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EXTENSION BULLETIN E-434 (REVISION—DESTROY PREVIOUS EDITIONS)

1986 WEED CONTROL GUIDE for Field Crops

COOPERATIVE EXTENSION SERVICE

MICHIGAN STATE UNIVERSITY

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GENERAL PESTICIDE INFORMATION AND REFERRALS

County Cooperative Extension Service Office (____) ____-____

Integrated Pest Management Programs

Michigan State University
East Lansing, MI 48824 (517) 355-0117

Center for Environmental Toxicology

Michigan State University
East Lansing, MI 48824 (517) 353-6469

Plant Industry Division

Michigan Department of Agriculture
Lansing, MI 48909 (517) 373-1087

Office of Hazardous Waste Management

Michigan Department of Natural Resources
Lansing, MI 48909 (517) 373-2730

Center for Environmental Health Sciences

Michigan Department of Public Health
Lansing, MI 48909 (517) 373-8050

PESTICIDE EMERGENCY INFORMATION

Human Pesticide Poisoning

(within Detroit City proper)

(313) 494-5711

(within the 313 area code)

(800) 462-6642

(statewide)

(800) 572-1655

Poison Control Center

Children's Hospital of Michigan

3901 Beaubien

Detroit, MI 48201

(within Grand Rapids City proper)

(616) 774-7854

(within the 616 area code)

(800) 442-4571

(statewide)

(800) 632-2727

Blodgett Regional Poison Center

Blodgett Memorial Medical Center

1840 Wealthy, S.E.

Grand Rapids, MI 49506

(within Marquette City proper)

(906) 228-9440

(Upper Peninsula only)

(800) 562-9781

U.P. Poison Control Center

Marquette General Hospital

420 West Magnetic Street

Marquette, MI 49855

Animal Pesticide Poisoning

Your Personal Veterinarian

(____) ____-____

and

Animal Health Diagnostic Laboratory

Michigan State University

East Lansing, MI 48824

(517) 353-1683

Pesticide Product Involved in a Fire

Local Fire Department

(____) ____-____

and

Fire Marshal Division, State Police

(517) 322-1924

Pesticide Product Involved in a Traffic Accident

Local Police Department, Sheriff's Office, or
State Police

(____) ____-____

and

Motor Carrier Division, State Police

(517) 373-3700

Pesticide Pollution Accident in the Environment

Pollution Emergency Alerting System

Michigan Department of Natural Resources

3500 N. Logan

Lansing, MI 48909

(800) 292-4706

1986 WEED CONTROL GUIDE for Field Crops

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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 sometimes 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 helps reduce this problem.

Cultural Control of Weeds

Crop competition is a very useful method of weed control. By maintaining production practices that optimize crop growth, the crop plants can more effectively compete with weeds. Several crop management practices can improve the competitive ability of the crop. These practices include crop and variety selection, planting date and population, 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 (ie. triazine-resistant weeds) becoming a problem.

Cultivation

Timely, shallow cultivation may be necessary following herbicide treatment. Be sure to cultivate as shallow 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 3 weeks after application unless weeds appear that are resistant to the chemical. If weeds appear and dry

weather persists for 2 weeks after herbicide application, rotary hoe or cultivate shallow. Delay cultivation after postemergence herbicide applications for at least 3 days (7 to 10 days following 2,4-D application in corn) to allow the chemical to move into stems and roots of the weed plants.

Chemical Control of Weeds

No one chemical used as an herbicide will kill all species of weeds. Therefore, select the right herbicide for the job. 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 easiest 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 will cause crop damage.

Types of Herbicides

Chemical control of weeds can be obtained with either preplant incorporated, preemergence, or post-emergence herbicides. Many herbicides can be applied in more than one of the above 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 which would occur if the materials were left on the soil surface. Other preplant incorporated herbicides insure good activity in the absence of the rainfall otherwise 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 control from soil applications of herbicides.

Advantages of preplant incorporated herbicides:

- (1) No weed competition to the crop with early control of weeds;
- (2) Weeds already controlled in cases 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 of 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. Cross-wise 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 appear above the ground.

Advantages of preemergence herbicides:

- (1) No weed competition to the crop with early control of weeds;
- (2) Weeds already controlled in cases where wet weather later delays cultivation or spraying;
- (3) Planting and herbicide application may be done in 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 pre-emergence 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 up;
- (2) Can be used on any soil type, and soil moisture conditions are usually not a problem;
- (3) Are usually more effective (though also 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 on 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 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 herbicide injury than are early morning applications. Early morning application predisposes the crop plant to danger periods of high temperatures, which increases 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. Once they are vaporized, wind may move sufficient vapors to areas with sensitive crops to cause crop injury. Amine formulations 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.

Formulations of Herbicides

Herbicides are available in a variety of formulations; granular and sprays are most common. Usually, equal weed control can be expected from granular and spray formulations. In some cases, however, granules have not given as good control as sprays. 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.

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 an 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 together 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 mixture 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 simple 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 to 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 of 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—reduces water surface tension causing better contact between spray solution and treated surfaces (spreader).
- (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 an 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 particular set of additives to accomplish this. However, 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. Postemergent herbicides, such as 2,4-D and Roundup, contain wetting agents which help spread the spray over the leaf surface.

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. Research in this area was conducted at several universities across the country. These experiments 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. Use of additives for soil applications of herbicides can help prevent clogging of lines and nozzles.

Crop Oil Concentrates

Crop oil concentrates contain higher concentrations of emulsifiers and surfactants than crop oils or vegetable oils. Crop oil concentrates are generally recommended at a rate of 1 quart per acre.

These additives are recommended for use with post-emergence applications of atrazine and Basagran. They should also be used in postemergence applications on sugarbeets when large weeds are present or the weeds are not vigorously growing. Aatrex and Basagran labels contain specific directions on the use of additives.

There is a greater risk for crop injury when using additives with postemergence atrazine applications. 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.

The use of crop oil concentrate is recommended with Basagran to insure good coverage of the weed foliage. Basagran requires good coverage for optimum weed control. Soybean injury can be increased with the addition of crop oil concentrate to Basagran sprays. If soybeans are growing poorly or were injured from soil applied herbicides be careful when using Basagran plus crop oil concentrate.

Adjuvants, Surfactants, Wetting Agents, Soaps

Many spray additives are currently available and many exaggerated claims have been made for them. 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 con-

centrates can be slightly superior. Remember that any benefit comes only in postemergence, not preemergence applications. Also, they aid performance of the herbicide in adverse conditions, but are not a way to use less herbicide.

The Bladex 80W label calls for the addition of a surfactant for postemergence applications under drought conditions. Weeds can become more difficult to kill under these conditions. However, because of the increased chance of crop injury and the infrequency of these conditions in the spring, additions of surfactants or oils are not recommended for postemergence Bladex 80W use in Michigan.

The paraquat CL label calls for the addition of a non-ionic surfactant (Ortho X-77). Good coverage is required for this contact herbicide. When paraquat is sprayed in a fertilizer solution, be sure the rate of surfactant is increased as outlined on the label.

Roundup is formulated with a surfactant. Additional surfactant is needed with low volume application (refer to the Roundup label). The addition of a defoaming agent can be a help if excessive foaming is a problem. This addition is explained in the "Mixing" portion of the Roundup label.

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 a 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.

Application Equipment

Sprayer Implements—A good weed control sprayer should be made of non-corrosive materials, 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 be able to 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 95° angle with replaceable tips are best suited for most weed control work. Nozzle volume can vary from 1 to 10 gallons per minute, depending on the application. 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.

Incorporation Implements—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. It does a good job of chopping the quackgrass rhizomes required for good 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 set-up and operation. Wide sweeps, set-up so they meet, 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.

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 greater 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 (metribuzin) are more available at higher soil pH. Rates must be reduced to avoid crop injury. Knowledge of the soil pH is needed to determine proper rate.

Organic matter analysis is available through county Cooperative Extension Service 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.

Organic matter 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 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 recalibrate 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 applications, 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 ft. nozzles, this places the nozzles about 20 in. apart on the boom and 20 in. 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 \times boom width (in feet) \div 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 recommendation 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 two adjacent nozzles.

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

<u>WIDTH</u> (inches)	<u>COURSE DISTANCE</u> (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 can not be emphasized enough.

Pesticide accidents occur most often during mixing and tank filling operations. Although accidental ingestion of chemicals is considered to be the greatest health hazard, there is also great danger of poisoning when pesticides contact skin or eyes, and 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 chemical resistant rubber gloves and boots, splash-guard goggles, and a respirator. 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 Bioassay

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. This fact is particularly true

since atrazine has come into common use on corn. 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 Table 1.

There have been reports of injury to crops following atrazine applications on corn. There is more likely to be a problem with herbicide residues in a season of limited rainfall and cool temperatures, due to the slow dissipation of the herbicide (See Extension Bulletin E-1215).

Carry-over problems have been most commonly reported for two groups of herbicides, the triazines (ex. atrazine) and the dinitroanilines (ex. trifluralin). If soybeans follow corn, or sugar beets follow a crop treated with a dinitroaniline and if herbicide carry-over is a possibility, a bioassay can be done. This will indicate whether enough herbicide is present to harm the crop. Do this 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 as when taking soil samples. 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 it is known 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 bottom 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. By knowing the exact number of seeds planted, seedling emergence can 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, or if carry-over 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 carry-over is observed, it is advisable to plant a resistant crop.

Application of Herbicides

Herbicide Spray Volumes and Rates

Table 1 lists 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 lb. is recommended for ground equipment. A minimum of 10 gal. of water per acre is recommended for the phenoxy herbicides (2,4-D, MCPA, 4-(2,4-DB)). With wettable powders such as atrazine and linuron, use nozzles that deliver at least 15 gal. per acre. Use 30 to 40 gal. of spray per acre when spraying quackgrass with atrazine or dalapon.

Some contact type postemergence herbicides (Basagran, 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 made 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 in Table 1 (col. 3) 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 1/2 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, cutting the cost per acre for the chemical. Where chemical costs are high, band spraying may be justified. However, with band spraying, 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.)

Herbicide Incorporation

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. Many growers are asking for the best way to achieve one-pass incorporation.

Soil Conditions

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 influenced 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.

Cleaning of Pesticide Sprayers

It is important to clean weed control 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 that is used for only soil ap-

plications of herbicides, only a thorough water rinse is necessary. 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.

For all other spraying purposes, thoroughly wash the entire spray system with one of the following cleaning agents in 100 gallons of water:

- (1) 1 gallon household ammonia (allowed to stand in spray tank and system overnight);
 - (2) 5 lb. of sal soda;
- or
- (3) 8 lb. trisodium phosphate.

Run the pump so that the cleaning solution is circulated throughout the entire system. Leave the cleaning solution in the spray 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 (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 hoses, and allow all water to drain out. Coat all bare metal parts with oil or a rust in-

hibitor. Disassemble metal nozzles, and store them in oil. Prepare the spray pump for storage based on the manufacturer's recommendations.

Pesticide Storage and Disposal

Reduce the need for, and the hazards of, pesticide storage and disposal by buying only what will be used during a growing season and mixing only what is needed for each application. In addition, try to apply leftovers, water rinsates, etc. to the appropriate crop rather than storing or disposing of them. Long-term storage may reduce the effectiveness and/or increase the toxicity of herbicides.

If storage is necessary, choose a suitable environment that is dry, cool, and out of direct sunlight. Avoid extreme heat or cold. Place in a location that is not accessible to children and animals and that is not near food, feed, or water. Keep pesticides in their original containers. Store pesticides under lock and key when not in use. Store herbicides separately from insecticides and fungicides to prevent possible interaction. Check the product label for specific storage instructions.

Always triple rinse pesticide containers immediately after emptying. Pour the container rinsate into the tank solution to be applied to the crop. After a triple rinse, crush or puncture the rinsed containers to prevent any misuse. Dispose of the triple-rinsed containers in a licensed sanitary landfill or recycle through a scrap metal dealer. Consult the telephone directory for scrap metal dealers and contact your nearest county Cooperative Extension office for the nearest landfills. Finally, read the pesticide product label for any important information on disposal procedures.

TABLE 1 — 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).

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.

Commercial atrazine is available under several trademarks. Atrazine is formulated as 80 W (80% wetttable powder)—1½ lb of product equals 1 lb of active ingredient—4L (flowable)—1 qt of product equals 1 lb of active ingredient—and Nine-O (90% water dispersible granule)—1.1 lb of product equals 1 lb of active ingredient. Princep is also available as 80W, 4L and as a 90% water dispersible granule (Caliber 90). Bladex is available as 80W or 4L.

Lexone and Sencor are available as 50 W (50% wetttable powder)—2 lb of product equals 1 lb of active ingredient—4 lb/gal flowable formulations (Lexone 4L, Sencor 4)—1 qt of product equals 1 lb of active ingre-

dient and as 75% dry flowable formulations (Lexone DF, Sencor DF)—1½ lb of product equals 1 lb of active ingredient.

Lorox and Linex are available as a 50% wetttable powder or 4L. Lorox is also available as a 50% DF.

Application rates of 2,4-D and MCPA are based on 3.8 lb/gal formulations.

Nortron is available as a 1.5 lb/gal liquid (Nortron E.C.)—1 qt of product equals 0.375 lb of active ingredient—and as a 4 lb/gal flowable (Nortron Flowable)—1 qt of product equals 1 lb of active ingredient.

Amiben is available as a liquid—2 lb/gal—one gal equals 2 lb of active ingredient and as a dry soluble granule (Amiben DS)—1 lb of product equals ½ lb of active ingredient.

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

WEED CONTROL GUIDE FOR CORN

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)	2	2½ lb 80W or 2 qt 4L or 2½ lb 90% WDG	— Usually obtain season-long control. — Do not plant small grain, small seed forages, sugar beets, field beans or vegetable crops the year following corn. — Rates of 2½ to 3 lb per acre may be necessary on soil high in organic matter (5 to 8%). — Residues more likely to persist if soil conditions are cool and dry. — Incorporation is not necessary.
Preplant — Mineral Soil				

Annual broadleaves Annual grasses (including green foxtail, giant foxtail, fall pani- cum, witchgrass, crab- grass and sandbur)	atrazine (commercial product)	1	1 ½ lb 80W or 1 qt 4L	— DO NOT USE ON CORN SEED STOCKS (Breeders, Foundation, or Increase). — Must be incorporated or mixed into top 2 to 3 in. of soil immediately after application; — Usually obtain season-long control. — <i>Bladex</i> may be included for more effective fall panicum control. (See remarks for three-way tank mixes, pg. 12.) — A commercial prepackaged mix of <i>Sutan Plus</i> and atra- zine (<i>Sutazine</i>) is available. — Increase <i>Sutan Plus</i> rate to 6 pt for more effective nut- sedge control.
Nutsedge	+ butylate (<i>Sutan Plus</i> or <i>Genate Plus</i>)	+ 4	+ 4 ¾ pt	
Annual broadleaves Annual grasses (including green foxtail, giant foxtail, fall pani- cum, witchgrass and crabgrass)	atrazine (commercial product)	1	1 ½ lb 80W or 1 qt 4L	— <i>Eradicane Extra</i> is also available and should be used at the rate of 4 qt per acre. — Incorporate to a depth of 4 to 5 in. immediately after application with a disk in both directions. — Quackgrass control with no soil residue or carry-over. — <i>Eradicane</i> or <i>Eradicane Extra</i> rate may be reduced to 5 pt per acre if quackgrass or nutsedge are not a prob- lem. — <i>Bladex</i> may be included for more effective fall panicum control. (See remarks for three-way tank mixes, pg.12.)
Nutsedge Quackgrass	+ EPTC with protectant (<i>Eradicane</i>)	+ 6	+ 3 ½ qt	
Annual broadleaves Annual grasses (including green foxtail, giant foxtail, fall pani- cum, witchgrass and crabgrass)	atrazine (commercial product)	1	1 ½ lb 80W or 1 qt 4L	— Gives 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. — <i>Bladex</i> may be included for more effective fall panicum control. (See remarks for three-way tank mixes, pg.12.) — Incorporated Dual rate of one quart may only give fair control of some annual grasses (especially fall panicum) and nutsedge. — A commercial prepackaged mix of Dual plus atrazine (BICEP) is available.
Nutsedge	+ metolachlor (<i>Dual</i>)	+ 2	+ 1 qt	
Annual broadleaves Annual grasses (including green foxtail, giant foxtail, fall pani- cum, witchgrass and crabgrass)	atrazine (commercial product)	1	1 ½ lb 80W or 1 qt 4L	— For fair to good control of nutsedge, increase rate of <i>Lasso</i> to 3 qt per acre. — Will be more effective preplant, especially on nutsedge, in areas where soils tend to be dry. — 2 ½ qt per acre of <i>Lasso</i> should be used for effective fall panicum control. — <i>Bladex</i> may be included for more effective fall panicum control. (See remarks for three-way tank mixes, pg.12.) — A commercial prepackaged mix of <i>Lasso</i> plus atrazine is available.
Nutsedge	+ alachlor (<i>Lasso</i>)	+ 2 ½	+ 2 ½ qt	

