



Cooperative Extension Service

NORTH DAKOTA STATE UNIVERSITY - FARGO, NORTH DAKOTA 58102
UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

CIRCULAR
W-253

PERM
COPY
WEED CONTROL

1971 CHEMICAL WEED CONTROL GUIDE for Field Crops and Perennial Weeds

Larry W. Mitich
Associate Professor
Extension Service

Alan G. Dexter
Assistant Professor
Extension Service

John D. Nalewaja
Professor
Agricultural Experiment Station

Calvin G. Messersmith
Assistant Professor
Agricultural Experiment Station

Weed control suggestions in this circular are based on Federal label clearances and on information obtained from the North Dakota Agricultural Experiment Station and the Research Committee of the North Central Weed Control Conference.

APPLICATION RATES are broadcast rates and are based on active ingredient or acid equivalent rather than the amount of commercial product. Commercial formulations of the same herbicide may vary in their amount of active ingredient. For example, a pint of 4 pound acid equivalent per gallon 2,4-D contains 1/2 pound acid equivalent, a pint of 3.3 pound acid equivalent per gallon contains 2/5 pound, and a pint of 6 pound acid equivalent per gallon contains 3/4 pound. Three pounds of atrazine (AAtrex 80W) powder contains 2.4 pounds active ingredient, or 3 pounds active ingredient is 3-3/4 pounds of product ($3 \div 0.80 = 3.75$).

WEED COMPETITION reduces crop yields severely, unless weeds are removed when small. Good cultural practices are one of the many methods of controlling weeds. However, selective herbicides can be an effective supplement. Timely applications of selective chemicals at the recommended rates will control many annual weeds satisfactorily without damaging the crop in which the weeds are growing.

PERENNIAL WEEDS in crops such as field bindweed, leafy spruce, Canada thistle and perennial sowthistle also can be controlled. MCPA is as effective as 2,4-D on Canada thistle but 2,4-D gives slightly better control of sowthistle. Use MCPA to suppress thistles in oats and flax. However, these crops do not tolerate rates of MCPA necessary to give adequate thistle control.

When controlling field bindweed and thistles in small grains except oats, apply the maximum rate of 2,4-D or

MCPA the crop will tolerate—3/4 pound per acre of 2,4-D or MCPA amine and 2/3 pound per acre of 2,4-D low volatile ester or MCPA ester. If such herbicides are planned for controlling hard-to-kill annuals or perennial weeds in crops, grow the more tolerant cereals—rye, wheat and barley.

CONSIDER BOTH the crop tolerance and kind of weeds present in determining the rate of herbicide to apply. A range of rates is given for most of the herbicides in this circular. Use the lowest recommended rate of postemergence herbicides under favorable growing conditions when weeds are small and actively growing. Under adverse conditions of drouth or prolonged cool weather, or for well established weeds, use the highest recommended rate, except for Carbyne. Do not apply Carbyne when freezing or prolonged cold weather is forecast as wheat and barley may be injured.

IDEAL TEMPERATURES for applying postemergence herbicides are between 65° and 85° F. Below 60°, weeds are killed very slowly or not at all; above 85° there is danger of herbicide injury to the crop. Avoid applying volatile herbicides such as 2,4-D ester, MCPA ester and dicamba (Banvel) during hot weather, especially near sensitive broad-leaf crops, shelterbelts or farmsteads.

Some of the so-called high volatile esters of 2,4-D vaporize at temperatures as low as 70° F and most vaporize readily at temperatures above 85° F. The temperature at ground level always is several degrees warmer than that at chest height. Consequently, vaporization from the high volatile esters could occur at temperature readings as low as 60° F. Vapor drift may be avoided by using the 2,4-D amines.

DO NOT SPRAY when there is danger of spray or vapor drift, or when the wind is blowing toward a neighboring crop or planting more susceptible than the crop being

sprayed. The amines of 2,4-D and MCPA are not volatile and eliminate the danger of vapor injury. However, spray drift from any herbicide will injure susceptible plants.

PREEMERGENCE HERBICIDES: Soil type, weather conditions and the weeds to be controlled determine the rate of preemergence herbicides to apply. Generally heavy clay soils high in organic matter require higher rates of such herbicides than lighter soils or those lower in organic matter.

Good weed control with preemergence herbicides depends on many factors, including rainfall after application, soil moisture, soil temperature and soil type. For these reasons, preemergence chemicals applied on the soil surface sometimes fail to give satisfactory weed control. Herbicides which are incorporated into the soil surface usually are less dependent upon rainfall after application for effective weed control.

HERBICIDE COMBINATIONS: The effect of postemergence herbicides often is increased when applied to areas already treated with a preemergence or pre-plant herbicide. Combinations of certain postemergence herbicides or preemergence herbicides may give better weed control than from the use of the individual herbicide alone. However, loss of weed control or increased crop damage may sometimes result from the use of certain other herbicides in combination.

Use herbicide combinations with caution until experience or research has shown that the combination is effective and safe.

See the discussion on individual crops for more specific information.

