1986 Row Crop Weed Control Guide

This guide is based on the results of research conducted by the University of Illinois Agricultural Experiment Station, other experiment stations, and the U.S. Department of Agriculture. Consideration has been given to the soils, crops, and weed problems of Illinois.

The effectiveness of herbicides is influenced by rainfall, soil factors, weed spectrum, method of application, and formulation. Under certain conditions some herbicides may damage the crops to which they are applied. In some cases, herbicide residues in the soil may damage crops that are grown later.

Precautions

When selecting a herbicide, consider both the risk involved in using the herbicide and the yield losses caused by weeds. You can reduce risks by taking the following precautions:

- Apply herbicides only to those crops for which use has been approved.
- Clean tanks thoroughly when changing herbicides, especially when using a postemergence herbicide. Use a 1 percent ammonia wash to clean out traces of 2,4-D or dicamba from the tank before spraying soybeans.
- Correctly calibrate the sprayer and check the nozzle output and adjustment before adding herbicide to a tank.
- Use recommended rates. Applying too much herbicide is costly and in addition may damage crops and cause illegal residues. Using too little herbicide can result in poor weed control.
- Apply herbicides only at times specified on the label. Observe the recommended intervals between treatment and pasturing or harvesting of crops.
- Wear goggles, rubber gloves, and other protective clothing as suggested by the label.
- Guard against drift injury to nearby susceptible plants, such as soybeans, grapes, and tomatoes. Mist or vapors from 2,4-D and dicamba sprays may drift several hundred yards. When possible, operate sprayers at low pressure with tips that deliver large droplets. Spray only on calm days or make sure that wind is not moving toward susceptible crop plants and ornamentals.
- Apply herbicides only when all animals and persons not directly involved in the application have been removed from the area. Avoid unnecessary exposure.
- Check the label for the proper method of container disposal. Triple rinse, puncture, and haul metal containers to an approved sanitary landfill. Haul paper containers to a sanitary landfill or burn them in an approved manner.
- Return unused herbicides to a safe storage place promptly. Store them in the original containers away from unauthorized persons, particularly children.
- Since formulations and labels are sometimes changed and government regulations modified, always refer to the most recent product label.

This guide has been developed to help you use herbicides as effectively and safely as possible. However, since no guide can remove all the risk involved, the University of Illinois and its employees assume no responsibility for the results of using herbicides, even if they have been used according to the suggestions, recommendations, or directions of the manufacturer or any governmental agency.

Cultural and Mechanical Control

Good cultural practices that aid in weed control include adequate seedbed preparation, adequate fertilization, crop rotation, planting on the proper date, use of the optimum row width, and seeding at the rate required for optimum stands.

Planting in relatively warm soils helps crops compete better with weeds. Good weed control during the first 3 to 5 weeks is extremely important for both corn and soybeans. If weed control is adequate during that period, corn and soybeans will usually compete quite well with most of the weeds that begin growing later.

Narrow rows will shade the centers faster and help the crop compete better with the weeds. However, if herbicides alone cannot give adequate weed control, then keep rows wide enough to allow for cultivation. Some of the newer herbicides are improving the chances of achieving adequate control without cultivation.

If a preemergence or preplant herbicide does not ap-

pear to be controlling weeds adequately, use the rotary hoe while weeds are still small enough to be controlled.

Use the rotary hoe after weed seeds have germinated but before most weeds have emerged. Operate it at 8 to 12 miles per hour and weight it enough to stir the soil and kill the tiny weeds. Rotary hoeing also aids crop emergence if the soil is crusted.

Row cultivators also should be used while weeds are small. Throwing soil into the row can help smother small weeds. Cultivate shallow to prevent injury to crop roots.

Herbicides can provide a convenient and economical means of early weed control and allow for delayed and faster cultivation. Furthermore, unless the soil is crusted, it is usually not necessary to cultivate at all when herbicides are controlling weeds adequately.

Herbicide Incorporation

Soil-applied herbicides are incorporated to minimize surface loss, reduce dependence upon rainfall, and provide appropriate placement of the herbicide. Sutan+ and Eradicane are incorporated soon after application to minimize surface loss from volatilization. Treflan and Sonolan are incorporated within a few hours to minimize loss due to photodecomposition and volatilization. Triazine herbicides such as atrazine and Bladex and acetamide herbicides such as Lasso and Dual may be incorporated to minimize dependence upon timely rainfall, but since these herbicides are not lost as quickly from the soil surface, the time of incorporation is less critical.

Incorporation should place the herbicide uniformly in the top 1 or 2 inches of soil for best control of small-seeded annual weeds that germinate from shallow depths. Slightly deeper placement may improve the control of certain weeds from deep-germinating seed under relatively dry conditions. The field cultivator and tandem disk place most of the herbicide at about one-half the depth of operation. Thus for most herbicides the suggested depth of operation is 3 to 4 inches.

Thorough incorporation with ground-drive implements may require two passes. Single-pass incorporation may result in streaked weed control, especially in wet soils. Single-pass incorporation may be adequate with some equipment, especially if rotary hoeing, cultivation, or subsequent herbicide treatments are used to improve weed control. If the herbicide is sufficiently covered to prevent surface loss with the first pass, the second pass can be delayed until immediately before planting.

The depth and thoroughness of incorporation depend upon the type of equipment used, the depth and speed of the operation, soil texture, and soil moisture. Field cultivators and tandem disks are commonly used for incorporation. However, disk-chisels and other combination tools are being used in some areas.

Field Cultivators

Field cultivators are frequently used for herbicide incorporation. They should have three or more rows of shanks with an effective shank spacing of no more than 8 to 9 inches (a spacing of 24 to 27 inches on each of three rows). The shanks can be equipped with points or sweeps. Sweeps usually give better incorporation, especially when soil conditions are a little too wet or dry for optimal soil flow and mixing. Sweeps for "C" shank cultivators should be at least as wide as the effective shank spacing.

The recommended operating depth for the field cultivator is 3 to 4 inches. It is usually necessary to operate it only deep enough to remove tractor tire depressions. The ground speed should be at least 6 miles per hour. The field cultivator must be operated in a level position so that the back shanks are not operating in untreated soil, which would result in streaked weed control. Two passes are recommended to obtain uniform weed control. If single-pass incorporation is preferred, the use of wider sweeps or narrower spacing with a 3- to 5-bar harrow or rolling baskets pulled behind will increase the probability of obtaining adequate weed control.

Tandem Disks

Tandem disk harrows invert the soil and usually place the herbicide deeper in the soil than most other incorporation tools. Tandem disks used for herbicide incorporation should have disk blade diameters of 20 inches or less and blade spacings of 7 to 9 inches. Larger disks are considered primary tillage tools and should not be used for incorporating herbicides. Spherical disk blades give better herbicide mixing than conical disk blades.

Tandem disks usually place most of the herbicide in the top 50 to 60 percent of the operating depth. For most herbicides, the suggested operating depth is from 3 to 4 inches. Two passes are recommended to obtain uniform mixing with a double disk. A leveling device (harrow or rolling baskets) should be used behind the disk to obtain proper mixing. Recommended ground speeds are usually between 4 and 6 miles per hour. The speed should be sufficient to move the soil the full width of the blade spacing. Lower speeds can result in herbicide streaking.

Combination Tools

Several new tillage tools combine disk gangs, field cultivator shanks, and leveling devices. Many of these combination tools can handle large amounts of surface residue without clogging and yet leave considerable crop residue on the soil surface for erosion control. Results indicate that these combination tools may provide more uniform one-pass incorporation than does a disk or field cultivator, but one pass with them is generally no better than two passes with the disk or field cultivator.

Chemical Weed Control

Plan your weed-control program to fit your soils, tillage program, crops, weed problems, and farming operations. Herbicide performance depends on the weather and on wise selection and application. Your decisions on herbicide use should be based on the nature and serious-

ness of your weed problems. The herbicide selectivity table at the end of this guide indicates the susceptibility of our most common weed species to herbicides.

Corn or soybeans may occasionally be injured by some of the herbicides registered for use on those crops. To reduce crop injury, apply the herbicide at the time specified on the label and at the correct rate (see section entitled "Herbicide Rates"). Crop tolerance ratings for various herbicides are also given in the table at the end of this guide. Unfavorable conditions such as cool, wet weather, delayed crop emergence, deep planting, seedling diseases, poor soil physical conditions, and poor-quality seed may contribute to crop stress and herbicide injury. Hybrids and varieties also vary in their tolerance to herbicides and environmental stress factors. Once injured by a herbicide, plants are prone to disease.

Crop planting intentions for the next season must also be considered. Where atrazine or simazine are used, you should not plant spring-seeded small grains, small-seeded legumes and grasses, or vegetables the following year. Be sure that the application of Treflan or similar herbicides for soybeans is uniform and sufficiently early to reduce the risk of injury to wheat or corn following soybeans. Refer to the herbicide label for information on cropping sequence.

Names of Some Herbicides

Trade	Common (generic)
AAtrex, Atrazine	atrazine
Amiben	chloramben
Banvel	dicamba
Basagran	bentazon
Bicep	metolachlor + atrazine
Bladex	cyanazine
Blazer	acifluorfen
Bronco	alachlor + glyphosate
Buctril, Brominal	bromoxynil
Butoxone, Butyrac	2,4-DB
Dowpon M	dalapon
Dual	metolachlor
Dyanap, Kleen Krop, Premerge Plus	naptalam plus dinoseb
Eradicane	EPTC plus safener
Eradicane Extra	EPTC plus safener and extender
Evik	ametryn
Furloe Chloro IPC	chlorpropham
Fusilade 2000	fluazifop
Hoelon	diclofop
Lasso	alachlor
Lorox, Linex	linuron
Marksman	dicamba plus atrazine
Modown	bifenox
Paraquat Plus, Gramoxone	paraquat
Poast	sethoxydim
Princep, Simazine, Caliber 90	simazine
Prowl	pendimethalin
Ramrod	propachlor
Rescue	naptalam plus 2,4-DB
Reward	vernolate plus extender
Roundup	glyphosate
Sencor, Lexone	metribuzin
(several)	2,4-D
Sonalan	ethalfluralin
Surflan	oryzalin
Sutan+, Genate Plus	butylate plus safener
Sutazine	butylate plus safener plus atrazine
Treflan	trifluralin
Vernam	vernolate

Some herbicides have different formulations and concentrations under the same trade name. *No endorsement of any trade name is implied, nor is discrimination against similar products intended.*

Herbicide Combinations

Herbicides are often combined to control more weed species, reduce carryover, or reduce crop injury. Some combinations are sold as a "package mix," while others are tank mixed. Tank mixing allows you to adjust the ratio to fit local weed and soil conditions. If you use a tank mix, you must follow restrictions on all products used in the combination.

Problems sometimes occur when mixing emulsifiable concentrate (EC) formulations with wettable powder (WP), water dispersible liquid (WDL), or water dispersible granule (WDG) formulations. These problems can sometimes be prevented by using proper mixing procedures. Fill tanks at least one-third full with water or liquid fertilizer before adding herbicides that are suspended. If using liquid fertilizers, check compatibility in a small lot before mixing a tankful. The addition of compatibility agents may be necessary. Wettable powders, WDGs, or WDLs should be added to the tank before ECs. Emulsify ECs by mixing with equal volumes of water before adding them to the tank. Empty and clean spray tanks often enough to prevent accumulation of material on the sides and the bottom of the tank.