CORN — Preplant — Mineral Soil (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves Annual grasses (including green foxtail, giant foxtail, fall pani- cum, witchgrass and crabgrass)	cyanazine (<i>Bladex</i>)	1%	2½ lb 80W or 1¾ qt 4L	— DO NOT USE ON CORN SEED STOCKS (Breeders, Foundation, or Increase). — Must be incorporated or mixed into top 2 to 3 in. of soil immediately after application.
	+ butylate (<i>Sutan Plus</i> or <i>Genate Plus</i>)	+ 4	1.9 lb 90% DF + 4¾ pt	— No residue carryover. — Can be used where residue problems have existed with atrazine. — Increase <i>Sutan Plus</i> or <i>Genate Plus</i> rate to 6 pt for more effective nutsedge control. — Both materials weak on pigweed.
Nutsedge	cyanazine (<i>Bladex</i>)	1%	2½ lb 80W or 1¾ qt 4L	— No residue carryover. — Can be used where residue problems have existed with atrazine.
	+ alachlor (<i>Lasso</i>)	+ 2½	1.9 lb 90% DF + 2½ qt	
	cyanazine (<i>Bladex</i>)	1%	2½ lb 80W or 1¾ qt 4L	— No residue carryover. — Can be used where residue problems have existed with atrazine.
	+ metolachlor (<i>Dual</i>)	+ 2	1.9 lb 90% DF + 1 qt	
	atrazine (commercial product)	½	% lb 80W or ½ qt 4L	— NOTE SPECIFIC REMARKS ABOVE FOR <i>SUTAN PLUS, ERADICANE EXTRA, DUAL AND LASSO</i> . — Can be used to reduce possibility of atrazine carry-over. — May substitute <i>Princep</i> for atrazine if fall panicum is a severe problem.
	+ cyanazine (<i>Bladex</i>)	+ 1	% lb 90% WDG + 1¾ lb 80W or 1 qt 4L	— <i>Eradicane Extra</i> is also available and should be used at the rate of 5 pt per acre.
	+ butylate (<i>Sutan Plus</i> or <i>Genate Plus</i>) or EPTC with protectant (<i>Eradicane</i>) or metolachlor (<i>Dual</i>) or alachlor (<i>Lasso</i>)	+ 4 or 4 or 2 or 2½	1.1 lb 90% DF + 4¾ pt or 5 pt or 1 qt or 2½ qt	

Preemergence — Mineral Soil

Annual broadleaves Annual grasses (including fall panicum, green foxtail, giant fox- tail, witchgrass and crab- grass)	atrazine (commercial product)	1	1½ lb 80W or 1 qt 4L	— 2½ qt per acre of <i>Lasso</i> should be used for more ef- fective fall panicum control. — <i>Bladex</i> may be included for more effective fall panicum control. (See remarks for three-way tank mixes, pg. 14.)
	+ alachlor (<i>Lasso</i>)	2	1.1 lb 90% WDG + 2 qt	
	atrazine (commercial product)	1	1½ lb 80W or 1 qt 4L	— <i>Bladex</i> may be included for more effective fall panicum control. (See remarks for three-way tank mixes, pg. 14.)
	+ metolachlor (<i>Dual</i>)	2	1.1 lb 90% WDG + 1 qt	
	atrazine (commercial product)	1	1½ lb 80W or 1 qt 4L	— DO NOT INCORPORATE. — Do not use on sandy soils with less than 1.5% organic matter.
	+ pendimethalin (<i>Prowl</i>)	1½	1.1 lb 90% WDG + 1½ qt	— <i>Bladex</i> may be included for more effective fall panicum control. (See remarks for three-way tank mixes, pg. 14.) — Do not use for no-till corn.
Annual broadleaves Annual grasses (including fall panicum, green foxtail, giant fox- tail, witchgrass and crab- grass)	cyazazine (<i>Bladex</i>)	1½	1.9 lb 80W or 1½ qt 4L	— No residue carry-over. — Can be used where residue problems have existed with atrazine.
	+ alachlor (<i>Lasso</i>)	2	1.7 lb 90% DF + 2 qt	
	cyazazine (<i>Bladex</i>)	1½	1.9 lb 80W or 1½ qt 4L	— No residue carry-over. — Can be used where residue problems have existed with atrazine.
	+ metolachlor (<i>Dual</i>)	2	1.7 lb 90% DF + 1 qt	
	cyazazine (<i>Bladex</i>)	1½	1.9 lb 80W or 1½ qt 4L	— Do not use on sandy soils with less than 1.5% organic matter.
	+ pendimethalin (<i>Prowl</i>)	1½	1.7 lb 90% DF + 1½ qt	— Both materials weak on pigweed. — Do not use for no-till corn.

CORN — Preemergence — Mineral Soil (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)	2	2½ lb 80W or 2 qt 4L or 2½ lb 90% WDG	— Usually obtain season-long control. — Do not plant small grain, small seeded forages, sugar beets, field beans or vegetable crops the year following this treatment. — Rates of 2½ to 3 lb per acre may be necessary on soils high in organic matter (5 to 8%). — Residues more likely to persist if soil conditions are cool and dry.
Annual broadleaves Annual grasses (including fall panicum, green foxtail, giant foxtail, witchgrass and crabgrass)	atrazine (commercial product) + cyanazine (<i>Bladex</i>) + alachlor (<i>Lasso</i>) or pendimethalin (<i>Prowl</i>) or metolachlor (<i>Dual</i>)	½ + 1 + 2 or 1½ or 2	% lb 80W or ½ qt 4L or % lb 90% WDG + 1½ lb 80W or 1 qt 4L or 1.1 lb 90% DF + 2 qt or 1½ qt or 1 qt	— Can be used to reduce possibility of atrazine carry-over. — See specific remarks for <i>Lasso</i> , <i>Dual</i> and <i>Prowl</i> in combination with atrazine. — May substitute <i>Princep</i> for atrazine if fall panicum is a severe problem.
Annual grasses (including fall panicum, green foxtail, giant foxtail, witchgrass and crabgrass) Pigweed	alachlor (<i>Lasso</i>) metolachlor (<i>Dual</i>)	2 2	2 qt 1 qt	— 2½ qt of <i>Lasso</i> should be used for more effective fall panicum control. — Follow with 2,4-D amine or <i>Banvel</i> postemergence for control of annual broadleaved weeds if needed. — Application may be made preplant. — (See remarks under "Nutsedge control.") — See 2,4-D amine and <i>Banvel</i> remarks under Postemergence—Mineral Soils section.
	metolachlor (<i>Dual</i>)	2	1 qt	— 2½ pt of <i>Dual</i> should be used for more effective fall panicum control. — Follow with 2,4-D amine or <i>Banvel</i> postemergence for control of annual broadleaved weeds if needed. — Application may be made preplant. — (See remarks under "Nutsedge control.") — See 2,4-D amine and <i>Banvel</i> remarks under Postemergence—Mineral Soils section.

Postemergence — Mineral Soils

- For corn over 6 to 8 in. use drop nozzles.
- Ester formulations will cause more crop injury and are not recommended.
- Oil soluble amines of 2,4-D (*Dacamine*, *Weedar E-3*) are available and are used at lower rates.
- Drift control additives can be used with some 2,4-D amine products to reduce danger of drift. Check the product label.

- Remarks and Limitations
- Not effective on smartweed or wild buckwheat.
 - Hybrids vary in tolerance.
 - Most effective when weeds are small (2-4 in.).

- Annual broadleaves only
- 2,4-D amine
- 1 pt
- 1/2

Annual broadleaves
Annual grasses

2

2 1/2 lb 80W
or
2.2 lb 90% DF

2

cyazine
(*Bladex*)

- USE WETTABLE POWDER OR DRY FLOWABLE ONLY.
- Apply before weeds are 1 1/2 in. tall.
- Apply before corn is 4 in. tall.
- Some temporary setback or stunting of corn may occur, especially in sandy soil.
- Do not use with crop oils, additives, or liquid herbicides as severe crop injury may occur.

ametryne
(*Evik*)
+
surfactant

1%

+

1/2%

2 lb

+

1/2%

- CAUTION—KEEP OFF CORN FOLIAGE.
- Do not use before corn is 12 inches tall.
- Emergency use.
- Use drop nozzles or directed spray.
- See label for maximum weed size. Selectivity is based on tall corn and small weeds.

linuron
(*Lorox* or *Linex*)
+
surfactant

1

+

1/2%

2 lb 50W
or
2 pt 4L
or
2 lb 50% DF

+

1/2%

- CAUTION—KEEP OFF CORN FOLIAGE.
- Do not use before corn is 15 inches tall.
- Emergency use.
- Use directed spray.
- Use lower rates on lighter soils low in organic matter or clay.
- For control of small weeds not over 2 in. tall. Selectivity is based on tall corn and small weeds.

Annual broadleaves
Annual grasses
(except green foxtail,
giant foxtail, fall panicum,
witchgrass and crabgrass)

2

+

1 qt

2 1/2 lb 80W
or
2 qt 4L
or
2 1/2 lb 90% WDG

+

1 qt

atrazine
(commercial product)
+
crop oil concentrate

- Emergency use.
- Grasses must be less than 1 1/2 in. tall.
- Timing of application is critical to get best results.
- Surfactants at 1 pt per A may be used in place of crop oil concentrate but are somewhat less effective.
- Greater chance for residue since treatment is later in season.
- Do not add *Banvel* or 2,4-D as injury may occur.
- Corn injury is possible during stress conditions (cold, wet, cloudy weather) or if the corn is succulent from recent rainfall.

Annual broadleaves
(including velvetleaf,
cocklebur, and jimson-weed)

1

+

1 qt

1 qt

bentazon
(*Basagran*)
+
crop oil concentrate

- Use a minimum of 40 psi and 20 gal/A of water.
- Weak on pigweed, nightshade, and lambsquarters.
- Controls specify broadleaves. See label.
- Corn is tolerant to *Basagran* at all growth stages. However, best results are obtained with early applications to small weeds.

CORN — Postemergence — Mineral Soil (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	bentazon (<i>Basagran</i>) + atrazine	¾ + ¾	¾ qt + 0.9 lb 80W or ¾ qt 4L or 0.8 lb 90% WDG	— Gives better control of some broadleaf weeds, especially pigweed, than <i>Basagran</i> alone. — Combination reduces carryover from postemergence application of atrazine. — Corn injury is possible during stress conditions (cold, wet, cloudy weather) or if the corn is succulent from recent rainfall.
	+ crop oil concentrate	+ 1 qt	+ 1 qt	
Nutsedge Canada thistle	bentazon (<i>Basagran</i>) + crop oil concentrate	¾ + ¾ See Remarks + 1 qt + 1 qt	1½ pt + 1½ pt + 1 qt + 1 qt	— TWO APPLICATIONS REQUIRED FOR BEST NUTSEDGE AND CANADA THISTLE CONTROL. — Increase <i>Basagran</i> rate to 1 qt per acre for each application for more effective Canada thistle control. — Controls only specific broadleaves. — Check label for specific rate at proper weed growth stage. — Treat when nutsedge is 4 to 6 in. and again 10 days later. — Use a minimum of 40 psi and 20 gal/A of water. Do not use flood nozzles.
Velvetleaf, jimsonweed, smartweed, wild buck- wheat, Canada thistle	dicamba (<i>Banvel</i>)	½	1 pt	— USE FOR CORN 5 IN. OR LESS TALL. FOR CORN OVER 5 IN., REDUCE RATE TO ½ PT PER ACRE. — USE EXTREME CAUTION. DRIFT TO NEARBY SENSITIVE CROPS IS A HAZARD. — A less volatile form of <i>Banvel</i> (<i>Banvel II</i>) is available and should be used if drift to sensitive crops is possible. <i>Banvel II</i> is one-half the concentration of <i>Banvel</i> . Use twice the amount of <i>Banvel II</i> as <i>Banvel</i> for equivalent rates. — For corn over 6 to 8 in. use drop nozzles.
				— USE FOR CORN 5 IN. OR LESS TALL. FOR CORN OVER 5 IN., REDUCE RATE TO ½ PT PER ACRE. — USE EXTREME CAUTION. DRIFT TO NEARBY SENSITIVE CROPS IS A HAZARD. — A less volatile form of <i>Banvel</i> (<i>Banvel II</i>) is available and should be used if drift to sensitive crops is possible. <i>Banvel II</i> is one-half the concentration of <i>Banvel</i> . Use twice the amount of <i>Banvel II</i> as <i>Banvel</i> for equivalent rates. — For corn over 6 to 8 in. use drop nozzles.
Annual broadleaves	bromoxynil (<i>Buctril</i>) or (<i>ME-4 Brominal</i>)	% or %	1½ pt or ¾ pt	— Apply to weeds less than 4 in. tall for effective control. — Do not mix with spray additives or liquid fertilizers. — For ground application, use minimum of 20 gal water per acre and 30 psi. — Apply before corn exceeds either the 8-leaf stage or 12 in. On larger corn use drop nozzles. — Redroot pigweed and mustard must be controlled when very small (refer to label for details).
Annual grasses	propachlor (<i>Ramrod</i>)	5	8 lb (65% WP)	— Must follow with a postemergence treatment for control of broadleaved weeds.

Preemergence — Organic Soils

Postemergence — Organic Soils

Annual broadleaves Annual grasses (except fall panicum, green foxtail, giant fox- tail, witchgrass and crab- grass)	atrazine (commercial product)	3	3% lb 80W or 3 qt 4L or 3½ lb 90% WDG + 1 qt	— Emergency use. — Grasses should be less than 1½ in. tall. — Timing of application is critical to get best results. — Surfactants at 1 pt per A may be used in place of crop oil concentrate but are somewhat less effective. — Greater chance for residue since treatment is later in season. — Corn injury is possible during stress conditions (cold, wet, cloudy weather) or if the corn is succulent from recent rainfall.
Annual broadleaves Annual grass	ametryne (Evik) + surfactant	1% + ½ %	2 lbs + ½ %	— CAUTION—KEEP OFF CORN FOLIAGE. — Do not use before corn is 12 in. tall. — Emergency use. — Use drop nozzles or directed spray. — See label for maximum weed size. Selectivity is based on tall corn and small weeds.
	linuron (Lorox or Linex) + surfactant	1½ + ½ %	3 lb 50W or 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 directed spray. — Use lower rates on lighter soils or soils low in organic matter. — For control of small weeds not over 2 in. tall. Selectivity is based on tall corn and small weeds.
Annual broadleaves	2,4-D amine	½	1 pt	— For corn over 6 to 8 in., use drop nozzles. — Ester formulations will cause more corn injury and are not recommended. — Oil soluble amines of 2,4-D (<i>Dacamine</i> , <i>Emulsamine</i>) are available and are used at lower rates. — Drift control additives can be used with some 2,4-D amine products to reduce danger of drift. Check the product label. — Not effective on smartweed or wild buckwheat. — Hybrids vary in tolerance.
Velvetleaf, jimsonweed, smartweed, wild buck- wheat, Canada thistle	dicamba (Banvel)	½ lb	1 pt	— USE FOR CORN 5 IN. OR LESS TALL. FOR CORN OVER 5 IN., REDUCE RATE TO ½ PT PER ACRE. — USE EXTREME CAUTION. — DRIFT TO NEARBY SENSITIVE CROPS IS A HAZARD. — A less volatile form of <i>Banvel II</i> is available and should be used if drift to sensitive crops is possible. <i>Banvel II</i> is one-half the concentration of <i>Banvel</i> . Use twice the amount of <i>Banvel II</i> as <i>Banvel</i> for equivalent rates. — For corn over 6 to 8 in., use drop nozzles.
Remarks and Limitations				
— Use pressure less 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 drift danger. — Volatility drift is increased at temperatures above 85° F. — Lower rates should be used on coarser soils or soils low in organic matter.				

