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CHEMICAL WEED CONTROL GUIDE for Field Crops and Perennial Weeds

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THE WEED CONTROL SUGGESTIONS 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 rate 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 spurge, 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 thistle 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

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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 broadleaf 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 depend less upon rainfall after application for effective weed control than unincorporated herbicides. If weeds are emerging through a preemergence herbicide treatment, the field may be rotary hoed without reducing the effect of the herbicide.

HERBICIDE COMBINATIONS: The effect of post-emergence herbicides often is increased when applied to areas already treated with a preemergence or pre-plant herbicide. Combinations of certain post-emergence 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 sugar beets. 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 broad-leaved crop areas without allowing seven 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: MCPA at 1/4 pound per acre controls most broadleaf weeds in flax when it is 2 to 6 inches tall. Avoid spraying flax during the period between bud stage and when 90 per cent 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. 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.

EPTC (Eptam) at 3 pounds per acre controls annual grass weeds, including wild oats, and some broadleaf weeds in flax. Incorporate EPTC immediately (within minutes) and thoroughly after application. Double disk twice in opposite directions or use any other method which will thoroughly mix the chemical with the top 3 inches of soil.

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. Caution: 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. Dalapon may be applied by ground or air.

Flax is a poorer competitor with weeds than are small grains. Consequently, grow flax 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.

Use flax in the rotation following corn, soybeans or other cultivated row crops. If good weed control practices were employed in the previous year's crop, flax would require only shallow tillage. 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 with late seeding.

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 five-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, kochia, 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. Oat varieties vary in their tolerance to 2,4-D but there is little or no difference 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 sweetclover, alfalfa or other legumes without seriously injuring or killing the legumes. Applying 2,4-DB when small grains are 6 to 8 inches tall will control many broadleaf weeds without injuring most legumes, except sweetclover is susceptible to 2,4-DB and would be killed. Wild mustard generally is not controlled by 2,4-DB, and higher rates of 2,4-DB than of MCPA or 2,4-D are required for weed control.

Dicamba (Banvel) controls wild buckwheat and smartweed in wheat and oats. It can be applied alone or in a mixture with MCPA to increase control of other broadleaf weeds. Dicamba alone usually gives unsatisfactory control of wild mustard. Oats is more tolerant than wheat. Both crops must be treated at the second through fourth leaf stage. Barley is more susceptible to injury from dicamba than wheat or oats.

Bromoxynil (Buctril, Brominal) controls wild buckwheat, fumitory and most annual broadleaf weeds in wheat and barley from the third leaf stage of the crop to early boot. Mixtures of bromoxynil plus MCPA ester (Bronate and Brominal Plus) are applied for better wild mustard 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 for con-

trolling weeds. Leave the space between the rows rough to discourage weed growth. Cultivate after the weed seeds have germinated or as soon as the weeds appear above the soil surface. Use a rotary hoe as soon as weeds appear.

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 per cent wettable powder formulation of atrazine, a 4-pound per gallon flowable liquid formulation is available.

Crops vary in their tolerance to atrazine. Corn and millet are tolerant. General ranking of other crops in order of least to most tolerant is: sugar beets, sunflowers, oats, wheat, barley, soybeans and flax. 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 used preemergence at 2 1/2 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 three weeks of planting while the weeds are less than 1 1/2 inches tall. Adding 1 to 2 gallons per acre of crop oil with an emulsifier increases the effectiveness of the treatment. Substituting 1 to 1 1/2 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.

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 1/8 to 1/4 pound per acre, either alone or in a mixture with 2,4-D amine at 1/4 to 1/2 pound per acre, can be applied postemergence in corn. It gives better control of Canada thistle, smartweed and wild buckwheat than 2,4-D with less effect on the corn. 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.

Emergency control of broadleaf and grassy weeds in corn can be obtained with directed applications of ametryne (Evik) or linuron (Lorox). Apply ametryne at 2 to 2.5 pounds per acre or linuron at 0.6 to 1.5 pounds per acre as a directed spray to the weeds. Keep the chemicals off the leaves of corn. Application over the top of corn will cause severe injury and contact with the leaves will cause burning. Ametryne should not be applied before corn is 12 inches high and linuron before corn is 15 inches high. The weeds should not be more than 6 inches high.