All agricultural pesticides which are tank mixed must be registered for use as a mixture by the Environmental Protection Agency. Illegal chemical residues may result from use of unregistered mixtures.

PERENNIAL WEEDS IN PASTURES: Picloram (Tordon 22K) has received state label clearance for the control of broadleaf perennial weeds such as leafy spurge, field bindweed, Canada thistle, and Russian knapweed on rangelands and permanent grass pastures. Rates of 1 to 2 pounds per acre give excellent control of these weeds and are economical for spot treatment. During a single growing season do not use more than 10 gallons of picloram for any 100-acre area and do not treat more than 20 acres of any 100-acre area. To suppress the growth of perennial broadleaf weeds in large areas, use 1/4 to 1/2 pound per acre and apply as a single broadcast spray during any one growing season. Retreatment at the same rate may be necessary the following year.

Picloram is a highly potent herbicide. Do not allow spray drift of picloram, as tiny amounts may cause damage to sensitive plants. Especially susceptible to picloram are soybeans, potatoes, safflower, sunflowers and sugarbeets. Picloram is highly water soluble and moves in the soil; consequently, do not apply in areas with a high water table. Do not apply near shelterbelts or shrubs or trees. Do not treat

or allow picloram spray drift to fall onto the inner banks or bottoms of irrigation and drainage ditches.

Do not graze picloram treated areas with dairy animals. Do not transfer beef cattle directly from areas treated in any one growing season onto broadleaved crop areas without allowing 7 days on untreated grass pastures, as urine may contain enough picloram to cause crop injury.

CAUTION:

The weed control suggestions in this circular are based on the assumption that all herbicides used in the past will have established tolerances with the Environmental Protection Agency.

USE EACH CHEMICAL ONLY AS RECOMMENDED ON THE LABEL OF THE CONTAINER.

WEED CONTROL IN FIELD CROPS

FLAX: Flax is the most tolerant to MCPA when it is 2 to 6 inches tall. Avoid spraying flax during the period between bud stage and when 90 percent of the bolls have formed, as serious crop injury would likely occur. In addition, applying MCPA between full bloom and the stage when flax seeds are colored may reduce germination of the seed.

Flax is more tolerant to MCPA than 2,4-D. Use 2,4-D only when such hard-to-kill weeds as redroot pigweed and Russian thistle are present. Rates of MCPA amine higher than 1/4 pound per acre or MCPA ester should be used in flax only for the more resistant weeds.

Chemical weed control in flax is most effective when the herbicide is applied as soon as most of the weeds have emerged. While an application of MCPA may reduce the yield of both seed and straw, weed competition generally is reduced sufficiently to compensate for any herbicide injury.

Dalapon (Dowpon) will control green and yellow foxtail (pigeongrass) in young flax. Apply dalapon when the flax is over 2 inches tall and the weeds less than 2 inches for best results. Spraying must be completed prior to the early bud stage. Generally dalapon is applied in a mixture with MCPA amine to control both the susceptible grassy and broadleaf weeds with one application.

Flax is a poorer competitor with weeds than are small grains. Consequently, flax should be grown on relatively weed-free fields. Early after-harvest tillage of small grain stubble will prevent weed seed production, control perennial weeds and encourage annual weed seed germination prior to freeze-up.

Follow corn, soybeans or other cultivated row crops with flax. If good weed control practices were employed in the previous year's crop, only shallow tillage would be required for the flax. One or more crops of wild oats frequently are destroyed by spring tillage before flax is sown. However, delayed planting sometimes reduces crop yields. Early maturing varieties should be planted under such conditions.

SMALL GRAINS—SPRING WHEAT (INCLUDING DURUM), BARLEY AND OATS: All small grains are sensitive to 2,4-D during the seedling stage but can be treated safely with MCPA from the time of emergence until the early boot stage. Wheat and barley, when treated from the fifth leaf to the early boot stage, are more tolerant than oats to 2,4-D applications. Oats is more resistant to MCPA than to 2,4-D, but crop injury is possible with either chemical at any growth stage. Oats in the 5-leaf stage of growth is especially susceptible to injury from 2,4-D. Use 2,4-D on oats only for such hard-to-kill weeds as Russian thistle, common ragweed and redroot pigweed. While some injury to the oats can be expected, the better control of these weeds with 2,4-D usually will compensate for any yield loss caused by the chemical. Do not treat small grains in the boot stage of development. Oat varieties vary in their tolerance to 2,4-D but there is little or no differences in such tolerance among the wheat and barley varieties.

Rates of 2,4-D or MCPA required to control most broadleaf weeds cannot be applied in small grain crops underseeded to legumes without seriously injuring or killing the legumes, sweetclover and alfalfa being especially sensitive. Applying 2,4-DB when small grains are 6 to 8 inches tall will control many broadleaf weeds without injuring the legumes, except sweetclover, which is susceptible to 2,4-DB and would be killed. Wild mustard generally is not controlled by 2,4-DB and other weeds require higher rates of 2,4-DB than of MCPA or 2,4-D.