CORN — Postemergence — Organic Soil (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Nutsedge Canada thistle	bentazon (<i>Basagran</i>) + crop oil concentrate	% + % See Remarks + 1 qt + 1 qt	1½ pt + 1½ pt + 1 qt + 1 qt	— TWO APPLICATIONS REQUIRED FOR BEST NUTSEDGE AND CANADA THISTLE CONTROL. — Increase rate to 1 qt per acre for each application for more effective Canada thistle control. — Controls only specific broadleaves. — Check label for specific rate at proper weed growth stage. — Treat when nutsedge is 4 to 6 in. and again 10 days later. — Use a minimum of 40 psi and 20 gal/A of water. Do not use flood nozzles.
Annual broadleaves (including velvetleaf, cocklebur, and jimson- weed)	bentazon (<i>Basagran</i>) + crop oil concentrate	1 + 1 qt	1 qt + 1 qt	— Use a minimum of 40 psi and 20 gal/A of water. — Weak on pigweed, nightshade, and lambsquarters. — Controls specific broadleaves. See label. — Corn is tolerant to <i>Basagran</i> at all growth stages. However, best results are obtained with early applications to small weeds.
Annual broadleaves	bentazon (<i>Basagran</i>) + atrazine	% + %	% qt + 0.9 lb 80W or ¾ qt 4L or 0.8 lb 90% WDG + 1 qt	— Gives better control of some broadleaf weeds, especially pigweed, than <i>Basagran</i> alone. — Combination reduces carryover from postemergence application of atrazine. — Corn injury is possible during stress conditions (cold, wet, cloudy weather) or if the corn is succulent from recent rainfall.
Annual broadleaves	crop oil concentrate + bromoxynil (<i>Buctril</i>) or (<i>ME-4 Brominal</i>)	+ 1 qt %	+ 1 qt 1½ pt or ¾ pt	— Apply to weeds less than 4 in. tall for effective control. — Do not mix with spray additives or liquid fertilizers. — For ground application, use minimum of 20 gal water per acre and 30 psi. — Apply before corn exceeds either the 8-leaf stage or 12 in. On larger corn use drop nozzles. — Redroot pigweed and mustard must be controlled when very small (refer to label for details).
Quackgrass	atrazine (commercial product)	4	5 lb 80W or 4 qt 4L or 4% lb 90% WDG	— When stand of quackgrass is heavy, apply in fall. Otherwise apply in spring before plowing when quackgrass is 4 to 8 in. tall. — Wait at least 10 days to plow. — Split application; apply 2 lb per acre preplow and 2 lb per acre preemergence to give control of annual weeds also. — When a total of 4 lb of atrazine is used, carryover may persist 2 to 3 years.

Quackgrass

atrazine (commercial product)	1	1½ lb 80W or 1 qt 4L or 1.1 lb 90% WDG + 3½ qt	<ul style="list-style-type: none"> — Incorporate to a depth of 4 to 5 in. immediately after application with a disk, 2 times in opposite directions. — Quackgrass control with minimum soil residue or carryover. — <i>Eradicane Extra</i> is also available and should be used at the rate of 4 qt per acre.
+ EPTC with protectant (<i>Eradicane</i>)	+ 6		
atrazine (commercial product)	2	2½ lb 80W or 2 qt 4L or 2½ lb 90% WDG + 1 qt	<ul style="list-style-type: none"> — Postemergence. Apply when quackgrass is 2 to 4 in. tall. — A second application may be needed 2-3 weeks later for more complete control. — Increase rate to 3 lb per acre active ingredient for heavy infestations. — When a total of 4 lb of atrazine is used, carryover may persist 2 to 3 years. — Corn injury is possible during stress conditions (cold, wet, cloudy weather) or if the corn is succulent from recent rainfall.
+ crop oil concentrate	+ 1 qt		

glyphosate (<i>Roundup</i>)	1½	2 qt	<ul style="list-style-type: none"> — Before planting in the spring or as a fall treatment. — Apply to actively growing quackgrass at least 8 in. tall. — Use 15 to 20 gal water per acre. — No soil residue. — Can plow or till 3 days after application and plant crop. — Do not plow or till prior to treatment. — <i>Roundup</i> rate of 1 qt may be used for <i>single season</i> quackgrass control. Apply 1 qt in 5-10 gal water per acre with 0.5% nonionic surfactant. This treatment is less effective on an undisturbed quackgrass sod.
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Nutsedge

Nutsedge butylate (<i>Sutan Plus</i> or <i>Genate Plus</i>)	5	3 qt	<ul style="list-style-type: none"> — Preplant incorporated to a depth of 2 to 3 in. — Control of annual grasses. — Combine or follow with another herbicide (see Preplant-Mineral Soil and Postemergence Mineral Soil Sections) for additional broadleaf weed control.
alachlor (<i>Lasso</i>)	3	3 qt	<ul style="list-style-type: none"> — Preplant incorporated to a depth of 2 to 3 in. for consistent nutsedge control. — Control of annual grasses. — Combine or follow with another herbicide (see Preplant-Mineral Soil and Postemergence-Mineral Soil sections) for additional broadleaf weed control.
metolachlor (<i>Dual</i>)	2½	1½ qt	<ul style="list-style-type: none"> — Preplant incorporated to a depth of 2 to 3 in. for consistent nutsedge control. — Control of annual grasses. — Follow with 2,4-D amine or <i>Banvel</i> (see Postemergence-Mineral Soil section) for additional broadleaf weed control.

CORN (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
	bentazon (<i>Basagran</i>) + crop oil concentrate	% + % + 1 qt + 1 qt	1 ½ pt + 1 ½ pt + 1 qt + 1 qt	— Postemergence application. — Two applications required for best nutsedge control. — Controls some broadleaves also. Check label. — Treat when nutsedge is 4 to 6 in. tall and again 10 days later. — Use a minimum of 40 psi and 20 gal/A of water. Do not use flood nozzles.
	atrazine (commercial product) + crop oil concentrate	2 + 2 + 1 qt + 1 qt	2 ½ 80W or 2 qt 4L or 2 ½ lb 90% WDG + 1 qt	— Apply 2 lb of atrazine per acre when nutsedge is 2 in. tall, and apply 2 lb atrazine 2 weeks later. On muck soils, apply 2 lb of atrazine per acre when the nutsedge is 2 in. tall, then apply 1 lb of atrazine per acre 1 and 2 weeks following the initial treatment. — Surfactants at 1 pt per acre may be used in place of crop oil concentrate but are somewhat less effective. — Corn injury is possible during stress conditions (cold, wet, cloudy weather) or if the corn is succulent from recent rainfall. — High atrazine carryover on mineral soils.

Hemp Dogbane

dicamba (<i>Banvel</i>) + 2,4-D ester	¼ + 1	½ pt + 1 qt	— <i>Preharvest</i> treatment. Apply after corn has reached the brown silk stage (R4) and all soybeans in the vicinity are <i>fully podded</i> with leaves turning yellow (R7). — Do not apply before September 1. — USE EXTREME CAUTION. DRIFT TO NEARBY CROPS IS A HAZARD. — Do not harvest for 7 days after application. — Do not graze or feed fodder from treated areas for 35 days after application. — This treatment is most effective when hemp dogbane is green and the underground rhizomes have swollen pink buds. — May require two years for complete control. — Treatment may be made by ground or aerial application.
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No-Till Alfalfa Sod

(Predominantly alfalfa with broadleaf weeds and some grasses such as timothy, bromegrass and annual weeds)

Alfalfa sod	1 1/4	1 1/4 qt	— Apply 2,4-D 7-10 days before planting.
Annual broadleaves			— Alfalfa should be at least 4 in. tall at treatment time.
Annual grasses (except green foxtail, giant foxtail, fall panicum, witchgrass, crabgrass, and sandbur)	2	2 1/2 lb 80W or 2 qt 4L or 2 1/2 lb 90% WDC	— Apply atrazine and paraquat or Roundup at planting time.
	+	+	— Use 1/2 pt X77 or similar non-ionic surfactant per 100 gal of spray when using paraquat. Double surfactant rate when using liquid N or liquid fertilizer.
	1/2	1 qt	— Use 20-60 gal spray/acre with paraquat and 20-30 gal spray/acre with Roundup.
	or	or	— Paraquat provides quicker burndown. Roundup may provide better control if sod growth is dense.
	1 1/2	1 1/2 qt	— Postemergence Banvel or 2,4-D (see sections above) may be needed to control alfalfa escapes.
			— Do not use paraquat with suspension or high phosphate carriers.

— Follow mixing directions for paraquat or Roundup.
— In a mixed alfalfa-quackgrass sod, an additional 2 lb per acre of atrazine may be applied at planting time, or with 1 qt per acre of crop oil concentrate with the 2,4-D ester or later as a postemergence treatment.
— Quackgrass is usually not at the proper stage of growth (8 in. tall) for maximum effectiveness from Roundup treatment at corn planting. (See "Quackgrass" section for notes on Roundup use.)
— Lasso or Dual may be included if annual grasses are expected to be a serious problem.

Grass Sod

(Predominant species bluegrass, timothy, orchardgrass, bromegrass, or tall fescue, Not quackgrass)

Grass sod	3	3 3/4 lb 80W	— Apply at planting time.
Annual broadleaves		or	— Use 1/2 pt X77 or similar non-ionic surfactant per 100 gal of spray when using paraquat. Double surfactant rate when liquid N or liquid fertilizer.
Annual grasses (except green foxtail, giant foxtail, fall panicum, witchgrass, crabgrass, and sandbur)	+	3 qt 4L or 3 1/2 lb 90% WDC	— Use 20-60 gal spray/acre with paraquat and 20-30 gal spray/acre with Roundup.
	1/2	1 qt	— Paraquat provides quicker burndown. Roundup may provide better control if sod growth is dense.
	or	or	— Do not use paraquat with suspension or high phosphate carriers.
	1 1/2	1 1/2 qt	— Follow mixing directions for paraquat or Roundup.
			— Lasso or Dual may be included if annual grasses are expected to be a serious problem.

CORN (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
<p>Quackgrass Annual broadleaves Annual grasses (except green foxtail, giant foxtail, fall pani- cum, witchgrass, crab- grass, and sandbur)</p>	<p>atrazine (commercial product) + crop oil concentrate</p>	<p>2 + 1 qt</p>	<p>Quackgrass Sod 2½ lb 80W or 2 qt 4L or 2½ lb 90% WDG + 1 qt</p>	<p>— Apply atrazine plus crop oil when quackgrass has started growth in spring, 7-10 days before planting. Make second application at planting. — High rate of atrazine (4 lb ai/A) will provide some additional annual grass control. — Quackgrass is usually not at the proper stage of growth (8 in. tall) for maximum effectiveness from <i>Roundup</i> treatment at corn planting. (See "Quackgrass" section for notes on <i>Roundup</i> use.) — When 4 lb of atrazine are used, carryover may persist 2 to 3 years.</p>
	<p>FOLLOWED BY: atrazine</p>	<p>2</p>	<p>2½ lb 80W or 2 qt 4L or 2½ lb 90% WDG + 1 qt</p>	<p>— See notes above for paraquat or <i>Roundup</i> use. — 2,4-D ester (1 lb ai/A or 1 qt/A) may be added to initial application of atrazine plus crop oil concentrate for perennial broadleaf weed suppression. — Lasso or Dual may be included if annual grasses are expected to be a serious problem.</p>
	<p>+ paraquat (<i>Paraquat, Gramoxone</i>) or glyphosate (<i>Roundup</i>)</p>	<p>+ ½ or 1 ½</p>	<p>or 1 ½ qt</p>	
	<p>atrazine (commercial product)</p>	<p>4</p>	<p>5 lb 80W or 4 qt 4L or 4½ lb 90% DWG + 1 qt</p>	<p>— Apply at planting time. — Atrazine carryover may persist 2 to 3 years. — See notes above for paraquat and <i>Roundup</i> use. — Lasso or Dual may be included if annual grasses are expected to be a serious problem.</p>
	<p>+ paraquat (<i>Paraquat, Gramoxone</i>) or glyphosate (<i>Roundup</i>)</p>	<p>+ ½ or 1 ½</p>	<p>or 1 ½ qt</p>	

CORN — Grain Stubble (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves Annual grasses	atrazine (commercial product)	¾	1 lb 80W or ¾ qt 4L	— Applied preemergence. — Reduces potential atrazine carryover. — May substitute <i>Princep</i> for atrazine if fall panicum is a severe problem.
	+ cyanazine (<i>Bladex</i>)	+ 1½	¾ bl 90% WDG + 2 lb 80W or 1½ qt 4L	— See notes above for paraquat or <i>Roundup</i> use. — Follow paraquat or <i>Roundup</i> mixing directions. — Prepackaged mixes of atrazine + <i>Lasso</i> or <i>Roundup</i> + <i>Lasso</i> (<i>Bronco</i>) are available.
	+ alachlor (<i>Lasso</i>) + paraquat (<i>Paraquat, Gramoxone</i>) or glyphosate (<i>Roundup</i>)	+ 2½ + ½ or 1½	1.7 lb 90% DF + 2½ qt + 1 qt or 1½ qt	— Where no cover crop is present and annual weeds are small, the rate of paraquat may be reduced to 1 pt per acre or the rate of <i>Roundup</i> may be reduced to 1 qt per acre or less. (See Label.) — Bladex rate varies depending on surface residue and soil type (refer to Bladex label for details).
	atrazine (commercial product)	¾	1 lb 80W or ¾ qt 4L or ¾ lb 90% WDG + 2 lb 80W or 1½ qt 4L or 1.7 lb 90% DF + 1 qt	— Applied preemergence. — Reduces potential atrazine carryover. — May substitute <i>Princep</i> for atrazine if fall panicum is a severe problem.
	+ cyanazine (<i>Bladex</i>)	+ 1½	¾ lb 90% WDG + 2 lb 80W or 1½ qt 4L or 1.7 lb 90% DF + 1 qt	— See notes above for paraquat or <i>Roundup</i> use. — Follow paraquat or <i>Roundup</i> mixing directions. — A prepackaged mix of atrazine + <i>Dual</i> (<i>Bicep</i>) is available.
	+ metolachlor (<i>Dual</i>) + paraquat (<i>Paraquat, Gramoxone</i>) or glyphosate (<i>Roundup</i>)	+ 2 + ½ or 1½	1 qt + 1 qt or 1½ qt	— Where no cover crop is present and annual weeds are small, the rate of paraquat may be reduced to 1 pt per acre or the rate of <i>Roundup</i> may be reduced to 1 qt per acre or less (See Label.) — Bladex rate varies depending on surface residue and soil type (refer to Bladex label for details).
	cyanazine (<i>Bladex</i>) + alachlor (<i>Lasso</i>) or metolachlor (<i>Dual</i>) + crop oil concentrate	2.2 + 2½ or 2 + 1 qt	2.2 qt 4L + 2½ qt or 1 qt + 1 qt	— Applied preemergence. — Use Bladex 4L only. — For small annual weeds no more than 3 in. in height, Bladex 4L rate must be reduced on sandy soils or soils with less than 3% organic matter to avoid injury. — Use a minimum of 25 gal of spray/acre. — 28% liquid nitrogen used as the herbicide carrier will add to the effectiveness of the treatment for burn-

down. When this carrier is used, substitute 1/2% surfactant for crop oil concentrate.
 -2,4-D ester (1/2 lb/A or 1 pt/A) may be included if perennials are present.