SUGAR BEETS: Herbicides may be used in sugar beets to supplement conventional cultivation practices. Hand labor, mostly hoeing, is still needed but can be reduced by timely cultivations and herbicide applications. The uses of preplant, preemergence and early postemergence herbicides in sugar beets are discussed in the table.

Late germinating weeds can become a problem in sugar beets with early seeding or when good moisture conditions prevail well into the season. Trifluralin (Treflan) is cleared at 3/4 lb/A and EPTC (Eptam) is cleared at 3 lb/A for use on sugar beets after thinning for annual grass and broadleaf control. The chemicals should be broadcast applied and incorporated immediately with cultivators or tillers adjusted to mix them thoroughly with soil in the row without damaging the sugar beets. The crop should be clean cultivated before application since established weeds are not controlled. Exposed sugar beet roots should be covered with soil prior to trifluralin application to reduce possibility of girdling.

SOYBEANS: Preemergence herbicides in soybeans are easily banded to reduce costs whereas preplant herbicides must be incorporated, making band application difficult. Soybeans are poor competitors with weeds when cool soil temperatures slow germination and growth. They are good competitors in warm soils, however, because germination and growth are rapid. Management practices such as thorough seedbed preparation, adequate soil fertility, choice of a well-adapted variety, and use of good quality seed all contribute to a soybean crop that will compete with weeds. Soybean production requires good cultural practices. Prepare the seedbed immediately prior to planting the crop to kill germinating weeds. After planting but before the soybeans emerge, kill weeds by using a rotary hoe, spike-tooth harrow or weeder. However, do not cultivate by these means when the soybeans are just emerging. Once the soybeans have emerged and are standing erect (beyond the crook stage), the crop can be harrowed.

The rotary hoe is an effective and economical weed killer in soybeans. For best results use it when the ground is not trashy, lumpy or wet and when weeds are just emerging, and not more than 1/4 inch tall. A rotary hoe, light harrow or weeder can be used effectively in soybeans 3 to 8 inches tall to effectively kill weed seedlings with little damage to the crop. Cultivation is most effective when the soybeans are slightly wilted during the warm part of the day, because the crop is less susceptible to breakage and the weeds will wilt and die most quickly.

Trifluralin (Treflan) applied 3/4 to 1 pound per acre preplanting and thoroughly incorporated gives good control of annual grasses and broadleaf weeds except wild mustard. Proper incorporation is essential. Incorporate thoroughly in two directions 3 to 4 inches deep. Proper incorporation of trifluralin can be accomplished by double disking twice in opposite directions or by other methods which thoroughly mix the chemical with the top 3 inches of soil. Incorporate as soon as possible after application for best results. Incorporation may be delayed up to eight hours on cool, dry soils.

Alachlor (Lasso) at 2 1/2 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.

Chloramben (Amiben) at 2 to 3 pounds per acre is applied preemergence to control most grassy and broadleaf weeds, including wild mustard. At least one-half 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. Excessive rainfall on light soils may leach chloramben below the level of germinating weed seeds resulting in poor weed control and/or crop injury.

Linuron (Lorox) is a preemergence herbicide for controlling most annual broadleaf weeds and grasses. Rates of application are 1/2 to 2 1/2 pounds per acre. Weed control and crop injury with linuron are greatly influenced by soil texture and organic matter. Linuron works best on medium textured soils with less than four per cent organic matter. Crop injury occurs occasionally on sandy soils. It is important to use rates recommended on the label for various soil types.

Chloroxuron (Tenoran) at 1 pound per acre is applied early postemergence as an emergency control measure for wild mustard. It also 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 trifoliolate 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.

Fluorodifen (Peforan) is used for broadleaf and grassy weed control, including wild mustard in most instances. It is applied preemergence at 4 1/2 pounds per acre. Fluorodifen appears to be more effective on light than heavy soils.

