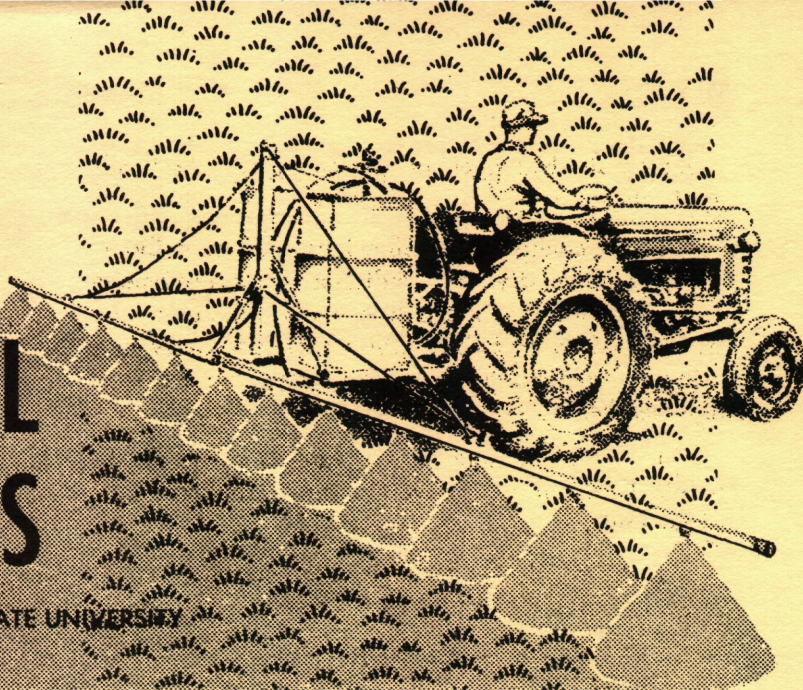


# WEED CONTROL IN FIELD CROPS

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**T**HE MAIN REASON for cultivating crops is to control weeds. Chemicals (herbicides) often control weeds at a considerable saving over cultivation costs, and in some cases herbicides control weeds that cannot be controlled by normal tillage practices. However, tillage is the only practical control measure in some situations.

## Cultural Control

Minimum tillage aids in control of annual weeds. The loose soil surface left by this method makes for a dry top-soil layer which discourages growth of weed seedlings.

The field cultivator equipped with duckfoot or wide shovels is one of the best tools for the control of weeds with deep roots, such as bindweed and thistles. Use the disk or springtooth harrow just before the duckfoot shovel if the soil is firm and needs loosening. Unplowed fields of quackgrass can be effectively controlled by a well-constructed field cultivator with narrow shovels if the operation is repeated often and if the season is dry.

The rotary hoe, spiketooth harrow, and weeder are effective on annual weed seedlings in row crops. Use these tools just after planting, while the crop is coming up, or just after it is up. For effective weed control, use these tools when the weed seedlings are just coming through the ground; weeds with much top-growth may not be controlled.

Plowing is usually necessary to kill and bury a heavy weed growth. Fall plowing brings roots and rootstocks to the surface where they are injured by winter freezing.

## Chemical Weed Control

A large number of chemical weed-killers are now available. Selective control of weeds in crops may be obtained by either foliage sprays (post emergence) or application of the chemical to the soil either as pre-planting or pre-emergence sprays.

Pre-planting and pre-emergence sprays are available for corn, potatoes, field beans, soybeans, sugar beets, alfalfa, and birdsfoot trefoil.

*Pre-planting sprays* sometimes are applied to the weed before plowing (quackgrass).

*Pre-emergence sprays* are applied after planting but before the crop appears above ground.

Some advantages of pre-emergence herbicide applications are:

- (1) Generally better weed control than with post-emergence applications;
- (2) less chance of damage to the crop, compared to post-emergence applications;
- (3) no weed competition to the crop with early control of weeds;
- (4) weeds already controlled in cases where wet weather later delays cultivation or spraying;
- (5) planting and herbicide application may be done in one operation;
- (6) In the case of corn, herbicides can be used which will not present a hazard to nearby 2,4-D sensitive crops and plants.