-Applied preemergence.
 -Use Bladex 4L only.
 -For small annual weeds no more than 3 in. in height.
 -Bladex 4L rate must be reduced on sandy soils or soils with less than 3% organic matter to avoid injury.
 -Use a minimum of 25 gal of spray/acre.
 -28% liquid nitrogen used as the herbicide carrier will add to the effectiveness of the treatment for burn-down. When this carrier is used, substitute 1/2% surfactant for crop oil concentrate.
 -2,4-D ester (1/2 lb/A or 1 pt/A) may be included if perennials are present.

cyazine (Bladex)	1 1/2	1 1/2 qt 4L
+ atrazine (commercial product)	+	+
+ alachlor (Lasso)	1/2	1/2 qt 4L
or metolachlor (Dual)	+	+
+ crop oil concentrate	2 1/2	2 1/2 qt
	or	or
	2	1 qt
	+	+
	1 qt	1 qt

WEED CONTROL GUIDE FOR SOYBEANS Preplant

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses Annual broadleaves Nutsedge	metribuzin (Lexone or Sencor)	%	1/2 lb 50W or % pt 4L	- Some control of jimsonweed, velvetleaf and cocklebur. - Reduce metribuzin rate if soil pH is above 7.0. - If soil pH is 7.4 or above, do not apply metribuzin. - Note label for rotational crop restrictions.
	+ alachlor (Lasso or Micro-Tech Lasso)	+	1/2 lb 75% DF +	- Lasso rate should be increased to 3 qt per acre and Dual to 2 1/2 pt per acre for effective nutsedge control.
	or metolachlor (Dual)	2	2 qt	
		or	or	
		2	2 pt	
Annual grasses Annual broadleaves (including nightshade) Nutsedge	chloramben (Ambiben)	2	1 gal 2L or 2 1/2 lb 75% DS	- Lasso rate should be increased to 3 qt per acre and Dual to 2 1/2 pt per acre for effective nutsedge control.
	+ alachlor (Lasso or Micro-Tech Lasso)	+	+	
	or metolachlor (Dual)	2	2 qt	
		or	or	
		2	2 pt	
Annual grasses	trifluralin (Treflan)	%	1 1/2 pt	- Incorporate or mix thoroughly into top 2 or 3 in. of soil within 24 hr after application. - On sandy and sandy loam soils low in organic matter, use 1/2 lb (1 pt) per acre. - Most effective control if application is made 10 days to 2 weeks ahead of planting and field reworked just prior to planting.

SOYBEANS — Preplant (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
	pendimethalin (<i>Prowl</i>)	1	2 pt	— Incorporate in top 2 to 3 in. — Incorporate within 168 hr (7 days) unless rainfall occurs ($\frac{1}{4}$ to $\frac{1}{2}$ in.).
	ethalfuralin (<i>Sonalan</i>)	0.9	2½ pt	— Incorporate in top 2-3 in. — Incorporate within 2 days of application.
Annual grasses Annual broadleaves (except nightshade)	Combine any of the above dinitroanilines (<i>Treflan</i> , <i>Sonalan</i> , or <i>Prowl</i>) with metribuzin (<i>Lexone</i> or <i>Sencor</i>)	%	¾ lb 50W or ¾ pt 4L or ¼ lb 75% DF	— Some control of jimsonweed, velvetleaf and cocklebur. — See specific remarks for each dinitroaniline herbicide. — Reduce rate if soil pH is above 7.0. — If soil pH is 7.4 or above, do not apply metribuzin. — Note label for rotational crop restrictions.
Annual grasses Annual broadleaves (including nightshade)	Combine any of the above dinitroanilines (<i>Treflan</i> , <i>Sonalan</i> , or <i>Prowl</i>) with chloramben (<i>Amiben</i>)	2	1 gal 2L or 2½ lb 75% DS	— See specific remarks for each dinitroaniline herbicide. — Increased mustard and ragweed control over dinitroaniline alone.

Preplant Followed by Preemergence

Annual broadleaves Annual grasses	<i>Dinitroanilines</i> (<i>Treflan</i> , <i>Sonalan</i> , or <i>Prowl</i>) as listed above applied preplant incorporated FOLLOWED BY: chloramben (<i>Amiben</i>)	2	1 gal 2L or 2½ lb 75% DS	— Applied preemergence.
	dinoseb (<i>Premerge</i>)	4½	1½ gal	— Applied preemergence.
	metribuzin (<i>Lexone</i> or <i>Sencor</i>)	%	¾ lb 50W or ¾ pt 4L or ¼ lb 75% DF	— Applied preemergence. — Some control of jimsonweed and cocklebur. — Reduce rate if soil pH is above 7.0. — If soil pH is 7.4 or above, do not apply metribuzin. — Note label for rotational crop restrictions.
	linuron (<i>Lorox</i> or <i>Linex</i>)	¾	1½ lb 50W or ¾ qt 4L or 1½ lb 50% DF	— Applied preemergence. — If heavy rainfall occurs soon after application, injury to crop may result.

Preemergence

Annual broadleaves Annual grasses	chloramben (<i>Amiben</i>)	3	1½ gal 2L or 3.6 lb 75% DS	— May be necessary to rotary hoe if rainfall does not occur within 4 to 5 days after application.
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linuron
(*Lorox* or *Linex*)

+
alachlor
(*Lasso* or *Micro-Tech Lasso*)

or
metolachlor
(*Dual*)

¼
1½ lb 50W
or
¾ qt 4L
or
1½ lb 50% DF
+
2 qt
or
2 pt

2
+
2
or
2

chloramben
(*Amiben*)

+
alachlor
(*Lasso* or *Micro-Tech Lasso*)

or
metolachlor
(*Dual*)

2
1 gal 2L
or
2½ lb 75% DS
+
2 qt
or
2 pt

2
+
2
or
2

metribuzin
(*Lexone* or *Sencor*)

+
alachlor
(*Lasso* or *Micro-Tech Lasso*)

or
metolachlor
(*Dual*)

¼ lb 50W
or
¼ pt 4L
or
½ lb 75% DF
+
2 qt
or
2 pt

2
+
2
or
2

alachlor
(*Lasso* or *Micro-Tech Lasso*)

or
metolachlor
(*Dual*)

+
naptalam + dimoseb
(*Dyanap*)

2 qt
2 qt
or
1 qt
+
6 qt

2
or
2
+
6 qt

acifluorfen
(*Blazer 2L*)

+
surfactant

½
1 qt
+
⅛ %

½
+
⅛ %

Postemergence

Annual broadleaves
(including nightshade,
pigweed and jimson-
weed)

— Use a minimum of 40 psi and 20 gal per acre of water.
Do not use flood nozzles.
— Increased crop injury may occur with the addition of a surfactant to *Blazer 2L*.
— Weak on velvetleaf and cocklebur.
— Delay 7 days between *Blazer* use and *Hoelon* treatment.

SOYBEANS — Postemergence

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves (including cocklebur, velvetleaf and jimsonweed)	bentazon (<i>Basagran</i>)	1	1 qt	— Use a minimum of 40 psi and 20 gal/A of water. Do not use flood nozzles.
	+	+	+	— No activity from <i>Basagran</i> preemergence.
	crop oil concentrate	1 qt	1 qt	— Weak on pigweed, nightshade, and lambsquarters. — Delay 7 days between <i>Basagran</i> use and <i>Hoelon</i> treatment.
Annual broadleaves	acifluorfen (<i>Blazer 2L</i>)	¼	1 pt	— Use a minimum of 40 psi and 20 gal per acre of water.
	+	+	+	— Do not apply if soybeans are under stress from herbicide injury, cold or dry weather, or hail damage.
	bentazon (<i>Basagran</i>)	¾	1½ pt	— Most effective on small weeds. See label.
	+	+	+	— Increased crop injury may occur with the addition of crop oil concentrate to <i>Blazer 2L</i> .
Annual grasses Volunteer corn	diclofop (<i>Hoelon</i>)	1	1½ qt	— Note <i>Hoelon</i> is a restricted use herbicide and requires a certified applicator for use.
	+	+	+	— Apply to grasses less than 4 in. tall.
	crop oil concentrate	1 qt	1 qt	— Apply to volunteer corn less than 12 in. tall. — Do not tank mix with other chemicals. — Delay 7 days between <i>Hoelon</i> use and <i>Basagran</i> or <i>Blazer</i> treatment.
Nutsedge Canada thistle	bentazon (<i>Basagran</i>)	¾ + ¾	1½ pt + 1½ pt	— Increase <i>Basagran</i> rate to 1 qt per acre for each application for more effective Canada thistle control.
	+	+	+	— Treat when nutsedge is 4 - 6 in. and again 10 days later.
	crop oil concentrate	1 qt + 1 qt	1 qt + 1 qt	— See nutsedge remarks under Special Weed Problems. — Use a minimum of 40 psi and 20 gal/A of water. Do not use flood nozzles. — Delay 7 days between <i>Basagran</i> use and <i>Hoelon</i> treatment.
Annual grasses Volunteer corn	fluazifop-butyl (<i>Fusilade 2000</i>)	.188	1½ pt	— Use ¾ pt per acre <i>Fusilade 2000</i> or 1¼ pt per acre <i>Poast</i> for volunteer corn.
	+	+	+	— No soil activity from <i>Poast</i> or <i>Fusilade 2000</i> . Controls only grasses present when sprayed.
	crop oil concentrate	1 qt	1 qt	— Treat actively-growing grass up to maximum of 4 inches tall (see labels) or volunteer corn 18 inches tall.
	or sethoxydim (<i>Poast</i>)	0.19	1 pt	— Use a minimum of 5 gal/A water and 40 psi for <i>Poast</i> or <i>Fusilade 2000</i> applications.
	+	+	+	— Avoid drift onto corn, sorghum, small grains, and turf. — Rainfall within 1 hour of application will reduce control. — Does not control nutsedge.

Special Weed Problems

Velvetleaf	trifluralin (<i>Treflan</i>)	¾	1½ pt	— Preplant incorporated.
Cocklebur	or	or	or	— Only fair control.
Jimsonweed	pendimethalin (<i>Prowl</i>)	1	1 qt	— Some soybean injury may occur.
	or	or	or	— Also more effective control of other broadleaved weeds.
				— Reduce metribuzin rate if soil pH is above 7.0.
				— If soil pH is 7.4 or above, do not apply metribuzin.

ethalfuralin (<i>Sonatan</i>)	0.9	2 1/2 pt
or		or
alachlor (<i>Lasso</i> or <i>Micro-Tech Lasso</i>)	2	2 qt
or		or
metolachlor (<i>Dual</i>)	2	1 qt
+		+
chloramben (<i>Amiben</i>)	2	4 qt 2L
+		or
		2 1/2 lb 75% DS
+		+
metribuzin (<i>Lexone</i> or <i>Sencor</i>)	%	3/4 lb 50W
		or
		3/4 pt 4L
		or
		1/2 lb 75% DF

— Follow with postemergence application of *Basagran* or *Blazer* (see sections above) if needed for complete control.

Preplant Incorporated

Velvetleaf
Jimsonweed
Cocklebur

trifluralin (<i>Treflan</i>)	%	1 1/2 pt
or		or
pendimethalin (<i>Proul</i>)	1	1 qt
or		or
alachlor (<i>Lasso</i> or <i>Micro-Tech Lasso</i>)	2	2 qt
or		or
metolachlor (<i>Dual</i>)	2	2 pt
+		+
metribuzin (<i>Lexone</i> or <i>Sencor</i>)	1/4	1/2 lb 50W
		or
		1/2 pt 4L
		or
		1/2 lb 75% DF

— Preplant incorporated tank mix of dimitroaniline or acetanilide plus metribuzin followed by second application of metribuzin preemergence.
— Both metribuzin treatments needed for effective control.
— Some soybean injury may occur.
— Reduce metribuzin rate if soil pH is above 7.0.
— If soil pH is 7.4 or above, do not apply metribuzin.
— May require postemergence application of either *Basagran* or *Blazer* for complete control. See appropriate sections above for particular weed species and use directions.

**FOLLOWED BY:
Preemergence**

metribuzin (<i>Lexone</i> or <i>Sencor</i>)	1/4	1/2 lb 50W
		or
		1/2 pt 4L
		or
		1/2 lb 75% DF
metribuzin (<i>Lexone</i> or <i>Sencor</i>)	%	3/4 lb 50W
		or
		3/4 pt 4L
		or
		1/2 lb 75% DF
+		+
trifluralin (<i>Treflan</i>)	3/4	1 1/2 pt

Preplant Incorporated

Jimsonweed
Velvetleaf
Cocklebur

— Reduce *Lexone* or *Sencor* rate if soil pH is above 7.0.
— Reduce metribuzin rate if soil pH is above 7.0.
— If soil pH is 7.4 or above, do not apply metribuzin.
— WILL REQUIRE POSTEMERGENCE APPLICATION OF EITHER *BASAGRAN* OR *BLAZER* FOR COMPLETE CONTROL. SEE APPROPRIATE SECTIONS ABOVE FOR PARTICULAR WEED SPECIES AND USE DIRECTIONS.

SOYBEANS — Special Weed Problems (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
	or pendimethalin (<i>Prowl</i>)	1	or 1 qt	— See appropriate sections above for directions on <i>Treflan</i> , <i>Prowl</i> , <i>Sonalan</i> , <i>Lasso</i> or <i>Dual</i> , plus metribuzin use. — <i>Lasso</i> & metribuzin or <i>Dual</i> & metribuzin may be applied preemergence.
	or alachlor (<i>Lasso</i> or <i>Micro-Tech Lasso</i>)	2	or 2 qt	
	or metolachlor (<i>Dual</i>)	2	or 1 qt	
FOLLOWED BY: Postemergence	acifluorfen (<i>Blazer 2L</i>) + surfactant	½ + ½ %	1 qt + ½ %	— Increased crop injury may occur with the addition of a surfactant to <i>Blazer 2L</i> . — See <i>Basagran</i> and <i>Blazer 2L</i> remarks under postemergence section.
	or bentazon (<i>Basagran</i>) + crop oil concentrate	or 1 + 1 qt	or 1 qt + 1 qt	
Nutsedge	alachlor (<i>Lasso</i> or <i>Micro-Tech Lasso</i>) or metolachlor (<i>Dual</i>) bentazon (<i>Basagran</i>) + crop oil concentrate	3 or 2½ % + % See Remarks + 1 qt + 1 qt	3 qt or 1½ qt 1½ pt + 1½ pt + 1 qt + 1 qt	— Preplant incorporation to a depth of 2-3 inches. — Some early distortion may be observed on soybean leaves. — Shallow incorporation will improve control under conditions of limited moisture. — TWO ¼-lb APPLICATIONS REQUIRED FOR BEST NUTSEEDGE CONTROL. — Use a minimum of 40 psi and 20 gal/A of water. Do not use flood nozzles. — Postemergence. — Treat when nutsedge is 4 to 6 in. and again 10 days later.
Volunteer corn Weed escapes Perennials	glyphosate (<i>Roundup</i>)	Rate varies, see label and perennial weed control section (pg 52-53)		— Use with rope-wick applicator, wipe-on applicator, or recirculating sprayer.
Quackgrass	fluzifop-butyl (<i>Fusilade 2000</i>) + crop oil concentrate or sethoxydim (<i>Poast</i>) + crop oil concentrate	.188 + .125 + 1 qt + 1 qt or 0.48 + 0.29 + 1 qt + 1 qt	1½ pt + 1 pt + 1 qt + 1 qt or 2½ pt + 1½ pt + 1 qt + 1 qt	— TWO APPLICATIONS ARE NEEDED FOR BEST QUACKGRASS CONTROL. MAKE SECOND APPLICATION 14-21 DAYS FOLLOWING INITIAL TREATMENT. CUTIVATION MAY REPLACE SECOND APPLICATION. — No soil activity from <i>Poast</i> or <i>Fusilade 2000</i> . Controls only grass present when sprayed. — Treat actively growing quackgrass 6-8 in. tall. — Use a minimum of 5 gal/A water and 40 psi for <i>Fusilade 2000</i> or <i>Poast</i> applications. — Avoid drift onto corn, sorghum, small grains, and turf. — Rainfall within one hour of application will reduce control.
			Remarks and Limitations	
				— Addition of other herbicides to tank may reduce quackgrass control.