The user can apply two treatments of the same herbicide (split application), or he can use two different ones, provided such uses are registered. The use of one herbicide after another is referred to as a sequential or overlay treatment. Sequential treatment can be done in a number of ways. For example, a preplant application might be followed by a preemergence application, or a soil-applied treatment might be followed by a postemergence treatment. One herbicide may be broadcast while the other is banded or directed.

Herbicide Rates

Herbicide rates vary according to the time of application, soil conditions, the tillage system used, and the seriousness of the weed infestation. Sometimes lower rates are specified for preemergence application than for pre-

plant incorporated application. Postemergence rates may be lower than preemergence rates if the herbicides can be applied at either time. Postemergence rates often vary depending on the size and species of the weeds and on whether an adjuvant is specified. Rates for combinations are usually lower than rates for herbicides used alone.

The rates for soil-applied herbicides usually vary with the texture of the soil and the amount of organic matter it contains. For instance, light-colored, medium-textured soils with little organic matter require relatively lower rates of most herbicides than do dark-colored, fine-textured soils with medium to high organic matter. For sandy soils the herbicide label may specify "do not use," "use a reduced rate," or "use a postemergence rather than soil-applied herbicide," depending on the herbicide and its adaptation and on crop tolerance.

The rates given in this publication are, unless otherwise specified, broadcast rates for the amount of formulated product. If you plan to band or direct herbicides, adjust the amount per crop acre according to the percentage of the area actually treated. Many herbicides have several formulations with different concentrations of active ingredient. Be sure to read the label and make the necessary adjustments when changing formulations.

Postemergence Herbicide Principles

Postemergence herbicides applied to growing weeds generally have foliar rather than soil action; however, some may have both. The rates and timing of applications are based on weed size and climatic conditions. Weeds can usually be controlled with a lower application rate when they are small and tender. Larger weeds often require a higher herbicide rate or the addition of a spray additive, especially if the weeds have developed under drouth conditions. Herbicide penetration and action are usually greater when the temperature and relative humidity are high. Rainfall occurring too soon after application (1 to 8 hours, depending on the herbicide) can cause poor weed control.

Translocated (hormone) herbicides can be effective with partial foliar coverage, whereas contact herbicides require more complete coverage. Foliar coverage increases as water volume and spray pressure are increased. Spray nozzles that produce small droplets also improve coverage. For contact herbicides, 20 to 40 gallons of water per acre are often recommended for ground application and a minimum of 5 gallons per acre for aerial application. Spray pressures of 30 to 50 psi are often suggested with flat-fan or hollow-cone nozzles to produce small droplets and improve canopy penetration. These small droplets are quite subject to drift.

The use of a surfactant or crop oil concentrate may be recommended to improve spray coverage. These spray additives will usually improve weed control but may increase crop injury. Spray additives may be needed only under drouth conditions or on larger weeds.

Crop size limitations may be specified on the label to minimize crop injury and maximize weed control. If weeds are smaller than the crop, basal-directed sprays may minimize crop injury because they place more herbicide on the weeds than on the crop. If the weeds are taller than the crop, rope-wick applicators or recirculating sprayers can be used to place the herbicides on the top of the weeds and minimize contact with the crop. *Follow the label directions and precautions for each herbicide.*

Conservation Tillage and Weed Control

Conservation tillage refers to tillage methods that provide efficient crop production along with adequate control of soil erosion caused by wind and water. Erosion is controlled by protecting the soil surface with plant residue. The amount of tillage is less than that used in conventional moldboard plowing. Chisel plowing, ridge tilling, or no tillage can be used; several other systems are also available.

With reduced tillage systems, there is often a greater reliance on herbicides for weed control. With these systems, herbicides cannot be incorporated without covering much of the residue that is necessary for effective erosion control. The early application of preplant, preemergence, and postemergence herbicides is an alternative to incorporation.

Early preplant herbicides may be applied several weeks before planting. Early application may reduce the need for a contact herbicide at planting. However, early preplant application may require additional herbicides (preemergence or postemergence) or cultivation for satisfactory weed control.

Compared with preplant incorporated herbicides, preemergence herbicides require less tillage, but their performance is more dependent upon timely rainfall. However, they have performed better than herbicides that are poorly incorporated. With conservation tillage, a higher application rate of surface-applied herbicides may be required for satisfactory weed control, especially in fields with considerable weed infestation or crop residue. Do not, however, use a higher rate than that stated on the label. Use great care when selecting herbicides and choosing application rates.

The use of effective postemergence herbicides, which depend upon foliar rather than soil action, may be a logical choice with some conservation tillage systems.

No-Till and Double-Crop

Corn, sorghum, and soybeans can be planted without seedbed preparation, either in last year's crop residue (no-till) or as a second crop after a small grain harvest or forage removal (double-crop). Because it conserves soil, soil moisture, and time, no-till planting has greatly improved the probability of success with double-cropping.

Several precautions should be observed in no-till cropping systems. Crop seed should be planted to the proper depth and adequately covered to avoid possible contact with herbicide sprays. (Several herbicide labels give the planting depths that are necessary to avoid possible injury.) Preemergence applications may give better weed

control than preplant applications because the planting process may expose untreated soil that contains viable weed seed. The total reliance on chemical weed control and the large amounts of crop residue present under no-till cropping systems may require that the higher labeled herbicide rates be used to obtain acceptable weed control.

Existing Vegetation Control in Reduced Tillage Program

Existing vegetation may be a perennial grass sod, a legume or legume-grass sod, an annual cover crop, or weeds. Perennial legume sods can often be controlled prior to planting corn or sorghum by preplant applications of 2,4-D or Banvel. Perennial grass sods can sometimes be controlled with preplant applications of Roundup. If a cutting of forages such as alfalfa or clover is removed before no-till planting, control of sod may be poor if herbicides are applied before there is sufficient regrowth.

Existing vegetation which consists of small annual weeds less than 2 inches may not require the necessity of utilizing paraquat or Roundup as knockdown herbicides. Residual herbicides which also have postemergence activity may often control existing vegetation. Bladex, atrazine, Sencor or Lexone, and Lorox or Linex have both preemergence and postemergence activity. Postemergence herbicides can also often be used to control existing vegetation. Poast is labeled to control existing grass weeds prior to planting soybeans.

Early preplant application of labeled residual herbicides can often prevent existing vegetation from being a problem before planting. The earlier applications are made before planting, the shorter the length of control after planting. To strengthen or lengthen control, an additional application of the same or another herbicide can be considered.

Paraquat Plus or Gramoxone (1 or 2 pints per acre) plus a *nonionic* surfactant at ½ pint per 100 gallons of diluted spray can be used to "knock down" existing foliage before crop emergence. Smartweed, giant ragweed, and fall panicum may not be controlled if they are over 4 to 6 inches high. A minimum of 40 gallons or more of spray per acre is suggested to ensure adequate coverage of the foliage. Paraquat can be applied with certain liquid fertilizers. *Do not* apply with suspension or high phosphate liquid fertilizers. *Paraquat and Gramoxone are restricted-use pesticides.*

Roundup (3 to 8 pints per acre) is another alternative for control of existing vegetation prior to crop emergence in situations where fall panicum, smartweed, or certain perennial weeds are a problem. Roundup can translocate to the roots to give better control of perennials. Use 10 to 40 gallons of spray volume per acre. Roundup + 2,4-D can be used in some situations to improve broadleaf control.

Bronco is a formulated mixture of glyphosate (Roundup) plus alachlor (Lasso). Application rates are 4 to 5 quarts per acre. Bronco may be applied in 10 to 30 gallons of water or in 10 to 50 gallons of 28 percent or 32 percent liquid nitrogen solutions. Application with a nitrogen solution should only be made for control of annual weeds that are less than 6 inches tall.

Roundup, paraquat, and Bronco are registered for use in combination with the preemergence herbicides indicated in Table 1. See the sections entitled "Herbicides for Corn" and "Herbicides for Soybeans" for more information on these products.

Herbicides for Corn

All herbicides mentioned in this section are registered for use on field corn and also on silage corn unless otherwise specified. See Table 2 for registered combinations. Herbicide suggestions for sweet corn and popcorn may be found in Circular 907, *1986 Weed Management Guide for Commercial Vegetable Growers.* Growers producing hybrid seed corn should check with the contracting company or inbred-seed producer about tolerance of the parent lines.

Preplant Not Incorporated

Interest in early preplant application is increasing, especially with the trend toward reduced tillage. Bladex and atrazine have postemergence as well as residual activity. Early weeds such as smartweed can be controlled while they are small, and emergence of others can be curtailed.

With AAtrex, Dual, or Bicep, preplant surface application may be made using a ⅔ rate up to 45 days before planting, followed by a ⅓ rate at planting. A single application can be made within 30 days before planting.

Bladex may be applied early preplant at labeled rates, but if applied earlier than 15 days before planting, a split application or use of another herbicide at or after planting is suggested. Banvel or 2,4-D are labeled in mixture with Bladex, Bladex plus atrazine, and Bicep for minimum or no-till corn.

Table 1. — Registered No-Till Herbicide Combinations

	Alone	Combination			
		Dual	Lasso	Surflan	Prowl
Soybeans					
Amiben	PR	PR	PR	PR	PR
Lorox	PBR	PR	PBR	PR	P
Lexone	PBR	PR	PBR	PR	P
Sencor	PBR	PR	PBR	PR	P
Corn					
Atrazine	PBR	PR	PBR	—	—
Bladex	PBR	P	PBR	—	—
Princep	BR	PR	PBR	—	—
Atrazine + Bladex	B	P	PB	—	—
Atrazine + Princep	PBR	PR	PBR	—	—
Bicep	PR	—	—	—	—

Knockdown herbicides:
P = Paraquat, Gramoxone (paraquat).
R = Roundup (glyphosate).
B = Bronco = Roundup + Lasso.
— = Not registered.

Table 2. — Registered Herbicide Combinations for Preplant Incorporated (PPI), Preemergence (Pre), or Early Postemergence (EPoE) Application in Corn

	Atrazine	Bladex	Princep	Atrazine + Bladex	Atrazine + Princep
PPI only					
Eradicane, Eradicane Extra	1	1	1	1	—
Genate Plus..	1	1	—	1	—
Sutan+	1	1	1	1	—
PPI or Pre or EPoE					
Used alone...	1,2,3	1,2,3	1,2	1,2,3	1,2
Dual	1,2,3	1,2	1,2	1,2	1,2
Lasso	1,2,3	1,2	2	1,2	—

1 = Preplant incorporated; 2 = preemergence; 3 = early postemergence.
— = Not registered.

Banvel (dicamba) can be used as a preplant herbicide prior to planting corn or sorghum. The rate is 1 to 2 pints per acre. It is suggested that you delay planting corn 1 week and sorghum 1 to 2 weeks after application.

Roundup can be used preplant to corn or sorghum at ¾ to 1 pint (12 to 16 fluid ounces) per acre to control small annual weeds. Use 5 to 10 gallons of water per acre plus a surfactant. Roundup may be mixed with Banvel or 2,4-D.

Preplant Incorporation

Some herbicides may be applied prior to planting and incorporated. The time of application will depend on the label directions and field conditions. Herbicides with sufficient residual activity, such as AAtrex, Bicep, and Dual, may be applied early preplant up to 45 days before planting. However, if applied too early, weed control may not last as long as desired after planting. Incorporation should distribute the herbicide uniformly in about the top 2 inches of soil. Do not apply herbicides too early or incorporate them too deeply.

