• Apply when sorghum is 6- to 8-in. tall. • If sorghum is planted in rows, drop nozzles can be used when the crop is 8- to 15-in. tall. • Do not graze or harvest for forage for 14 days after treatment. • See remarks and limitations for 2,4-D under "Corn – Postemergence." • Do not apply to sudangrass or sorghum-sudangrass hybrids. • Consult the 2,4-D label for clearance on forage sorghum.

(Continued on next page)

FORAGE SORGHUM – POSTEMERGENCE (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
(continued)				
Annual broadleaves	bromoxynil *(Buctril, Moxy)*	⅜	1½ pt 2L	• Apply to weeds less than 4 in. tall for effective control. • Do not mix with spray additives or liquid fertilizers. • Redroot pigweed and mustard must be controlled when very small (see label for details). • Some leaf burn may occur, especially under cool and cloudy or hot and humid conditions. • Do not cut for feed or graze for 30 days after application. • Do not apply to sudangrass or sorghum-sudangrass hybrids.
	bentazon *(Basagran)* + atrazine (commercial product) + crop oil concentrate	¾ + ¾ + 1 qt	¾ qt + ¾ qt 4L OR 0.8 lb 90% DG + 1 qt	• Do not apply to sorghum that is headed out. • Do not graze treated area or feed treated forage to livestock for 21 days following application. • Do not make more than one application per season. • Do not treat when plants are under stress. • Gives better control of some broadleaf weeds, especially pigweed, than *Basagran* alone. • Combination reduces risk of carryover from post-emergence application of atrazine alone. • Urea ammonium nitrate (28% liquid nitrogen) may be used at 1 gal/A instead of crop oil concentrate. Do not use urea ammonium nitrate if common lambsquarters is present. • Commercial prepackaged mix of *Basagran* plus atrazine *(Laddok)* is available. See Table 1F. • Rates may be reduced to ½ lb a.i. for each herbicide if weeds are small. See *Laddok* label for details. • Do not apply to sudangrass or sorghum-sudangrass hybrids.

TABLE 9–WEED RESPONSE TO NON-SELECTIVE HERBICIDES*

		ANNUAL BROADLEAVES									ANNUAL GRASSES								PERENNIALS				
	MODE OF ACTION	COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (BLACK)	PIGWEED (REDROOT)	RAGWEED (COMMON)	SMARTWEED	VELVETLEAF	WILD MUSTARD	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	WILD PROSSO MILLET (SANDBUR)	BINDWEED (FIELD)	BINDWEED (HEDGE)	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDGE
GRAMOXONE EXTRA/GRAMOXONE MAX	O	**E**	**E**	**E**	**E**	**E**	**E**	F	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	P	P	P	P	P
ROUNDUP ULTRA/TOUCHDOWN/OTHERS[a]	O	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	**G**	**G**	**E**	P

Herbicide mode of Action: A = ACCase inhibitor; B = ALS inhibitor; C = Photosynthesis inhibitor; O = Other.
Herbicide Effectiveness: P = Poor; F = Fair; **G** = Good; **E** = Excellent; N = None; - = Not enough information to rank.

* The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.

[a] Other glyphosate products can be substituted for *Roundup Ultra*. Always check the herbicide label for instructions on the addition of non-ionic surfactant.

TABLE 10 – RAINFREE PERIOD FOR POSTEMERGENCE HERBICIDE APPLICATIONS*

HERBICIDE	RAINFREE PERIOD (in hours)	HERBICIDE	RAINFREE PERIOD (in hours)
Accent	4	Glyphomax Plus	1–2‡
Accent Gold	6	Gramoxone Extra/Gramoxone Max	0.5
Acquire	2–6***	Harmony Extra	Several
Aim	1	Herbicide 273	NL
Assure II	1	Hornet	6
Atrazine	1–2**	Hornet WDG	6
Backdraft	NL	Laddok	NL*
Banvel/Clarity	6–8	Liberty	4
Basagran	NL*	Liberty ATZ	4
Basis	4	Lightning	1
Basis Gold	4	Marksman	4
Beacon	4	MCPA	4
Betamix	6	Mirage	NL
Betamix Progress	6	Moxy	1
Betanex	6	Northstar	4
Bladex	1–2**	Option II	4
Bronco	6	Permit	4
Buctril	1	Pinnacle	1
Buctril/Atrazine	1	Poast	1
Butoxone (2,4-DB)	NL	Poast Plus	1
Butyrac (2,4-DB)	NL	Prism	1
Canopy	1	Pursuit	1
Celebrity	4	Raptor	1
Classic	1	Reflex	1
Cobra	0.5	Resource	1
Concert	1	Rezult B	NL
Curtail	6	Rezult G	1
2,4-D Amine	6–8	Roundup Original	NL
2,4-D Ester	1	Roundup Ultra	1–2‡
Diquat	NL	Roundup UltraDry	NL
Distinct	4	Roundup UltraMax	NL
Evik	NL	Scepter	NL
Express	Several	Scorpion III	6
Extreme	NL	Select	1
FirstRate	2	Silhouette	2–6***
Flexstar	1	Stinger	6
Fusilade DX	1	Storm	NL*
Fusion	1	Synchrony STS	1
Galaxy	NL*	Touchdown	1–2‡
Glyfos	2–6***	Ultra Blazer	4
Glyphos X-tra	NL	UpBeet	4
Glyphomax	2–6***		

NL – not listed on label.
*Old labels were 8 hr. for Basagran, Laddok, Galaxy, and Storm.
**Rainfall will improve control from root uptake.
***Rainfall within 6 hr. after application may reduce effectiveness. Heavy rainfall within 2 hr. after application may wash the chemical off foliage and a repeat treatment may be required.
‡Extended time interval (6 hr.) recommended with cool, cloudy conditions. Heavy rainfall within 2 hr. may wash chemical off of foliage.