Preemergence — Organic Soils

Annual grasses	3	chloramben (<i>Amiben</i>)	1 ½ gal 2L	— May require postemergence applications for complete control (see below).
Annual broadleaves	+ 4	+ alachlor (<i>Lasso</i>)	or 3.6 lb 75% DS + 1 gal	

Postemergence — Organic Soils

Annual broadleaves (including nightshade, pigweed, and jimson- weed)	½ + ⅓ %	acifluorfen (<i>Blazer 2L</i>) + surfactant	1 qt + ⅓ %	— Use a minimum of 40 psi and 20 gal per acre of water. Do not use flood nozzles. — Increased crop injury may occur with the addition of a surfactant to <i>Blazer 2L</i> . — Weak on velvetleaf and cocklebur. — Delay 7 days between <i>Blazer</i> use and <i>Hoelon</i> treatment.
Annual broadleaves (including cocklebur, vel- vetleaf and jimsonweed)	1 + 1 qt	bentazon (<i>Basagran</i>) + crop oil concentrate	1 qt + 1 qt	— Weak on pigweed, nightshade, and lambsquarters. — Use a minimum of 40 psi and 20 gal/A water. Do not use flood nozzles. — No activity from <i>Basagran</i> preemergence. — Delay 7 days between <i>Basagran</i> use and <i>Hoelon</i> treatment.
Annual broadleaves	¼ + ¾ + 1 pt	acifluorfen (<i>Blazer 2L</i>) + bentazon (<i>Basagran</i>) + crop oil concentrate	1 pt + 1 ½ pt + 1 pt	— Use a minimum of 40 psi and 20 gal per acre of water. — Do not apply if soybeans are under stress from herbicide injury, cold or dry weather, or hail damage. — Most effective on small weeds. See label. — Increased crop injury may occur with the addition of crop oil concentrate to <i>Blazer 2L</i> .
Annual grasses Volunteer corn	1 + 1 qt	diclofop (<i>Hoelon</i>) + crop oil concentrate	1 ½ qt + 1 qt	— Note <i>Hoelon</i> is a restricted use herbicide and requires a certified applicator for use. — Apply to grasses less than 4 in. tall. — Apply to volunteer corn less than 12 in. tall. — Do not tank mix with other chemicals. — Delay 7 days between <i>Hoelon</i> use and <i>Basagran</i> or <i>Blazer</i> treatment.
Annual grasses Volunteer corn	0.19 + 1 qt or .188 + 1 qt	sethoxydim (<i>Poast</i>) + crop oil concentrate or fluazifop - butyl (<i>Fusilade 2000</i>) + crop oil concentrate	1 pt + 1 qt or 1 ½ pt + 1 qt	— Use ¼ pt per acre <i>Fusilade 2000</i> or 1 ¼ pt per acre <i>Poast</i> for volunteer corn. — No soil activity from <i>Poast</i> or <i>Fusilade 2000</i> . Controls only grasses present when sprayed. — Treat actively growing grasses a maximum of 4 in. tall (see label) or volunteer corn 18 in. tall. — Use a minimum of 5 gal/A water and 40 psi for <i>Poast</i> or <i>Fusilade 2000</i> applications. — Avoid drift onto corn, sorghum, small grains, and turf. — Rainfall within one hour of application will reduce control. — Does not control nutsedge.

SOYBEANS — Postemergence — Organic Soils (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Quackgrass	sethoxydim (<i>Poast</i>) + crop oil concentrate	0.48 + 0.29 +	2 ½ pt + 1 ½ pt +	— TWO APPLICATIONS ARE NEEDED FOR BEST QUACKGRASS CONTROL. MAKE SECOND APPLICATION 14-21 DAYS FOLLOWING INITIAL TREATMENT. CULTIVATION MAY REPLACE SECOND APPLICATION.
	or fluzifop - butyl (<i>Fusilade 2000</i>) +	.188 + .125 +	1 qt + 1 qt or 1 ½ pt + 1 pt +	— No soil activity from <i>Poast</i> or <i>Fusilade 2000</i> . Controls only grass present when sprayed.
	crop oil concentrate	1 qt + 1 qt	1 qt + 1 qt	— Treat actively growing quackgrass 6-8 inches tall.
				— Use a minimum of 5 gal/A water and 40 psi for <i>Poast</i> or <i>Fusilade 2000</i> applications.
				— Avoid drift onto corn, sorghum, small grains, and turf.
				— Rainfall within 1 hour of application will reduce control.
				— Addition of other herbicides to tank may reduce quackgrass control.

No Till

(Following corn, small grains, or with rye or wheat cover crop)

Annual broadleaves	metribuzin (<i>Lexone</i> or <i>Sencor</i>)	%	¼ lb 50W or % pt 4L	— Applied preemergence.
Annual grasses	+ alachlor (<i>Lasso</i> or <i>Micro-Tech Lasso</i>) or metolachlor (<i>Dual</i>)	+ 2 ½ or 2	or ½ lb 75% DF + 2 ½ qt	— Reduce metribuzin rate if soil pH is above 7.0.
	or oryzalin (<i>Surflan</i>)	or 1	or 1 qt 4L or 1 ½ lb 75% WP	— If soil pH is 7.4 or above, do not apply metribuzin.
	+ paraquat (<i>Paraquat, Gramoxone</i>) or glyphosate (<i>Roundup</i>)	+ ½ or 1 ¼	+ 1 qt	— Note label for rotational crop restrictions.
				— Paraquat applied before rye jointing (24-26" tall) may not provide complete control.
				— To avoid excessive cover crop growth, paraquat or <i>Roundup</i> may be applied prior to planting.
				— Use 3 qt <i>Lasso</i> with heavy annual grass (especially fall panicum and crabgrass) infestations.
				— Maximum <i>Dual</i> rate in metribuzin tank mixes is 2 ½ pt on fine textured soils.
				— Use 20 to 60 gal spray per acre with paraquat and 20 to 30 gal spray per acre with <i>Roundup</i> .
				— Use ½ pt X77 or similar non-ionic surfactant per 100 gal water with paraquat applications. Double surfactant rate if liquid fertilizer is used as a carrier.
				— Do not use suspension or high phosphate liquid fertilizers as carriers for paraquat applications.
				— Follow mixing directions on paraquat and <i>Roundup</i> labels.
				— Paraquat gives faster knockdown. <i>Roundup</i> may provide better control if weed or cover crop growth is dense.
				— May need follow up treatment with <i>Basagran, Blazer, Hoelon, Poast</i> , or <i>Fusilade 2000</i> (see "Postemergence" section for weeds controlled and use directions) for weed escapes.

—Where no cover crop is present and annual weeds are small, the rate of paraquat may be reduced to 1 pt per acre or the rate of *Roundup* may be reduced to 1 qt per acre or less. (See Label.)
 —A prepackaged mix of *Lasso* + *Roundup* (*Bronco*) is available.

linuron (<i>Lorox</i> or <i>Linex</i>)	3/4	1 1/2 lb 50 W or 3/4 qt 4L	— Applied preemergence. — Do not use on coarse textured sandy or loamy sand soils or on soils with less than 2.5% organic matter. — If heavy rainfall occurs soon after application, injury to crop may result. — Plant soybeans at least 1 1/4 in. deep. — Paraquat applied before rye jointing (24-36" tall) may not provide complete control. — To avoid excessive cover crop growth, paraquat or <i>Roundup</i> may be applied prior to planting. — Use 3 qt <i>Lasso</i> with heavy annual grass (especially fall panicum and crabgrass) infestations. — Maximum <i>Dual</i> rate in <i>Lorox</i> tank mixes is 2 1/2 pt on fine textured soils. — Use 20 to 60 gal spray per acre with paraquat and 20 to 30 gal spray per acre with <i>Roundup</i> . — Use 1/2 pt X77 or similar non-ionic surfactant per 100 gal water with paraquat applications. Double surfactant rate if liquid fertilizer is used as a carrier. — Do not use suspension or high phosphate liquid fertilizers as carriers for paraquat applications. — Follow mixing directions on paraquat or <i>Roundup</i> labels. — Paraquat gives faster knockdown. <i>Roundup</i> may provide better control if weed or cover crop growth is dense. — Where no cover crop is present and annual weeds are small, the rate of paraquat may be reduced to 1 pt per acre or the rate of <i>Roundup</i> may be reduced to 1 qt per acre or less. (See Label.) — May need follow up treatment with <i>Basagran</i> , <i>Blazer</i> , <i>Hoelon</i> , <i>Poast</i> , or <i>Fusilade 2000</i> (see "Postemergence" section for weeds controlled and use directions) for weed escapes. — A prepackaged mix of <i>Lasso</i> + <i>Roundup</i> (<i>Bronco</i>) is available.
+ alachlor (<i>Lasso</i> or <i>Micro-Tech Lasso</i>)	+ 2 1/2	1 1/2 lb 50% DF + 2 1/2 qt	
or metolachlor (<i>Dual</i>) or	or 2 or	or 1 qt or	
oryzalin (<i>Surflan</i>)	1	1 qt 4L or 1 1/3 lb 75% WP	
+ paraquat (<i>Paraquat</i> , <i>Gramoxone</i>)	+ 1/2 or 1 1/2	+ 1 qt or 1 1/2 qt	
or glyphosate (<i>Roundup</i>)			

SOYBEANS — Postemergence (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	metribuzin (<i>Lexone</i> or <i>Sencor</i>)	¾	¾ lb 50W or ¾ pt 4L	— Applied preemergence. — Reduce metribuzin rate if soil pH is above 7.0. — If soil pH is 7.4 or above, do not apply metribuzin. — Note label for rotational crop restrictions.
Annual grasses	+ chloramben (<i>Amiben</i>)	+ 2	½ lb 75% DF + 4 qt 2L	— Paraquat applied before rye jointing (24-26 in. tall) may not provide complete control. — To avoid excessive cover crop growth, paraquat or <i>Roundup</i> may be applied prior to planting.
	+ alachlor (<i>Lasso</i> or <i>Micro-Tech Lasso</i>)	+ 2½	2½ lb 75% DS + 2½ qt	— Use 3 qt <i>Lasso</i> with heavy annual grass (especially fall panicum and crabgrass) infestations. — Maximum <i>Dual</i> rate in metribuzin tank mixes is 2½ pt on fine textured soils.
	or metolachlor (<i>Dual</i>)	or 2	or 1 qt	— Use 20 to 60 gal spray per acre with paraquat and 20 to 30 gal spray per acre with <i>Roundup</i> .
	+ paraquat (<i>Paraquat, Gramoxone</i>)	+ ½	+ 1 qt	— Use ½ pt X77 or similar non-ionic surfactant per 100 gal water with paraquat applications. Double surfactant rate if liquid fertilizer is used as a carrier.
	or glyphosate (<i>Roundup</i>)	or 1½	or 1½ qt	— Do not use suspension or high phosphate liquid fertilizers as carriers for paraquat applications. — Follow mixing directions on paraquat and <i>Roundup</i> labels.
				— Paraquat gives faster knockdown. <i>Roundup</i> may provide better control if weed or cover crop growth is dense.
				— Where no cover crop is present and annual weeds are small, the rate of paraquat may be reduced to 1 pt per acre or the rate of <i>Roundup</i> may be reduced to 1 qt per acre or less. (See Label.)
				— May need follow up treatments with <i>Basagran, Blazer, Hoelon, Poast</i> , or <i>Fusilade 2000</i> (see "Postemergence" section for weeds controlled and use directions) for weed escapes.
				— A prepackaged mix of <i>Lasso + Roundup (Bronco)</i> is available.

WEED CONTROL GUIDE FOR SMALL GRAINS

Barley and Wheat (without legume seedings)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	2,4-D amine	½	1 pt	<ul style="list-style-type: none"> — Apply at or after full tillering but before the boot stage (the grain is usually 6 to 8 in. tall at full tillering, and the boot stage is reached when the upper sheath is beginning to swell with the enlarging head). — Do not apply in the fall.
	bromoxynil (<i>Buctril</i>) or (<i>ME4 Brominal</i>)	¾ or ¾	1½ pt or ¾ pt	<ul style="list-style-type: none"> — May be applied from emergence and up to boot stage. — Good coverage essential. — Bromoxynil must be applied to small weeds (less than 4" tall, or 1" rosettes) for effective control. — Redroot pigweed and mustard must be controlled when very small (refer to label for details).
Perennials (bindweed, thistles)	2,4-D ester	¾	1½ pt	<ul style="list-style-type: none"> — Use when grain is fully tillered but before the boot stage. — Control is limited. — Injury may occur. — Some control of wild onion and wild garlic.
	dicamba (<i>Banvel</i>) or (<i>Banvel II</i>)	¾ or ⅛	¼ pt or ½ pt	<ul style="list-style-type: none"> — Do not apply to spring-seeded barley. — Some control of wild onion and wild garlic. — Injury may occur on some varieties of wheat—<i>Tecumseh</i>, <i>Abe</i>, <i>Arthur</i>—do not use on these varieties. — May be applied from early spring until full tillering (the grain is usually 6 to 8 in. tall at this stage).
Wild garlic Wild onion	dicamba (<i>Banvel</i>) or (<i>Banvel II</i>) + 2,4-D	¾ or ⅛ + ¾	¼ pt or ½ pt + 1 pt	<ul style="list-style-type: none"> — Do not apply to spring-seeded barley. — Injury may occur on some varieties of wheat—<i>Tecumseh</i>, <i>Abe</i>, <i>Arthur</i>—do not use on these varieties. — May use either ester or amine 2,4-D. — Should be applied at full tillering (the grain is usually 6 to 8 in. tall at this stage).

Oats without Legume Seedings

Annual broadleaves	2,4-D (amine)	¾	¾ pt	<ul style="list-style-type: none"> — Use when grain is fully tillered but before boot stage. — Some yield reduction may occur but generally less than caused by weeds.
	MCPA	¾	¾ pt	<ul style="list-style-type: none"> — Less injurious than 2,4-D. — Less effective than 2,4-D. — Use when grain is tillering but before the boot stage.
	bromoxynil (<i>Buctril</i>) or (<i>ME4 Brominal</i>)	¾ or ¾	1½ pt or ¾ pt	<ul style="list-style-type: none"> — May be applied from emergence and up to boot stage. — Good coverage essential. — Bromoxynil must be applied to small weeds (less than 4" tall, or 1" rosettes) for effective control. — Redroot pigweed and mustard must be controlled when very small (refer to label for details).

SMALL GRAINS (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Small Grains Seeded to Legumes				
Annual broadleaves	MCPA	%	% pt	<ul style="list-style-type: none"> — Use when grain is fully tillered but before the boot stage. — A canopy of grain and weeds over the seeding will reduce the possibility of injury to the legume. — Apply with 5 to 6 GPA to minimize crop injury. — Sweet clover is very sensitive to MCPA.
	dinoseb (<i>Premerge</i>)	1.1	1½ qt	<ul style="list-style-type: none"> — Use when grain is 2 to 6 in. tall and weeds are small. — Use between 30 and 50 gal of water per acre. — Greater injury to crop if sprayed during cloudy weather.

WEED CONTROL GUIDE FOR FORAGES

Alfalfa, Trefoil and Clover Seedings

(clear seedings without small grain companion crops)

Annual broadleaves	EPTC (<i>Eptam</i> or <i>Genep</i>)	3	3½ pt	<ul style="list-style-type: none"> — Work into soil immediately after application. — Seed may be planted immediately after this operation. — Do not use when grass is seeded with legumes.
Annual grasses	benefin (<i>Balan</i>)	1½	3 qt	— See remarks above for EPTC.
Annual broadleaves	4-(2,4-DB) amine (<i>Butoxone 200</i> or <i>Butyrac 200</i>)	1	2 qt	<ul style="list-style-type: none"> — Apply postemergence when seedlings are at or beyond the 2 to 3 trifoliolate leaf stage. — Can use if annual broadleaf problem develops after using <i>Eptam</i>, <i>Genep</i> or <i>Balan</i>. — 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.
Perennial weeds (quackgrass, Canada thistle, milkweed, etc.)	glyphosate (<i>Roundup</i>)	Rate varies, see label and perennial weed control section (pgs. 52-53)		— Apply to perennials at labeled rate and growth stage before alfalfa establishment.