Dicamba (Banvel) controls wild buckwheat and smartweed in wheat and oats. It can be applied alone or in a mixture with MCPA to control other broadleaf weeds. Oats is more tolerant than wheat. Both crops must be treated at the 2nd through 4th leaf stage. Barley is more susceptible to injury from dicamba than wheat or oats. However, dicamba at 1 ounce per acre applied to barley in the 2 to 3 leaf stage controls wild buckwheat without severely injuring the crop.

Bromoxynil (Buctril, Brominal) controls wild buckwheat, fumitory and most annual broadleaf weeds in wheat and barley from the 3rd leaf stage of the crop to early boot. Bromoxynil generally is applied in a mixture with MCPA ester to enhance weed control.

Wild oat control in small grains is discussed in the wild oat section of this circular.

CORN: A combination of cultural practices and herbicide applications is necessary for weed control in corn.

Destroy early germinating weeds by cultivation before planting if conventional tillage is used. Leave the space between the rows rough to discourage weed growth. Cultivate after the weed seeds have germinated and before or as soon as the weeds appear above the soil surface. Use row cultivators while the weeds are still very small. Use a rotary hoe or cultivator as soon as weeds appear, even if preemergence herbicides have been applied.

Atrazine (AAtrex) applied preemergence at 2 to 4 pounds per acre gives good control of annual weeds without crop injury. Fine textured soils and those high in organic matter require a 4-pound per acre application. Toxic atrazine residues may remain in certain soils longer than one growing season. Residues are more likely to persist under low soil temperatures and moisture conditions. In addition to the 80% wettable powder formulation of atrazine, a 4-pound per gallon flowable liquid formulation is available.

Crops vary in their tolerance to atrazine and the general ranking in order of least to most tolerant is: sugarbeets, sunflowers, oats, wheat, barley, soybeans, flax, millet, sorghum and corn. Minimize residues by applying the lowest rate of chemical consistent with good weed control, using band instead of broadcast applications, and plowing the field prior to planting the next crop.

Propachlor (Ramrod) applied preemergence at 4 to 5 pounds per acre controls annual grasses and some broadleaf weeds, but is ineffective against wild mustard or perennial weeds. Propachlor often is used in mixtures with atrazine or linuron to enhance broadleaf weed control.

Alachlor (Lasso) is related to propachlor and is used preemergence at 2½ pounds per acre primarily for control of annual grasses and certain broadleaf weeds such as redroot pigweed, common lambsquarters and common ragweed.

Early postemergence weed control must be done at the proper time for satisfactory results. Atrazine effectively controls most annual weeds in corn and control of broadleaf weeds is excellent. Apply 1 to 2 pounds per acre of atrazine within 3 weeks of planting while the weeds are less than 1½ inches tall. Adding 1 to 2 gallons per acre of crop oil with an emulsifier increases the effectiveness of the treatment. Substituting 1 to 1½ quarts per acre of emulsifiable vegetable oil (Bio-Veg, a linseed oil) gives results similar to petroleum oil applied at 1 to 2 gallons per acre. Do not mix other chemicals with atrazine and oil as severe corn injury may result.

When corn is 3 to 8 inches tall, an overall broadcast application of 2,4-D amine at 1/4 to 1/2 pound per acre can be made to control broadleaf weeds. Use the 1/4 pound rate for susceptible weeds like wild mustard. The 1/2 pound rate is satisfactory for controlling the more resistant weeds, but corn may be injured. Do not use MCPA, as it is more injurious to corn than 2,4-D. When corn is over 8 inches tall, use drop nozzles to avoid getting the 2,4-D on the upper leaves and leaf whorl of the crop. This reduces the danger of 2,4-D injury.

Corn sprayed with 2,4-D may show signs of injury. Brittleness, followed by bending or breaking of the stalks, sometimes occurs. A severe stand loss may result when applications of 2,4-D are followed by a storm or careless cultivation.

Dicamba (Banvel) at 1/4 pound per acre applied postemergence in corn gives better control of Canada thistle, smartweed and wild buckwheat than 2,4-D with less effect on the corn. Dicamba can be applied in a mixture with

2,4-D amine at 1/4 to 1/2 pound per acre. Make applications until corn is 3 feet tall or until 10 days before tasseling, whichever comes first. Use drop nozzles after corn is 8 inches tall.

SOYBEANS: Soybeans are poor competitors with weeds, when cool soil temperatures slow their germination and growth. They are good competitors in warm soils, however, because germination and growth are rapid. Good cultural practices should be used in soybean production. Prepare the seedbed immediately prior to planting the soybeans to kill numerous weeds. Cultivate with a rotary hoe or harrow after the soybeans are up and when the weeds are small and soil conditions favorable.

Trifluralin (Treflan) applied 1/2 to 1 pound per acre preplanting and thoroughly incorporated gives good control of annual grasses, except wild oats and some broadleaf weeds, except wild mustard. Proper incorporation is essential. Tandem disking in two directions 4 to 6 inches deep gives satisfactory results.