Some disadvantages of pre-emergence herbicide applications are:

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

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

(3) Perennial weeds usually are not controlled by pre-emergence herbicide applications.

(4) Planting operations may be slowed somewhat when herbicides are applied at planting time.

*Post-emergence sprays*, applied after the crop has emerged, are available for corn, small grains and small seeded legumes but not for field beans, soybeans or sugar beets. Post-emergence sprays have the advantage of use in emergencies since they are not applied until the weeds are up. They usually cost less per acre but in many cases are not effective on grassy weeds. They can be used on any soil type, and soil moisture conditions are not a problem. However, in some cases there is greater risk of crop injury. Post-emergence sprays should not be applied when the plants are already wet with dew or rain. Post-emergence sprays are usually more effective (though also more injurious to the crop) at high temperatures.

The ester forms of 2,4-D are not recommended for post-emergence use on corn because they are volatile (produce vapors) and may injure the corn. The ester forms vary in volatility, and the possibility of injury to corn varies with temperature and humidity conditions. Post-emergence applications of 2,4-D ester in Michigan have resulted in increased stalk lodging and reduced yields in some years.

The amine form of 2,4-D is recommended for post-emergence use because it has little or no volatility and is least likely to damage the crop.

Where corn growers insist on using 2,4-D esters post-emergence despite the risks involved, the low volatile form should be used at  $\frac{1}{4}$  pound acid equivalent per acre. Drop nozzles should always be used when corn is more than 6 to 8 inches tall.

## Principles of Chemical Control of Weeds

1. Weeds are easiest to kill when they are small seedlings and when conditions favor rapid growth. Crop plants also are most easily injured under these conditions. Selective sprays (see table 1) will control the weeds with little or no injury to the crop.

2. Pre-emergence applications will generally give better weed control than post-emergence applications.

3. Time of spraying and rate of application are very important. Spraying at the wrong time often results in poor weed control and greater crop injury. No crop plant is completely resistant to injury from herbicides. Too much chemical will cause damage.

4. With 2,4-D and most pre-emergence herbicides, do not cultivate for at least 3 weeks after pre-emergence spraying unless weeds appear that are resistant to the chemical. In the case of atrazine on corn, rotary hoe or cultivate shallow if weeds appear and dry weather persists for 2 weeks after herbicide application. Delay cultivation after post-emergence herbicide applications for at least 2 or 3 days to allow the chemical to move into stems and roots of the weed plants.

5. No one chemical used as a selective spray will kill all species of weeds. Therefore, select the right chemical for the job. Some weeds are resistant to all of the present selective sprays.

6. Read labels carefully and never apply a chemical at rates higher than recommended on the label. Use chemicals only on crops for which they are recommended on the label. Store chemicals in a room not subject to freezing temperatures and away from both seeds and fertilizers.

## Weed Sprayers

Crop injuries often result when sprayers used for weed control are also used for disease and insect control. Some chemicals are more difficult to wash from a sprayer than others, and wooden tanks are more difficult to clean than steel tanks. Hand sprayers of 3- or 4-gallon capacity are suitable for small areas of 1 acre or less and for patch spraying. Tractor-mounted sprayers driven from the power takeoff are very satisfactory for larger areas. (See Michigan Circular Bulletin CE-24 for types of spray equipment.)

A good weed sprayer should:

1. Have a pump which is inexpensive, easily replaced, resistant to wear and chemicals, and which has a minimum capacity of 4 gallons per minute.

2. Provide some means of keeping the solution well mixed. This can be by mechanical or jet agitation, using a bypass from the pump.

3. Have 50-mesh screens for suction line and nozzles.

4. Have a gauge which measures pressure accurately in the range of 20 to 100 pounds per square inch.

5. Have flat fan nozzles with replaceable tips. Wide-angle nozzles (73 to 80 degrees) will permit the boom to be carried closer to the ground and thus reduce spray drift.