Metribuzin (Sencor) is a new preemergence herbicide for soybeans. It controls many kinds of broadleaf weeds, including wild mustard, and certain grass weeds. The rate is critical. Consult the label for the proper dosage based on soil type and per cent organic matter. Do not apply to sandy soils. Seed soybeans at least 1 1/2 inches below the soil surface to reduce possible soybean injury. Some injury has been observed in wheat and oats the year following metribuzin application. Metribuzin may be used in a tank-mix combination with alachlor (Lasso) as a pre-emergence broadcast or band application to soybeans. Also it may be applied in soybeans as a preemergence broadcast or band overlay application following a preplant incorporated treatment of trifluralin (Treflan). Alachlor and trifluralin do not give adequate wild mustard control but good control is possible when used in combination with metribuzin. Also these combinations permit a lower rate of metribuzin to be used thus reducing the risk of soybean injury.

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 about one week after sowing but prior to germination of the crop will kill many weeds. After sunflowers reach the four to six leaf stage, kill weeds in the row by using a weeder, coil spring or spiketooth 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. See the preceding soybean discussion concerning the incorporation of trifluralin. Apply trifluralin on sandy soil at 3/4 pound per acre and increase the rate to 1 pound per acre on clay soil. Apply EPTC at 3 pounds per acre and incorporate immediately (within minutes) and thoroughly. Proper incorporation of EPTC can be accomplished by double disking twice in opposite directions or by other methods which thoroughly mix the chemical with the top 3 inches of soil. Trifluralin and EPTC control grasses and some broadleaf weeds.

Chloramben (Amiben) at 2 to 3 pounds per acre is applied preemergence to control most grassy and broadleaf weeds, including wild mustard. 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. Excessive rainfall on light soils may leach chloramben below the level of germinating weed seeds resulting in poor weed control and/or crop injury.

LEGUME ESTABLISHMENT: Seedling legumes usually are poor competitors with weeds. Good management practices in preceding crops are recommended such as clean cultivation of row crops and after harvest tillage to reduce the amount of weed seeds in the soil. Mowing seedling legumes (except sweetclover) when sown alone, or the stubble of companion crops, and mowing patches of perennial weeds also aid in weed control.

When alfalfa, sweetclover, alsike clover or birdsfoot trefoil are sown without a companion crop or a grass in a mixture, EPTC (Eptam) at 2 to 3 pounds per acre preplant incorporated effectively controls annual grass and broadleaf weeds except wild mustard.

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. Wild oat seeds are abundant in infested soils. Wild oats is a cool season plant and seeds germinate in the spring and fall when favorable temperature and moisture conditions exist.

Apply barban (Carbyne) for postemergence control of wild oats when the majority of the weeds are in the 1 1/2 leaf stage, which generally occurs from four to nine days after emergence. Rates of 4 to 6 ounces per acre are applied to wheat, barley, flax, soybeans, 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 sugar beets apply 12 to 16 ounces per acre of barban.

Barban must be applied before the fourteenth day after wheat, durum and barley emerge and before the fourth leaf stage of the crop to avoid injury and poor wild oat control. Treat flax before the twelfth leaf stage and soybeans before the first trifoliate leaf stage or no later than 14 days after crop emergence. There are no restrictions on winter wheat, sunflowers or sugar beets. Do not mix barban with any other chemical, including fertilizers.

Preplant or preemergence incorporated applications of diallate (Avadex) at 1 1/2 pounds per acre controls wild oats in flax, corn, soybeans, potatoes and sugar beets. Triallate (Far-go) is applied preemergence to wheat at 1 pound per acre and barley at 1 1/4 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.

Wild oats in alfalfa seeded with barley as a companion crop can be controlled with diallate. Apply diallate at 1 1/4 pounds per acre in the spring as a preemergence soil incorporated treatment. Or make a fall preplant soil incorporation treatment within three weeks of soil freeze-up and plant the alfalfa and barley the following spring.

Diallate and triallate can be applied in the fall after October 15 until freeze-up. Granular formulations of both are available for use as fall applications.