Alachlor (Lasso) at 2½ pounds per acre gives good preemergence control of annual grasses and some broadleaf weeds, including redroot pigweed and common lambsquarters. It is ineffective against wild mustard. Soybeans have good tolerance to alachlor.

Linuron (Lorox) is a preemergence herbicide for controlling most annual broadleaf weeds and grasses. Rates of application are ½ to 2½ pounds per acre. This chemical is soil sensitive so it is extremely important to use the rates recommended on the label for your soil type. Linuron works best on medium textured soils with less than 4 percent organic matter and clay. Crop injury occasionally occurs on sandy soils.

Chloroxuron (Tenoran) at 1 pound per acre is applied early postemergence as an emergency control measure for wild mustard. It gives fair to good control of redroot pigweed and common lambsquarters. Grasses are not controlled. Chloroxuron is applied over the soybeans when they are in the first trifoliate leaf stage. Broadleaf weeds should be less than 2 inches tall at application time as larger weeds will not be controlled. Some crop leaf burn generally occurs following treatment.

SUNFLOWERS: Weeds usually are a problem in sunflowers as the crop does not develop ground cover rapidly enough to prevent weeds from becoming established.

Since weeds generally emerge before the sunflowers, cultivating with a spiketooth or coil spring harrow 1 week after sowing but prior to germination of the crop will kill many weeds. After crop emergence, kill weeds by using a weeder, coil spring or spike-tooth harrow or rotary hoe. Weeds between the rows are controlled by cultivation.

Trifluralin (Treflan) and EPTC (Eptam) are herbicides that are applied preplanting and incorporated into the soil while being applied or within a few minutes after application. On sandy soil apply 1/2 to 3/4 pound per acre of trifluralin, increasing the rate to 1 pound per acre on clay soil,

or apply 3 pounds per acre of EPTC. A tandem disk should be used for incorporation. Disk the field twice, once in each direction. While both herbicides control grasses and some broadleaf weeds, they are not effective on wild oats or wild mustard.

Amiben at 2 to 3 pounds per acre is applied preemergence to control most grassy and broadleaf weeds, including wild mustard. Band application reduces the cost. A granule formulation is available. At least 1/2 inch of rain is necessary within 10 days after application to activate the herbicide. If rain falls later than this, the degree of weed control will be reduced.

SPECIAL WEED PROBLEMS

WILD OATS is difficult to control because the plants shatter their seeds before crops are harvested and because of seed dormancy which results in delayed germination. In infested areas, the soil is saturated with wild oats seeds. Wild oats is a cool season plant and seeds germinate only in the spring and fall when favorable temperature and moisture conditions exist.

Apply barban (Carbyne) for postemergence control of wild oats when the weed is in the 1½ leaf stage, which occurs from 4 to 9 days after emergence. Rates of 4 to 6 ounces per acre are applied to wheat, barley, flax, sunflowers and mustard. Thick, vigorous stands of crop plants help suppress wild oats and enhance the degree of control obtained with barban. Crop competition is important for wild oat control; therefore, control may not be satisfactory in thin crop stands. In sugarbeets apply 12 to 16 ounces per acre of barban.

Barban must be applied before the 14th day after wheat, durum and barley emerge and before the 4th leaf stage to avoid serious crop injury and poor wild oats control. Treat flax before the 12th leaf stage. There are no restrictions on winter wheat, sunflowers or sugarbeets. Do not mix barban with any other chemical including fertilizers.

Preplant or preemergence incorporated applications of diallate (Avadex) at 1½ pounds per acre controls wild oats in flax and sugarbeets. Triallate (Far-go) is a related compound, applied preemergence to wheat at 1 pound per acre and barley at 1¼ pounds per acre for wild oat control. Both herbicides are volatile and should be incorporated in the top 2 inches of soil by harrowing immediately after application to prevent losses by evaporation.

Diallate and triallate can be applied in the fall after October 15 until freeze-up. A granular formulation of diallate is available for use as a fall application.

See Circular A-351, "Chemical Control of Wild Oats in Field Crops" for additional information.