## Band Application

In cultivated crops, spraying narrow bands of herbicide over the rows will take less material per acre, cutting the cost per acre for the chemical. Where chemical costs are high (as for field beans or soybeans), band spraying may be justified. However, with band spraying, timely cultivation of weeds in the unsprayed area between rows is necessary. In seasons when the soil is too wet to cultivate, overall spraying has the advantage of controlling weeds between the rows.

When band spraying, be very careful to maintain the proper rate of application on the area sprayed. (If you lower the spray boom to narrow the area covered by a given nozzle, remember that each nozzle is still delivering

the same amount of spray mixture as it did on the wider area.)

### Sprayer Calibration

Be sure to apply the correct amount of material per acre. To do this, you must know how much liquid the sprayer is delivering per acre at a given speed and pressure. To calibrate your sprayer:

1. Fill the spray tank with water only.
2. Spray a measured area at a fixed speed and a fixed pressure (4 miles per hour and 40 pounds suggested).
3. Measure the amount of liquid required to fill the tank.
4. Divide this amount (in 3 above) by portion of an acre sprayed to find the gallons applied per acre. (Width of boom coverage times feet traveled gives square feet of area covered. This figure divided by 43,560 gives the portion of an acre covered.)
5. Mix the amount of material recommended per acre with the number of gallons the sprayer uses per acre (the answer in 4 above).

### Cleaning Sprayers

Keep weed sprayers clean. Where pre-emergence spraying only is practiced, thorough rinsing with water is sufficient. For other spraying purposes, wash out the sprayer (tank, hose, boom, nozzles) with one of the following in 100 gallons of water:

1. 1 gallon household ammonia (allow to stand in sprayer overnight).
2. 5 pounds sal soda.
3. 8 pounds trisodium phosphate.

### Herbicide Rates and Spray Volume

Table 1 lists chemicals which will give satisfactory weed control without injury to crops, except as noted under "Remarks." The volume of water to use will vary with the herbicide, although generally 10 to 40 gallons per acre and a spraying pressure of 35 to 40 pounds is recommended. A minimum of 10 gallons of water per acre is recommended for the phenoxy herbicides [2,4-D, MCPA, 4-(2,4-DB)]. With wettable powders such as atrazine and linuron, use nozzles that deliver at least 20 gallons per acre. Thirty to 40-gallons of spray per acre should be used when spraying quackgrass with amitrol-T, atrazine, or dalapon. Twenty-five to 40 gallons of spray per acre should be used when applying DNBP for weed control.

Some herbicides are available in a number of different formulations and concentrations. For this reason the recommended rates in Table 1 are given as pounds of active ingredients per acre. Thus when a liquid formulation contains 4 pounds of active ingredient (or acid equivalent) per gallon, one pint will provide  $\frac{1}{2}$  pound of active ingredient, or one quart will provide 1 pound of active ingredient.

### Granular Formulations

Herbicides are available in granular form for dry application. Granules are usually applied in a band over the row at planting time, but they may also be broadcast. Usually equal weed control can be expected from granular and spray formulations, but in some cases granules have not given as good weed control as the spray. This generally has been due to either the use of equipment giving non-uniform distribution of the granules or to formulations with too high a concentration, resulting in inadequate volume for uniform distribution. At least 30 pounds of granules per acre (overall coverage) is required for uniform distribution with equipment presently available.

Granular herbicides eliminate the need for a water supply and they reduce the drift hazard. But there still is a volatility hazard from granular formulations of 2,4-D ester applied near sensitive crops—especially grapes and tomatoes. Granules give best results on fine, firm seedbeds. A wide, flat press wheel on the planter is desirable for band application at planting. Weed control may be hampered when granules are applied on a rough seedbed, because of uneven application, such as that often obtained with minimum tillage.

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

### Soil Residues

With the advent of pre-plant and pre-emergence herbicides which give season-long weed control, the accumulation of herbicides in the soil and their influence on subsequent crops in the rotation have become important in crop management. This is particularly true since it has come into common use on corn. However, when used at recommended rates in seasons of normal rainfall and temperature, most recommended herbicides for field crops do not present a problem on crops planted the following season. Exceptions are listed in the "Remarks" column of Table 1.