TABLE 11 – HERBICIDE CROP ROTATION RESTRICTIONS

		(in months)													
	SOIL pH RESTRICTION	SOYBEANS	FIELD CORN	SEED CORN	WHEAT	OATS	BARLEY	RYE	ALFALFA	DRY BEANS	SUGAR BEETS	POTATOES	CANOLA	CUCUMBERS	TOMATOES
Accent	None	½	0	0	4	8	8	4	10	10	10/18[k]	10/18[k]	10/18[k]	10/18[k]	10/18[k]
Accent Gold	None	10.5[l]	0	10.5	4	8	8	4	10.5[z]	10.5[l]	26[q]	18	26[q]	26[q]	26[q]
Aim	None	1	1	1	1	12	12	12	1	1	1	1	1	1	1
Atrazine° 1 lb a.i./A	None	10	0	0	3	21	21	3	15	21	21	10	21	21	21
Atrazine° 2 lb a.i./A	None	18	0	0	15	21	21	15	21	21	33	18	33	33	33
Authority	None	0	10	10[n]	4	30	4	4	12[ag]	12	30	30	30	18	30
Axiom	None	0	0	0	12	12	12	12	12	–	–	1	–	–	–
Basis	None	0.5	0	–	4	8	8	–	10	8	10	4	18	18	18
Basis Gold[ab]	None	10	0	10	10[aa]	–	10[aa]	10[aa]	18	18	18	18	18	18	18
Beacon	None	8	0.5[g]	–	3	8	8	3	8	8	18[v]	8[ac]	18[v]	18[v]	18[v]
Boundary	≥7.5	0	8	8	4.5[aj]	12	4.5[aj]	12	4.5	12	18	8	12	12	12
Broadstrike/Dual	>7.8[p]	0	0	0	4.5	4.5	4.5	4.5	4	4	26[q]	12	26[q]	26[q]	26[q]
Broadstrike+Treflan	>7.8[p]	0	8	8	4	12	4	4	4	4	26[q]	12	26[q]	26[q]	26[q]
Canopy[m]	>6.8[m]	0	10[x]	10[n]	4	30	4	4	10[a]	12	30	30	18	18	10[t]
Canopy XL	>6.8[m]	0	10	10[n]	4	30	12	12	12	12	30	30	30	18	12
Classic[c,w]	>7.0[w,m]	0	9	9[n]	3	3	3	3	9	9	30	30	30	18	15[t]
Command[d] 2pt	≤5.9	0	9[g,h]	9[n]	12	16	16	16	16	9	9	9	16	9	9,12[s]
Command Xtra[d]	≤5.9	0	10	10[n]	12	16	16	16	18	18	24	18	24	18	18
Curtail	None	10.5[ah]/18	1	–	1	1	1	–	10.5	10.5[ah]/18	12[ai]	18	10.5	18	18
Domain	None	0	0	–	12	12	12	12	12	–	–	1	–	–	–
FirstRate	None	0	9	9	3	30[ae]	30[ae]	30[ae]	9	9	30[ae]	30[ae]	30[ae]	30[ae]	30[ae]
Gauntlet	None	0	10	10[n]	4	30[ae]	30[ae]	30[ae]	12	12	30[ae]	30[ae]	24	30[ae]	30[ae]
Harness/Surpass/ TopNotch/Degree	None	10	0	0	4	–	–	–	–	–	–	–	–	–	–
Hornet	>7.8[p]	10½[l]	0	–	4	4	4	4	10½	10½[l]	26[q]	18	26[q]	26[q]	26[q]
Lightning	None	9.5	8.5	8.5	4	18	9	4	9.5	9.5	40**	26	40**	40**	40**
Matrix	None	9	1	10	4	9	9	4	12	10	18	0	12	12	1
Northstar	None	8	0.5	–	3	8	8	3	8	8	18	8	18	18	18
Permit	None	9	1	2	2	2	2	2	9	9	21	9	15	9	8
Princep 1 lb a.i./A	None	10	0	0	3	21	21	3	15	21	21	10	21	21	21
Pursuit[f]	None	0	8½	8½[n]	4	18[n]	9½	4	4	4	40	26	40	40	40
Python	>7.8[p]	0	0	0	4	4	4	4	4	4	26[q]	12	26[q]	26[q]	26[q]
Raptor	None[af]	0	9	9	3	9	4	4	9	9	18[af]	9	18	9	9
Reflex/Flexstar	None	0	10	10	4	4	4	4	18	18	18	18	18	18	18
Scepter[b,e] ⅔ pt (2.8oz)															
southern 2 tiers of counties	None	0	9½	9½	4	11	11	18	18	11	26	18	18	18	18
all other counties	None	0	18[r]	18	4	18	18	18	18	11	26	18	18	18	18
Sencor[aj]	≥7.0[ak]	4	4	4	4[al]	4	4[al]	12[am]	4	12	18	4	12	12	12
Scorpion III	None	10½[l]	0	–	4	4	4	4	10½[l]	10½[l]	26[q]	18	26[q]	26[q]	26[q]
Steel	None	0	9.5	18	4	18	11	18	18	11	40	26	40	40	40
Stinger	None	10.5[l]	0	–	0	0	0	0	10.5	10.5[l]	0	18	10.5	18	18
Synchrony STS[c,u]															
South of I-96	None	0	9	9[n]	3	3	3	3	12	9	30	30	18	18	9
North of I-96	>7.0[m]	0	9	9[n]	3	3	3	3	12	9	30	30	18	18	9

** Field bioassay after 40 months.
– No information on the label.
[a] 12 months on clover.
[b] Extension of recrop intervals of *Scepter* application following *Scepter, Canopy.*
[c] Extension of recrop intervals following *Scepter, Canopy,* or *Canopy XL.*
[d] Carryover may increase if extreme dryness occurs in the four months following herbicide application.
[e] and *TriScept, Squadron, Detail, Backdraft.*
[f] and *Pursuit Plus, Extreme.*

(Continued on next page)

TABLE 11 – HERBICIDE CROP ROTATION RESTRICTIONS (cont.)