CHEMICAL WEED CONTROL For Field Crops

Crop	Herbicide	Act. Ingrid. lb. per Acre	Weeds	When to Apply	Remarks
WHEAT, DURUM OR BARLEY	2, 4-D amine ester	1/4 to 1/2	Broadleaf	Crops - 5th leaf to early boot	Do not apply later than boot stage. Barley more sensitive than wheat.
	MCPA amine or ester	1/4 to 2/3	Broadleaf	Crops - - emergence to early boot	Can be applied earlier than 2, 4-D.
	Bromoxynil plus MCPA ester	1/4 plus 1/4	Wild buckwheat and most broad- leaf weeds	Crops - - 3rd leaf to boot stage	Apply when weeds are in early seed- ling stage. Commercial mixtures are available.
WHEAT OR DURUM	Dicamba (Banvel)	2 oz (1/8 lb)	Wild buckwheat	Crops - - 2nd through 4th leaf stage	Mix with 4 to 6 oz. per acre of MCPA for control of broadleaf weeds
WINTER WHEAT OR RYE	2, 4-D amine ester	1/4 to 1/2 1/4 to 1/3	Broadleaf	Crops - - fully tillered to early boot	Do not apply in the fall.
OATS	MCPA amine or ester	1/4 to 1/2	Broadleaf	Oats - - emergence to early boot	Early jointing stage most sensi- tive. Possible injury to oats at any growth stage.
FLAX	Dicamba (Banvel)	2 oz	Wild buckwheat	Oats - - 2nd through 4th leaf stage	Mix with 4 oz. per acre of MCPA for control of other broadleaf weeds.
	MCPA amine	1/4	Broadleaf	Flax 2 to 6 inches tall	Use higher rates or esters only for hard-to-kill weeds.
	Dalapon (Dowpon)	3/4	Annual grasses except wild oats	Best results obtained when flax is over 2 inches and weeds are under 2 inches tall	Mix MCPA or 2, 4-D with dalapon to control both broadleaf and annual grassy weeds. Legumes not injured by dalapon.
SMALL GRAIN PRE-HARVEST	2, 4-D L.V. ester or oil soluble amine	1	Broadleaf	Crops - - early dough stage	Use only when weeds threaten to interfere with harvest operations.
SORGHUM AND MILLET	2, 4-D amine	1/4 to 1/2	Broadleaf	Sorghum - - 4 to 12 inches tall, Millet - - 5th leaf to early boot	Preemergence herbicides such as propachlor (Ramrod) and propazine (Milogard) can be used in sorghum but not in millet.
CORN	Propachlor (Ramrod)	4 to 5	Grasses and some broadleaf weeds	Preemergence	Wettable powder or granules avail- able. Ineffective against wild mustard.
	Atrazine plus propachlor	1 plus 3 (tank mix)	Broadleaf and annual grasses	Preemergence	Atrazine residue may occur. Commer- cial mixture is available (ratio 1 lb. atrazine to 2.3 lb. propachlor).
	Linuron plus propachlor (Londax)	3/4 to 1 1/2 plus 1 1/2 to 3	Broadleaf and annual grasses	Preemergence	Use the higher rate on heavy soils. Soil residues not likely to occur.
	Atrazine (AAtrex)	2 to 4	Broadleaf and grasses	Preemergence	Atrazine may remain in soil longer than one year and damage following crops other than corn. Use higher rate on heavy soils and for quack- grass control.

CORN (cont.)	Atrazine (AAtrex) (cont.)	1 to 2 plus 1 to 2 gal. oil	Broadleaf and grasses	Early postemergence-- weeds 1 1/2 inches tall or less	Application when weeds are over 1 1/2 inches may result in poor control. Soil residues may occur.
	2, 4-D amine	1/4 to 1/2	Broadleaf weeds	Postemergence, corn-- 3 to 8 inches tall	Use drop nozzle when corn is over 8 inches tall but before tasseling.
	Alachlor (Lasso)	2 1/2	Grasses and some broadleaf weeds	Preemergence	Ineffective against wild mustard.
	Alachlor plus Atrazine	1 1/2 plus 1	Most grasses and broadleaf weeds	Preemergence	Atrazine residue may occur.
	Butylate (Sutan) plus Atrazine	3 plus 1	Most grasses and broadleaf weeds	Preplant and incorporate	Trial use only. Incorporate immediately (within minutes) and thoroughly with tandem disk in two directions 4 to 6 inches deep. Atrazine residue may occur.
SOYBEANS (See later section for wild oat control)	Amiben	2 to 3	Annual grasses and broadleaf weeds	Preemergence	Wild oat control not adequate. Band application reduces cost.
	Trifluralin (Treflan)	3/4 to 1	Grasses and broadleaf except mustard	Preplant and incorporate	Tandem disk in two directions 4 to 6 inches deep. Wild oat control not adequate
	Chloroxuron (Tenoran)	1	Wild mustard and some other broad- leaf weeds. NOT GRASSES	When weeds are less than 2 inches tall and crop has first trifoliate leaf	Use as emergency wild mustard con- trol measure. Must be applied with surfactant (Adjuvan T).
	Alachlor (Lasso)	2 1/2	Grasses and some broad- leaf weeds	Preemergence	Ineffective against wild mustard.
	Amiben	2	Annual grasses and broadleaf weeds	Preemergence	Band application reduces cost. Wild oat control not adequate.
PINTO BEANS	EPTC (Eptam)	3	Grasses and some broad- leaf weeds	Preplant and incorporate	Weak on wild mustard. Wild oat control not adequate.
	Trifluralin (Treflan)	1/2 to 1	Grasses and broadleaf except mustard	Preplant and incorporate	Tandem disk in two directions 4 to 6 inches deep. Wild oat control not adequate.
	EPTC (Eptam)	3	Grasses and some broad- leaf weeds	Preplant and incorporate	Generally gives short-term weed control.
	Trifluralin (Treflan)	1/2 to 1	Grasses and broadleaf except mustard	Preplant and incorporate	Tandem disk in two directions 4 to 6 inches deep. Wild oat control not adequate.
	Amiben	2 to 3	Annual grasses and broadleaf weeds	Preemergence	Wild oat control not adequate. Band application reduces cost.
SUNFLOWERS (See later section for wild oat control)					