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

CHEMICAL WEED CONTROL
For Field Crops

Crop	Herbicide	Act. Ingred. lb. per Acre	Weeds	When to Apply	Remarks
WHEAT, DURUM OR BARLEY	2,4-D amine 2,4-D L.V. ester	1/4 to 1/2	Broadleaf	Crops—5th leaf to boot	Do not apply later than boot stage. Barley more sensitive than wheat.
	MCPA amine MCPA ester	1/4 to 2/3	Broadleaf	Crops—emergence to early boot	Apply 1/2 lb/A or less from emergence to tiller stage.
	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 seedling stage for best results. Commercial mixtures (Brominal Plus & Bronate) are available.
WHEAT OR DURUM	Dicamba (Banvel) plus MCPA amine	1/8 plus 1/4	Wild buckwheat and most broad-leaf weeds	Crops—2nd through 4th leaf stage	Commercial mixture (Mondak) is available.
WINTER WHEAT OR RYE	2,4-D amine 2,4-D L.V. ester	1/4 to 1/2	Broadleaf	Crops—fully tillered to boot	Do not apply in the fall.
OATS	MCPA amine MCPA ester	1/4 to 1/2	Broadleaf	Oats—emergence to boot	Early jointing stage most sensitive. Possible injury to oats at any growth stage.
	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 seedling stage for best results. Commercial mixtures (Brominal Plus & Bronate) are available.
	Dicamba (Banvel) plus MCPA amine	1/8 plus 1/4	Wild buckwheat and most broad-leaf weeds	Crops—2nd through 4th leaf stage	Commercial mixture (Mondak) is available.
SMALL GRAIN PRE-HARVEST	2,4-D L.V. ester or 2,4-D oil soluble amine	3/4 to 1 1/2	Broadleaf	Crops—dough stage to harvest	Use only when weeds may interfere with harvest operations. Do not feed straw to livestock.
FLAX (cont. on next page)	MCPA amine	1/4	Broadleaf	Flax 2 to 6 inches tall	Use higher rates or MCPA ester 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 with dalapon to control broadleaf and annual grassy weeds. Under drouth conditions, grass control is poor and flax injury may occur.

Crop	Herbicide	Act. Ingrid. lb. per Acre	Weeds	When to Apply	Remarks
FLAX (cont.)	Bromoxynil plus MCPA ester	1/4 plus 1/4	Wild buckwheat and most broad-leaf weeds	Flax—2 to 6 inches tall	Use for wild buckwheat control. Flax injury is possible.
	EPTC (Eptam)	3	Grasses and some broad-leaf weeds	Preplant incorporated	Incorporation directions discussed under sunflower narrative at beginning of Weed Control Guide. Weak on wild mustard.
CORN (cont. on next page)	Alachlor (Lasso)	2 1/2	Grasses and some broad-leaf weeds	Preplant incorporated or pre-emergence	Ineffective against wild mustard. Usually less effective preemergence than propachlor (Ramrod) in North Dakota. Preplant incorporation gives more consistent weed control.
	Atrazine (AAtrex)	2 to 4	Broadleaf and grasses	Preplant incorporated or preemergence	Atrazine may remain in soil longer than one year and damage following crops other than corn or millet. Use higher rate on heavy soils and for quackgrass control.
	Cyanazine (Bladex)	2 to 3.2	Broadleaf and annual grasses	Preemergence	Soil residues unlikely the year after treatment. Weak on redroot pigweed. Use higher rate on heavy soils.
	Propachlor (Ramrod)	4 to 5	Grasses and some broad-leaf weeds	Preemergence	Ineffective against wild mustard.
	Atrazine plus Alachlor	1 plus 2	Most grasses and broadleaf weeds	Preplant incorporated or preemergence	See soil residue comment under atrazine.
	Atrazine plus propachlor	1 plus 3 (tank mix)	Broadleaf and annual grasses	Preemergence	Commercial mixture is available (ratio 1 lb. atrazine to 2.3 lb. propachlor). See soil residue comment under atrazine.
	Atrazine plus Butylate (Sutan)	1 plus 3	Most grasses and broad-leaf weeds	Preplant incorporated	Incorporate immediately (within minutes) and thoroughly in two directions 4 to 6 inches deep with tandem disk. See soil residue comments under atrazine.
	Linuron plus propachlor	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 unlikely the year after treatment.