[g] Choice of rotational crop hybrid is important. See herbicide labels and information provided by the manufacturer.
[h] Do not use an organophosphate at-plant insecticide on field corn following the previous year use of *Command* if soil pH is less than 5.9. Also – do not use an organophosphate at-plant insecticide on field corn following the previous year use of *Command* AND then apply *Accent* or *Beacon* postemergence in corn.
[j] Not recommended in fields where these crops are planned as rotation crops.
[k] Sugar beets: pH <7.5/pH ≥7.5 (if 25 in. rain falls between application and planting sugar beets). Potatoes, Canola, Cucumber: pH ≤6.5/pH >6.5.
[l] Time interval extended to 18 months if organic matter <2% AND less than 15 in. of rainfall in the 12 months following treatment.
[m] **Soil pH may be quite variable in a field.** If the composite soil pH is near 6.8, areas in the field may be higher than 6.8 and herbicide carryover may occur. Know the pH variability in the field before applying *Canopy, Canopy XL,* or *Classic.* This may require sampling several smaller areas within a field. If only spots in the field exceed 6.8 a grower may apply these herbicides and then rotate the following year to either soybeans or an imidazolinone resistant corn hybrid.
[n] Seed corn inbred lines and oat varieties vary in their sensitivity. Damage or yield loss may occur.
[o] These are recommended time intervals which do not appear on atrazine labels. Carryover risk is affected by soil pH, tillage, rainfall, and temperature. Where risk of carryover exists, fields should be sampled and a bioassay conducted. See pg. 8 for details. Refer to an atrazine label for additional restrictions regarding rotational crops. Carryover risk with *Princep* is similar to or slightly greater than atrazine.
[p] DO NOT apply to areas where the soil pH is less than 5.9 AND organic matter is greater than 5%. Also DO NOT apply where soil pH is greater than 7.8 as this may result in decreased crop tolerance.
[q] Requires a 26 month rotation interval and a successful field bioassay.
[r] Imidazolinone resistant (IR or IMR) and imidazolinone tolerant (IT) corn hybrids can be planted the year following *Scepter* application.
[s] 9 month seed – 12 month transplant.
[t] Transplant only.
[u] No soil pH restrictions south of I-96. Use only if soil pH is less than 7.0 on fields north of I-96.
[v] The full rate (0.76 oz/A) is not recommended in fields where these crops are planned as rotation crops. A rotation interval of two growing seasons is recommended for rates 50% or less of the full rate.
[w] No pH restriction if *Classic* is applied at ¼ or ⅓ oz/A. At ½ oz/A or higher, pH must be below 7.0.
[x] IR or IMR corn – 8 month.
[y] If application is made after June 30, if an extended dry period occurs after application, or if the soil pH is greater than 7.8,rotate only to corn or small grains the next year.
[z] Extend interval to 12 months if soil pH >8.0.
[aa] Fall seeded cereals only.
[ab] If applied after July 1, do not plant crop other than corn or sorghum the following year.
[ac] Rotation restriction is 18 months for rates higher than 0.38 oz/A.
[ae] Requires 30 month rotation interval and a successful field bioassay.
[af] Extend interval for sugarbeet rotation to 26 months if soil pH is below 6.2.
[ag] Clover recrop interval is 18 months.
[ah] Rotation interval is extended to 18 months if soils contain less than 2% organic matter and natural precipitation is less than 15 inches during the 10.5 months following treatment.
[ai] Do not plant sugarbeets in the same growing season following an application of *Curtail.*
[aj] Winter barley and winter wheat: 4.5 month rotation restriction, spring wheat and spring barley: 8 month rotation restriction.
[ak] Corn: do not apply *Sencor* to corn in fields with pH ≥7.0, in soybean fields with pH ≥7.5.
[al] Wheat and barley: 4 month rotation restriction when following peas, lentils, or soybeans, 8 months when following other crops.
[am] Rye: cover crops for soil building or erosion control may be planted anytime, but do not graze or harvest for feed. Stand reductions may occur in some areas.

TABLE 12 – TOXICITY, SOLUBILITY, ADSORPTIVITY, AND PERSISTENCE OF HERBICIDES

HERBICIDE	TOXICITY[1] LD_{50} mg/kg Oral	Dermal	WATER SOLUBILITY (ppm at 25°C)	ADSORPTIVITY TO SOIL	SOIL PERSISTENCE AT STANDARD RATE (months)	RUNOFF/[2] LEACHING POTENTIAL	RESTRICTED[3] ENTRY INTERVAL
Accent	>5000	>2000	70 (pH 7.0)	weak–moderate	1–10	3/1	4–48 hrs
Accent Gold	>5000	>2000	–	–	–	3/1	48 hrs
Aim	>5000	>5000	22	strong	–	–/–	12 hrs
Assure II	4100–5900	>2000	<1	moderate	½	1/2	12 hrs
Atrazine	1075–2000	>5000	33	strong	2–8	2/1	12 hrs
Authority	2416	>5000	110	moderate	2–8	–/–	12 hrs
Axiom	2072–2347	>2000	56	moderate	2	2/1	12 hrs
Banvel/Clarity	3512–6764	>2000	4500	weak	1–6	3/1	24 hrs
Basagran	2063	>10,000	500	weak	½	3/1	12 hrs
Basis	>5000	>2000	–	–	–	–/–	4 hrs
Basis Gold	>5000	>2000	–	–	–	–/–	12 hrs
Beacon	>5050	>2010	18,000 (pH 7.2)	weak	1–5	2/1	12 hrs
Betamix	4059	>1980	1	moderate	1	1/3	24 hrs
Betanex	3960	>9900	7	moderate	1	1/3	24 hrs
Bladex	271–510	>2000	171	strong	2–3	2/2	12 hrs
Blazer	4790	3250	infinite	strong	1	2/2	48 hrs
Broadstrike + Treflan	3100	>2000	5650	moderate	2–8	1/1	12 hrs
Broadstrike/Dual	>2000	–	5650	moderate	2–8	2/1	12 hrs
Buctril/Moxy	780	2000	50	moderate	0.5	2/3	12 hrs
Canopy	1500–1600	2000	**	v. strong	1–10	2/1	12 hrs
Classic	>5000	>2000	300	strong	1–10	2/1	12 hrs
Cobra	2400–2600	>2000	0.1	strong	0.5	2/3	12 hrs
Command	>5000	>5000	1100	v. strong	3–6	2/2	12 hrs
2,4-D	375–1492	>2000	900	weak	1	2/2	12–48 hrs
2,4-DB	>1706	>10,000	insoluble	weak	1	2/3	48 hrs
Defol 6	–	–	–	–	–	3/1	12 hrs
Degree	>5000	>5000	223	moderate	1–2	2/2	12 hrs
DESICATE II	233	481	100,000	moderate	¼	3/2	48 hrs
Diquat	600–810	260–315	infinite	v. strong	–	1/3	24 hrs
Distinct	>1800	>5000	–	–	–	–	–
Domain	2347	>2000	56	moderate	2	2/1	12 hr
Dual II Magnum	820–5000	>2010	530	strong	1–3	2/1	12–24 hrs
Eptam	1325–5000	2750–5000	370	strong	1.5–2	2/3	12 hrs
Eradicane	2000–5000	2000–4000	370	strong	1.5–2	2/3	12 hrs
Evik	4494	>2020	185	v. strong	1–3	2/2	12 hrs
Express	>5000	>2000	286	–	½	2/2	12 hrs
FirstRate	>5000	>2000	184	moderate	1–4	–/–	
Frontier	849	>2000	1174	moderate	1–2	2/1	12 hrs
Fusilade DX	>5000	>2000	2	moderate	¼	1/3	12 hrs
Fusion	3154	>2000	2 to 0.9	moderate	½	1/3	24 hrs
glyphosate***	>5000	>5000	900,000 (pH 7.0)	v. strong	1	1/3	SL
Gramoxone Extra/ Gramoxone Max	283	>2000	infinite	v. strong	1	1/3	12–48 hrs
Harmony Extra	>5000	>2000	*	*	½	2/2	12 hrs
Harness	1249–2690	>5000	223	moderate	1–2	2/2	12 hrs
Herbicide 273	100	>2000	100,000	moderate	0.25	3/2	48 hrs
Hornet	3126–4444	>2000	–	moderate	2–8	3/1	48 hrs
Hornet WDG	>5000	>5000	–	–	–	3/1	48 hrs
Kerb	>5000	>2000	15	strong	2–9	2/1	24 hrs
Lasso/Microtech/ Partner	1782–5000	5000–7800	242	strong	1–2	2/2	12 hrs
Liberty	2119–2030	1390–5319	–	–	–	–	12 hrs
Lightning	>5000	>2000	–	–	–	2/1	12 hrs
Lorox/Linex	4060–4833	>2000	75	v. strong	2–4	1/2	24 hrs
Matrix	>5000	>2000	–	–		–/–	4 hrs
MCPA	700	15,000	insoluble	v. weak	1–4	1/3	12–48 hrs
Nortron SC	>2100	>4100	110	strong	1–4	2/2	12 hrs