Crop	Herbicide	Act. Ingrid. lb. per Acre	Weeds	When to Apply	Remarks
SUGARBEETS (See later section for wild oat control)	EPTC (Eptam)	2 to 3	Annual grasses and some broad- leaf weeds, not wild mustard	Preplant followed by an immediate (within minutes) and thorough incorporation	Use higher rates on heavy, high organic matter soils. Some stand reduction and temporary stunting may occur from the use of EPTC.
	Cycloate (Ro-Neet)	3 to 4	Annual grasses and some broad- leaf weeds, not wild mustard	Preplant to a dry soil surface followed by an immediate (within minutes) and thorough incorpora- tion	Use lower rate only on light, sandy soils. Sugarbeets have better tolerance to cycloate than to EPTC. Following cycloate with a postemergence herbicide is suggested.
	Pyrazon (Pyramin)	3.8	Most broadleaf weeds	Preemergence or post- emergence on soils with less than 5% organic matter. Can be used only postemer- gence on higher organic matter soils. Broadleaf weeds should be treated at the two-leaf stage	Pyrazon used postemergence on high organic matter soils has given erratic results. Applying pyrazon to areas previously treated with a preemergence or preplant herbicide and adding a surfactant or oil to the post- emergence spray solution has improved weed control with post- emergence pyrazon. Preemergence pyrazon should be used with preemergence TCA.
	Pyrazon Dalapon (Pyramin Plus)	3.8 (pyrazon) 2.2 (dalapon)	Most annual grasses and most broadleaf weeds	Postemergence when broadleaf weeds are in the two-leaf stage	The remarks with regard to pyrazon used postemergence alone (see above) still apply. A sur- factant is included in this product.
	Endothall (Herbicide 273)	.75 to 1.5	Wild buckwheat smartweed marshelder	Sugarbeets should have 4-6 leaves. Do not apply later than 40 days after emergence. Average temperature should be above 60° F.	When temperatures are over 80° F., endothall may cause excessive injury especially to very small sugarbeets. Endothall is inef- fective at temperatures below 60° F.
	TCA (various names)	6 to 8	Most annual grasses except wild oats	Preemergence	Do not use sugarbeet tops for livestock feed.
	Dalapon (Dowpon)	2 to 3	Most annual grasses	Apply from emergence to 6-leaf stage of sugarbeets. Use directed spray after beets have 6 leaves	Use high rate if grasses have over 2-4 leaves or if they are growing slowly due to dry condi- tions. May be applied more than once up to a maximum of 5.9 lb/A per year. Some yield reduction may occur from rates over 3 lb/A.
	Phenmedipham (Betanal)	1 to 1.5	Most annual grasses and broadleaf weeds, not redroot pigweed	Sugarbeets should have 2-4 leaves	Use when weeds are between coty- ledon and four-leaf stage. Use no more than 1 lb/A when follow- ing EPTC or TCA. Do not apply if temperature is over 85° F.

GRASS Seedling Established	2, 4-D	1/2 to 3/4	Broadleaf	After 3-leaf stage of grasses	Use rate for established grasses after tillering.
	2, 4-D	3/4 to 2	Broadleaf	Weeds- -emergence to bud stage	Do not graze dairy cows for 7 days after application. Do not apply after boot stage on grasses for seed production.
	Dicamba (Banvel)	1/4 to 1/2	White cockle, nightflowering catchfly and alfalfa	In spring when seed crop is 2 to 4 inches high	Use only in established perennial grasses grown for seed.
LEGUMES Alfalfa and clover with nurse crop	2, 4-DB	1/2 to 1	Broadleaf	After legumes are at least 2 inches tall	Sweetclover killed by 2, 4-DB. Delay to get weed and crop canopy.
	MCPA amine	1/8 to 1/4			NOTE: POSSIBLE INJURY TO SWEETCLOVER AND ALFALFA.
	2, 4-DB	1/2 to 1	Broadleaf, wild mustard control generally not adequate	When weeds are small	2, 4-DB and dalapon can be mixed but no dalapon label clearance for hay or pasture. 2, 4-DB must be applied 30 days before hay harvest or grazing.
Alfalfa only	Simazine (Princep)	0.8 to 1.6	Grasses and broadleaf including wild oats and mustard	After last cutting but before freeze- up	Do not use on sands or loamy sands or where soil pH is above 7.5. Use low rate on sandy loam. Apply to pure stands of alfalfa established at least 12 months.
Weed	Herbicide	Rate Per Acre	Crop	When to Apply	Remarks
WILD OATS Selective control in crops	Triallate (Far-go)	1 1/4 lb	Barley	Fall- - after October 15 and until freeze- up	Incorporate immediately by cultiva- tion. Keep spring tillage to minimum.
		1 lb	Wheat and durum		
	Diallate (Avadex)	1 1/4 lb	Barley	Spring- -immediately after planting	Apply on smooth soil surface and incorporate immediately in top 2 inches by cultivation.
		1 lb	Wheat and durum	Preplanting	Incorporate immediately by cultivation.
		1 1/2 - 2 lb	Flax, sugar- beets and potatoes		
		1 1/2 lb	Corn	Preplanting or preemergence	
		1 1/4 lb	Peas		
		1 1/2 lb	Flax and sugarbeets	Fall- -after October 15 and until freeze- up	Incorporate shallowly by cultiva- tion. Keep spring tillage to mini- mum.