Sutan+, Genate Plus (butylate), Eradicane, and Eradicane Extra (EPTC) contain crop safening agents. Crop injury is unlikely, but may occur when growing conditions are unfavorable or when certain hybrids are used. Eradicane Extra also contains an extender to lengthen weed control. These herbicides control annual grass weeds and can control or suppress shattercane and johnsongrass at higher rates. The rate for Sutan+ and Genate Plus is 4¾ to 7⅓ pints per acre. The rate for Eradicane 6.7E is 4¾ to 7⅓ pints per acre. The rate for Eradicane Extra 6E is 5⅓ to 8 pints per acre. Use the higher rates for heavy infestations of shattercane and yellow nutsedge and for johnsongrass.

These herbicides should be incorporated into the soil soon after application. Although some labels allow application up to 4 weeks prior to planting, application close to planting time is generally preferable.

Sutan+, Genate Plus, Eradicane, or Eradicane Extra can be tank-mixed with atrazine or Bladex to improve broadleaf control. Sutan+ or Eradicane can be tank-mixed with Princep. The atrazine rate is 2 to 3 pints of 4L or equivalent amounts of 80W or 90WDG per acre. The Bladex rate is 3 to 4 pints of 4L or 2 to 2½ pounds of 80W per acre. Three-way combinations with atrazine plus Bladex are also registered.

Sutazine+ 6-ME is a 4:1 mixture of Sutan+ and atrazine. The application rate is 5¼ to 10½ pints per acre. Sutazine+ and Sutan+ are available as granular formulations.

Preplant or Preemergence Herbicides

Incorporation of the following herbicides is optional, depending upon the weeds to be controlled and the likelihood of rainfall. Incorporation of these herbicides should be shallow but thorough.

AAtrex, Atrazine (atrazine), or Princep (simazine) can be applied anytime during the 2 weeks prior to planting or soon after planting. If rainfall is limited, incorporation may aid performance. Corn tolerance of atrazine and simazine is good, but carryover to subsequent crops can occur.

Princep controls fall panicum and crabgrass better than atrazine but is less effective in controlling cocklebur, velvetleaf, and yellow nutsedge. Princep is less soluble and more persistent than atrazine. Thus, Princep is usually applied preplant. Princep plus atrazine can be used in 1:1 or 2:1 combinations; the total rate is the same as for atrazine used alone.

The rate for atrazine used alone is 2½ to 3¾ pounds of atrazine 80W, 4 to 6 pints of 4L, or 2.2 to 3.3 pounds of AAtrex 90WDG. Atrazine controls annual broadleaf weeds better than it does grasses, and it is often used at reduced rates in tank mix combinations to improve broadleaf weed control. The rate for atrazine in combinations is 1½ to 2 pounds of atrazine 80W, 2 to 3 pints of atrazine 4L, or 1.1 to 1.8 pounds of AAtrex 90WDG. These rates may not provide adequate control of cocklebur, morningglory, and velvetleaf but can reduce the risk of carryover.

You can minimize carryover injury by mixing and applying the herbicides accurately, by applying them early, by using the lowest rates consistent with good weed control, and by tilling the soil to dilute the herbicide. The risk of carryover is greater after a cool, dry season and on soils with a pH over 7.3.

If you use atrazine at more than 3 pounds of active ingredient per acre or if you apply after June 10, plant only corn or sorghum the next year. If you use atrazine in the spring and must replant, then plant only corn or sorghum that year. Do not plant small grains, small seeded legumes, or vegetables in the fall or the following spring. Soybeans planted the year after an application of atrazine can also be affected from carryover, especially if you use Sencor or Lexone.

Bladex (cyanazine) does not persist in the soil as long as atrazine, but atrazine does have the advantage of better corn tolerance. Bladex provides better control than

atrazine of fall panicum, giant foxtail, and some other grass weeds, but not all broadleaf weeds. Bladex can be combined with atrazine at 3:1, 2:1, or 1:1 ratios of Bladex to atrazine (see label for rates). The higher ratios will provide better grass control, while the 1:1 ratio will provide better broadleaf weed control.

Rates of Bladex must be selected accurately on the basis of soil texture and organic matter to reduce the possibility of corn injury. Bladex rates are 1½ to 6 pounds of 80W, 1.35 to 5.3 pounds of Bladex 90DF, or 1¼ to 4¾ quarts of 4L. You can lessen the risk of corn injury by using reduced rates of Bladex in combinations.

Bladex can be tank-mixed with Lasso, Dual, Ramrod, or Prowl to improve grass control. The Lasso or Dual combination can be applied immediately before planting or after planting. Do not incorporate the Prowl or Ramrod combinations.

Three-way combinations of Bladex plus atrazine plus Lasso, Dual, Sutan+, or Eradicane are registered. The addition of a limited amount of atrazine should improve broadleaf control without increasing concern about carryover.

Lasso (alachlor) or Dual (metolachlor) can be preplant incorporated or applied at the preemergence stage. Preplant incorporation can improve control of yellow nutsedge and can lessen dependence upon rainfall. Incorporation should distribute the herbicide evenly in the top 2 inches of soil.

Lasso and Dual control annual grasses and help control yellow nutsedge. You can improve broadleaf weed control by using atrazine or Bladex or both in either a preplant or in a preemergence combination.

Lasso can be applied anytime during the week before planting corn and shallowly incorporated, or it can be used after planting but before the crop and weeds emerge and within 5 days after the last tillage operation. The rate is 2 to 4 quarts of Lasso 4E or 16 to 26 pounds of Lasso 15G. Use the higher rate for the soil if you plan to incorporate Lasso.

Dual can be applied anytime during the 2 weeks prior to planting corn and shallowly incorporated, or it can be used soon after planting. The rates are 1½ to 4 pints of Dual 8E or 6 to 16 pounds of Dual 25G per acre.

Lasso or Dual plus atrazine can be preplant incorporated or applied after planting until corn is 5 inches tall and grass weeds have not passed the two-leaf stage. *Do not apply with liquid fertilizer after the crop emerges.* The suggested rate is 1½ to 4 quarts of Lasso or 1¼ to 2½ pints of Dual 8E plus 1½ to 2½ pounds of atrazine 80W, 1 to 2 quarts of atrazine 4L, or 1.1 to 2.2 pounds of AAtrex 90WDG. Dual is also cleared in a combination with atrazine plus Princep.

Dual and Lasso are both formulated as packaged mixes with atrazine. Bicep contains a 5:4 ratio of metolachlor (Dual): atrazine per gallon. The rate is 2 to 4 quarts of Bicep 4.5L or 1½ to 3 quarts of Bicep 6L per acre. Lasso/atrazine (flowable) contains 2½ pounds of alachlor (Lasso) and 1½ pounds of atrazine per gallon. The rate is 3½ to 4½ quarts per acre.

Dual or Lasso plus Bladex can be applied prior to planting and incorporated, or they can be applied during the preemergence stage after planting. The rate is 2 to 4 quarts of Lasso 4E or 1¼ to 2½ pints of Dual 8E plus 1 to 3¾ pounds of Bladex 80W or 1 to 3 quarts of Bladex 4L. Adjust the rate carefully according to soil texture and organic matter.

Preemergence Herbicides

Ramrod (propachlor) can be applied alone or with atrazine after the corn is planted but before grasses reach the two-leaf stage. Granular formulations should be applied before crop or weeds emerge. Ramrod performs well on soils with over 3 percent organic matter.

Ramrod is irritating to the skin and eyes, so observe label precautions. Corn tolerance is good. It controls annual grasses and pigweed. The rate is 4 to 6 quarts of Ramrod 4L or 20 to 30 pounds of 20G per acre.

Banvel (dicamba) can be applied alone after planting until corn is no more than 5 inches tall. Banvel is approved for use in combinations with Lasso, Dual, atrazine, or Bladex. Banvel may injure corn, especially if recommended rates are exceeded, applications are not accurate and uniform, or if corn is planted too shallow (less than 1½ inches). Do not use this treatment on coarse-textured soils or soils that are low in organic matter. The rate on fine-textured soils with over 2½ percent organic matter is 1 pint of Banvel.

Prowl (pendimethalin) is registered for use only on corn after planting. Incorporation of Prowl may result in serious corn injury. Use only where it is possible to cover seed adequately with soil. Prowl can control annual grasses and pigweed and provides some control of smartweed and velvetleaf. You can improve broadleaf weed control by combining Prowl with atrazine, Bladex, or Banvel. Prowl plus atrazine or Bladex may be applied in the early postemergence period before grasses are in the two-leaf stage. These combinations may also help reduce the competition from wild proso millet. However, avoid postemergence application when corn is under stress from cool, wet weather; otherwise, corn injury may result. The rate for such combinations is 1 to 1½ quarts of Prowl 4E. Do not use Prowl plus Banvel on sandy soils or soils with less than 1½ percent organic matter.

Postemergence Herbicides

Lasso, Dual, Ramrod, or Prowl plus atrazine, or Lasso or Dual plus Banvel can be used on corn between the preemergence and very early postemergence stages (see preemergence section). To obtain satisfactory control, apply before grasses reach the two-leaf stage. For more information on postemergence principles, see section entitled "Postemergence Herbicide Principles."

Atrazine can be applied before grass weeds are more than 1½ inches high. Many annual broadleaf seedlings

are more susceptible than grass weeds and may be treated until they are up to 4 inches tall. For control of some broadleaf weeds, 1.2 pounds active ingredient of atrazine may be sufficient. This rate will generally need to be increased to 2 pounds for control of annual grass weeds.

The addition of oil-surfactant mixes or surfactants has generally increased the effectiveness of postemergence atrazine. Crop oil concentrates (80 percent oil and 20 percent surfactant) are used at the rate of 1 quart per acre. Surfactants are usually added at 0.5 percent of the total spray volume or at a rate of about 1 pint per acre. Results with the oil-surfactant mixes have generally been better than those with surfactants.

Applications of atrazine and oil sometimes damage corn that has been under stress from prolonged cold, wet weather or other factors. Do not use more than 2½ pounds of atrazine 80W, 2 quarts of atrazine 4L, or 2.2 pounds AAtrex Nine-O per acre if you mix with oil or oil concentrate. *Do not* add 2,4-D to the atrazine-oil treatment or severe injury may result. Mix the atrazine with water first and add the oil last. If atrazine is applied after June 10, do not plant any crop except corn or sorghum the next year.

Bladex (cyanazine) can be applied through the four-leaf stage of corn growth but before weeds exceed 1½ inches in height. The Bladex rate is 1½ to 2½ pounds of 80W or 1.1 to 2.2 pounds of 90DF per acre. *Do not use Bladex 4L* because it contains oil and can increase the potential for injury. Injury to corn may occur under cold, adverse growing conditions. The injury may only be temporary yellowing but can be more severe. Under drouthy conditions certain agricultural surfactants or vegetable oils may be added to Bladex 80W to improve weed control. Do not use petroleum crop oils or apply with liquid fertilizers for postemergence application. Do not apply Bladex postemergence on corn that is under severe stress.

One may combine Bladex 80W with atrazine 80W, substituting atrazine for 30 percent of the Bladex. A Bladex plus Banvel combination is also registered that allows for the addition of ½ to ⅔ pint per acre of Banvel; no surfactant or any type of oil should be added with this combination.

Banvel (dicamba) can be applied from emergence until corn is 36 inches tall or 15 days before tassel emergence, whichever comes first. Best results can be expected when using ½ to 1 pint of Banvel per acre when the corn is in the spike to 5-inch stage. Application at this time can offer several weeks of soil (residual) activity when the 1-pint rate is used. With this timing, crop tolerance is better than with preemergence treatments of Banvel. In addition, application rates can be higher than in the later postemergence treatment, and the likelihood of injury to nearby soybeans is diminished. For applications on corn from 5 to 36 inches tall, the rate is ½ pint per acre. Banvel is labeled as an overlay (sequential) treatment following Sutan+, Eradicane, Lasso, Dual, Bicep, Ramrod, atrazine, Bladex, Princep, Roundup, Bronco, or paraquat.