Although there have been reports of injury to crops following atrazine applications on corn, these reports generally have been in situations where more than the recommended rate of 2 pounds per acre has been applied, exceptions have been on oats, sugar beets and field beans. There is more likely to be a problem with soil residues in a season of limited rainfall and cool temperatures, due to the slow dissipation of the herbicide.

In situations where corn follows corn, a soil residue problem may develop if atrazine is used in two or more consecutive years. When corn is grown 2 or three years consecutively, herbicides other than atrazine, such as 2,4-D, Ramrod, or Sutan should be used on the last year of corn.

When one intends to plant wheat after corn the same year, it is safer to reduce the rate of atrazine on corn to 1 pound per acre. Band application of atrazine is recom-

mended where a cover crop is to be seeded in corn; the cover crop can be established between the bands.

It should be noted that the amitrole-T — atrazine combination and atrazine alone for quackgrass control are recommended *only* for quackgrass control in corn. There are two reasons for this: (1) Atrazine is specific for corn and will leave a soil residue which may damage other crops, and (2) Amitrole-T is only cleared at this time by the Pesticide Regulation Branch of the U.S. Department of Agriculture for use directly ahead of corn. An 8-month waiting period is required between the application of amitrole-T and the planting of all other crops. Dalapon is recommended for quackgrass control ahead of crops other than corn (see Quackgrass in Table 1, page 6).

1. Read the label on the container carefully.
2. Use herbicides only on crops listed on the product label.
3. Apply at time and rate recommended.
4. Drift from any herbicidal spray can injure nearby crops, therefore, do all spraying on calm days.
5. A hood or shield built over the boom will help to control drift.
6. Do not spray 2,4-D within ½ mile of grapes or tomatoes. (State law prohibits use of 2,4-D esters in certain areas.)
7. Calibrate your sprayer carefully.

## TABLE 1. CHEMICALS FOR WEED CONTROL IN FIELD CROPS

Rates are expressed in pounds of active ingredients per acre for the area actually sprayed, unless otherwise noted. All agricultural chemicals should be applied in accordance with regulations and the Federal Insecticide, Fungicide, and Rodenticide Act as to rates, timing, and crops for which they may be used. The recommendations given here conform with these regulations.

Crop	Chemical	Rate*	Time of Application	Weeds Controlled	Remarks
Corn (Mineral Soils)	Atrazine (AAtrex)	2	Pre-emergence or Pre-plant	Annual grasses except Panicum and annual broad-leaved weeds	Usually obtain season-long weed control. Cultivation may not be necessary with an over-all spray application. If dry weather persists for 2 weeks after application, cultivate or rotary hoe to control weeds. Band application, reduces herbicide cost. Do not plant oats, sugar beets, field beans or vegetable crops the year following corn. See page 4 for the discussion on soil residues when atrazine is used 2 or more years consecutively. Rates of 2.5-3 lbs. per acre may be necessary on soils high in organic matter (greater than 6%).
	Atrazine (AAtrex) plus Linuron (Lorox)	1 plus 1	Pre-emergence	Annual grasses and annual broad-leaved weeds	Usually obtain season-long weed control. Band application reduces herbicide cost. Note that rate is in pounds of "active ingredients" per acre and that atrazine is an 80% wettable powder and linuron a 50% wettable powder. Do not spray corn after emergence. Corn injury may occur on light sandy soils. Plant corn at least 1¾ inches deep.
	Atrazine (AAtrex) plus Propachlor (Ramrod)	1 plus 3	Pre-emergence	Annual broad- leaved weeds and annual grasses	Ramrod is a 65% wettable powder. A commercial mixture is available or a tank mix can be made.
	Atrazine (AAtrex) plus Prometryne (Primaze)	1 plus 1	Pre-emergence	Annual broad- leaved weeds and annual grasses	Not quite as effective as the other combinations according to current tests. Do not use on sandy soils low in organic matter. Do not apply after corn has emerged.
	Propachlor (Ramrod)	4	Pre-emergence	Annual grasses	Must be followed with 2,4-D amine post-emergence for effective control of broad-leaved weeds.