Weed	Herbicide	Rate Per Acre	Weeds	When to Apply	Remarks
WILD OATS (cont.)	Barban (Carbyne)	4 to 6 oz	Wheat, winter wheat, durum, barley, flax, peas, mustard and sunflowers	Wild oats- 1 1/2 leaf stage. Crops: Small grain before 4th leaf stage; flax before 12th leaf stage; peas before 6th leaf stage; mustard before true 3rd leaf stage; winter wheat, sugarbeets and sunflowers- no restrictions	Usually applied 4 to 9 days after wild oats emerge. Must be applied before the 14th day after wheat, durum and barley emergence and before the 4th leaf stage to avoid serious crop injury and poor wild oat control. Do not mix Carbyne with any other chemicals including fertilizers.
		12 to 16 oz	Sugarbeets		
		4 to 6oz	Soybeans	Before the first trifoliolate leaf stage or no later than 14 days after crop emerges	
FUMITORY	Triallate (Far-go) Diallate (Avadex)	1 1/4 lb	Barley	Immediately after planting	Use only if wild oats also is a problem because of cost. Incorporate in top 2 inches of soil by cultivation.
		1 lb	Wheat and durum		
		1 1/2 lb	Flax	Preplanting	
	Bromoxynil plus MCPA ester	1/4 to 1/3 lb plus 1/4 to 1/3 lb	Wheat and barley	After fumitory is established to boot stage of crop	Apply in 10 to 15 gal. water per acre. Other broadleaf weeds also will be controlled. Commercial mixtures are available.

CHEMICAL WEED CONTROL **For Perennial Weeds**

Weed	Herbicide ^{1/}	Act. Ingrid. Lb/A or Sq. Rd.	When to Apply	Remarks
FIELD BINDWEED On fallow	2, 4-D L.V. ester or oil soluble amine	3/4 lb/A	Regrowth 4 to 6 inches	Cultivate fallow until mid-July, then spray. Respray in following year's crop.
Wheat and barley	2, 4-D amine 2, 4-D L.V. ester	3/4 lb/A 2/3 lb/A	Tiller stage of crop	Higher rates may injure crop but may be worthwhile, especially in small areas, to control bindweed.
Patches or individual plants on non-cropland ^{2/} areas	Benzabor	1 to 1 1/2 lb/sq rd	Late fall or early spring	Vegetation may not grow in treated area for some time.
	TBA	10 to 20 lb/A	Bud stage	Residual effect 1 year or more.
	Picloram (Tordon 22K)	1 lb /A	When bindweed is actively growing	Tordon granules available. Do not use in areas with high water table.
Patches or individual plants in pastures	Dicamba (Banvel)	4 to 8 lb/A	When weed is actively growing	Apply to foliage and/or soil. Do not graze for 60 days or make hay for 90 days for dairy cows or graze or feed hay to beef cattle 30 days before slaughter.
LEAFY SPURGE On fallow	2, 4-D L.V. ester	1 to 2 lb/A	4 to 6 inches	Do not cultivate before spraying. Apply whenever regrowth is 4 inches high. Respray in following year's crop.
Pasture and Rangeland	2, 4-D L.V. ester or oil soluble amine Picloram (Tordon 22K)	1 to 2 lb/A 1/4 to 1/2 lb/A	Early bud stage and fall Anytime spurge is actively growing	Apply both spring and fall for satis- factory control. Broadcast treatment to suppress growth. Retreatment at the same rate may be necessary the following year. Do not graze dairy cattle on treated area.
Patches or individual plants in pastures	Dicamba (Banvel)	4 to 8 lb/A	When spurge is actively growing	Apply to foliage and/or soil. Do not graze for 60 days or make hay for 90 days for dairy cows or graze or feed hay to beef cattle 30 days before slaughter.

1/ Several soil sterilants will do a very good job of perennial weed control. Follow directions of the manufacturer as they appear on the label.

2/ Non-cropland means roadsides and waste areas not used to produce animal feed.