Banvel is also labeled for postemergence use as a tank mix with atrazine, Bladex 80W, or 2,4-D. The postemergence rate for Banvel is ½ pint (¼ pound active ingredient per acre) after corn is 5 inches tall. The label allows for the addition of ⅛ to ¼ pound of 2,4-D acid equivalent per treated acre. With Banvel or Banvel plus 2,4-D, drop pipes should be used on the nozzles if corn is taller than 8 inches to help keep the spray off the corn leaves and out of the whorl.

For best results, use Banvel before June 20 with a spray volume of 20 gallons per acre and a spray pressure of no more than 20 psi to help reduce the risk to plants outside the target area.

To aid in the control of hemp dogbane, Banvel is approved for use at ½ pint with 1 pound acid equivalent per acre of 2,4-D LV ester or amine after corn is in the brown silk stage but at least 7 days before harvest.

Marksman (dicamba + atrazine) is a formulated mixture of 1.1 pound dicamba (active ingredient in Banvel) and 2.1 pounds of atrazine per gallon. The rate is 2 to 3.5 pints per acre depending on the soil texture and organic matter. On most Illinois soils, the rate is 3.5 pints per acre or 0.48 pound of dicamba and 0.92 pound of atrazine per acre. Marksman is cleared as a tank-mix and in sequential combinations with many other herbicides.

Marksman may be applied to actively growing weeds prior to, during, or after planting but before corn exceeds the 5-leaf stage. In most conventional tillage applications the recommended timing would be emergence to the 5-leaf stage of corn. Most annual broadleaf weeds should be controlled, and some perennial broadleaf weeds should be suppressed. This formulated mixture will be targeted at the velvetleaf market in Illinois where Banvel has needed some help.

2,4-D is effective in controlling many broadleaf weeds in corn. Use drop nozzles if corn is more than 8 inches high to decrease the possibility of injury. If you direct the nozzles toward the row, adjust the spray concentration so that excessive amounts are not applied to the corn.

Do not apply 2,4-D to corn from the tasseling to dough stage. After the hard dough to dent stage, you can apply 1 to 2 pints of certain 2,4-Ds by air or high clearance equipment to control some broadleaf weeds that may interfere with harvest or to suppress certain perennial weeds. Do not forage or feed fodder for 7 days after treatment.

The suggested broadcast rate is ⅓ to ½ pint of ester or 1 pint of amine for formulations with 3.8 pounds of 2,4-D acid equivalent per gallon. Use equivalent rates with other formulation concentrations. Use proportionately less when using directed nozzles.

The ester forms of 2,4-D can vaporize and injure nearby susceptible plants. This vapor movement is more likely with high-volatile than with low-volatile esters. Spray particles of either the ester or the amine form can drift and cause injury.

Corn is often brittle for 7 to 10 days after application of 2,4-D and thus is susceptible to stalk breakage from

high winds or cultivation. Other symptoms of 2,4-D injury are stalk bending or lodging, abnormal brace roots, and failure of leaves to unroll.

High temperature and high humidity can increase the potential for 2,4-D injury, especially if corn is growing rapidly. If it is necessary to spray under these conditions, it may be wise to reduce the rate by about 25 percent. Corn hybrids differ in their sensitivity, and the probability of injury increases when corn is under stress.

Buctril or Brominal (bromoxynil) may be used to control broadleaf weeds in field and silage corn. It is important to treat when the weeds are small. For ground applications, use 20 gallons of water per acre, a spray pressure of 30 psi, and flat fan nozzles.

Buctril 2E rates are 1 to 1½ pints per acre when corn and weeds are in the 3- to 8-leaf stage. Brominal 4E rates are ½ to 1 pint per acre when corn is in the 2-leaf to 14-inch stage and before weeds are 4 to 6 inches tall. Use the higher rate on larger corn and weeds. Most annual broadleaved weeds are controlled. Larger pigweed and velvetleaf may require the higher rate, or a combination with atrazine. Atrazine 4L at 0.5 to 1.0 quart (equivalent rates of 80W or 90DF) can be combined with Buctril or Brominal. Do not add Bladex to bromoxynil.

Bromoxynil will not volatilize and cause the drift injury associated with 2,4-D or Banvel. Bromoxynil, under some conditions, may cause some burning of corn leaf tips, but the effects are usually temporary. Do not add surfactant or crop oil to Buctril or Brominal.

Basagran (bentazon) is registered for postemergence use in corn similar to that for soybeans (see soybean section). The rate is 1½ to 2 pints of Basagran 2S per acre. Crop oil concentrate can be added at one quart per acre. Basagran is also cleared at the rate of 1 to 1½ pints per acre in combination with atrazine at 0.6 to 1.0 pound of 80W, 0.6 to 0.9 pound of 90DF, or 1 to 1½ pints of 4L per acre. Crop oil concentrate is added at 1 quart per acre. This combination controls only annual broadleaf weeds and not annual grasses. The combination provides better control of pigweed and lambsquarters than Basagran alone, and will create less risk of carryover than atrazine alone.

Roundup (glyphosate) may be applied as a spot treatment in corn prior to silking. For applications made on a spray-to-wet basis use a 1 to 2 percent solution of Roundup in water. For motorized spot treatments where less than complete coverage of weeds may result, use a 5 percent solution. Avoid contact of spray with the corn. Add a dye for increased visibility.

Postemergence Soil-Applied Herbicides

Prowl, Treflan, or Lasso can be applied to the soil as a postemergence treatment. It may be necessary to use drop nozzles to avoid interference from corn leaves and ensure uniform application to the soil.

Prowl (pendimethalin) or **Treflan (trifluralin)** may be applied to the soil and incorporated after field corn is 4 inches high (for Prowl) or 8 inches high (for Treflan) and up to the time of the last cultivation. The field should be cultivated to control existing weeds and cover the roots at the base of the corn before application. The herbicide should then be thoroughly and uniformly incorporated into the top inch of the soil with a sweep type or rolling cultivator. Prowl may not need incorporation if irrigation or rainfall occurs soon after application. Prowl can be combined with atrazine.

These treatments may help control late-emerging grasses such as shattercane, wild proso millet, fall panicum, or woolly cupgrass.

Lasso (alachlor) may be used alone or with atrazine as a soil-applied postemergence treatment to help control midseason annual grass weeds in corn that is grown for seed. Application should preferably be made after cultivation before weeds emerge and before the crop is 40 inches tall.

Directed Postemergence Herbicides

Directed sprays are sometimes needed for emergency situations, especially when grass weeds become too tall to be controlled by cultivation. However, weeds are often too large for directed sprays to be effective. Directed sprays cannot be used on small corn because a height difference between corn and weeds is needed to keep the spray off the corn. Corn leaves that come into contact with the spray can be killed, and injury may affect yields.

Lorox or Linex (linuron) may be applied as a directed spray after corn is at least 15 inches tall (free standing) but before weeds are 8 inches tall (preferably no more than 5 inches). Linuron controls broadleaf and grass weeds.

The broadcast rate is 1¼ to 3 pounds of Lorox 50W (or 50DF) or 1¼ to 3 pints of 4L per acre, depending on weed size and soil type. Add Surfactant WK at the rate of 1 pint per 25 gallons of spray mixture. Cover the weeds with the spray, but keep it off the corn as much as possible. *Consider this an emergency treatment.*

Evik 80W (ametryn) is registered for directed use when corn is more than 12 inches tall and weeds are less than 6 inches tall. Evik should not be applied within 3 weeks of tasseling. The rate is 2 to 2½ pounds Evik 80W per acre (broadcast) plus 2 quarts of surfactant per 100 gallons of spray mixture. Extreme care is necessary to keep the spray from contacting the leaves. *Consider this an emergency treatment.*

Bladex 80W (cyanazine) or **Bladex 80W plus atrazine** may be used as a directed spray for lay-by treatment for *corn seed production fields* at least 60 days before harvest. Seed corn should be at least 10 inches tall and there should be a sufficient height difference between the corn and the weeds to allow the spray to cover the weeds but not touch the corn leaves. This treatment can control weeds that are up to 1½ inches tall and suppress weeds that are a little taller. The use of nitrogen solutions as carriers and/or the addition of crop oil or surfactant can enhance control. Do not apply over the top of corn.

Herbicides for Sorghum

Many herbicides used to control weeds in corn can also be used in sorghum.

Atrazine may be used for weed control in sorghum (grain and forage types) or sorghum-sudan hybrids. Application may be made preemergence or postemergence. A preplant surface application may be made using a single application within 30 days of planting or a ⅔ plus ⅓ split application within 45 days of planting. Plant seed at least 1 inch deep. Do not use preplant or preemergence on soils with less than 1 percent organic matter. Incorporated treatments may cause injury if rainfall occurs prior to or shortly after sorghum emergence.

Injury may occur when sorghum is under stress from unusual soil or weather conditions or when rates are too high. The rate of application for preplant and preemergence is 2 to 3 pounds of atrazine 80W per acre. The postemergence rate is 4 to 6 pints 4L per acre without crop oil or 2.4 pints 4L (broadleaf control only) with crop oil or crop oil concentrate. Use equivalent rates of atrazine 80W or AAtrex 90DF formulations. Rotational crop recommendations and weed control are the same as for atrazine used in corn. Failure to control fall panicum has been a major problem.

Ramrod (propachlor) may be used alone or in combination with atrazine, Milogard, Bladex, or Modown for sorghum. Ramrod can improve grass control, but rates must not be skimpy, especially on soils that are relatively low in organic matter. For specific rates, consult the label. Do not graze or feed forage to dairy animals.

Lasso (alachlor) alone or plus atrazine may be preplant incorporated or used preemergence for grain sorghum if seed is treated with Screen (flurazole). This use also applies to Lasso/atrazine and Bronco (see below).

Dual (metolachlor) or Dual plus atrazine (Bicep) can be used for sorghum if seed has had the Concep-seed treatment. These herbicides will control grasses better than will atrazine applied alone. An early preplant treatment of Dual or Bicep may be used in a similar manner as for corn, but Concep-treated seed should still be used.

Basagran (bentazon) is registered for postemergence use in sorghum in a manner similar to that for corn (see corn section). Since sorghum is quite tolerant of Basagran up to and including early boot stage, the addition of a crop oil concentrate is considered relatively safe. Do not apply to grain sorghum that is heading or blooming. Apply Basagran at the rate of 1 to 1½ pints in combination with atrazine at 0.6 to 1.0 pound of 80W, 0.6 to 0.9 pound of 90WDG, or 1 to 1½ pints of 4L per acre.

2,4-D may be applied postemergence for broadleaf control in 4- to 24-inch-tall sorghum. Use drop pipes on nozzles if sorghum is more than 8 inches tall. Rates are similar to those for use in corn (see section on corn herbicides).

Banvel can be applied preplant to emerged and actively growing weeds up to 15 days before planting. It may be applied postemergence to sorghum that is between the 3-leaf and 15-inch stage. The 3- to 5-leaf stage is preferred. The rate is ½ pint per acre. Do not graze or feed treated forage or silage prior to the mature grain stage. Sorghum may be injured by Banvel.