\*Rate is pounds of active ingredient per acre for the area actually sprayed unless otherwise noted.

Crop	Chemical	Rate*	Time of Application	Weeds Controlled	Remarks
	Atrazine (AAtrex) plus Alachlor (Lasso)	1 plus 2	Pre-emergence	Annual broad-leaved weeds and grasses	Control of late season grasses such as fall panicum, witchgrass, crabgrass.
	Alachlor (Lasso)	2	Pre-emergence	Annual grasses	Fair to good control of nutsedge at 3 lb./A. Application may also be made preplant and followed with shallow tillage. Follow with 2,4-D amine post-emergence for control of annual broadleaved weeds. Control of late season grasses.
	2,4-D (amine)	½	Post-emergence Corn up to 6-8 inches tall	Broad-leaved annuals only	For corn taller than 6-8 inches, use drop nozzles. 2,4-D esters are not recommended for post-emergence application because of the greater possibility of damage to corn and other crops when they are used.
	(Emergency Use) Atrazine (AAtrex) plus Oil	2 plus 1 gallon	Early post-emergence before weeds are 1½ inch tall	Annual grasses and annual broad-leaved weeds	See above for restrictions on atrazine on use. This should be used in an emergency when weather conditions did not allow the use of atrazine pre-emergence. The timing of the application is critical to get the desired results. Use a high grade non-phytotoxic crop oil which is specified for this purpose. There is a greater chance for residue since treatment is later in season.
	Butylate (Sutan)	4	Before planting incorporated	Annual grasses	Fair to good control of nutsedge; must be incorporated or mixed in soil immediately after application. Follow with 2,4-D amine post-emergence for broad-leaved weeds. Injury to some corn plants may be evident under certain environmental conditions. Control of late season grasses.
	Atrazine plus Butylate (AAtrex + Sutan)	1 plus 3	Before planting incorporated	Annual broad-leaved weeds and grasses	Incorporate immediately after application. Increase rate to 1 plus 4 lbs. per acre for nutsedge control. Injury to some plants may be evident under certain environmental conditions. Control of late season grasses.
Corn (Organic Soils)	CDAA (Randex)	4	Pre-emergence	Annual grasses	Avoid cultivation as long as possible. Band spraying will reduce herbicide cost. Usually obtain grass control for 4-6 weeks. Spray post-emergence with 2,4-D amine to control broad-leaved annuals.
	Propachlor (Ramrod)	5	Pre-emergence	Annual grasses	Must be followed with 2,4-D amine post-emergence for effective control of broad-leaved weeds.
	2,4-D (amine)	½	Post-emergence Corn up to 6-8 inches tall	Broad-leaved annuals only	For corn taller than 6-8 inches and up to 18 inches, use drop nozzles; 2,4-D esters are <i>not</i> recommended for post-emergence application because of the greater possibility of damage to corn and other crops when they are used.
	Atrazine (AAtrex) plus Oil	3 plus 1 gallon	Early post-emergence before weeds are 1½ inch tall	Annual grasses and annual broad-leaved weeds	See above for restrictions on atrazine on use. This should be used in an emergency when weather conditions did not allow the use of atrazine pre-emergence. The timing of the application is critical to get the desired results. Use a high grade non-phytotoxic crop oil which is specified for this purpose.
Corn (Quackgrass Control)	Amitrole-T (Amitrol-T) (Cytrol) plus Atrazine	2 plus 2	Pre-plow  Pre-emergence	Quackgrass and annual weeds	Apply Amitrole-T in fall or spring when quackgrass is 4-8 inches tall. Plow 7-10 days later. If freezing weather occurs 7-10 days after fall application, fall plowing will not be necessary. Plant corn and apply atrazine per pre-emergence instructions above. Do not plant sugar beets or vegetable crops the year following corn. See Extension Folder F-312 on Quackgrass Control for more details.
	Atrazine	4	Pre-plow	Quackgrass	When stand of quackgrass is heavy, apply in fall. Otherwise apply in spring when quackgrass is 4-8 inches tall. Wait at least 10 days to plow. Can split application to apply 2# pre-plow and 2# pre-emergence; this will give control of annual weeds also. When a total of 4# of atrazine is used, corn must be grown 2 consecutive years. See Folder F-312 for more details.