Weed	Herbicide ^{1/}	Act. Ingrid. Lb/A or Sq Rd.	When to Apply	Remarks
LEAFY SPURGE (cont.) Patches or individual plants in pastures	Picloram (Tordon 22K)	1 to 2 lb/A	Anytime spurge is actively growing	During a single season do not use more than 10 gals. of Tordon 22K for any 100 acre area. Do not treat more than 20 acres of any 100 acre area. Tordon granules available.
CANADA THISTLE AND SOWTHISTLE Wheat and Barley	MCPA amine MCPA ester	3/4 lb/A 2/3 lb/A	Tiller stage of crop	Higher rates than listed may injure crop but may be worthwhile, especially in small areas, to achieve thistle control.
On fallow	Amitrole or Amitrole-T	4 lb/A	Bud to bloom stage	Wet thoroughly. Keep livestock off treated areas for 8 months.
	2, 4-D	1 lb/A	Bud stage	Retreat as needed.
	Dicamba (Banvel)	4 to 8 lb/A	When weed is actively growing	Apply to foliage and/or soil. Do not graze for 60 days.
Pasture and Rangeland	Picloram (Tordon 22K)	1/4 to 1/2 lb/A	Anytime thistles are actively growing	Broadcast treatment to suppress growth. Retreatment at the same rate may be necessary the following year. Do not graze dairy cattle on treated area.
Patches or individual plants in pastures	Picloram (Tordon 22K)	1 lb/A	Anytime thistles are actively growing	During a single season do not use more than 10 gals. of Tordon 22K for any 100 acres. Do not treat more than 20 acres of any 100 acre area.
QUACKGRASS On fallow	Dalapon (Dowpon)	7 to 10 lb/A	Spring after 4 to 6 inches growth	Cultivate after 2 to 3 weeks.
	Atrazine (AATrex)	2 lb/A spring plus 2 lb/A planting time	Apply 2 lb/A early spring and an additional 2 lb/A at planting time	Plant only corn year of application and year following treatment.
Patches	Dalapon	20 to 25 lb/A	Grass 4 to 10 inches high	Use where cultivation after treatment is not possible. There may be a carryover of dalapon to the next year.
	Amitrole-T	4 to 8 lb/A	Actively growing	Cultivate after 3 weeks. Keep live- stock off treated areas for 8 months.
WEEDS IN NATIVE OR CULTIVATED PASTURES ^{2/}	2, 4-D low volatile ester or oil soluble amine	1 to 2 lb/A	In early June when weeds are young and actively growing	Use 1 lb/A on annuals and gumweed and 2 lb/A on sages and other perennials. Retreat following year if necessary.
AROUND BLDGS., TELEPHONE POLES, ETC.	Atrazine, bromacil, monuron, prometon or similar products	See label	Anytime during and prior to growing season. See label	Use heavy rates for complete long- time soil sterility.

^{1/} Several soil sterilants will do a very good job of perennial weed control. Follow directions of the manufacturer as they appear on the label.

^{2/} Legumes in pastures will be killed or severely injured by 2, 4-D.

GLOSSARY OF CHEMICAL NAMES

COMMON NAME	TRADE NAME ^{1/} AND MANUFACTURER	COMMON NAME	TRADE NAME ^{1/} AND MANUFACTURER
Alachlor	Lasso (Monsanto)	Linuron	Lorox (DuPont)
Amitrole	Amino Triazole Weedkiller (American Cyanamid) Weedazol (Amchem Products)	Linuron - Propachlor Mixture	Londax (DuPont)
Amitrole-T	Amitrol-T (Amchem Products) Cytrol (American Cyanamid)	MCPA	Amine salts - - Various Ester - - Various
Atrazine	AAtrex 80W, AAtrex 4L (Geigy)	Monuron	Telvar (DuPont)
Barban	Carbyne (Gulf Oil Corp.)	Phenmedipham	Betanal (Nor-Am)
Bromacil	Hyvar X (DuPont)	Picloram	Tordon 22K (Dow)
Bromoxynil	Buctril (Chipman) Brominal (Amchem)	Propachlor	Ramrod (Monsanto)
Bromoxynil-MCPA Mixture	Bronate (Chipman) Brominal Plus (Amchem)	Propazine	Milogard 80W (Geigy)
Butylate	Sutan (Stauffer)	Pyrazon	Pyramin (BASF)
Chloramben	Amiberf (Amchem Products)	Pyrazon-dalapon Mixture	Pyramin Plus (BASF)
Chloroxuron	Tenoran (Ciba)	Simazine	Princep 80W (Geigy)
Cycloate	Ro-Neet (Stauffer)	TBA	Various
Dalapon	Dowpon (Dow)	TBA-Sodium borate mixture	Benzabor (U. S. Borax)
Diallate	Avadex (Monsanto)	TCA	Various
Dicamba	Banvel (Velsicol) Dow Dicamba (Dow)	Triallate	Far-go (Monsanto)
Endothall	Herbicide 273, Endothal, Aquathal (Pennsalt)	Trifluralin	Treflan (Elanco Products)
EPTC	Eptam (Stauffer)	2, 4-D	Various
		2, 4-DB	Butyrac 118 (Amchem Products) Butoxone (Chipman)

^{1/} The mention of trade names does not imply that they are endorsed or recommended over those of similar nature not listed.