(Continued on next page)

TABLE 12 – TOXICITY, SOLUBILITY, ADSORPTIVITY, AND PERSISTENCE OF HERBICIDES (continued)

HERBICIDE	TOXICITY[1] LD_{50} mg/kg Oral	Dermal	WATER SOLUBILITY (ppm at 25°C)	SOIL PERSISTENCE ADSORPTIVITY TO SOIL	AT STANDARD RATE (months)	RUNOFF/[2] LEACHING POTENTIAL	RESTRICTED[3] ENTRY INTERVAL
Outlook	695	>2000	1174	moderate	1–2	2/2	12 hrs
Permit	1287	>5000	15	–	–	2/2	12 hrs
Pinnacle	>5000	>2000	2400	–	¼	2/2	12 hrs
Poast	2200–4100	2000–5000	48	moderate	¼	2/3	12 hrs
Princep	>5000	>2500	5	strong	2–8	2/1	12 hrs
Prowl	3956	>2200	<1	v. strong	3–6	1/3	24 hrs
Pursuit	3506–5000	>2000	1,400	weak	2–8	1/1	12–24 hrs
Pyramin	1160	>2000	1	strong	1–2	2/2	12 hrs
Python	>5000	>2000	49	moderate	2–8	3/1	12 hrs
Raptor	>5000	>4000	–	weak	1–2	–/–	4 hrs
Reflex/Flexstar	3683–8160	>1000	600,000	weak	6	2/1	24 hrs
Resource	3200–4100	>2000	.189	strong		3/2	12 hrs
Ro-Neet	3160–3690	>4640	85	strong	1–3	2/2	12 hrs
Scepter	>5000	2000–5000	60	moderate	2–8	3/1	12–48 hrs
Select	2920–3610	>5000	infinite	moderate	¼	3/3	24 hrs
Sencor	1500–2794	>5000	1200	moderate	2–4	2/1	12 hrs
Sinbar	5000–7500	>5000	710	moderate	5–6	2/1	12 hrs
Sonalan	3300–5000	>5000	1	v. strong	3–5	1/3	12 hrs
Stinger	>5000	>5000	1000	moderate	1–10	3/1	12 hrs
Surpass	1426–5470	>2000	223	moderate	1–2	2/2	12 hrs
Touchdown 5	500–2000	>2000	infinite	v. strong	1	1/3	12 hrs
Treflan	3700–10,000	>2000	<1	v. strong	3–6	1/3	12 hrs
Ultra Blazer	4790	3250	infinite	strong	1	2/2	48 hrs
Upbeet	>5000	>2000	110 (pH 7.0)	weak		–/–	4 hrs
Velpar	1100–4120	>5000	33,000	strong	4–6	2/1	24 hrs
(Table Salt)	3320		360,000	–	–	–	
(Aspirin)	1200		2,500	–	–	–	

-- No information available.

Sources: numerous, including *Herbicide Handbook, 1989 Herbicide Manual for Ag Chem. Dealers,* Iowa State; *U of Illionois Custom Spray Operation Training Manual, 1979; 1987 Illinois Pest Control; Farm Chemical Handbook.*

[1]The LD50 is a standard toxicological term which indicates the number of milligrams (mg) of pesticide per kilogram (kg) of test animal body weight required to kill 50% of a test animal poulation. Values less than 10 indicate extremely high toxicity to mammals. The LD50 data have been obtained from the Material Data Safety Sheets or Farm Chemical Handbook.

[2]The runoff/leaching potential ratings are from the ARS/NRCS pesticide properties database and were developed for use with the NRCS soils ratings for water quality in the NRCS "Soil-Pesticide Interaction Ratings." 1=high, 2=medium, 3=low.

[3]Read and follow label directions. Post areas or give oral warnings that areas have been treated to warn workers not to enter until the REI has elapsed as required by the label. SL=See Label.

* Combination of *Express* and the active ingredient in *Pinnacle*

** Combination of *Lexone* plus chlorimuron

*** Glyphosate IPA salt; active ingredient in *Acquire, Glyfos X-tra, Mirage, Roundup Original, Roundup Ultra, Roundup UltraDry, Roundup UltraMax,* and *Silhouette.*

Premixes: Refer to Tables 1I and 2F for components of herbicide premixes.