Crop	Herbicide	Act. Ingrid. lb. per Acre	Weeds	When to Apply	Remarks
CORN (cont.)	Atrazine (AAtrex) plus phyto- bland oil	1 to 2 plus a phytobland oil	Broadleaf and grasses	Early postemergence— weeds less than 1 1/2 inches tall	Use emulsifiable linseed or petrole- um oils at volume recommended on label. See soil residue comment under atrazine.
	Cyprazine (Outfox)	3/4	Broadleaf and annual grasses	Early postemergence	Cyprazine residue remains in soil longer than one year and may damage following crops other than corn. Best results when weeds less than 2 inches high.
	2,4-D amine	1/4 to 1/2	Broadleaf weeds	Postemergence, corn— 3 inches to tasseling	Use drop nozzle when corn is over 8 inches tall but before tasseling.
	Dicamba (Banvel)	1/8 to 1/4	Wild buckwheat, Canada thistle, P. sowthistle	Postemergence, before corn is 36 inches tall	See narrative under corn at begin- ning of the Weed Control Guide.
SOYBEANS (See later section for wild oat control)	Chloramben (Amiben)	2 to 3	Annual grasses and broadleaf weeds	Preemergence	Wild oat control not adequate.
	Trifluralin (Treflan)	3/4 to 1	Grasses and some broadleaf weeds	Preplant incorporated	Incorporation directions discussed under soybean narrative at beginning of Weed Control Guide. No wild mustard control.
	Chloroxuron (Tenoran, Norex)	1	Wild mustard and some other broadleaf weeds, NOT GRASSES	When weeds are less than 2 inches tall and crop has first trifoliolate leaf	Use as emergency wild mustard con- trol measure. Must be applied with surfactant (Adjuvan T).
	Alachlor (Lasso)	2 1/2	Grasses and some broadleaf weeds	Preemergence	Wild mustard and wild oat control not adequate.
	Fluorodifen (Preforan, Soyex)	4 1/2	Broadleaf and grasses	Preemergence	Wild oat control not adequate. Generally more effective on light soils.
	Metribuzin (Sencor)	0.4 to 0.8	Broadleaf weeds including wild mustard and some grasses	Preemergence	Seed at least 1 1/2 inches below soil surface to reduce possible soybean injury. The rate is critical. See label for details.
	Dinoseb, amine salts	1 1/2 to 2 1/4	Wild mustard	Cracking stage	Use the higher rate below 75°F and the lower rate above 75°F.

Crop	Herbicide	Act. Ingrid. lb. per Acre	Weeds	When to Apply	Remarks
PINTO BEANS	Chloramben (Amiben)	2	Annual grasses and broadleaf weeds	Preemergence	Wild oat control not adequate.
	EPTC (Eptam)	3	Grasses and some broad- leaf weeds	Preplant incorporated	Incorporation directions discussed under sunflower narrative at begin- ning of Weed Control Guide. Weak on wild mustard.
	Trifluralin (Treflan)	3/4 to 1	Grasses and some broad- leaf weeds	Preplant incorporated	Incorporation directions discussed under soybean narrative at begin- ning of Weed Control Guide. No wild mustard control.
	Fluorodifen (Preforan, Soyex)	4 1/2	Broadleaf and grasses	Preemergence	Wild oat control not adequate. Generally more effective on light soils.
SUNFLOWERS (See later section for wild oat control)	EPTC (Eptam)	3	Grasses and some broadleaf weeds	Preplant incorporated	Incorporation directions discussed under sunflower narrative at beginning of Weed Control Guide. Weak on wild mustard.
	Trifluralin (Treflan)	1/2 to 1	Grasses and some broad- leaf weeds	Preplant incorporated	Incorporation directions discussed under soybean narrative at begin- ning of Weed Control Guide. No wild mustard control.
	Chloramben (Amiben)	2 to 3	Annual grasses and broadleaf weeds	Preemergence	Wild oat control not adequate.
SUGAR BEETS (See later section for wild oat control)	EPTC (Eptam)	2 to 3 4 to 4 1/2	Annual grasses and some broad- leaf weeds	Preplant incorporated Fall incorporated after October 15 until freeze-up	Incorporation directions discussed under sunflower narrative at begin- ning of Weed Control Guide. Use higher rates on heavy, high organic matter soils. Some stand reduction and temporary stunting may occur from the use of EPTC. Weak on wild mustard.
	Cycloate (Ro-Neet)	3 to 4	Annual grasses and some broad- leaf weeds	Preplant incorporated	Use lower rate only on light, sandy soils. Incorporate same as EPTC. Sugar beets have better tolerance to cycloate than to EPTC. Following cycloate with a postemergence herbi- cide is suggested. Weak on wild mustard.