Brominal or Buctril (bromoxynil) can control broadleaf weeds in grain sorghum that is past the 3-leaf stage and up to 14 inches tall and before weeds are 4 to 6 inches tall. It is generally safer than 2,4-D on grain sorghum. Combination with atrazine is also registered to improve pigweed control and provide some residual control of germinating seedlings.

Prowl (pendimethalin) may be applied to grain sorghum from the 4-inch growth stage to as late as the last cultivation primarily for control of late-season annual grass weeds. See the section entitled "Herbicides for Corn," subsection on postemergence soil-applied herbicides, for more information.

Roundup may be applied as a spot-treatment in sorghum (milo) prior to heading. For applications on a spray-to-wet basis use a 1 to 2 percent solution of Roundup in water. For motorized spot treatments where less complete coverage of weeds may result, use a 5 percent solution. Avoid contact with the sorghum. Add a dye for increased visibility.

Bronco (glyphosate plus alachlor) may be used alone or with atrazine where grain sorghum is to be planted directly into a cover crop or in previous crop residue. It can control emerged annual weeds and suppress many emerged perennial weeds, as well as give preemergence control. As with Lasso, grain sorghum seed must be treated with Screen.

Paraquat may be used for control of annual weeds where grain sorghum is to be planted into previous crop residues.

Herbicides for Soybeans

Consider the kinds of weeds expected when you select a herbicide program for soybeans, especially when growing soybeans in narrow rows. The herbicide selectivity table (see last page of this guide) lists herbicides and their relative weed control ratings for various weeds.

Soybeans may be injured by some herbicides. However, they usually outgrow early injury with little or no effect on yield if stands have not been significantly reduced. Significant yield decreases can result when injury occurs during the bloom to pod fill stages. Excessively shallow planting may increase the risk of injury from some herbicides. Accurate rate selection for soil type is especially essential for Lorox, Linex, Lexone, and Sencor. Do not apply Lorox, Linex, Lexone, Sencor, or Modown after soybeans have begun to emerge. Follow label instructions as to rates, timing, incorporation, and restrictions. For registered combinations, see Table 3.

Table 3. — Registered Herbicide Combinations for Preplant Incorporated (PPI) or Preemergence (Pre) Use in Soybeans

	Amiben	Sencor or Lexone	Amiben + Sencor or Lexone	Lorox or Linex
PPI only				
Sonalan	1	1	—	—
Treflan	1	1	1	—
PPI or Pre				
Dual	1,2	1,2	1,2	2
Lasso	1,2	1,2	1,2	2
Prowl	1,2	1,2	1,2	2
Surflan*	2	2	—	2

1 = Preplant incorporated; 2 = preemergence.
— = Not registered.
* Not for preplant incorporation.

Preplant Not Incorporated

Early preplant application can be utilized in many conservation tillage programs such as no-till, ridge-till, or mulch-till to minimize existing vegetation problems at planting and thus reduce the need for knockdown herbicides. Lorox or Linex (linuron) and Sencor or Lexone (metribuzin) have both postemergence and residual activity but postemergence activity varies with climatic conditions. If weeds have emerged prior to preplant application, the use of a foliar knockdown herbicide such as paraquat or Roundup may be necessary. (See No-Till subsection.)

Several preemergence herbicides are registered for application prior to planting soybeans. Surflan can be applied anytime prior to planting no-till soybeans. Surflan can be applied in fully-tillered wheat before heading, and soybeans can then be planted no-till into wheat before harvest or wheat stubble immediately after harvest. Surflan plus Lexone can be applied up to 30 days prior to planting. Prowl can be applied 15 to 30 days prior to planting. Dual can be applied up to 30 days prior to planting soybeans or as a split application using a ⅔ rate up to 45 days before planting, followed by a ⅓ rate at planting.

Sencor can be applied with Dual or Lasso 15 to 30 days prior to planting soybeans when using a sequential (split) preemergence application: the first made early followed by the second at planting.

Some foliar postemergence herbicides can also be used prior to planting soybeans.

Roundup can also be used preplant in soybeans to control small annual weeds. The rate is 12 to 16 fluid ounces (¾ to 1 pint) per acre in 5 to 10 gallons of water with the addition of a surfactant.

Poast may be applied prior to planting soybeans with no time interval restriction.

2,4-D *is not registered* prior to planting soybeans although a registration has been submitted to EPA.

Preplant Incorporation

Incorporation is required for Treflan, Sonalan, Vernam, and Reward. Incorporation is optional for Amiben, Dual, Lasso, Modown, and Prowl when used alone and in some combinations. Dyanap, Lorox, and Surflan should not be incorporated.

Incorporation can improve performance if rainfall is limited and may increase the effectiveness of Dual or Lasso in controlling nutsedge. Incorporation should distribute the herbicide evenly in the top 1 to 3 inches of soil. Deep incorporation or very early application of the herbicide can cause significant reductions in weed control. For more information, see the section entitled "Herbicide Incorporation."

Dinitroaniline herbicides registered for weed control in soybeans are Treflan, Prowl, Sonalan, and Surflan. Treflan and Sonalan should be incorporated because they have low solubility and are subject to loss by vaporization and photodecomposition. Incorporation is optional with Prowl, but variable weed control and soybean injury may result if Prowl is not incorporated. Incorporation should distribute the herbicide uniformly in the top 2 to 3 inches of soil (see label for implement settings). Do not incorporate Surflan (see preemergence section).

The dinitroaniline herbicides control annual grasses, pigweed, and lambsquarters and may provide some control of smartweed and annual morningglory. Prowl and Surflan may also partially control velvetleaf. However, acceptable control of most other broadleaf weeds requires combinations or sequential treatments with other herbicides.

Soybeans are sometimes injured by dinitroaniline herbicides. Plants that have been injured by incorporated treatments may be stunted and have swollen hypocotyls and shortened lateral roots. Such injuries are not usually serious. Plants injured by preemergence applications may have stem calluses at the soil surface, which can cause lodging and yield loss.

Corn, sorghum, and small grains may be injured if they are grown after a soybean crop that has been treated with a dinitroaniline herbicide. The symptoms are poor germination and stunted, purple plants with poor root systems. To avoid carryover, use no more than the recommended rates and be sure that application and incorporation are uniform. The likelihood of carryover increases with double cropping or late application and after a cool, dry season. Adequate tillage may help dilute herbicide residue to help alleviate a carryover problem.

Treflan (trifluralin) can be applied alone anytime in the spring. Combinations with Sencor or Lexone should be applied no more than 2 weeks prior to planting, and combinations with Amiben, Furloe, or Modown should be applied within a few days prior to planting. Incorporate as soon as possible, but do not delay incorporation more than 24 hours (8 hours if soil is warm and moist). The rate is 1 to 2 pints of Treflan 4E or 5 to 10 pounds of Treflan 10G per acre. Treflan MTF is a multitemperature formulation that can be used to avoid problems associated with freezing in storage. Treflan Pro-5 contains 5 pounds trifluralin per gallon.

Sonalan (ethalfluralin) may be applied up to 3 weeks prior to planting and should be incorporated within 2 days after application. The rate for general weed control ranges from 1½ to 3 pints per acre, depending on soil texture. Sonalan may provide some control of nightshade at rates of 3 to 3½ pints per acre, but for this purpose it should be used in conjunction with Amiben, Dual, or Lasso or followed with Blazer. Sonalan is less likely to injure corn following soybeans than is Treflan. Sonalan may be tank-mixed with Amiben, Lasso, Dual, metribuzin, or Vernam.

Prowl (pendimethalin) can be applied within 60 days (alone) or 7 days (with Sencor or Lexone) prior to planting soybeans or applied after planting (see preemergence section). Preplant treatments should be incorporated within 7 days of application. Mechanical incorporation may not be necessary if adequate rainfall occurs. Rates are 1 to 3 pints of Prowl 4E per acre, although rates for combinations with Sencor or Lexone are lower than when the herbicide is used alone.

Sencor or Lexone (metribuzin) plus Treflan, Sonalan, or Prowl can be tank-mixed and applied within 7 to 14 days of planting. Incorporate uniformly into the top 2 inches of soil. The rate of Sencor or Lexone in these combinations is ½ to 1 pint of 4L or ⅓ to ⅔ pound of 75DF. Use the normal rate, or slightly less, of the dinitroaniline herbicide (see labels).

The application of Sencor or Lexone can also be split, one part being incorporated and the other part applied to the surface preemergence. This method requires two applications but can give better broadleaf control and less injury than incorporating the same total amount of Sencor or Lexone in a single application.

Amiben (chloramben) can be incorporated with Treflan, Sonalan, or Prowl. The rate is 4 to 6 quarts of Amiben 2S or 2.4 to 3.6 pounds of 75DS per acre. Amiben can also be applied and incorporated with Treflan or Prowl plus Sencor or Lexone as a three-way combination.

Vernam (vernolate) and Reward 6E (vernolate plus extender) control annual grasses and pigweed. They sometimes provide fair control of annual morningglory, velvetleaf, and yellow nutsedge. Some soybean injury may occur in the form of delayed emergence, stunting, and leaf crinkling. Vernolate or Reward can be applied within 10 days prior to planting and should be incorporated immediately. The broadcast rate is 2⅓ to 3½ pints of Vernam 7E or 20 to 30 pounds of Vernam 10G or 2⅔ to 4 pints Reward 6E per acre. Vernam or Reward plus Treflan is labeled at the rate of 1 pint of Treflan plus 2⅓ to 3 pints of Vernam 7E or 2⅔ to 4 pints Reward 6E per acre. The combination may reduce the risk of soybean injury. For yellow nutsedge and velvetleaf control use at least 3 pints Vernam 7E or 3⅓ pints Reward 6E per acre. Other labeled combinations include Vernam or Reward plus Amiben, Sonalan, Prowl, Lasso, Furloe, or Treflan/Sencor or Lexone.

Preplant or Preemergence Herbicides

Lasso (alachlor) or Dual (metolachlor) can be applied to soybeans as a preplant incorporated or preemergence treatment. Lasso may be applied within 1 week of planting. Dual may be applied to the soil surface early preplant up to 30 days before planting as a single treatment. Or a ⅔ rate can be used within 45 days of planting along with a ⅓ rate at planting. If rainfall is limited, incorporation can improve performance and increase yellow nutsedge control. Soybeans are quite tolerant of Lasso or Dual. The first to second trifoliate leaves often appear crinkled and have a drawstring effect on the middle leaflet, but these symptoms should not cause concern.

Lasso or Dual controls annual grasses and pigweed and can help control nutsedge and black nightshade. These herbicides can be combined with Lexone, Sencor, or Amiben (incorporated or preemergence) and with Lorox or Dyanap (preemergence only) to improve broadleaf weed control.

The rate for Lasso is 2 to 4 quarts Lasso 4E or Microtech 4L or 16 to 26 pounds of Lasso II 15G per acre. The rate for Dual 8E is 1½ to 3 pints per acre, and the rate for Dual 25G is 6 to 12 pounds per acre. Use the higher amount for the soil when incorporating or when black nightshade or yellow nutsedge are to be controlled. The rate for combinations is slightly less than that for the herbicide used alone (see labels). Lasso may be applied after soybean emergence but before soybeans pass the unifoliate stage.

Amiben (chloramben) can control annual grasses and many broadleaf weeds in soybeans when used at the full rate. Do not expect control of cocklebur or annual morningglory. Control of velvetleaf and jimsonweed is often erratic. Amiben occasionally injures soybeans, but damage does not usually affect yield. Injured plants may be stunted and have abnormal, shortened roots. If rain does not occur within 3 to 5 days of an Amiben preemergence application, you should rotary hoe. Amiben is best suited to soils that have over 2.5 percent organic matter.