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Crop	Chemical	Rate*	Time of Application	Weeds Controlled	Remarks
Corn (Nutsedge control)	Sutan	4	Pre-plant Incorporated	Nutsedge and annual grasses	Thoroughly mix to depth of 2-3 inches. Control of late season grasses.
	Lasso	3	Pre-emergence or Pre-plant		Under conditions of limited rainfall, shallow incorporation (2-3 inches) may improve control.
	Atrazine plus oil	2 plus 1 gal.	Post-emergence		Apply when nutsedge is 2 inches tall and repeat 2 weeks later. On muck soils the repeat applications should be at 1 lb./A plus 1 gal. of oil at 1 week intervals after the initial treatment.
Barley and Wheat (Without Seedings)	2,4-D (amine)	½	Fully tillered	Broad-leaved annuals	Use when grain is fully tillered but before the boot stage. Grain is usually 6-8 inches tall at this stage. Do not apply in the fall.
	2,4-D (ester)	½	Fully tillered	Perennials	Use only when bindweed, wild onion, and various thistles are present. Apply after fully tillered but before boot stage.
Oats (Without Seeding)	2,4-D (amine)	¼	Fully tillered	Broad-leaved annuals	Grain is usually at proper stage for spraying when 6-8 inches tall. Some yield reduction may occur but generally less than caused by weeds.
	MCPA	¾	Fully tillered	Broad-leaved annuals	Less injurious than 2,4-D.
Small Grains Seeded to Legumes	MCPA	¾	Spring	Broad-leaved annuals	Spray when grains are 6-8 inches high. A canopy of grain and weeds over the seeding will reduce possibility of injury to alfalfa. Sweet clover is very sensitive to MCPA.
	DNBP (Premerge) (Sinox PE)	¾	Spring	Broad-leaved annuals	Spray when grains are 6-8 inches tall.
	4-(2,4-DB) ester (Butoxone) (Butyrac 118)	¾	Spring	Broad-leaved annuals	Spray when grains are 6-8 inches high.
Alfalfa, Trefoil and Clover Seedings Without Small Grain Companion Crops	EPTC (Eptam)	3 lbs.	Before planting	Annuals	Work into soil immediately after application. Seed may be planted immediately after this operation. Do not use when grass is seeded with legumes.
	4-(2,4-DB) ester (Butoxone) (Butyrac 118)	¾	Post-emergence Seedlings in 2-3 leaf stage	Broad-leaved annuals	Can use if broad-leaved annual weed problem develops after use of EPTC.
Alfalfa (Established Stand)	MCPA	½	Late fall	Yellow rocket Broad-leaved winter annuals	Do not apply in the fall of the year the alfalfa is seeded. Spray after killing frost (legumes dormant).
	Simazine (Princep)	1 ¼	Fall	Yellow rocket Broad-leaved winter annuals	For fall application on <i>established</i> (1 year) alfalfa; apply after killing frost; will control winter annuals, yellow rocket, henbit, chickweed, peppergrass, shepherds purse, downy brome. Forage grasses will be injured or killed; some injury to alfalfa may occur on sands and loamy sands low in organic matter. 1.6 lb. on fine textured soils with organic matter 4-6%—some effect on seedling white cockle.
Red Clover (Current Year Seeding)	MCPA	½	Late fall	Yellow rocket Broad-leaved winter annuals	Spray after killing frost (legumes dormant).
Hay & Pasture (Legume or Grass)	4-(2,4-DB) ester (Butoxone) (Butyrac 118)	1	Early April	Hoary alyssum Broad-leaved annuals	Spray; when hoary alyssum seedlings are in two to four leaf stage. Do not graze or harvest for forage for 30 days after spraying.
Pastures (Grass)	2,4-D (ester)	1	Fall or spring	Biennials and perennials	
Pasture (Legumes)	2,4-D (ester)	1	Late fall	Perennials	Legumes may be injured or killed. Spot spray patches. Spray after killing frost in fall (legumes dormant).