Alfalfa (Established Stand)

- Forage grasses will be injured or killed.
- Use 2 lb *Princep* on fine textured soils with 4 to 6% organic matter (established stands only).
- Some control of seedling white cockle.
- For fall application on established (1 year) alfalfa or after the last cutting (before the ground freezes) of a spring seeded (by June 1) new alfalfa stand.
- Will control winter annuals: yellow rocket, henbit, chickweed, peppergrass, shepherd's purse and downy brome.
- Some injury to alfalfa may occur on sands and loamy sands low in organic matter.

1
 1 1/4 lb 80W
 or
 1.1 lb 90% WDG

simazine
(Princep)

Yellow rocket and broad-leaved winter annuals

- Apply to *dormant* alfalfa in late fall or early spring.
- Non-dormant alfalfa may be severely injured.

1/2
 1 lb 50W
 or
 1 pt 4L
 or
 3/4 lb 75% DF

metribuzin
(Lexone or Sencor)

- Apply to *dormant* alfalfa in late fall or early spring.
- Note label for rotational crop restrictions.
- Early spring applications will control other broadleaf weeds and suppress quackgrass infestations.

1
 1 1/4 80W

terbacil
(Sinbar)

- 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, however, 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 while crop is under stress.
- Do not apply to snow covered or frozen ground.
- Use 20 or more gallons of water per acre for ground application.
- Do not graze or feed treated forage to livestock for 30 days following application.
- **Rotational restriction:** Corn may be planted 12 months following the last application provided the soil is moldboard plowed prior to planting. Do not plant any other crop for two years after application.

1/2
 .6 lb 90W
 or
 1 qt 2L

hexazinone
(Velpar)

FORAGES — Alfalfa (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Dandelions	metribuzin (<i>Lexone</i> or <i>Sencor</i>)	1	2 lb 50W or 1 qt 4L or 1½ lb 75% DF	<ul style="list-style-type: none"> — 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.
	hexazinone (<i>Velpar</i>)	1	1.1 lb 90W or 2 qt 2L	<ul style="list-style-type: none"> — Apply in spring before alfalfa growth exceeds 2 in. Spring applications to <i>dormant</i> alfalfa provide the greatest crop safety. — Application can be made between cuttings before regrowth exceeds 2 in. in height, however, 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 while crop is under stress. — Do not apply to snow covered or frozen ground. — Use 20 or more gallons of water per acre for ground application.
				<p>Remarks and Limitations</p> <ul style="list-style-type: none"> — Do not graze or feed treated forage to livestock for 30 days following application. — Rotational restriction: Corn may be planted 12 months following the last application provided the soil is moldboard plowed prior to planting. Do not plant any other crop for two years after application. — Will also provide partial control of quackgrass.
Hoary alyssum Annual broadleaves	4-(2,4-DB) amine (<i>Butoxone 200</i> or <i>Butyrac 200</i>)	1	2 qt	<ul style="list-style-type: none"> — Early April. — Spray when hoary alyssum seedlings are in two to four 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 temperature is expected to fall below 40°F shortly after treatment.
Quackgrass	pronamide (<i>Kerb</i>)	1½	3 lb	<ul style="list-style-type: none"> — 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./acre (2 lb/acre of formulated product).

Birdsfoot Trefoil (Established Stand)

Hoary alyssum Annual broadleaves	4-(2,4-DB) amine (<i>Butoxone 200</i> or <i>Butyrac 200</i>)	1	2 qt	<ul style="list-style-type: none"> — Early April. — Spray when hoary alyssum seedlings are two to four leaf stage. — 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.
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Quackgrass	pronamide (<i>Kerb</i>)	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./acre (2 lb/acre of formulated product).
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Red Clover (current year seeding)

Yellow rocket and broad-leaved winter annuals	MCPA	½	1 pt	— Spray after killing frost; legumes dormant.
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Grass Pasture

Biennials and Perennials	2,4-D ester	1	1 qt	— Apply in fall or spring.
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Legume Pasture

Perennials	2,4-D ester	1	1 qt	— Legumes may be injured or killed. — Spot spray patches.
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WEED CONTROL GUIDE FOR FIELD BEANS

Preplant

Annual broadleaves (including nightshade)	alachlor (<i>Lasso</i>)	2	2 qt	— Check label for use on coarse-textured soils low in organic matter.
Annual grasses	or metolachlor (<i>Dual</i>)	2	1 qt	— This treatment is used for black nightshade control. — <i>Lasso</i> or <i>Dual</i> must be applied preplant incorporated to minimize danger of bean injury.
	+ chloramben (<i>Amiben</i>)	+	+	— <i>Amiben</i> may be applied preplant incorporated or pre-emergence.
		2	4 qt 2L or 2½ lb 75% DS	— <i>Lasso</i> will provide better nightshade control than <i>Dual</i> . — <i>Dual</i> will provide yellow nutsedge suppression.
Annual broadleaves (except nightshade)	EPTC (<i>Eptam</i> or <i>Genep</i>)	2¼	1¼ qt	— Incorporate immediately after application.
Annual grasses	+ trifluralin (<i>Treflan</i>)	+	+	
	or pendimethalin (<i>Prowl</i>)	½	1 pt	
	or ethalfluralin (<i>Sonalan</i>)	or ¾	or 1½ pt	
		or ¾	or 2 pt	

FIELD BEANS — Preplant-Preemergence (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves	EPTC (<i>Eptam or Genep</i>)	2½	1½ qt	— Incorporate immediately after application. — Rainfall isn't as critical for activation of <i>Amiben</i> as when it is surface applied. — Provides some nightshade control. — Nightshade control is improved when <i>Amiben</i> is applied as a preemergence overlay (see below).
Annual grasses	chloramben (<i>Amiben</i>)	+	+	
	+ trifluralin (<i>Treflan</i>)	2	4 qt 2L or 2½ lb 75% DS	
	or pendimethalin (<i>Prowl</i>)	+	+	
	or ethalfluralin (<i>Sonalan</i>)	¾ or ¾	1 pt or 1½ pt	
		or ¾	or 2 pt	

Preplant Followed by Preemergence

<i>Preplant Incorporated</i>				— PREPLANT.
Annual broadleaves (including nightshade)	EPTC (<i>Eptam or Genep</i>)	2½	1½ qt	— Incorporate immediately after application.
Annual grasses	+ trifluralin (<i>Treflan</i>)	+	+	— Follow with preemergence treatment for complete control.
	or pendimethalin (<i>Prowl</i>)	¾ or ¾	1 pt or 1½ pt	
	or ethalfluralin (<i>Sonalan</i>)	or ¾	or 2 pt	
<hr/>				
FOLLOWED BY: Preemergence	chloramben (<i>Amiben</i>)	2	4 qt 2L or 2½ lb 75% DS	— Effectiveness depends on adequate rainfall after treatment.
	or dinoseb (<i>Premerge</i>)	or	or	
	or chloramben (<i>Amiben</i>)	4½ or 1	6 qt or 2 qt 2L or 1½ lb 75% DS	
	+ dinoseb (<i>Premerge</i>)	+	+	
		3	4 qt	

Postemergence

Annual broadleaves	bentazon (<i>Basagran</i>) + crop oil concentrate	$\frac{3}{4}$ + 1 qt	$1\frac{1}{2}$ pt + 1 qt	— Controls only certain broadleaves. See label and post-emergence soybean section. — Check label for specific rate and proper weed growth stage. — Beans must have 1 to 2 trifoliolate leaves before application.
Nutsedge Canada thistle	bentazon (<i>Basagran</i>) + crop oil concentrate	$\frac{3}{4}$ + $\frac{3}{4}$ + 1 qt + 1 qt	$1\frac{1}{2}$ pt + $1\frac{1}{2}$ pt + 1 qt + 1 qt	— See remarks for nutsedge control under soybeans. — Beans must have 1 to 2 trifoliolate leaves before application.

WEED CONTROL GUIDE FOR SUNFLOWERS

Preplant

Annual grasses Annual broadleaves	chloramben (<i>Amiben</i>) + trifluralin (<i>Treflan</i>) or pendimethalin (<i>Prowl</i>)	2 + $\frac{3}{4}$ or 1	1 gal 2L or $2\frac{1}{2}$ lb 75% DS + $1\frac{1}{2}$ pt or 2 pt	— Incorporate or mix <i>Treflan</i> thoroughly into top 2 or 3 in. of soil within 24 hours after application. <i>Prowl</i> incorporation may be delayed 7 days. — On light soils (sandy and sandy loam) low in organic matter use $\frac{1}{2}$ lb <i>Treflan</i> or $\frac{3}{4}$ lb <i>Prowl</i> . — Use 6 qt of <i>Amiben</i> for heavy ragweed, mustard, or nightshade populations.
Annual grasses Annual broadleaves (except ragweed, smartweed, mustard and nightshade)	chloramben (<i>Amiben</i>) + alachlor (<i>Lasso</i>) trifluralin (<i>Treflan</i>) or pendimethalin (<i>Prowl</i>)	2 + $2\frac{1}{2}$ $\frac{3}{4}$ or 1	1 gal 2L or $2\frac{1}{2}$ lb 75% DS + $2\frac{1}{2}$ qt	— May be applied either preplant incorporated or pre-emergence. — Incorporate <i>Treflan</i> within 24 hours or <i>Prowl</i> within 7 days into top 2 or 3 in. of soil. — On light soils (sandy and sandy loam) low in organic matter use $\frac{1}{2}$ lb <i>Treflan</i> or $\frac{3}{4}$ lb <i>Prowl</i> .

SUNFLOWER — Preemergence (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Preemergence				
Annual grasses Annual broadleaves	chloramben (<i>Amiben</i>)	2	1 gal 2L or 2½ lb 75% DS	— Do not graze or feed sunflower forage from <i>Amiben</i> -treated areas. — <i>Amiben</i> may follow preplant treatments of <i>Treflan</i> or <i>Prowl</i> . — Use 6 qt of <i>Amiben</i> for heavy ragweed, mustard, or nightshade populations.
	chloramben (<i>Amiben</i>) + alachlor (<i>Lasso</i>)	2 + 2½	1 gal 2L or 2½ lb 75% DS + 2½ qt	— May be applied either preplant incorporated or pre-emergence.

WEED CONTROL GUIDE FOR POTATOES

Quackgrass	dalapon (<i>Dowpon M</i>)	10	13½ lb	— Spray in spring when quackgrass is 4 to 6 in. tall. Wait one week before plowing. — Use in 30 to 40 gal water per acre. — Control of quackgrass will be reduced when heavy stand of rye cover is present.
	glyphosate (<i>Roundup</i>)	1½	2 qt	— Apply to actively growing quackgrass at least 8 in. tall. — Use 15 to 20 gal water per acre. — No soil residue. — Can plow or till 3 days after application and plant crop. — Do not plow or till prior to treatment. — <i>Emerged</i> potatoes are very sensitive to <i>Roundup</i> damage. Do not use near growing potato plants.
Remarks and Limitations				
— Heavy stand of rye cover may reduce quackgrass control. — <i>Roundup</i> rate of 1 qt may be used for <i>single season</i> quackgrass control. Apply 1 qt in 5-10 gal water per acre with 0.5% nonionic surfactant.				

Preplant Incorporated

Preplant Followed by Delayed Preemergence

Annual grasses Annual broadleaves	EPTC (<i>Eptam</i> or <i>Genep</i>)	4	4½ pt	— Work into soil immediately after application. — Six lb per acre may be used if nutsedge is a problem. — Preplant incorporated.
FOLLOWED BY: <i>Delayed Preemergence</i>	linuron (<i>Lorox</i> or <i>Linex</i>)	1	2 lb 50W or 1 qt 4L or 2 lb 50% DF	— Treatment should be made prior to potato emergence and after weed emergence. — Do not apply <i>Sencor</i> to Atlantic variety.
	or metribuzin (<i>Lexone</i> or <i>Sencor</i>)	or ½	or 1 lb 50W or 1 pt 4L or ¾ lb 75% DF	

Early Preemergence Followed by Delayed Preemergence

Early Preemergence

Annual grasses (especially barnyard- grass)	2	2 pt	— If field leveling is necessary it should be done soon after planting.
Annual broadleaves	or 3/4	or 1 1/2 pt	— Apply <i>early preemergence</i> —make application soon after planting.
			— Most effective on germinating grasses that have <i>not</i> emerged.
			— Do not use <i>Prowl</i> on muck soils or loamy sands with less than 1.5% organic matter.
			— Follow with <i>Lexone</i> or <i>Sencor</i> or <i>Lorox</i> or <i>Linex</i> or <i>Premerge</i> .

FOLLOWED BY: Delayed Preemergence

metolachlor (<i>Dual</i>)	1/2	1 lb 50W	— Most effective on small emerged weeds.
or		or	— Delayed preemergence.
pendimethalin (<i>Prowl</i>)		1 pt 4L	— These treatments follow <i>Prowl</i> or <i>Dual</i> preemergence.
		or	— Do not apply <i>Sencor</i> to Atlantic variety.
		3/4 lb 75% DF	
or		or	
linuron (<i>Lorox</i> or <i>Linex</i>)	or 1	2 lb 50W	
		or	
		1 qt 4L	
or	or	or	
dinoseb (<i>Premerge</i>)	3	2 lb 50% DF	
		or	
		4 qt	

Delayed Preemergence

Annual broadleaves	1 1/2	3 lb 50W	— Apply delayed preemergence; after weeds emerge but before potatoes emerge.
		or	— If field leveling is necessary, it should be done soon after planting to allow weed emergence before spraying.
		1 1/2 qt 4L	
		or	
		3 lb 50% DF	
linuron (<i>Lorox</i> or <i>Linex</i>)	1/4	1 lb 50W	— Refer to remarks under <i>Lorox</i> .
		or	— Use up to 1 lb active ingredient metribuzin on high organic muck soil.
		1 pt 4L	— Do not apply <i>Sencor</i> to Atlantic variety.
		or	
		3/4 lb 75% DF	

Postemergence

Annual broadleaves	1/4	3/4 lb 50W	— Do not make overall postemergence applications following 3 days of cool, wet or cloudy weather as crop injury may occur.
Annual grasses		or	— Do not use on early maturing varieties.
		1/4 pt 4L	— Do not use on red skin varieties.
		or	— Do not apply postemergence within 60 days of harvest.
		3/4 lb 75% DF	— Greater possibility of injury to potatoes when sprayed overall at 12- to 15-in. stages.

WEED CONTROL GUIDE FOR MINT Row Mint and Meadow Mint

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual broadleaves Annual grasses	terbacil (<i>Sinbar</i>)	1½	2 lb	— Apply preemergence only. — Rates may be reduced to 1 lb per acre if terbacil was used the previous year. — Do not plant any other crop for two years following application. — Terbacil is also labeled postemergence. (See label for details.)
Annual broadleaves (See label for specific species)	bentazon (<i>Basagran</i>) + crop oil concentration	1 + 1 qt	1 qt + 1 qt	— Postemergence application. — Controls only certain broadleaves. — Use a minimum of 40 psi and 20 gal/A of water. — Do not use flood nozzles. — Check label for proper weed stage for applications. — Weak on pigweed, nightshade and lambsquarters.
Nutsedge	bentazon + crop oil concentration	¾ + ¾ + + 1 qt + 1 qt	¾ qt + ¾ qt + + 1 qt + 1 qt	— Postemergence application. — See "Remarks" under nutsedge control in soybean section (Page 17).
Canada thistle	bentazon + crop oil concentration	2 + 2 + + 1 qt + 1 qt	2 qt + 2 qt + + 1 qt + 1 qt	— Postemergence application. — Two applications required for best thistle control. — Make first application when thistle is 8 inches tall and second application 7 to 10 days later. — Use a minimum of 40 psi and 20 gal/A of water. Do not use flood nozzles.