TABLE 13 – GLOSSARY OF CHEMICAL NAMES

TRADE NAME** AND (MANUFACTURER)	COMMON NAME	CONCENTRATION COMMERCIAL FORMULATION†
ACCENT (DuPont)	NICOSULFURON	75% DF, SP
ACCENT GOLD (DuPont)	CLOPYRALID+FLUMETSULAM+ NICOSULFURON+RIMSULFURON	83.8% DG (51.7 + 19.1 + 6.5 + 6.5)
ACQUIRE (BASF)	GLYPHOSATE	3 lb/gal (ae)
AIM (FMC)	CARFENTRAZONE ETHYL	40% DF
ASSURE II (DuPont)	QUIZALOFOP-P-ETHYL	0.88 lb/gal L
* ATRAZINE Several (various)	ATRAZINE	4 lb/gal L; 90% DG
AUTHORITY (DuPont)	SULFENTRAZONE	75% DG
AXIOM (Bayer Inc)	FLUFENACET+METRIBUZIN	68% DF (54.4 + 13.6)
* AXIOM AT (Bayer Inc)	FLUFENACET+METRIBUZIN+ATRAZINE	75% DG (19.6 + 4.9 + 50.5)
BACKDRAFT (BASF)	GLYPHOSATE+IMAZAQUIN	1.5 lb/gal
BANVEL (BASF)	DICAMBA	4 lb/gal L
BASAGRAN (BASF)	BENTAZON	4 lb/gal L
BASIS (DuPont)	RIMSULFURON+THIFENSULFURON	75% DG (50 + 25)
* BASIS GOLD (DuPont)	NICOSULFURON+RIMSULFURON+ATRAZINE	89.5% DG (1.34 + 1.34 + 86.78)
BEACON (Novartis)	PRIMISULFURON	75% DG (in pouches)
BETAMIX (Aventis)	DESMEDIPHAM+PHENMEDIPHAM	1.3 lb/gal L (0.65 + 0.65)
BETANEX (Aventis)	DESMEDIPHAM	1.3 lb/gal L
* BICEP LITE II (Novartis)	ATRAZINE+METOLACHLOR (+SAFENER)	4.9 lb/gal L (1.7 + 3.2)
* BICEP II (Novartis)	ATRAZINE+METOLACHLOR (+SAFENER)	5.9 lb/gal L (2.7 + 3.2)
* BICEP II MAGNUM (Novartis)	ATRAZINE+S-METOLACHLOR (+SAFENER)	5.5 lb/gal L (3.1 + 2.4)
* BICEP LITE II MAGNUM (Novartis)	ATRAZINE+S-METOLACHLOR (+SAFENER)	6 lb/gal L (2.67 + 3.33)
* BLADEX (DuPont)	CYANAZINE	4L; 90% DF
BLAZER 2L (BASF)	ACIFLUORFEN	2 lb/gal L
BOUNDARY (Novartis)	METOLACHLOR+METRIBUZIN	7.8 lb/gal
BROADSTRIKE+TREFLAN (Dow AgroSciences)	FLUMETSULAM+TRIFLURALIN	3.65 lb/gal L (0.25 + 3.4)
BROADSTRIKE/DUAL (Novartis)	FLUMETSULAM+METOLACHLOR	7.67 lb/gal L (0.2 + 7.47)
* BRONCO (Monsanto)	ALACHLOR+GLYPHOSATE	3.6 lb/gal L (2.6 + 1)
BUCTRIL (Aventis)	BROMOXYNIL	2 lb/gal L
* BUCTRIL-ATRAZINE (Aventis)	ATRAZINE+BROMOXYNIL	3 lb/gal L (2 + 1)
* BULLET (Monsanto)	ATRAZINE+ALACHLOR	4 lb/gal L (1.5 + 2.5)
BUTOXONE (Cedar)	2,4-DB	2 lb/gal L
BUTYRAC (Albaugh)	2,4-DB	2 lb/gal L
CANOPY (DuPont)	METRIBUZIN+CHLORIMURON ETHYL	75% DG (64.3 + 10.7)
CANOPY XL (DuPont)	SULFENTRAZONE+CHLORIMURON ETHYL	56.3% DG (46.9 + 9.4)
CELEBRITY (BASF)	NICOSULFURON+DICAMBA	Co-Pack
CELEBRITY PLUS (BASF)	DICAMBA+DIFLUFENZOPYR+NICOSULFURON	70% DG (42.4 + 17.0 + 10.6)
CLARITY (BASF)	DICAMBA	4 lb/gal L
CLASSIC (DuPont)	CHLORIMURON ETHYL	25% DF
COBRA (Valent)	LACTOFEN	2 lb/gal L
COMMAND (FMC)	CLOMAZONE	3 ME
COMMAND EXTRA (FMC)	CLOMAZONE+SULFENTRAZONE	Co-pack
* CONTOUR (BASF)	IMAZETHAPYR+ATRAZINE	3.38 L (0.38 + 3.0)
CURTAIL (Dow AgroSciences)	CLOPYRALID+2,4-D	2.38 lb/gal L (0.38 + 2.0)
2,4-D (Several)	2,4-D	various
* DEGREE (Monsanto)	ACETOCHLOR (+SAFENER)	3.8 lb/gal L
* DEGREE XTRA (Monsanto)	ACETOCHLOR (+SAFENER)+ATRAZINE	4.0 lb/gal L (2.7 + 1.3)
DESICATE II (Atochem)	ENDOTHALL	2.0 lb/gal L
DETAIL (BASF)	DIMETHENAMID+IMAZAQUIN	4.1 lb/gal EC (3.6 + 0.5)
DIQUAT (Zeneca)	DIQUAT	2 lb/gal L
DISTINCT (BASF)	DICAMBA+DIFLUFENZOPYR	70% DS (50 + 20)
DOMAIN (Bayer Inc.)	FLUFENACET+METRIBUZIN	60% DF (24 + 36)

(Continued on next page)

TABLE 13 – GLOSSARY OF CHEMICAL NAMES (continued)