(cont. on
next page)

Crop	Herbicide	Act. Ingrid. lb. per Acre	Weeds	When to Apply	Remarks
SUGAR BEETS (cont.)	Pyrazon (Pyramin plus TCA)	3.8 plus 6 to 8	Annual grasses and most broad- leaf weeds	Preemergence	Has not been effective on soils with more than 5% organic matter.
	Pyrazon plus Dalapon (Pyramin Plus)	3.8 plus 2.2	Most annual grasses and broadleaf weeds	Postemergence when broadleaf weeds are in the two-leaf stage or earlier, and the sugar beets are in the two-leaf stage or later	Results on soils with more than 5% organic matter have been erratic.
	Endothall (Herbicide 273)	3/4 to 1 1/2	Wild buckwheat smartweed marshelder	Sugar beets should have 4-6 leaves. Do not apply later than 40 days after emer- gence	When temperatures are over 80°F., endothall may cause excessive injury, especially to very small sugar beets. Endothall is ineffective at tempera- tures below 60°F.
	TCA (various names)	6 to 8	Most annual grasses	Preemergence	Weak on wild oats. Do not use sugar beet tops for livestock feed.
	Dalapon (Dowpon)	2 to 3	Most annual grasses	Apply from emergence to 6-leaf stage of sugar beets. 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 conditions. 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	Postemergence when broadleaf weeds are between cotyledon and four-leaf stage and the sugar beets are in the four-leaf stage or later	To avoid sugar beet injury, use no more than 1 lb/A following EPTC or TCA, do not apply if highest temperature during day is over 85°F., and apply late in afternoon or early in the evening. Weak on redroot pigweed.
POTATOES (cont. on next page)	Chlorbromuron (Maloran, Bromex)	2 to 4	Most annual grasses and broadleaf weeds	Preemergence, after planting or dragoff	Do not plant crops other than pota- toes, corn or soybeans within 6 months after application. Generally does not perform satisfactorily on heavy, organic soils.