Amiben can be applied alone or with Dual, Lasso, or Prowl as a preplant-incorporated or preemergence treatment. Amiben plus Sencor can also be mixed with Lasso, Dual, or Prowl as a preplant or preemergence treatment. Amiben can be applied as a preemergence treatment with Lorox, Lexone, or Sencor.

The Amiben broadcast rate alone is 20 to 30 pounds of 10G, 4 to 6 quarts of 2S, or 2.4 to 3.6 pounds of 75DS per acre. The Amiben rate in combinations is 3 to 6 quarts of 2S (1.8 to 3.6 pounds of 75DS) per acre. Use the higher rate where black nightshade, velvetleaf, or common ragweed is a problem weed.

Sencor or Lexone (metribuzin) can be applied anytime during the 1 to 2 weeks prior to planting and incorporated with Dual, Lasso, Prowl, Sonalan, or Treflan. Incorporation should distribute the herbicide evenly in the top 2 inches of soil. It can be applied preemergence

by itself or with Amiben, Dual, Lasso, Prowl, Surflan, or Dyanap. A three way combination of metribuzin plus linuron (Lorox or Linex) plus Lasso or Dual can be applied preemergence.

Sencor or Lexone can control many annual broadleaf weeds but cannot control annual morningglory. Control of giant ragweed, jimsonweed, and cocklebur is marginal at the reduced rates necessary to minimize soybean injury.

Adjust rates accurately according to soil conditions. *Do not apply to very sandy soil.* Combinations allow for reduced rates and thus reduce risk of soybean injury. The combination rate of Sencor or Lexone is ½ to 1 pint of 4L, or ⅓ to ⅔ pound of 75DF. You can use higher amounts as a split preplant and preemergence application. The higher amounts can improve broadleaf control but also increase the risk of soybean injury.

One symptom of soybean injury is yellowing (chlorosis) of the lower leaves at about the first trifoliate stage or later; it may be followed by browning of leaves and death of plants, depending upon the severity of the injury. Seedling diseases, weather stress, and atrazine carryover may increase the possibility of soybean injury. Injury may be greater on soils with a pH over 7.5. Accurate, uniform application and incorporation are essential. Some soybean varieties are more sensitive than others. Injury has sometimes occurred when organophosphate insecticides such as Thimet, Counter, Dyfonate, Lorsban, or Mocap were left in applicators used for corn planting and were applied to soybeans that were then being treated with metribuzin.

Modown (bifenox) can control pigweed, lambsquarters, and smartweed and can provide some control of velvetleaf. Modown 4F rates are 2½ to 4 pints per acre. Combinations with Dual, Lasso, or Surflan, or an overlay after Treflan can improve grass control. For preplant incorporation, the application should be made within 2 to 3 days of planting, and incorporation should distribute the herbicides uniformly in the top 1 inch of soil. Do not apply Modown after soybeans begin to emerge.

Soybeans may show stunting from Modown, especially from preemergence use followed by cold, wet soil conditions during early growth stages. Injury symptoms are cupping and crinkling of the first few leaves. Soybean injury is usually not reflected in yield.

Furloe Chloro IPC (chlorpropham) can be preplant incorporated with Treflan or Vernam; or it can be applied preemergence by itself or with Lasso to improve smartweed control. Preplant application should be done within a few days of planting soybeans, and incorporation should distribute the herbicide uniformly in the top 1 to 2 inches of soil. The rate in sequential or tank mix combinations is 2 to 3 quarts of Furloe 4E per acre. Furloe 20G is used preemergence at 10 to 15 pounds per acre.

Preemergence Herbicides

Lorox or Linex (linuron) is best suited to silt loam soils that contain 1 to 3 percent organic matter. *Do not apply to very sandy soils.* Linuron controls broadleaf weeds better than grass weeds. It does not control annual morningglory, and control of cocklebur and jimsonweed is variable. Accurate and uniform application and proper rate selection are necessary to minimize the risk of crop injury. Tank mix combinations allow the use of a reduced rate of linuron to decrease the risk of soybean injury, but may also decrease the degree of weed control.

Linuron is registered in tank mix combinations with Amiben, Lasso, Dual, Prowl, or Surflan to improve grass control. The rate of linuron in these combinations is 1 to 1⅔ pounds of linuron 50W or 1 to 1⅔ pints of linuron 4L on silt loam soils that have less than 3 percent organic matter.

Surflan (oryzalin) can control annual grasses, pigweed, and lambsquarters if there is adequate rainfall. You should rotary hoe to control emerging weeds if adequate rain does not fall within 7 days after application. Surflan can be used for early preplant application for no-till soybeans. Do not use on soils that have more than 5 percent organic matter. The rate is 1 to 2 pounds per acre of Surflan 75W (¾ to 1½ quarts AS [aqueous suspension]) used alone or ⅔ to 1⅔ pounds of Surflan 75W in combinations. Surflan can be tank-mixed with Amiben, Lorox, Lexone, Sencor, or Dyanap to improve broadleaf weed control. Surflan may cause stem callusing, which can lead to soybean lodging. Do not allow Surflan to contact the soybean seed. For no-till soybeans, Surflan can be applied in fall or early spring over undisturbed stubble from the previous crop.

Prowl can be applied preemergence in combination with Amiben, Lorox, Lexone, or Sencor. When applied to the soil surface, Prowl may cause stem callusing, which can lead to soybean lodging. (See preplant section for more information.)

Dyanap (dinoseb plus naptalam) can be applied to soybeans from the time they are planted until the time the unifoliate leaves of the seedling unfold and expose the growing point. Tank mixes of Dyanap plus Lasso, Dual, or Surflan are registered to improve grass control. Dyanap can also be tank-mixed with Lasso 4E plus Sencor. The Dyanap rate is 4 to 6 quarts per acre for preemergence application.

Postemergence Herbicides

Research suggests that soybean yields will probably not be reduced if weeds are controlled within 3 to 4 weeks after planting. Postemergence herbicides are most effective when their use is part of a planned program and when they are applied while the weeds are young and tender. They should not be considered simply as emergency treatments. It is especially important to use timely treatments when using postemergence herbicides in narrow-row soybeans. Postemergence herbicides are often the best choice for controlling problem weeds such as cocklebur, annual morningglory, and volunteer corn. Registered combinations are shown in Table 4. For more

Table 4. — Registered Postemergence Herbicide Combinations for Broadleaf Weed Control in Soybeans

	Amiben	Blazer	Butoxone*	Butyrac*
Alanap	X	—	X	X
Amiben		X	—	X
Basagran	—	X	—	X
Blazer	X		X	X
Dyanap	—	—	X	X

X = Registered.
— = Not registered.
* 2,4-DB.

information on conditions affecting application, see the section entitled "Postemergence Herbicide Principles."

Basagran (bentazon) can control many broadleaf weeds, such as cocklebur, jimsonweed, and velvetleaf. It is weak on pigweed, lambsquarters, and annual morningglory. It can be used for control of yellow nutsedge and Canada thistle but does not control annual grasses.

The suggested rate for Basagran is ¾ to 1 quart per acre, depending on the weed size and species. Application should be made when weeds are small (2-3 inches) and actively growing. These conditions usually exist when the soybeans are in the unifoliate to second trifoliate stage or within 2 to 3 weeks of planting. Spraying during warm sunny weather can also improve performance. Do not spray if rain is expected within 8 hours. Use a minimum of 20 gallons of water per acre and 40 psi spray pressure to get complete weed coverage. Adding a crop oil concentrate to Basagran may increase performance on most weeds but may cause some soybean injury. Morningglory that is up to 10 inches long can be controlled with the addition of 2 fluid ounces of 2,4-DB with Basagran. Do not add crop oil when mixing with 2,4-DB. Do not mix or apply Basagran with other pesticides or liquid fertilizer except as specified on the product label. Basagran may be labeled in 1986 with a 28-0-0 liquid fertilizer adjuvant.

Blazer (acifluorfen) should be applied when broadleaf weeds are in the 2- to 4-inch stage and actively growing. Weeds controlled include annual morningglory, pigweed, jimsonweed, and black nightshade. Cocklebur and morningglory control can be improved with the addition of 2 fluid ounces of 2,4-DB. Apply the mixture when cocklebur and morningglory measure no more than 10 to 12 inches.

The rate is 2 pints of Blazer 2L per acre. Blazer requires the addition of a nonionic surfactant at a minimum of 1 pint per 100 gallons of spray. The rate of surfactant may be increased to 2 to 4 pints per acre to improve control of small escaped grasses. Surfactant addition is recommended when combining Blazer and 2,4-DB.

Since Blazer is a contact herbicide, leaf burn often occurs; however, the crop usually recovers within 2 to 3 weeks. For ground application, use 20 to 40 gallons of water per acre applied with a minimum spray pressure of 40 psi. Do not spray if rain is expected within 6 hours.

Basagran plus Blazer provides a means of broadening the spectrum of control. The rate is 1 to 2 pints of each product in the combination. Crop oil concentrate may be added. To improve velvetleaf control with Blazer plus Basagran, 10-34-0 liquid fertilizer can be used at one quart per acre to replace the surfactant or crop oil concentrate (COC). Do not add COC when using 10-34-0. A mixture of Blazer plus Basagran plus 2 fluid ounces of 2,4-DB can be used to control cocklebur and morningglory under dry weather conditions. Refer to individual product labels for specifics.

Dyanap (dinoseb plus naptalam) at 2 quarts per acre can be applied to soybeans after the first trifoliate leaf is fully expanded until the soybeans become 20 inches tall. After 2 trifoliates are fully expanded, 3 quarts per acre may be used. Dyanap controls cocklebur, jimsonweed, and annual morningglory. A split application of 2 quarts at the first to second trifoliate stage, followed by 2 quarts 10 to 14 days later, is suggested for severe weed infestations. The addition of 2 fluid ounces per acre of 2,4-DB can improve control of some of the larger and more difficult weeds, especially if they are over 6 inches tall.

Best results are obtained by using high pressure (40 to 60 psi) and 8 to 10 gallons of water per acre. Use 5 gallons of water for aerial application. Although leaf burn can occur, the crop usually recovers within 2 to 3 weeks with little or no yield loss. Do not apply Dyanap to wet soybean foliage or if rain is expected within 6 hours. Do not add a surfactant or crop oil.

Amiben (chloramben) can be used for postemergence application on soybeans in the cracking to fourth trifoliate stage, but only within 33 days after planting. This treatment can be especially helpful in controlling velvetleaf, but smartweed, common ragweed, and pigweed may also be controlled or suppressed. Velvetleaf may be 1 to 8 inches tall and smartweed may be 1 to 3 inches tall. For ground applications, 10 to 20 gallons of water per acre, a spray pressure of 30 psi, and flat fan nozzle tips are suggested. The rate of Amiben 2S alone is 6 quarts; it is 5 to 6 quarts per acre in combination with either 2 to 3 fluid ounces of Butyrac 200, 2 to 3 quarts of Alanap, or 1½ to 2 pints of Blazer per acre. Crop oil concentrate should be used at 1 quart per acre with the Amiben alone or tank-mixed with Alanap. Do not add crop oil when tank-mixing with Butyrac. The Amiben plus Alanap or 2,4-DB should be applied when soybeans are in the third to sixth trifoliate stage. Apply the Amiben tank-mixed with Blazer at the appropriate rate for the weed size indicated on the Blazer label but within 33 days after planting. If Amiben is also soil-applied, do not use more than a total of 12 quarts per season.