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Crop	Chemical	Rate*	Time of Application	Weeds Controlled	Remarks
Field Beans	EPTC (Eptam)	3	Before planting	Annuals	Work into soil immediately after application.
	Amiben plus CDAA (Radox)	2 plus 2	Pre-emergence	Annuals	Band spray to reduce cost. Combination not available commercially as a mixture; so must be mixed in sprayer. Note that rate is in pounds of active ingredients per acre.
	Trifluralin (Treflan)	¾	Before Planting Incorporated (see remarks)	Annual grasses and annual broad-leaved weeds except ragweed, smartweed and mustard	Work into soil immediately after application by double disking twice in different directions. On light soils (sandy and sandy loam) low in organic matter use ½ lb. per acre. Some injury has occurred at higher rates.
Soybeans	Amiben	3	Pre-emergence	Annuals	Band application will reduce cost. Use 4 lbs. per acre on muck soil.
	Linuron (Lorox)	1½	Pre-emergence	Annual broad-leaved weeds and grasses	Some injury has occurred at higher rates and on light sandy soils or soils low in organic matter.
	Amiben plus Linuron (Amiben plus Lorox)	2 plus 1	Pre-emergence	Annual broad-leaved weeds and grasses	Less hazard on sandy and sandy loam soil; more effective under conditions where only small amounts of rainfall occur after application; use ¾ lb. Lorox on sandy and sandy loam soils low in organic matter.
	Linuron plus Alachlor (Lorox + Lasso)	1 plus 2	Pre-emergence	Annual broad-leaved and grass weeds	Less hazard than Lorox alone on sandy and sandy loam soils low in organic matter.
	Alachlor (Lasso)	2	Pre-emergence	Annual grasses	
	Trifluralin				More effective control is possible if the application is made 10 days to 2 weeks ahead of planting and field reworked just prior to planting.
	Naptalam plus Chloropropham (Solo)	1 gallon	At planting	Annual broad-leaved weeds and grasses	Not effective on muck or highly organic mineral soil. Band spraying will reduce cost. Injury may occur on soils low in organic matter.
Potatoes	Trifluralin (Treflan)	¾	Before Planting Incorporated (see remarks)	Annual grasses and annual broad-leaved weeds except ragweed, smartweed and mustard	Work into soil immediately or within 4 hours after application by double disking twice in different directions. On light soils (sandy and sandy loam) low in organic matter use ½ lbs. per acre. Some injury has occurred at higher rates. On silt loam and clay loam soils 1 lb. per acre may be used.
	EPTC (Eptam)	4	Before planting Incorporated	Annuals	Work into soil immediately after application. If nutgrass is a problem, use 6 lbs. per acre.
	Linuron (Lorox)	2	Pre-emergence	Annual grasses and annual broad-leaved weeds	Apply pre-emergence after weeds have emerged but before potatoes emerge. If field leveling is necessary, it should be done soon after planting to allow weed emergence before spraying.
	Patoran	2	Pre-emergence	Annual and broadleaved grass weeds	Apply pre-emergence after weeds emerge but before potatoes emerge. May require 3 lb./A for control on fine textured soils and organic matter 4-6%.
	DNBP (Premerge) (Sinox PE) plus Dalapon	3 plus 2½	Pre-emergence	Annual grasses and annual broad-leaved weeds	Refer to statement for Linuron (Lorox) above.
2,4-D (ester) plus Dalapon	1 plus 2½	Pre-emergence	Annual grasses and annual broad-leaved weeds	Do not use on fields grown for certification. Refer to statement for Linuron (Lorox) above.	