Crop	Herbicide	Act. Ingrid. lb. per Acre	Weeds	When to Apply	Remarks
POTATOES (cont.)	Dalapon (Dowpon)	6	Quackgrass	Preplant in spring when grass is 4 to 6 inches tall	Plow after 4 days and potatoes may be planted immediately.
	EPTC (Eptam)	3 to 6	Grasses and some broadleaf weeds	Preplant or directed spray at dragoff	Incorporation directions discussed under sunflower narrative at beginning of Weed Control Guide. Weak on wild mustard.
	Linuron (Lorox)	3/4 to 2	Most annual grasses and broadleaf weeds	Preemergence (just before crop emerges)	Apply to crop planted 2 inches deep, after dragoff or hilling. Do not plant to other crops within 4 months after treatment.
	Paraquat	1	Most annual grasses and broadleaf weeds	Preemergence—when weeds are up but before crop emerges	Do not apply later than ground cracking. Paraquat kills only emerged weeds.
	Trifluralin (Treflan)	1/2 to 1	Grasses and broadleaf weeds	After planting, incorporated. Use up to or immediately following dragoff	Care should be taken that incor- poration machinery does not damage seed pieces or elongating sprouts.
GRASS Seedling	2,4-D	1/2 to 3/4	Broadleaf	After 3-leaf stage of grasses	Use rate for established grasses after tillering.
Established (See later section for control of specific perennial weeds)	2,4-D	3/4 to 2 lb/A	Annual and perennial broad- leaf weeds	Weeds—emergence to bud stage, pref- erably when young and actively growing	Do not graze dairy cows for 7 days after application. Do not apply after boot stage on grasses for seed production. Use 1 lb/A on annuals and gumweed and 2 lb/A on sages and other perennials.
LEGUMES Alfalfa and clover with nurse crop	MCPA	1/8 to 1/4	Broadleaf	Legumes 2-3 inches tall and nurse crop 4-16 inches tall	Canopy of crop or weeds reduces injury. NOTE: POSSIBLE INJURY TO SWEETCLOVER AND ALFALFA.
	2,4-DB	1/2 to 1	Broadleaf	Weeds and legumes less than 3 inches tall, nurse crop 1- 6 inches tall	Sweetclover killed by 2,4-DB. Wild mustard control generally not adequate. 2,4-DB must be applied 30 days before hay harvest or grazing. See narrative at beginning of Weed Control Guide for herbicides in legume establishment.
Alfalfa or trefoil alone. Established or seedling stage	2,4-DB	1/2 to 1	Broadleaf		
Alfalfa only	Simazine (Princep)	0.8 to 1.6	Grasses and broadleaf weeds 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 liquid	Barley	Fall—after October 15 and until freeze- up	Incorporate immediately by cultivation. Keep spring tillage to minimum. Use lower rate of granules on wheat.	
		1 1/4-1 1/2 lb granules	Wheat and durum			
		1 lb liquid	Barley, peas and lentils	Spring—immediately after planting		
		1 1/4-1 1/2 lb granules				Wheat and durum
	Diallate (Avadex)	1 1/4 lb	Flax, sugar beets, soybeans and potatoes	Preplanting	Incorporate immediately by cultivation.	
		1 1/2 lb				Corn and lentils
		1 1/4 lb	Peas			
		1 1/2 to 2 lb liquid	Flax and sugar beets	Fall—after October 15 and until freeze- up		
		1 1/2 to 4 lb granules				Sugar beets
	Barban (Carbyne)	4 to 6 oz	Wheat, winter wheat, durum, barley, flax, peas, mustard, sunflowers and lentils	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; win- ter wheat, sugar beets and sunflowers — no restrictions	Usually applied 4 to 9 days after wild oats emerge. Must be applied before the 14th day after wheat, Jurum, barley and lentils 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 ferti- lizers. Use the higher rate with high temperatures, low soil fertility or droughty conditions.	
		12 to 16 oz	Sugar beets			
		4 to 6 oz	Soybeans			Before the first tri- foliate leaf stage or no later than 14 days after crop emerges
FUMITORY	Triallate (Far-go)	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			
	Diallate (Avadex)	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. Commer- cial mixtures (Brominal Plus and Bronate) are available.

**CHEMICAL WEED CONTROL
For Perennial Weeds**

Weed	Herbicide ^{1/}	Act. Incred. Lb/A or Sq. Rd.	When to Apply	Remarks
FIELD BINDWEED Fallow or post harvest	2,4-D L.V. ester or oil soluble amine	1 to 2 lb/A	Regrowth 6 inches to bud stage	Cultivate fallow until mid-July. Spray in late August or September. 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 in pastures or non-cropland ^{2/}	Picloram (Tordon 22K)	1 lb/A	When bindweed is actively growing	Tordon granules available. Do not use in areas with high water table. Do not graze dairy cattle on treated area.
	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	Cultivate or respray whenever regrowth is 4 to 6 inches high. Respray in following year's crop.
Pasture and Rangeland	2,4-D L.V. ester or oil soluble amine	1 to 2 lb/A	Early bud stage and fall	Apply both spring and fall for satisfactory control. Do not graze dairy cows for 7 days after treatment.
	Picloram (Tordon 22K)	1/4 to 1/2 lb/A	Any time spurge is actively growing	Retreatment at the same time usually will be necessary the following year. Do not graze dairy cattle on treated area.
Patches 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.
	Picloram (Tordon 22K)	1 to 2 lb/A	Any time 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.