Rescue (naptalam plus 2,4-DB) can be used for mid- to late-season postemergence control of cocklebur, giant ragweed, and wild sunflower; it may also suppress annual morningglory. Apply 3 quarts per acre after soybeans are about 14 inches tall or after first bloom. Use the lower rate when weeds are less than 12 inches tall. The addition of a crop oil concentrate or surfactant can improve

control. Application before the weeds flower is suggested for best control. The water volume per acre is 10 to 25 gallons for ground application and a minimum of 5 gallons for aerial application. If rain occurs within 6 hours, effectiveness may be reduced. Activity may not be very noticeable until 10 to 14 days after application; maximum activity should occur 20 to 30 days after application. Crop injury such as leaf twisting and terminal droop may occur. To avoid possible yield losses, do not apply Rescue to soybeans under stress from drought, disease, or injury from another herbicide. *Do not apply Rescue within 60 days of harvest.*

Hoelon (diclofop) can control small annual grasses in the 1- to 4-leaf stage and volunteer corn. Let all the volunteer corn emerge, but apply Hoelon before the corn that emerged first is too large to obtain adequate spray coverage. For ground application, use a minimum of 20 gallons of water per acre and 40 psi spray pressure. For aerial application, use a minimum of 5 gallons of water per acre. The Hoelon rate for annual grasses, including volunteer corn, is 2 to 3⅓ pints. Crop oil concentrate can be added at 1 to 2 pints per acre. Do not tank-mix Hoelon with other postemergence herbicides. *Hoelon is a restricted-use herbicide.*

Poast (sethoxydim) can be used for postemergence control of annual and perennial grasses in soybeans. The rate is 1 pint per acre to control foxtails or most other annual grasses that are 3 to 18 inches tall or volunteer corn or shattercane that is 6 to 18 inches tall. Apply ½ pint per acre when wild proso millet is 4 to 10 inches tall. For control of volunteer cereals, apply 1½ pints per acre before tillering, up to 6 inches tall. Poast is not recommended for spring control of volunteer cereals that emerged the previous fall. Wirestem muhly up to 6 inches tall can usually be controlled by a single application of 1¼ pints per acre. Poast can also be used as a rescue treatment for controlling selected annual grasses. Apply Poast at a rate of 1½ pints per acre for control of actively growing foxtails or seedling johnsongrass (up to 16 inch height), fall panicum or barnyardgrass (up to 12 inch height), and crabgrass or goosegrass (up to 8 inch height). For control of actively growing wild proso millet up to 24 inch height, apply Poast at 1 pint per acre.

Use 5 to 20 gallons of spray solution per acre for ground application and a minimum of 5 gallons per acre for aerial application. Use only standard high pressure hollow cone or flat fan nozzles with pressure at the nozzle adjusted to a minimum of 40 psi and a maximum of 60 psi. Always add crop oil concentrate at 2 pints per acre. Do not cultivate 5 days prior to Poast application or within 7 days following application.

Poast can be tank-mixed with Basagran, provided the Poast rate is increased by 50 percent to compensate for the reduced grass control that often occurs with this treatment. Sequential applications at least 24 hours apart may be more economical and practical, depending upon the weeds to be controlled and their size. Do not apply Poast if rainfall is expected within 1 hour. Do not apply Poast to grasses under stress from hot, dry weather or herbicide injury.

Blazer may be tank mixed with Poast (Blazer label) for postemergence control of broadleaf and annual grasses in soybeans. The rate per acre is 1½ to 2 pints of Blazer plus 1 pint of Poast plus 2 pints of crop oil concentrate for fall panicum and giant foxtail that are 3 to 8 inches tall. For other annual grasses on the Poast label increase the rate of Poast by 50 percent. Sequential applications should always be used in place of the tank mixtures for perennials and may be more economical for many annuals.

Fusilade 2000 (fluazifop) can be used for postemergence control of annual and perennial grass weeds in soybeans. Apply only to actively growing grasses before they tiller. The rate is 1½ pints per acre when giant foxtail is 2 to 6 inches tall and other annual grass weeds are 2 to 4 inches tall. Use ¾ pint per acre when volunteer corn is 12 to 24 inches tall, shattercane is 6 to 12 inches tall, or wild proso millet is 6 to 12 inches tall. For control of volunteer cereals, apply 1 pint per acre before plants are 2 to 6 inches tall. To control wirestem muhly, apply 1½ pint per acre when plants are 4 to 12 inches tall. Fusilade can also control johnsongrass and quackgrass (see specific weed section), but sequential applications may be needed.

The spray volume should be a minimum of 10 gallons per acre for ground application and 5 gallons per acre for aerial application. Add either crop oil concentrate at 1 percent by volume (1 gallon per 100 gallons of spray) or a nonionic surfactant at ¼ percent of spray volume. For aerial application add 1 pint of crop oil concentrate or surfactant per acre. Apply before soybeans bloom. *Do not tank-mix Fusilade with other postemergence herbicides intended for control of broadleaf weeds except as specified.* A tank mix of Fusilade 4E and Blazer 2L is labeled for use without an increase in the Fusilade rate.

Roundup (glyphosate) can be applied through several types of selective applicators — recirculating sprayers, wipers, or rope wicks. This application is particularly useful for control of volunteer corn, shattercane, and johnsongrass. Roundup may also suppress hemp dogbane and common milkweed. Weeds should be at least 6 inches above the soybeans. Avoid contact with the crop. Equipment should be adjusted so that the lowest spray stream or wiper contact is at least 2 inches above the soybeans. For equipment calibration, refer to the Roundup label. For recirculating sprayers and wipers, use the rates given on the label. For rope-wick applicators, mix 1 gallon of Roundup in 2 gallons of water. A spot treatment with Roundup is also a good option in many fields. For application made on a spray-to-wet basis, use a 1 to 2 percent solution of Roundup in water. For motorized spot treatments where less than complete coverage of weeds may result, use a 5 percent solution. Avoid contact of the spray with the soybeans. Add a dye for increased visibility.

Paraquat Harvest Aid

Paraquat and Gramoxone are registered for drying weeds in soybeans just before harvest. For indeterminate varieties (most Illinois varieties), apply when 65 percent of the seed pods have reached a mature brown color or when seed moisture is 30 percent or less. For determinate varieties, apply when at least one-half of the leaves have dropped and the rest of the leaves are turning yellow.

The rate is ½ to 1 pint of Paraquat or Gramoxone per acre. The higher rate is for cocklebur. The total spray volume per acre is 2 to 5 gallons for aerial application and 20 to 40 gallons for ground application. Add 1 quart of nonionic surfactant per 100 gallons of spray. Do not pasture livestock within 15 days of treatment, and remove livestock from treated fields at least 30 days before slaughter.

Specific Weed Problems

Yellow Nutsedge

Yellow nutsedge is a perennial sedge with a triangular stem. It reproduces mainly by tubers. Yellow nutsedge tubers begin sprouting about May 1 in central Illinois. For the most effective control, soil-applied herbicides should be incorporated into the top 2 inches of the soil.

For soybeans, a delay in planting until late May allows time for two or three tillage operations to destroy many nutsedge sprouts. These operations help deplete food reserves in nutsedge tubers. Row cultivation is helpful. Preplant applications of Lasso, Dual, Vernam, or Reward will also help.

Lasso (alachlor) preplant incorporated at 2½ to 4 quarts per acre can often give good control of nutsedge.

Dual (metolachlor) can be applied at 2 to 3 pints per acre to control nutsedge. Preplant incorporated treatment is preferred to treatment at the preemergence stage.

Vernam 7E (vernolate) applied preplant at 3½ pints per acre is also effective against yellow nutsedge. Reward 6E at 4 pints per acre is an alternative to Vernam. Immediate incorporation is necessary with Vernam or Reward.

Basagran (bentazon) applied postemergence can also help control nutsedge in soybeans. When nutsedge is 6 to 8 inches tall, ¾ to 1 quart per acre can be applied. If needed, a second application can be made 7 to 10 days later. The addition of a crop oil concentrate to Basagran may improve performance.

For corn that is planted relatively early, preplant tillage before nutsedge sprouts is of little help in control. Timely cultivation gives some control, but a program of herbicides plus cultivation has provided the most effective control of nutsedge.

Several preplant treatments are available. **Eradicane Extra** at 2⅔ to 4 quarts or **Eradicane, Sutan+**, or **Genate Plus** at 4¾ to 7⅓ pints per acre are effective for control of yellow nutsedge in corn. They must be incorporated immediately. **Lasso** or **Dual** applied in corn as for soybeans can also be quite effective.

The combinations of Lasso, Dual, Sutan+, Genate Plus or Eradicane incorporated with atrazine may improve control of nutsedge while also controlling broadleaf weeds.

Atrazine or Bladex (cyanazine) can be used as a postemergence spray to control emerged yellow nutsedge when it is small. Split applications of atrazine plus oil have been more effective than single applications. **Basagran** can be used in corn in a manner similar to that for soybeans. **Lorox or Linex (linuron)** directed postemergence spray has also given some control.

Johnsongrass

Johnsongrass can reproduce both from seeds and by rhizomes. Both chemical and cultural methods are needed to control johnsongrass rhizomes.

Much of the rhizome growth occurs after the johnsongrass head begins to appear. Mowing, grazing, or cultivating to keep the grass less than 12 inches tall can reduce rhizome production significantly.

Control of johnsongrass can also be improved with tillage. Fall plowing and disking bring the rhizomes to the soil surface, where many of them are winter-killed. Disking also cuts the rhizomes into small pieces, making them more susceptible to chemical control.

Johnsongrass rhizomes can be controlled or suppressed with the use of certain herbicides in various cropping programs. Several herbicides can provide control of johnsongrass seedlings in soybeans or corn (see the table at the end of this publication).

Treflan (trifluralin) or Prowl (pendimethalin) used in a 3-year soybean program has been fairly successful in controlling rhizome johnsongrass. They are used at 1½ to 2 times the normal rate each year for 2 years; in the third year, either they are used at the normal rate, or another suitable herbicide is used before a regular cropping sequence is resumed. Thorough preplant tillage and incorporation are necessary for satisfactory control. Be certain not to plant crops such as corn or sorghum the year following application of these herbicides at the higher rates.

Fusilade 2000 (fluazifop) can control johnsongrass in soybeans. Apply 1½ pints per acre when the weed is 8 to 18 inches tall. Apply before the boot stage of growth. If new shoots or regrowth occur, make a second application of 1 pint per acre when johnsongrass is 6 to 12 inches tall. Always add crop oil concentrate at 1 percent of volume or nonionic surfactant at 0.25 percent of volume.

Poast (sethoxydim) can control johnsongrass in soybeans. Apply 1½ pints plus 1 quart crop oil concentrate per acre when the johnsongrass is 15 to 25 inches tall. If regrowth or new growth occurs, apply 1 pint per acre when the johnsongrass is 6 to 12 inches tall.

Eradicane Extra can help control rhizome johnsongrass in corn when used at a rate of 4 quarts per acre

with a tillage program; or Eradicane 6.7E can be used at 7⅓ pints per acre.

Roundup (glyphosate) can be used as a spot treatment to control johnsongrass in corn, soybeans, or sorghum. Apply a 1 percent solution when johnsongrass has reached the boot to head stage and is actively growing. Use of Roundup in rope-wick applicators or recovery-type sprayers is effective for control of johnsongrass in soybeans. (See section on postemergence herbicides for soybeans.)