TRADE NAME** AND (MANUFACTURER)	COMMON NAME	CONCENTRATION COMMERCIAL FORMULATION†
* DOUBLEPLAY (Zeneca)	EPTC+ACETOCHLOR (+SAFENER)	7L (5.6 + 1.4)
DUAL MAGNUM (Novartis)	S-METOLACHLOR	7.62 lb/gal L
DUAL II (Novartis)	METOLACHLOR (+SAFENER)	7.8 lb/gal L; 25% G
DUAL II MAGNUM (Novartis)	S-METOLACHLOR (+SAFENER)	7.64 lb/gal L
DUAL IIG MAGNUM (Novartis)	S-METOLACHLOR (+SAFENER)	16% G
EPTAM (Zeneca)	EPTC	7 lb/gal L; 10% G
ERADICANE (Zeneca)	EPTC (+SAFENER)	6.7 lb/gal L
EVIK (Novartis)	AMETRYNE	80% DF
EXPRESS (DuPont)	TRIBENURON METHYL	75% DF
* EXTRAZINE II (DuPont)	ATRAZINE+CYANAZINE	4 lb/gal L (1 + 3) 90% DF (21.4 + 67.5)
EXTREME (BASF)	GLYPHOSATE+IMAZETHAPYR	2.17 lb/gal
* FIELDMASTER (Monsanto)	ACETOCHLOR (+SAFENER)+ ATRAZINE+GLYPHOSATE	4.06 lb/gal L (2 + 1.5 + 0.56 (ae))
FIRSTRATE (Dow AgroSciences)	CLORANSULAM METHYL	84% WDG
FLEXSTAR (Zeneca)	FOMESAFEN	1.88 lb/gal L
FRONTIER (BASF)	DIMETHENAMID	6 lb/gal L
* FULTIME (Zeneca)	ACETOCHLOR (+SAFENER)+ATRAZINE	4 lb/gal L (2.4 + 1.6)
FUSILADE DX (Zeneca)	FLUAZIFOP-P-BUTYL	2 lb/gal L
FUSION (Zeneca)	FLUAZIFOP-P-BUTYL+FENOXAPROP	2.66 lb/gal L (2.0 + 0.66)
GALAXY (BASF)	BENTAZON+ACIFLUORFEN	3.68 lb/gal L (3 + 0.68)
GAUNTLET (FMC)	CLORANSULAM-METHYL+SULFENTRAZONE	Co-pack
GLYFOS X-TRA (Cheminova)	GLYPHOSATE	3 lb/gal (ae)
GLYPHOMAX (Dow AgroSciences)	GLYPHOSATE	3 lb/gal L (ae)
GLYPHOMAX PLUS (Dow AgroSciences)	GLYPHOSATE	3 lb/gal L (ae)
* GRAMOXONE EXTRA (Zeneca)	PARAQUAT	2.5 lb/gal L
* GRAMOXONE MAX (Zeneca)	PARAQUAT	3 lb/gal
* GUARDSMAN (BASF)	DIMETHENAMID+ATRAZINE	5 lb/gal L (2.33 + 2.67)
HARMONY EXTRA (DuPont)	THIFENSULFURON METHYL+TRIBENURON METHYL	75% DF
* HARNESS (Monsanto)	ACETOCHLOR (+SAFENER)	7 lb/gal L; 20% G
* HARNESS XTRA (Monsanto)	ACETOCHLOR (+SAFENER)+ATRAZINE	6 lb/gal L (4.3 + 1.7)
* HARNESS XTRA 5.6L (Monsanto)	ACETOCHLOR (+SAFENER)+ATRAZINE	5.6 lb/gal L (3.1 + 2.5)
HERBICIDE 273 (Atochem)	ENDOTHALL	3 lb/gal L
HORNET (Dow AgroSciences)	FLUMETSULAM+CLOPYRALID	85.6% DG (23.1 + 62.5)
HORNET WDG (Dow AgroSciences)	FLUMETSULAM+CLOPYRALID	68% WDG (18.5 + 60.0)
KERB (Rohm and Haas)	PRONAMIDE	50% WP (in soluble pouches)
* LASSO (Monsanto)	ALACHLOR	4 lb/gal L; 15% G
* LADDOK (BASF)	ATRAZINE+BENTAZON	3.3 lb/gal L (1.7 + 1.7)
* LARIAT (Monsanto)	ATRAZINE+ALACHLOR	4 lb/gal L (1.5 + 2.5)
* LEADOFF (DuPont)	DIMETHENAMID+ATRZINE	5 lb/gal L (2.33 + 2.67)
LIBERTY (Aventis)	GLUFOSINATE	1.67 lb/gal L
* LIBERTY ATZ (Aventis)	ATRAZINE+GLUFOSINATE	4.3 lb/gal L (3.3 + 1.0)
LIGHTNING (BASF)	IMAZETHAPYR+IMAZAPYR	70% DG (52.5 + 17.5)
LOROX (Griffin)	LINURON	4 lb/gal L; 50% DF
* MARKSMAN (BASF)	ATRAZINE+DICAMBA	3.2 lb/gal L (2.1 + 1.1)
MCPA Several (various)	MCPA	Various L
* MICRO-TECH (Monsanto)	ALACHLOR	4 lb/gal L
MIRAGE (UAP)	GLYPHOSATE	3 lb/gal (ae)
MOXY (Terra)	BROMOXYNIL	2 lb/gal L
NORTHSTAR (Novartis)	PRIMISULFURON + DICAMBA	43.8% DG (7.5 + 36.3)
NORTRON SC (Aventis)	ETHOFUMESATE	1½ lb/gal L; 4 lb/gal SC

(Continued on next page)

TABLE 13 – GLOSSARY OF CHEMICAL NAMES (continued)

TRADE NAME** AND (MANUFACTURER)	COMMON NAME	CONCENTRATION COMMERCIAL FORMULATION†
OUTLOOK (BASF)	DIMETHENAMID	6 lb/gal
* PARTNER (Monsanto)	ALACHLOR	65% DG
PEAK (Novartis)	PROSULFURON	57% DG
PERMIT (Monsanto)	HALOSULFURON	75% DS
PINNACLE (DuPont)	THIFENSULFURON METHYL	25% DF
POAST (BASF)	SETHOXYDIM	1.53 lb/gal L
POAST PLUS (BASF)	SETHOXYDIM+DASH	1.0 lb/gal L
PRINCEP (Novartis)	SIMAZINE	4.lb/gal L; 80% WP; 90% DG
* PROGRESS (Aventis)	DESMEDIPHAM+PHENMEDIPHAM+ ETHOFUMESATE	1.8 lb/gal L (0.6 + 0.6 + 0.6)
PROWL (BASF)	PENDIMETHALIN	3.3 EC
PURSUIT (BASF)	IMAZETHAPYR	2 lb/gal L; 70% DG, ECO-PAK
PURSUIT PLUS (BASF)	IMAZETHAPYR+PENDIMETHALIN	3 lb/gal L (0.2 + 2.8)
PYRAMIN (BASF)	PYRAZON	67% DF
PYTHON (Dow AgroSciences)	FLUMETSULAM	80% WDG
RAPTOR (BASF)	IMAZAMOX	1 lb/gal L
* READY MASTER ATZ (Monsanto)	GLYPHOSATE+ATRAZINE	3.5 lb/gal L (1.5 ae + 2)
REFLEX (Zeneca)	FOMESAFEN	2 lb/gal L
RESOURCE (Valent)	FLUMICLORAC	0.86 lb/gal L
REZULT (BASF)	BENTAZON+SETHOXYDIM+DASH	Co-Pack
RO-NEET (Zeneca)	CYCLOATE	6 lb/gal L; 10% G
ROUNDUP ORIGINAL (Monsanto)	GLYPHOSATE	3 lb/gal (ae)
ROUNDUP ULTRA (Monsanto)	GLYPHOSATE	3 lb/gal L (ae)
ROUNDUP ULTRADRY (Monsanto)	GLYPHOSATE	65% (ae)
ROUNDUP ULTRAMAX (Monsanto)	GLYPHOSATE	3.7 ae
SCEPTER (BASF)	IMAZAQUIN	1.5 lb/gal L; 70% DG, ECO-PAK
SCORPION III (Dow AgroSciences)	FLUMETSULAM+CLOPYRALID+2,4-D	84.3% DG (9.3 + 25 + 50)
SELECT (Valent)	CLETHODIM	2 lb/gal L
SENCOR (Bayer Inc.)	METRIBUZIN	50% WP; 75% DF; 4 lb/gal L; Solupak
* SHOTGUN (United Agro Products)	ATRAZINE+2,4-D ESTER	3.25 lb/gal L (2.25 + 1)
SINBAR (DuPont)	TERBACIL	80% WP
SILHOUETTE (Agriliance)	GLYPHOSATE	3 lb/gal (ae)
SONALAN (Dow AgroSciences)	ETHALFLURALIN	3 lb/gal L
STINGER (Dow AgroSciences)	CLOPYRALID	3 lb/gal L
SQUADRON (BASF)	PENDIMETHALIN+IMAZAQUIN	2.33 lb/gal L; (2.0 + 0.33)
STORM (BASF)	BENTAZON+ACIFLUORFEN	4 lb/gal L (2.7 + 1.3)
* SURPASS (Zeneca)	ACETOCHLOR (+SAFENER)	6.4 lb/gal L
* SURPASS 100 (Zeneca)	ACETOCHLOR (+SAFENER)+ATRAZINE	4.9 lb/gal L (2.9 + 2)
SYNCHRONY STS (DuPont)	CHLORIMURON ETHYL+THIFENSULFURON METHYL	42% DF, Solupak (32 + 10)
* TOPNOTCH (Zeneca)	ACETOCHLOR (+SAFENER)	3.2 lb/gal L
TOUCHDOWN 5 (Zeneca)	GLYPHOSATE	3.45 lb/gal L (ae)
TREFLAN (Dow AgroSciences)	TRIFLURALIN	4 lb/gal L; 10% G
TURBO (Novartis)	METRIBUZIN+METOLACHLOR	8 lb/gal L (1.45 + 6.55)
ULTRA BLAZER (BASF)	ACIFLUORFEN	2 lb/gal
VELPAR (DuPont)	HEXAZINONE	2 lb/gal L; 90% SP, 75% DF