WEED CONTROL GUIDE FOR SUGAR BEETS

Preplant

Annual grasses	cycloate (<i>Ro-Neet</i>)	3 lb	2 qt	— Incorporate immediately to 2 to 3 in. — Must be followed preemergence by <i>Pyramin</i> . — Injury may occur when <i>Betamix</i> or <i>Betanex</i> are applied postemergence.
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Preemergence

Annual broadleaves Annual grasses	ethofumesate (<i>Nortron</i>) + pyrazon (<i>Pyramin</i>) + TCA (<i>TCA</i>)	2 + 3 + 6	5½ qt 1.5 lb/gal E.C. or 2 qt 4 lb/gal L + 3 qt + 5 qt	— Soybeans or alfalfa may be injured following <i>Nortron</i> . — On sandy soil with less than 1½% organic matter reduce <i>Nortron</i> rate to 1½ lb/A ai. — In order to get near 100% weed control it will, in most cases, be necessary to follow up with a postemergence application.
	pyrazon (<i>Pyramin</i>) + TCA (<i>TCA</i>)	4 + 6	4 qt + 5 qt	— TCA should be included even if grasses aren't a problem, as better control of annual broadleaves will result. — In order to get near 100% weed control it will, in most cases, be necessary to follow up with a postemergence application.

Annual broadleaves
Annual grasses
(continued)

PYRAMIN + TCA (continued)

— For soils high in clay content or organic matter, the rate should be 4 lb Pyramin + 8 lb TCA.
— For soils low in clay and organic matter the Pyramin rate may be reduced to 3 qt.
— See remarks for Pyramin + TCA.

pyrazon (Pyramin)	4	4 qt	
+ diethyllethyl (Antor)	3	3 qt	
pyrazon (Pyramin)	3	3 qt	
+ ethofumesate (Nortron)	2	5½ qt 1.5 lb/gal E.C. or 2 qt 4 lb/gal L	
+ diethyllethyl (Antor)	2	2 qt	

— See remarks for Pyramin + Nortron + TCA.

Annual broadleaves
(including smartweed)

Postemergence

— Add one qt. oil conc. per acre for hard to control large weeds or if plants are not vigorously growing.
— Apply when the beets are in the 2-4 true leaf stage.
— When cultivating the unsprayed area, care should be taken so as to cut away a portion of the sprayed area on the first cultivation and don't roll fresh unsprayed soil back beyond the cut away point.
— When temperature is 75° F or greater, apply in late afternoon or early evening.
— Do not apply when plants are under stress such as temperatures above 85° F as injury may occur.

desmedipham + phenmedipham (Betamix)	1	6.2 pt	
+ endothall (H273)	½	1½ pt	

— Refer to remarks under Betamix + H273.
— More effective pigweed control.

desmedipham (Betanex)	1	6.2 pt	
+ endothall (H273)	½	1½ pt	

— Provides full season weed control.
— Refer to remarks under Betamix + H273.
— Do not use oil concentrate.

ethofumesate (Nortron)	¾	4 pt 1.5 lb/gal E.C. or 1½ pt 4 lb/gal L	
+ desmedipham + phenmedipham (Betamix)	1	6.2 pt	
+ endothall (H273)	½	1½ pt	

SUGAR BEETS — Postemergence (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
	ethofumesate (<i>Nortron</i>)	%	4 pt 1.5 lb/gal E.C. or 1½ pt 4 lb/gal L	— Provides full season weed control. — Refer to remarks under <i>Betanex</i> + <i>H273</i> . — Do not use oil concentrate.
	+ desmedipham (<i>Betanex</i>)	+	+ 6.2 pt	
	+ endothall (<i>H273</i>)	½	+ 1½ pt	
Annual broadleaves (including smartweed)	pyrazon (<i>Pyramin</i>)	2	2 qt	— Apply when the beets are in the 2-4 true leaf stage. — When cultivating the unsprayed area, care should be taken so as to cut away a portion of the sprayed area on the first cultivation and don't roll fresh unsprayed soil back beyond the cut away point.
	+ desmedipham + phenmedipham (<i>Betanex</i>)	+	+ 6.2 pt	— Maximum total amount of pyrazon that can be used for beets grown and processed in Michigan is 8 lb per acre (2 lb on a 7-in. band).
	+ endothall (<i>H273</i>)	½	+ 1½ pt	— When temperature is 75° F or greater, apply in late afternoon or early evening. — Do not apply when plants are under stress such as temperatures above 85° F as injury may occur. — Add one qt. oil concentrate per acre for hard to control large weeds or if plants are not vigorously growing.
	pyrazon (<i>Pyramin</i>)	2	2 qt	— Much better pigweed control than <i>Betanex</i> . — Refer to remarks under <i>Pyramin</i> + <i>Betanex</i> + <i>H273</i> .
	+ desmedipham (<i>Betanex</i>)	+	+ 6.2 pt	
	+ endothall (<i>H273</i>)	½	+ 1½ pt	
Annual broadleaves (except smartweed and wild buckwheat)	pyrazon (<i>Pyramin</i>)	2	2 qt	— Refer to remarks under <i>Pyramin</i> + <i>Betanex</i> + <i>H273</i> .
	+ dalapon (<i>Downon M</i>)	+	+ 1½ lb	
	+ crop oil emulsifiable concentrate	+	+ 1 qt	
Smartweed and buckwheat	endothall (<i>H273</i>)	1	2⅔ pt	— Refer to remarks under <i>Betanex</i> and <i>H273</i> . — Volume based on 3 lb per gal formulation.

Annual grasses
Volunteer corn

sethoxydim
(Poast)
+
crop oil concentrate

0.19
+
1 qt

1 pt
+
1 qt

— Use 1¼ pt per acre Poast for volunteer corn.
— No soil activity from Poast. Controls only grasses present when sprayed.
— Treat actively growing grass up to maximum of 4 in. tall (see label) or volunteer corn 18 in. tall.
— Use a minimum of 5 gal/A water and 40 psi for Poast.
— Avoid drift onto corn, sorghum, small grains or turf.
— Rainfall within one hour of application will reduce control.
— Does not control nutsedge.

Quackgrass

sethoxydim
(Poast)
+
crop oil concentrate

0.48 + 0.29
+
1 qt + 1 qt

2½ pt + 1½ pt
+
1 qt + 1 qt

— TWO APPLICATIONS ARE NEEDED FOR BEST QUACKGRASS CONTROL. MAKE SECOND APPLICATION 14-21 DAYS FOLLOWING INITIAL TREATMENT. CULTIVATION MAY REPLACE SECOND APPLICATION.
— No soil activity from Poast. Controls only grass present when sprayed.
— Treat actively growing quackgrass 6-8 in. tall.
— Use a minimum of 5 gal/A water and 40 psi for Poast application.
— Avoid drift onto corn, sorghum, small grains or turf.
— Rainfall within one hour of application will reduce control.
— Addition of other herbicides to tank may reduce quackgrass control.

WEED CONTROL GUIDE FOR GRAIN SORGHUM

Preemergence

Annual broadleaves
Annual grasses

propazine
(Milogard)

2

2½ lb 80W
or
2 qt 4L
or
2.2 lb 90% WDC

— Do not use on sandy soils.
— Do not plant small grains, small seeded forages, sugar beets, field beans or vegetable crops the following year.

Annual broadleaves
Annual grasses

atrazine
(commercial product)
+
propachlor
(Ramrod)

1
+
3

1¼ lb 80W
or
1 qt 4L
or
1.1 lb 90% WDC
+
4½ lb (65% WP)

— Do not feed silage made from treated sorghum to producing dairy animals.
— A commercial mix of Ramrod plus atrazine is available.
— Not labeled for forage sorghum.

GRAIN SORGHUM — Postemergence (Continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Postemergence				
Annual broadleaves	2,4-D amine	1/3	1/3 qt	<ul style="list-style-type: none"> — Apply when sorghum is 6 to 12 in. high. — Do not use unless weeds are a serious problem because injury may occur. — Not labeled for forage sorghum. — Hybrids vary in tolerance.

TABLE 2 — PERENNIAL WEEDS NON-SELECTIVE CONTROL

Quackgrass (for spring seeded crops)	dalapon (<i>Dowpon M</i>)	15	20 lb	<ul style="list-style-type: none"> — Apply in fall. — Fall plow 7 to 10 days after spraying if possible. — Land can be planted to spring sown crops. — Use 30 to 40 gal water per acre. — For quackgrass control in corn, potatoes and sugar beets, see specific crop.
Quackgrass (for fall seeded crops)	dalapon (<i>Dowpon M</i>)	10	13 1/2 lb	<ul style="list-style-type: none"> — Apply in spring or early summer (prior to July). — Plow 7 to 10 days after spraying. — Land can be planted to alfalfa, wheat or winter barley. — Use 30 to 40 gal water per acre.
Quackgrass (prior to corn, soybeans, wheat, barley, oats, sorghum, field beans, forages, potatoes, or following small grains or silage corn in the fall)	glyphosate (<i>Roundup</i>)	1 1/2	2 qt	<ul style="list-style-type: none"> — Apply to actively growing quackgrass at least 8 in. tall. — Use 15 to 20 gal water per acre. — No soil residue. — Can plow or till 3 days after application and plant crop. — Do not plow or till prior to treatment. — Roundup rate of 1 qt may be used for <i>single season</i> quackgrass control. Apply 1 qt in 5-10 gal water per acre with 0.5% nonionic surfactant. This treatment is less effective on an undisturbed quackgrass sod.
Canada thistle (prior to corn, soybeans, wheat, barley, oats, sorghum, field beans, forages, potatoes, or following small grains in the fall)	glyphosate (<i>Roundup</i>)	2 1/4	3 qt	<ul style="list-style-type: none"> — Apply when thistle is at bud stage or beyond. — Do not plow or till prior to treatment. — Poor control will result if application is made during times of poor growing conditions. — Can plow or till 3 days after application and plant crop.
Field bindweed (prior to corn, soybeans, wheat, barley, oats, sorghum, field beans, forages, potatoes, or following small grains or silage corn in the fall)	glyphosate (<i>Roundup</i>)	2 1/4	3 qt	<ul style="list-style-type: none"> — Apply at or beyond full bloom. — Do not plow or till prior to treatment. — Poor control will result if application is made during times of poor growing conditions. — Can plow or till 7 days after application and plant crop.

Common milkweed (prior to corn, soybeans, wheat, barley, oats, sorghum, field beans, forages, potatoes, or following small grains or silage corn in the fall)	glyphosate (<i>Roundup</i>)	2¼	3 qt	— Apply when actively growing and most plants have reached late bud to flower stage. — Spot treatment in labeled crops. — Rope-wick, wipe-on, or recirculating sprayer may be used in soybeans.
Hemp dogbane (prior to corn, soybeans, wheat, barley, oats, sorghum, field beans, forages, potatoes, or following small grains in the fall)	glyphosate (<i>Roundup</i>)	3	4 qt	— Apply when actively growing and most plants have reached late bud to flower stage. — Can plow or till 7 days after application. — Rope-wick, wipe-on, or recirculating sprayer may be used in soybeans. (See Label.)
Johnsongrass (prior to corn, soybeans, wheat, barley, oats, sorghum, field beans, forages, potatoes)	glyphosate (<i>Roundup</i>)	2¼	2 qt	— Apply when actively growing when most plants are in the boot to head stage, at least 18 in. tall. — Rope-wick, wipe-on, or recirculating sprayer may be used in soybeans. (See Label.)
Cattail	dalapon (<i>Downon M</i>)	15	20 lb	— Apply in June or July. — Use 80 to 100 gal water. — Keep livestock out.
Cattail	glyphosate (<i>Roundup</i>)	3	4 qt	— Applying when actively growing and most plants have reached early head stage.
Reed canarygrass (prior to corn, soybeans, wheat, barley, oats, sorghum, field beans, forages, potatoes)	glyphosate (<i>Roundup</i>)	2¼	3 qt	— Apply when actively growing and most plants have reached the boot to head stage.
Poison ivy	amitrolet	2	1 gal	— Apply in June or July. — Spray when in full leaf.
Canada thistle Horse nettle	amitrolet	4	2 gal	— Apply in June or July. — Do not pasture.

† *Amitrole may not be used on cropland areas.*

TABLE 3 — WEED RESPONSE TO HERBICIDES IN CORN*

	ANNUAL BROADLEAVES									ANNUAL GRASSES							PERENNIALS					
	Cocklebur	Jimsonweed	Lambsquarter	Nightshade (Black)	Pigweed (Redroot)	Ragweed	Smartweed	Velvetleaf	Wild mustard	Barnyardgrass	Crabgrass	Giant foxtail	Green foxtail	Yellow foxtail	Fall panicum	Witchgrass	Wild proso millet	Bindweed (Field)	Bindweed (Hedge)	Canada thistle	Quackgrass	Yellow nutsedge
PREPLANT INCORPORATED																						
ATRAZINE	F	F	E	E	G	E	G	F	E	G	P	F	F	G	P	P	P	P	P	F	G	F
BLADEX	F	P	E	G	F	E	G	P	G	G	F	F	G	G	F	F	F	N	N	N	N	N
DUAL	N	N	P	F	G	P	P	N	P	E	E	E	E	E	G	G	F	N	N	N	N	E
ERADICANE	P	P	G	P	F	F	F	F	F	E	E	E	E	E	E	E	G	N	N	N	G	G
ERADICANE EXTRA	P	P	G	P	F	F	F	F	F	E	E	E	E	E	E	E	G	N	N	N	G	G
GENATE + /SUTAN +	P	P	P	N	P	P	P	P	P	E	E	E	E	E	E	F	F	N	N	N	P	G
LASO	N	N	P	G	G	P	P	N	P	E	E	E	E	E	G	F	F	N	N	N	N	G
PRINCEP	G	F	E	E	E	E	G	F	E	G	F	F	F	G	P	P	P	P	P	P	F	F
PREEMERGENCE																						
ATRAZINE	F	F	E	E	G	E	G	F	E	G	P	F	F	G	P	P	P	P	P	F	G	F
BLADEX	F	P	E	G	F	E	G	P	G	G	F	F	G	G	F	F	F	N	N	N	N	N
DUAL	N	N	P	F	G	P	P	N	P	E	E	E	E	E	G	G	F	N	N	N	N	G
LASSO	N	N	P	G	G	P	P	N	P	E	E	E	E	E	G	G	F	N	N	N	N	F
PRINCEP	G	F	E	E	E	E	G	F	E	G	F	F	F	G	P	P	P	P	P	P	F	F
PROWL	N	N	G	P	F	P	P	P	P	E	E	E	E	E	E	E	F	N	N	N	N	N
RAMROD	N	P	P	N	F	P	P	P	P	G	E	E	E	E	G	G	-	N	N	N	N	N
POSTEMERGENCE																						
ATRAZINE + OIL	G	G	E	G	E	E	G	G	E	F	P	F	G	G	P	P	P	P	P	G	G	G
BANVEL	G	G	G	G	G	G	E	G	F	N	N	N	N	N	N	N	N	F	G	F	N	N
BASAGRAN + OIL	E	G	F	P	P	F	G	G	E	N	N	N	N	N	N	N	N	N	N	G	N	G
BLADEX	F	P	E	G	F	E	G	P	G	G	F	F	G	G	F	F	F	N	N	N	N	N
BUCTRIL/ME-4 BROMINAL ..	G	G	G	G	F	G	G	G	F	N	N	N	N	N	N	N	N	P	P	P	N	N
EVIK ¹	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	F	F	F	P	F
LINEX/LOROX ¹	F	F	G	G	G	G	G	G	G	F	F	F	F	F	F	F	F	N	N	N	N	N
2,4-D AMINE	F	F	G	G	G	G	P	F	G	N	N	N	N	N	N	N	N	P	F	F	N	N
2,4-D ESTER	F	F	G	G	G	G	P	F	G	N	N	N	N	N	N	N	N	F	G	G	N	N

P = Poor; F = Fair; G = Good; E = Excellent; N = None

¹Post Directed Only

*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 4 — WEED RESPONSE TO HERBICIDES IN SOYBEANS*