Roundup may be applied in small grain stubble when johnsongrass is in the early head stage. Fall applications should be made before the first frost. At least 7 days should be allowed after treatment before tillage.

Quackgrass

Quackgrass is a perennial grass with shallow rhizomes. It is found primarily in the northern part of Illinois.

Atrazine is quite effective when used as a split application in corn. Apply 2 quarts of atrazine 4L per acre in the fall or spring and plow 1 to 3 weeks later. Another 2 quarts per acre should be applied as a preplant or preemergence treatment. Postemergence application is usually less effective. A single treatment with 3 to 4 quarts per acre can be applied either in the spring or fall 1 to 3 weeks before plowing, but the split application usually gives better control of annual weeds. Use equivalent rates of other formulations. If more than 3 pounds of atrazine active ingredient is applied per acre, plant no crops other than corn or sorghum the next year.

Eradicane Extra can be used to suppress quackgrass in corn where more flexibility in cropping sequence is desired. A rate of 2⅔ quarts per acre of Eradicane Extra can be used on light infestations, while 4 quarts per acre is suggested for heavier infestations. There is some risk of corn injury, especially at the higher rate. A tank mix with atrazine should improve control. If Eradicane 6.7E is used, the rate should range from 4¾ to 7⅓ pints per acre.

Fusilade 2000 (fluazifop) may be used for quackgrass control in soybeans at 1½ pints per acre. Apply when quackgrass is 6 to 10 inches tall. If regrowth occurs, a second application of 1 pint per acre may be made. Best results are obtained with Fusilade and most other treatments if rhizomes are cut up by preplant tillage to stimulate maximum emergence of grass shoots. Always add crop oil concentrate or nonionic surfactant to Fusilade.

Poast (sethoxydim) can be applied in soybeans at the rate of 2½ pints plus 1 quart of crop oil concentrate per acre when quackgrass is 6 to 8 inches tall. If regrowth occurs or new plants emerge, apply 1½ pints per acre when the quackgrass is 6 to 8 inches high.

Roundup (glyphosate) can be used for controlling quackgrass before planting corn, sorghum, or soybeans. Apply 1 to 3 quarts per acre when quackgrass is 8 inches tall and actively growing (fall or spring). For annual cropping systems apply 1 quart per acre in 5 to 10 gallons of spray with surfactant added. Delay tillage for 3 or more days after application.

Wirestem Muhly

Wirestem muhly occurs primarily as a problem in northern and western Illinois. It is a perennial which reproduces by seeds and scaly rhizomes. These rhizomes are often moved by chisel plows, field cultivators, and shovel cultivators. Many farmers report that delayed seedbed preparation, where possible, can provide some control of wirestem muhly. However, wirestem muhly does not start growth until late in the spring.

Roundup can be used early preplant (early June) or post-harvest when wirestem muhly is at least 8 inches tall and actively growing. Do not fall or spring till before applications. The rate is 1 quart of Roundup in 5 to 10 gallons of water per acre with surfactant added at 2 to 4 quarts per 100 gallons. Use flat fan nozzles. Wait 3 days before tillage after application.

Atrazine at high rates can provide some control of wirestem muhly in corn. Rates must be at highest labeled rates for the soil (see Quackgrass section).

Fusilade can be used postemergence to control wirestem muhly in soybeans. The rate is 1½ pints per acre when wirestem muhly plants are 4 to 12 inches.

Poast can also be used postemergence in soybeans to control wirestem muhly which is 6 inches tall. The rate is 1½ pints per acre. See Soybean Postemergence section for more information on Poast and Fusilade.

Canada Thistle

Canada thistle is a perennial weed that has large food reserves in its root system. There are several varieties of Canada thistle. They differ not only in appearance but also in their susceptibility to herbicides.

2,4-D may give fairly good control of some strains. Rates will depend on where the thistle is growing. For example, higher rates can be used in grass pastures or in noncrop areas than can be used in corn.

Banvel (dicamba) often is a little more effective than 2,4-D and may be used alone or in combination with 2,4-D. Banvel can be used as an after-harvest treatment in wheat, corn, or soybean fields or in fallow fields. Rates vary from 1 to 2 quarts of Banvel alone or in tank-mix combinations with 2,4-D or Roundup. Fall treatments should be applied before killing frosts. For best results thistles should be fully emerged and actively growing. Fields treated in the fall with Banvel may be planted to corn, sorghum, or wheat the next season.

Atrazine and oil applied postemergence has been fairly effective in controlling Canada thistle in corn. Make the application before thistles are 6 inches tall.

Basagran (bentazon) can be used for control of Canada thistle in soybeans or corn when the thistles are 8 to 12 inches tall. Apply ¾ to 1 quart per acre in a single application, or for better control make two applications of ¾ to 1 quart per acre each, 7 to 10 days apart.

Roundup (glyphosate) can be used at 2 to 3 quarts per acre when Canada thistle is at or beyond the early bud stage. Fall treatments must be applied before frost for best results. Allow 3 or more days after application before tillage.

Black Nightshade

Black nightshade has become an increasing problem for Illinois soybean growers. The berries are about the same size as soybeans at harvest. They contain a sticky juice that can gum up a combine.

Black nightshade can be controlled easier in corn than in soybeans. Herbicides such as atrazine, Bladex, Banvel, Lasso, and Dual are helpful for controlling this weed in corn.

If possible, plant suspect fields to corn rather than to soybeans. If soybeans must be planted, plant suspect fields last. Preemergence applications usually maintain control longer than those that are preplant incorporated.

For control in soybeans, Lasso, Dual, Amiben, or linuron at full rates or a combination of Amiben or linuron with Lasso or Dual is helpful. Suspect fields should be monitored and a postemergence application of Blazer considered. Blazer 2L at 2 pints per acre can control nightshade when applied at the 2- to 4-leaf stage.

Harvest-aid sprays generally do not solve the problem because they do not make the berries fall before the soybeans are harvested.

Additional Information

Not all herbicides and herbicide combinations available are mentioned in this publication. Some are relatively new and are still being tested. Some are not considered to be well adapted to Illinois or are not used very extensively. For further information on field crop weed control, consult your county extension adviser or write to the Department of Agronomy, N-305 Turner Hall, University of Illinois at Urbana-Champaign, 1102 S. Goodwin Avenue, Urbana, Illinois 61801.

Relative Effectiveness of Herbicides on Major Weeds

This chart gives a general comparative rating. Under unfavorable conditions, some herbicides rated good or fair may give erratic or poor results. Under very favorable conditions, control may be better than indicated. Type of soil is also a very important factor to consider when selecting herbicides. Rate of herbicide used also will influence results. G = good, F = fair or variable, and P = poor.

		Grasses							Broadleaf Weeds										
	Crop tolerance	Foxtail	Barnyardgrass	Crabgrass	Fall panicum	Johnsongrass seedlings or Shattercane	Volunteer corn	Yellow nutsedge	Annual morningglory	Cocklebur	Jimsonweed	Lambsquarters	Nightshade, black	Pigweed	Ragweed, common	Ragweed, giant	Smartweed	Sunflower, wild	Velvetleaf
SOYBEANS																			
Preplant																			
Treflan, Sonalan	F-G	G	G	G	G	G	F	P	P-F	P	P	G	P-F	G	P	P	P-F	P	P
Sencor, Lexone + dinitroaniline	F	G	G	G	G	G	F	P	F	F	F-G	G	P	G	G	F	G	F	F-G
Vernam, Reward	F	G	G	G	G	G	P-F	F	P-F	P	P	F	P	G	P	P	P	P	F
Preplant or Preemergence																			
Amiben	F-G	G	F-G	F-G	F-G	F	P	P	P	P	P-F	G	F-G	G	F-G	F	F-G	P	F
Lasso, Dual	G	G	G	G	G	P-F	P	F-G	P	P	P	F	F-G	G	P-F	P	P-F	P	P
Lasso or Dual + Sencor or Lexone	F	G	G	G	G	P	P	F	P	F	F-G	G	F-G	G	F	F	G	F	F-G
Lasso or Dual + Lorox,[1] Linex[1]	F	G	G	G	G	P	P	P-F	P	F	F	G	F-G	G	G	F	G	F	F-G
Lorox,[1] Linex[1]	F	F	F	F	F	P	P	P	P	F	F	G	F	G	G	F	G	F	F-G
Sencor, Lexone	F	F	F	F	F	P	P	P	P	F	F-G	G	P	G	G	F	G	F	F-G
Surflan,[1] Prowl	F-G	G	G	G	G	G	F	P	P-F	P	P	G	P	G	P	P	P-F	P	P-F
Postemergence																			
Basagran	F-G	P	P	P	P	P	P	F	P-F	G	G	F-P	P	P	F	F	G	G	F-G
Blazer	F	P-F	P	P-F	P	P	P	P	G	F	G	F-P	F-G	G	F-G	F-G	G	F	P
Dyanap	F	P	P	P	P	P	P	P	F-G	G	G	F	P-F	F	F	F	P-F	F	P
2,4-DB	P-F	P	P	P	P	P	P	P	F-G	G	P-F	F	P	F	F	F	P	F	P
Poast, Fusilade	G	G	G	G	G	G	G	P	P	P	P	P	P	P	P	P	P	P	P
Rescue	F-G	P	P	P	P	P	P	P	F	G	F	P-F	P	F-G	P	G	P	G	P
CORN																			
Preplant																			
Butylate, EPTC	F-G	G	G	G	G	F-G		F-G	P	P	P	P-F	F	G	P	P	P	P	F
Butylate, EPTC + atrazine, Bladex	F-G	G	G	G	G	F-G		F-G	F-G	F-G	G	G	G	G	G	F	G	F-G	F-G
Princep + atrazine	G	F-G	F-G	F	F	P-F		P	F-G	F-G	G	G	G	G	G	G	G	G	F
Preplant or Preemergence																			
Atrazine	G	F-G	F	P	P	P		F	G	F-G	G	G	G	G	G	G	G	G	F-G
Bladex	F-G	F-G	F-G	F-G	G	P		P	F	F-G	G	G	G	F	G	F-G	G	F-G	F-G
Bladex + atrazine	F-G	F-G	F	F	F-G	P		P	F-G	F-G	G	G	G	G	G	F-G	G	F-G	F-G
Lasso, Dual	F-G	G	G	G	G	P-F		F-G	P	P	P	F	F-G	G	P-F	P	P-F	P	P
Lasso or Dual + atrazine or Bladex	F-G	G	G	G	G	P		F-G	F-G	F	G	G	G	G	G	F	G	F-G	F
Prowl + atrazine or Bladex[1]	F	G	G	G	G	F		P	F-G	F	G	G	G	G	G	F	G	F-G	F-G
Ramrod[1]	G	G	F	F-G	F	P		P-F	P	P	P	F	P	G	P	P	P	P	P
Postemergence																			
Atrazine + oil	F-G	F-G	G	P	P	P		F	G	G	G	G	G	G	G	F	G	G	G
Banvel	F-G	P	P	P	P	P		P	G	G	G	G	G	G	G	G	G	G	F
Basagran	G	P	P	P	P	P		F	P-F	G	G	F-P	P	P	F	F	G	G	F-G
Bladex	F-G	G	G	F	F-G	P		F	F	F-G	G	F	G	F-G	G	F	G	F	F-G
Buctril, Brominal	F-G	P	P	P	P	P		P	G	G	G	G	G	F	G	F	G	F-G	F
2,4-D	P	P	P	P	P	P		P	G	G	F	G	F	G	G	G	P-F	G	F-G

[1] Do not use for preplant incorporation.

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