*Restricted Use Pesticides

**"Several" means there are numerous trade names for the chemical. The mention of trade names does not imply that they are endorsed or recommended over those of similar nature not listed.

† DC – dry concentrate, DF – dry flowable, DS – dry soluble granule, EC – emulsifiable concentrate, G – granular, L – liquid, DG – dispersible granule, WP – wettable powder, WSP – wettable soluble powder.

TABLE 14 – GLOSSARY OF EPA REGISTRATION NUMBERS

Aatrex 4L	Novartis	100-497
Aatrex 90	Novartis	100-585
Accent Gold	DuPont	352-593
Accent	DuPont	352-560
Acquire	BASF	51036-312-7969
Aim	FMC	279-3194
Alachlor-4EC	Micro Flo	524-314-51036
Assure II	DuPont	352-541
Authority	DuPont	352-590
Axiom	Bayer	3125-488
Axiom AT	Bayer	3125-523
Backdraft	BASF	241-407
Banvel	BASF	7969-131
Basagran	BASF	7969-45
Basis	DuPont	352-571
Basis Gold	DuPont	352-585
Beacon	Novartis	100-705
Betamix	Aventis	45639-87
Betanex	Aventis	45639-86
Bicep II	Novartis	100-710
Bicep II Magnum	Novartis	100-817
Bicep Lite II Magnum	Novartis	100-827
Bladex 4L	DuPont	352-470
Bladex 90 DF	DuPont	352-495
Blazer	BASF	7969-79
Boundary	Novartis	100-958
Broadstrike/Dual	Dow AgroSciences	62719-239
Broadstrike + Treflan	Dow AgroSciences	62719-222
Bronco	Monsanto	524-341
Buctril	Aventis	264-437
Buctril + Atrazine	Aventis	264-477
Bullet	Monsanto	524-418
Butyrac 200	Albaugh	42 750-38
Canopy	DuPont	352-444
Canopy XL	DuPont	352-589
Celebrity	BASF	7969-166
Celebrity Plus	BASF	7969-175
Clarity	BASF	7969-137
Classic	DuPont	352-436
Cobra	Valent	59639-34
Command 3ME	FMC	279-3158
Command Extra	FMC	279-3232
Curtail	Dow AgroSciences	62719-48
2,4-D	many	many
Defol 6	Drexel	19713-85
Degree	Monsanto	524-496
Degree Xtra	Monsanto	524-511
Desicate II	Atochem	4581-381
Detail	BASF	241-361
Diquat	Zeneca	10182-353
Distinct	BASF	7969-150
Domain	Bayer	3125-527
Dual	Novartis	100-673
Dual Magnum	Novartis	100-816
Dual II	Novartis	100-711
Dual II Magnum	Novartis	100-818
Dual II G	Novartis	100-712
Eptam 7-E	Zeneca	10182-220
Eptam 10-G	Zeneca	10182-160
Eptam 20-G	Zeneca	10182-199
Eradicane 6.7-E	Zeneca	10182-223
Eradicane 25-G	Zeneca	10182-323
Evik DF	Novartis	100-786
Express	DuPont	352-509
Extrazine II 4L	DuPont	352-500
Extrazine II DF	DuPont	352-577
Extreme	BASF	241-405
FirstRate	Dow AgroSciences	62719-275
Flexstar	Zeneca	10182-418
Frontier 6L	BASF	7969-147
Fusilade DX	Zeneca	10182-367
Fusion	Zeneca	10182-343
Galaxy	BASF	7969-77
Gauntlet	FMC	279-3231
Glyfos X-tra	Cheminova	4787-23
Glyphomax	Dow AgroSciences	62719-323
Glyphomax Plus	Dow AgroSciences	62719-322
Gramoxone Extra	Zeneca	10182-280
Gramoxone Max	Zeneca	10182-372
Guardsman	BASF	7969-146
Harmony Extra	DuPont	352-538
Harness	Monsanto	524-473
Harness Xtra 5.6L	Monsanto	524-485
Harness Xtra	Monsanto	524-480
Herbicide 273	Atochem	4581-223
Hornet	Dow AgroSciences	62719-253
Hornet WDG	Dow AgroSciences	62719-315
Kerb 50-W	Rohm & Haas	707-159
Laddok S-12	BASF	7969-100
Lariat	Monsanto	524-329
Lasso	Monsanto	524-314
LeadOff	DuPont	352-600
Liberty	Aventis	264-660
Liberty ATZ	Aventis	264-668
Lightning	BASF	241-377
Linex 4L	Griffin	1812-245
Linex 50DF	Griffin	1812-320
Lorox DF	DuPont	352-394
Marksman	BASF	7969-136
MCPA Amine	Terra	9779-262
Micro-Tech	Monsanto	524-344
Mirage	UAP	524-445-34704
Moxy	Terra	51036-256-9779
Northstar	Novartis	100-923
Nortron SC	Aventis	45639-8
Outlook	BASF	7969-156
Partner	Monsanto	524-403
Permit	Monsanto	524-465
Pinnacle	DuPont	352-525
Poast	BASF	7969-58
Poast Plus	BASF	7969-88
Princep 4L	Novartis	100-526
Princep Caliber 90	Novartis	100-603
Progress	Aventis	45639-159
Prowl 3.3 EC	BASF	241-337
Pursuit	BASF	241-310
Pursuit DG	BASF	241-350
Pursuit Plus EC	BASF	241-331
Pyramin DF	BASF	7969-81
Python	Dow AgroSciences	62719-277
Raptor	BASF	241-379
Reflex	Zeneca	10182-83

(Continued on next page)

TABLE 14 – GLOSSARY OF EPA REGISTRATION NUMBERS (cont.)