\*Rate is pounds of active ingredient per acre for the area actually sprayed unless otherwise noted.

Crop	Chemical	Rate*	Time of Application	Weeds Controlled	Remarks
	Dalapon (Dowpon)	10	Spring-on quackgrass	Quackgrass	Spray when quackgrass is 4 to 6 inches tall. Wait one week before plowing. Use in 30-40 gallons of water per acre. Control of quackgrass will be reduced when heavy stand of rye cover is present.
Sugar Beets	Pyrazon (Pyramin) plus TCA	4 plus 6	At planting	Annuals	Gives good control of annual grasses and annual broad-leaved weeds, including lambs-quarter. Band application will reduce cost. Use pyramin at 3 lb/A on sandy loam soils with less than 2.5% organic matter.
Sugar Beets	Dalapon (Dowpon)	15	Fall-on quackgrass	Quackgrass	Use 30-40 gallons of water per acre. Plow 7-10 days after spraying, if possible.
Row Mint Meadow Mint	Terrbacil (Sinbar)	2	Pre-emergence	Annual broad-leaved weeds and grasses	Rates may be reduced to 1 lb. per acre if terrbacil was used the previous year. Do not plant any crop except potatoes for two years following application.
Quackgrass (For Spring Seeded Crops)	Dalapon (Dowpon)	15	Fall		Fall plow 7 to 10 days after spraying, if possible. Land can be planted to spring sown crops. Use 30-40 gallons of water per acre. For quackgrass control in corn, potatoes and sugar beets — see above under specific crop
Quackgrass (For Fall Seeded Crops)	Dalapon (Dowpon)	10	Spring		Apply prior to July 1. Plow 7-10 days after spraying. Land can be planted to alfalfa, wheat, or winter barley. Use 30-40 gallons of water per acre.
Fence Rows, Roadsides, Ditches	Silvex	2	Spring or fall	Broad-leaved perennials	Spray before crops are planted or after harvest. Do not pasture area.
	Dalapon (Dowpon)	15	June-July	Cattail	Use 80 to 100 gallons water, keep livestock out.
	Amitrole	2	June-July	Poison ivy	Spray when in full leaf.
	Amitrole	4	June-July	Canada thistle Horse nettle	Do not pasture.
Brush (Fence Rows, Roadsides, Ditches)	Mixture of 2,4,5-T and 2,4-D esters ("Brushkiller") Foliage Spray		Spring or Summer	Most woody species	Add one pound acid equivalent to 25-35 gallons of water. For small amounts, mix 2 tablespoons of 4 pounds per gallon acid equivalent material to one gallon of water. Apply a drenching spray to foliage. Best results obtained soon after maximum leaf-development in spring, but summer sprays are also effective. Best control on brush up to 8 feet tall.
	2,4,5-T ester Foliage spray		Spring or Summer	Hard-to-kill woody species	Use for hard-to-kill species such as ash, brambles, oak, and maple, or for surviving plants after spraying with a mixture of 2,4,5-T and 2,4-D "Brushkiller." Follow rates and instructions given above for "brushkiller."
	Mixture of 2,4,5-T and 2,4-D esters ("Brushkiller") in oil Basal Spray		Any time	Most woody species	Using a concentrate that contains 4 pounds acid equivalent per gallon, mix one pint of concentrate in 3 gallons of diesel fuel or kerosene, or use 10 tablespoons of concentrate per gallon. Thoroughly wet the bark on the lower 18 inches of the brush. Can use on small trees up to 6" in diameter. Usually more effective than foliage sprays. Can use in fall, winter, and spring, when susceptible crops are not present.
	2,4,5-T ester in oil Basal Spray		Any time	Hard-to-kill woody species	Follow rates and instructions given above for basal spray with "brushkiller."
	Fenuron (Dybar)			Any time	Most woody species

\*Rate is pounds of active ingredient per acre for the area actually sprayed unless otherwise noted.