	ANNUAL BROADLEAVES									ANNUAL GRASSES							PERENNIALS					
	Cocklebur	Jimsonweed	Lambsquarter	Nightshade (Black)	Pigweed (Redroot)	Ragweed	Smartweed	Velvetleaf	Wild mustard	Barnyardgrass	Crabgrass	Giant foxtail	Green foxtail	Yellow foxtail	Fall panicum	Witchgrass	Wild proso millet	Bindweed (Field)	Bindweed (Hedge)	Canada thistle	Quackgrass	Yellow nutsedge
PREPLANT INCORPORATED																						
AMIBEN	P	P	G	G	G	G	G	F	F	P	P	P	P	P	P	P	P	N	N	N	N	N
DUAL	N	N	P	F	G	P	P	N	P	P	P	P	P	P	P	P	P	N	N	N	N	N
LASSO	N	N	P	G	G	P	P	N	P	P	P	P	P	P	P	P	P	N	N	N	N	N
LEXONE/SENCOR	G	F	F	N	F	F	F	G	P	P	P	P	P	P	P	P	P	N	N	N	N	N
PROWL	N	N	G	P	F	F	F	P	P	P	P	P	P	P	P	P	P	N	N	N	N	N
TREFLAN	N	N	G	N	G	N	P	N	P	P	P	P	P	P	P	P	P	N	N	N	N	N
PREEMERGENCE																						
AMIBEN	P	P	G	G	F	F	G	F	F	F	F	F	F	F	F	F	F	N	N	N	N	N
DUAL	N	N	P	F	G	P	P	N	P	P	P	P	P	P	P	P	P	N	N	N	N	N
DYANAP	F	F	G	F	G	G	G	P	G	F	F	F	F	F	F	F	F	N	N	N	N	N
LASSO	N	N	P	G	G	P	P	N	P	P	P	P	P	P	P	P	P	N	N	N	N	N
LEXONE/SENCOR	G	F	F	N	F	F	F	G	P	P	P	P	P	P	P	P	P	N	N	N	N	N
LINEX/LOROX	P	P	G	G	G	G	G	F	G	P	P	P	P	P	P	P	P	N	N	N	N	N
PREMERGE	P	P	G	G	G	F	G	P	G	P	P	P	P	P	P	P	P	N	N	N	N	N
SURFLAN	N	N	G	P	G	P	P	P	P	P	P	P	P	P	P	P	P	N	N	N	N	N
POSTEMERGENCE																						
BASAGRAN + OIL	F	G	F	P	P	F	G	G	F	N	N	N	N	N	N	N	N	N	N	G	N	G
BLAZER 2L	F	G	F	G	F	G	G	F	F	N	N	F	N	N	F	N	N	P	P	P	N	N
FUSILADE	N	N	N	N	N	N	N	N	N	F	F	F	F	F	F	F	F	N	N	N	G	N
HOELON	N	N	N	N	N	N	N	N	N	G	G	G	G	G	G	G	G	N	N	N	N	N
POAST	N	N	N	N	N	N	N	N	N	F	F	F	F	F	F	F	F	N	N	N	F	N

TABLE 5 — WEED RESPONSE TO HERBICIDES IN FORAGES*

	ANNUAL BROADLEAVES									ANNUAL GRASSES							PERENNIALS							
	Cocklebur	Jimsonweed	Lambsquarter	Nightshade (Black)	Pigweed (Redroot)	Ragweed	Smartweed	Velvetleaf	Wild mustard	Hoary allysum	Barnyardgrass	Crabgrass	Giant foxtail	Green foxtail	Yellow foxtail	Fall panicum	Witchgrass	Wild proso millet	Bindweed (Field)	Bindweed (Hedge)	Canada thistle	Quackgrass	Yellow nutsedge	Dandelion
BALAN	N	N	G	N	G	N	P	N	P	F	F	F	F	F	F	G	P	N	N	N	N	P	N	N
EPTAM/GENEP	P	P	G	P	F	F	F	F	F	F	F	F	F	F	F	F	F	N	N	N	N	F	P	N
KERB	P	P	P	P	P	P	P	P	P	F	F	P	F	F	P	P	P	N	N	N	G	N	N	N
LEXONE/SENCOR	F	G	F	N	F	F	F	F	F	G	G	G	F	F	G	G	I	N	N	N	P	P	G	N
MCPA	F	F	G	G	G	G	G	F	G	N	N	N	N	N	N	N	N	P	P	F	N	N	P	P
PRINCEP	G	F	F	F	F	F	G	F	F	G	F	F	F	G	P	P	P	P	P	P	P	F	P	P
SINBAR	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	P	P	P	F	F	P	F	F
2,4-DB	P	P	G	F	G	F	P	F	G	N	N	N	N	N	N	N	N	P	P	N	N	N	N	N

P = Poor; F = Fair; G = Good; E = Excellent; N = None

*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 6 — WEED RESPONSE TO HERBICIDES IN FIELD BEANS*

	ANNUAL BROADLEAVES								ANNUAL GRASSES							PERENNIALS							
	Cocklebur	Jimsonweed	Lambsquarter	Nightshade (Black)	Pigweed (Redroot)	Ragweed	Smartweed	Velvetleaf	Wild mustard	Barnyardgrass	Crabgrass	Giant foxtail	Green foxtail	Yellow foxtail	Fall panicum	Witchgrass	Wild proso millet	Bindweed (Field)	Bindweed (Hedge)	Canada thistle	Quackgrass	Yellow nutsedge	
PREPLANT INCORPORATED																							
AMIBEN	P	P	G	G	G	G	G	F	F	P	P	P	P	P	P	P	P	N	N	N	N	N	
DUAL	N	N	P	F	G	P	P	N	P	F	F	F	F	F	G	F	F	N	N	N	N	G	
EPTAM/GENEP	P	P	G	P	F	F	F	F	F	F	F	F	F	F	F	F	F	N	N	N	F	P	
LESSO	N	N	P	G	G	P	P	N	P	F	F	F	F	F	G	F	F	N	N	N	N	F	
TREFLAN	N	N	G	N	G	N	P	N	P	F	F	F	F	F	F	F	F	N	N	N	N	N	
PREEMERGENCE																							
AMIBEN	P	P	G	G	F	F	G	F	F	F	F	F	F	F	F	F	F	N	N	N	N	N	
PREMERGE	P	P	G	G	G	F	G	P	G	P	P	P	P	P	P	P	P	N	N	N	N	N	
POSTEMERGENCE																							
BASAGRAN + OIL	E	G	F	P	P	F	G	G	E	N	N	N	N	N	N	N	N	N	N	G	N	G	

TABLE 7 — WEED RESPONSE TO HERBICIDES IN POTATOES*

	ANNUAL BROADLEAVES								ANNUAL GRASSES							PERENNIALS						
	Cocklebur	Jimsonweed	Lambsquarter	Nightshade (Black)	Pigweed (Redroot)	Ragweed	Smartweed	Velvetleaf	Wild mustard	Barnyardgrass	Crabgrass	Giant foxtail	Green foxtail	Yellow foxtail	Fall panicum	Witchgrass	Wild proso millet	Bindweed (Field)	Bindweed (Hedge)	Canada thistle	Quackgrass	Yellow nutsedge
PREPLANT INCORPORATED																						
EPTAM/GENEP	P	P	G	P	F	F	F	F	F	E	E	E	E	E	E	E	F	N	N	N	F	F
PREEMERGENCE																						
DUAL	N	N	P	F	G	P	P	N	P	F	F	F	F	G	G	F	N	N	N	N	F	
LEXONE/SENCOR	P	P	F	N	F	F	F	F	F	F	F	F	F	F	F	F	F	N	N	N	N	N
LINEX/LOROX	P	P	G	G	G	F	G	P	G	P	P	P	P	P	P	P	P	N	N	N	N	N
PREMERGE	P	P	G	G	G	F	G	P	G	P	P	P	P	P	P	P	P	N	N	N	N	N
PROWL	N	N	G	P	F	P	P	P	P	F	F	F	F	F	F	F	F	N	N	N	N	N
POSTEMERGENCE																						
LEXONE/SENCOR	G	F	E	N	E	E	E	G	E	F	F	F	F	F	F	F	P	N	N	N	N	N

P = Poor; F = Fair; G = Good; E = Excellent; N = None

*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 8 — WEED RESPONSE TO HERBICIDES IN SUGARBEETS*

	ANNUAL BROADLEAVES								ANNUAL GRASSES							PERENNIALS					
	Cocklebur	Jimsonweed	Lambsquarter	Nightshade (Black)	Pigweed (Redroot)	Ragweed	Smartweed	Velvetleaf	Wild mustard	Barnyardgrass	Crabgrass	Giant foxtail	Green foxtail	Yellow foxtail	Fall panicum	Witchgrass	Bindweed (Field)	Bindweed (Hedge)	Canada thistle	Quackgrass	Yellow nutsedge
PREPLANT INCORPORATED																					
RO-NEET	P	P	P	P	P	P	P	P	P	G	G	G	G	G	G	G	N	N	N	N	F
PREEMERGENCE																					
ANTOR	N	N	P	F	F	P	P	N	P	G	G	G	G	G	G	G	N	N	N	N	G
NORTRON	F	F	G	G	G	P	G	P	G	P	G	P	F	F	P	P	N	N	N	N	P
PYRAMIN	P	P	E	G	G	G	G	P	G	F	F	F	F	F	F	F	N	N	N	N	N
TCA	N	N	F	P	F	F	F	N	P	G	G	G	G	G	G	G	N	N	N	G	P
POSTEMERGENCE																					
BETAMIX	F	F	E	F	F	G	G	P	G	P	P	P	P	P	P	P	N	N	N	N	N
BETANEX	F	F	G	F	G	G	G	P	G	P	P	P	P	P	P	P	N	N	N	N	N
DOWPON	N	N	N	N	N	N	N	N	N	G	F	G	G	G	G	G	N	N	N	G	P
H273	P	P	P	P	P	P	E	P	P	N	N	N	N	N	N	N	N	N	P	N	N
NORTRON	F	F	G	G	G	P	G	P	G	P	G	P	F	F	P	P	N	N	N	N	P
POAST	N	N	N	N	N	N	N	N	N	E	E	E	E	E	E	E	N	N	N	F	N

TABLE 9 — WEED RESPONSE TO MISCELLANEOUS AND NON-SELECTIVE HERBICIDES*

	ANNUAL BROADLEAVES								ANNUAL GRASSES							PERENNIALS						
	Cocklebur	Jimsonweed	Lambsquarter	Nightshade (Black)	Pigweed (Redroot)	Ragweed	Smartweed	Velvetleaf	Wild mustard	Barnyardgrass	Crabgrass	Giant foxtail	Green foxtail	Yellow foxtail	Fall panicum	Witchgrass	Wild proso millet	Bindweed (Field)	Bindweed (Hedge)	Canada thistle	Quackgrass	Yellow nutsedge
AMITROL	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	G	G	G	P
DOWPON	N	N	N	N	N	N	N	N	N	G	F	G	G	G	G	G	G	N	N	N	G	P
GRAMOXONE/PARAQUAT	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	P	P	P	P	P
MILOGARD	G	F	G	E	E	E	E	P	E	G	P	F	P	G	P	P	P	P	P	P	F	F
ROUNDUP	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	G	G	G	E	P

P = Poor; F = Fair; G = Good; E = Excellent; N = None

*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 10 — GLOSSARY OF CHEMICAL NAMES

COMMON NAME	TRADE NAME* AND MANUFACTURER	CONCENTRATION AND COMMERCIAL FORMULATION†
ACIFLUORFEN	Blazer 2L (Rohm and Haas)	2 lb/gal L
ALACHLOR	Lasso, Micro-Tech Lasso (Monsanto)	4 lb/gal L; 15% G
ALACHLOR + ATRAZINE	Lasso-Atrazine (Monsanto)	4 lb/gal L (2.5 + 1.5)
AMETRYN	Evik (Ciba-Geigy)	80% WP
AMITROL	Amitrol T (Union Carbide) Amino Triazole, Cytrol Amitrol-T (American Cyanamid)	90% WSP 90% WSP, 2 lb/gal L
ATRAZINE	Several (various)	80% WP; 4 lb/gal L, 90% WDG
ATRAZINE + BUTYLATE + R-25788	Sutazine (Stauffer)	6 lb/gal L (1.2 + 4.8)
ATRAZINE + METOLACHLOR	Bicep (Ciba-Geigy)	4.5 lb/gal L (2 + 2.5)
BENEFIN	Balan (Elanco)	1 1/2 lb/gal L
BENTAZON	Basagran (BASF)	4 lb/gal L
BROMOXYNIL	ME4 Brominal (Union Carbide) Buctril (Rhone-Poulenc)	4 lb/gal L 2 lb/gal L
BUTYLATE + R-25788	Sutan Plus (Stauffer), Genate Plus (PPG)	6.7 lb/gal L; 10% G
CHLORAMBEN	Amiben (Union Carbide)	10% G; 2 lb/gal L; 75% DS
CYANAZINE	Bladex (Shell)	80% WP, 4 L, 90% DF, 15% G
CYCLOATE	Ro-Neet (Stauffer)	6 lb/gal L; 10% G
DALAPON	Dowpon M (Dow)	74% WSP
DESMEDIPHAM	Betanex (Nor-Am)	1.3 lb/gal L
DESMEDIPHAM + PHENMEDIPHAM	Betamix (Nor-Am)	1.3 lb/gal L (.65 + .65)
DICAMBA	Banvel or Banvel II (Velsicol)	4 lb/gal or 2 lb/gal L
DICLOFOP	Hoelon (Am. Hoechst)	3 lb/gal L
DIETHATYLETHYL	Antor (Nor-Am)	4 lb/gal L
DINOSEB	amine salt Premerge (Vertac)	3 lb/gal L
(DNBP)	oil soluble General Weed Killer (Vertac)	5 lb/gal L
ENDOTHALL	Herbicide, 273 (Pennwalt)	3 lb/gal L; 5% G
EPTC	Eptam (Stauffer), Genep (PPG)	7 lb/gal L; 10% G
EPTC + R-25788	Eradicane (Stauffer)	6.7 lb/gal L
EPTC + R-25788 + R-33865	Eradicane Extra (Stauffer)	6 lb/gal L
ETHALFLURALIN	Sonalan (Elanco)	3 lb/gal L
ETHOFUMESATE	Nortron (Nor-Am)	1 1/2 lb/gal L., 4 lb/gal L
FLUAZIFOP-BUTYL	Fusilade 2000 (ICI)	1 lb gal/L
GLYPHOSATE	Roundup (Monsanto)	3 lb/gal L
HEXAZINONE	Velpar (DuPont)	2 lb/gal L, 90% WP
LINURON	Lorox (DuPont), Linex (Griffin)	50% WP, 4 lb/gal L, 50% DF
MCPA	Several (various)	Various L
METOLACHLOR	Dual (Ciba-Geigy)	8 lb/gal L
METRIBUZIN	Lexone, Lexone DF, Lexone 4L (DuPont), Sencor Sencor DF, Sencor 4 (Mobay)	50% WP; 75% DF, 4 lb/gal L Various
NAPTALAM + DINOSEB	Various	3 lb/gal L (2 + 1)
ORYZALIN	Surflan (Elanco)	75% WP, 4 lb/gal L
PARAQUAT	Ortho Paraquat (Chevron) Gramoxone (ICI)	2 lb/gal L
PENDIMETHALIN	Prowl (American Cyanamid)	4 lb/gal L
PRONAMIDE	Kerb (Rohm + Haas)	50% WP
PROPACHLOR	Ramrod (Monsanto)	65% WP; 20% G
PROPAZINE	Milogard (Ciba-Geigy)	4 lb/gal L; 80% WP; 90% WDG
PYRAZON	Pyramin (BASF)	80% WP
SETHOXYDIM	Poast (BASF)	1.53 lb/gal L
SIMAZINE	Princep (Ciba-Geigy)	80% WP; 4% G, 4 lb/gal L; 90% WDG
TCA	TCA (various)	4.76 lb/gal L; 79.3% WSP
TERBACIL	Sinbar (DuPont)	80% WP
TRIFLURALIN	Treflan (Elanco)	4 lb/gal L; 5% G
2,4-D	Several (various)	L, G, various
2,4-DB	Butyrac (Union Carbide) Butoxone (Vertac)	2 lb/gal L

*"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.

†DF—dry flowable, G—granular, L—liquid, WDG—water dispersible granule, WP—wetable powder, WSP—water soluble powder.

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