Resource	Valent	59639-82
Rezult B	BASF	7969-112
Rezult G	BASF	7969-88
Ro-Neet 6-E	Zeneca	10182-178
Roundup Original	Monsanto	524-445
Roundup Ultra	Monsanto	524-475
Roundup UltraDry	Monsanto	524-504
Roundup UltraMAX	Monsanto	524-512
Scepter	BASF	241-289
Scepter O.T.	BASF	241-321
Scepter 70 DG	BASF	241-306
Scorpion III	Dow AgroSciences	62719-264
Select 2EC	Valent	59639-3
Sencor 4	Bayer	3125-314
Sencor DF	Bayer	3125-325
Sencor Solupak	Bayer	3125-402
Shotgun	United Agri Products	34704-728
Silhouette	Cenex/Land O'Lakes	524-445-1381
Sinbar	DuPont	352-317
Sonalan 10G	Dow AgroSciences	62719-184
Sonalan HFP	Dow AgroSciences	62719-188
Stinger	Dow AgroSciences	62719-73
Squadron	BASF	241-327
Storm	BASF	7969-76
Surpass EC	Zeneca	10182-325
Surpass 100	Zeneca	10182-363
Synchrony STS	DuPont	352-573
Touchdown 5	Zeneca	10182-429
Treflan E.C.	Dow AgroSciences	62719-97
Treflan HFP	Dow AgroSciences	62719-250
Treflan TR-10	Dow AgroSciences	62719-131
Turbo 8EC	Novartis	3125-366
Ultra Blazer	BASF	7969-79
Upbeet	DuPont	352-569
Velpar	DuPont	352-378
Velpar DF	DuPont	352-581
Velpar L	DuPont	352-392
Velpar ULW	DuPont	352-450

The *Field Crop Advisory Team Alert* Newsletter

Pest management news for whatever the season brings

The CAT Alert is MSU's targeted advice for growing field crops during the 2001 season

No one knows what the weather or pest pressure will be this spring and summer. The Field Crop Advisory Team (CAT) is structured to respond to the conditions with timely advice for growers and consultants. Members of the team are Extension field staff and faculty representing more than five MSU departments. Our county-based agents know the status of crop development and pest outbreaks in their region. Through conference calls, agents discuss current pest concerns with the faculty on their team. Based on these discussions, faculty write newsletter articles with advice for managing current pest and crop conditions. Agents write regional reports on crop development and pest management tactics for local conditions.

Timing matters, so we offer prompt delivery to you by mail or Internet

Our newsletters are written, formatted, printed and mailed within 48 hours. With Internet access, you can view the newsletter even faster, typically within 8 hours of the start of our production. We look at conditions in surrounding states, data on trends from past years, insects trap catches, forecasting tools and the reports of our agricultural meteorologist to predict what your pest management needs will be.

We cover immediate and long-term pest management tactics

The newsletter articles respond to current outbreaks and recommend long-term preventative actions. Our recommendations include resistance management and protecting beneficial organisms. Some of the subjects covered last year include:

- How to determine if you have ALS-resistant weeds in your field.
- The arrival of the soybean aphid in Michigan and management options.
- Considerations for handling frost damaged corn.
- How to control European chafers feeding on wheat and alfalfa.
- Dealing with soybean cyst nematode.
- Stopping the spread of downy mildew in soybeans.
- Weather conditions, growing degree days, and production implications

How to read us on the Internet

See issues and archives of the *CAT Alert* at the MSU IPM Program website: http://www.msue.msu.edu/ipm/fieldCAT.htm

Thanks to a grant from the Michigan Department of Agriculture, we are able to offer this free Internet service and keep subscription costs down for our mail recipients.

Subscribe for 19 issues throughout 2001

Our season begins March 2001. Most issues arrive during the growing season, but pre- and post- season issues will address preventative measures and harvest or storage concerns. Send your subscription in any time during the year. We'll send back issues from the current publishing year, if you subscribe before July 1. **After July 1, the price is $15 and does not include back issues.** Editions of the CAT Alert are also available for fruit, vegetables, and landscape.

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Make your check payable to: **Michigan State University.** Send your check and this form to: CAT Alerts, B18 Food Safety & Toxicology Building, Michigan State University, East Lansing, MI 48824 (Phone: 517-353-4703)

PESTICIDE EMERGENCY INFORMATION

For any type of an emergency involving a pesticide, immediately contact the following emergency information centers for assistance.

Current as of August 2000

Human Pesticide Poisoning

MICHIGAN POISON CONTROL SYSTEM

From anywhere in Michigan, call

1-800-POISON 1

1-800-764-7661

Special Pesticide Emergencies

Animal Poisoning

Your veterinarian:

_____

Phone No.

or

Animal Health Diagnostic Laboratory (Toxicology) Michigan State University:

(517) 355-0281

Pesticide Fire

Local fire department:

_____

Phone No.

and

Fire Marshal Division, Michigan State Police:

M–F: 8–12, 1–5

(517) 322-1924

Traffic Accident

Local police department or sheriff's department:

_____

Phone No.

and

Operations Division, Michigan State Police:

****(517) 336-6605***

* ***Telephone Number Operated 24 Hours***

Environmental Pollution

Pollution Emergency Alerting System (PEAS), Michigan Department of Environmental Quality:

_____

District MDEQ Office Phone No.

and

For environmental emergencies:

****1-800-292-4706***

also

****1-800-405-0101***

Michigan Department of Agriculture Spill Response

Pesticide Disposal Information

Michigan Department of Environmental Quality. Waste Management Division.

Monday– Friday: 8 a.m.–5 p.m.

(517) 373-2730

National Pesticide Telecommunications Network

Provides advice on recognizing and managing pesticide poisoning, toxicology, general pesticide information and emergency response assistance. Funded by EPA, based at Oregon State University

7 days a week; excluding holidays

6:30 a.m. – 4:30 p.m. **Pacific Time Zone**

1-800-858-7378

FAX: 1-541-737-0761

Revised by Carolyn J. Randall, *Pesticide Education Program, Michigan State University Extension*

This publication contains pesticide recommendations based on research and pesticide regulations. However, changes in pesticide regulations occur constantly. Some pesticides mentioned may no longer be available, and some uses may no longer be legal. If you have questions about the legality and/or registration status for using pesticides, contact your county MSU Extension office.

To protect yourself and others and the environment, always read the label before applying any pesticide.

MICHIGAN STATE UNIVERSITY EXTENSION

11:00 - 3M - KMF - J-Ad, Major Revision – destroy previous editions. Price $12, File 22.0, (Weeds).