^{1/} Several soil sterilants will control perennial weeds. Follow directions 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
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.
Fallow or post harvest	2,4-D Dicamba (Banvel)	1 lb/A 1 to 2 lb/A	6 inches tall and actively growing. Post harvest mowing promotes active regrowth	Cultivate fallow until mid-July. Spray in late August or September.
Pasture and Rangeland	Picloram (Tordon 22K)	1/4 to 1/2 lb/A	6 inches tall and actively growing. For fall treatment, mowing promotes active growth	Retreatment at the same rate usually will be necessary the following year. Do not graze dairy cattle on treated area.
	Dicamba (Banvel)	1/2 lb/A		Do not graze dairy cows for 7 days or make hay for 37 days after treatment. Do not graze meat animals in treated areas within 30 days of slaughter.
	2,4-D	1 to 2 lb/A		Do not graze dairy cows for 7 days after treatment.
Patches or individual plants in pastures	Picloram (Tordon 22K)	1 lb/A	When 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.
	Dicamba (Banvel)	4 lb/A		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.
QUACKGRASS On fallow	Dalapon (Dowpon)	6 to 11 lb/A	After 4 to 6 inches growth	Cultivate after 10 to 20 days.
	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.
AROUND BLDGS., TELEPHONE POLES, ETC.	Atrazine, bromacil, monuron, benzbabor, prometone or similar products	See label	Any time during and prior to growing season. See label.	Use heavy rates for complete long-time soil sterility.

^{1/} Several soil sterilants will control perennial weeds. Follow directions on the label.

GLOSSARY OF CHEMICAL NAMES

COMMON NAME	TRADE NAME ^{1/} AND MANUFACTURER	CONCENTRATION AND COMMERCIAL FORMULATIONS ^{2/}
Alachlor	Lasso (Monsanto)	4 lb/gal L 15% G
Ametryne	Evik (Ciba-Geigy)	80% WP
Atrazine	AAtrex (Ciba-Geigy)	80% WP 4 lb/gal L
Barban	Carbyne (Gulf)	1 lb/gal L
Bromacil	Hyvar-X, Hyvar-XL (DuPont)	80% WP 2 lb/gal L
Bromoxynil	Buctril (Chipman) Brominal (Amchem)	2 lb/gal L
Bromoxynil and MCPA	Bronate (Chipman) Brominal Plus (Amchem)	2 lb/gal MCPA plus 2 lb/gal bromoxynil L
Butylate	Sutan (Stauffer)	6 lb/gal L, 10% G
Chloramben	Amiben (Amchem)	10% G 2 lb/gal L
Chlorbromuron	Bromex (Nor-Am) Maloran (Ciba-Geigy)	50% WP
Chloroxuron	Norex (Nor-Am) Tenoran (Ciba-Geigy)	50% WP
Cyanazine	Bladex (Shell)	80% WP 15% G
Cycloate	Ro-neet (Stauffer)	6 lb/gal L
Cyprazine	Outfox (Gulf)	1 lb/gal L
Dalapon	Basfapon (BASF) Dowpon M (Dow)	74% WSP
Dalapon and TCA	Dowpon C (Dow)	46.5% dalapon 26.2% TCA WSP
Diallate	Avadex (Monsanto)	4 lb/gal L 10% G
Dicamba	Banvel (Velsicol)	4 lb/gal L
Dicamba and MCPA	MonDak (Velsicol)	1.25 lb/gal dicamba 2.50 lb/gal MCPA L
Dinoseb (DNBP)	Severol (various)	1, 3, 5 lb/gal L 10% G
Endothal	Endothal, Herbicide 273 (Pennwalt)	1.46 lb/gal L 3 lb/gal L, 5% G
EPTC	Eptam (Stauffer)	6 lb/gal L 10% G
Fluorodifen	Preforan (Ciba-Geigy) Soyex (Nor-Am)	3 lb/gal L
Linuron	Lorox (DuPont)	50% WP
MCPA	Severol (various)	Various L
Metribuzin	Sencor (Chemagro)	50% WP
Monuron	Telvar (DuPont)	G, L, WP Various
Paraquat	Paraquat (Chevron)	2 lb/gal L
Phenmedipham	Betanal (Nor-Am)	1.3 lb/gal L
Picloram	Tordon 22K, Tordon 10K, Tordon Beads (Dow)	10%, 2% G 2 lb/gal L
Propachlor	Ramrod (Monsanto)	65% WP 20% G
Propazine	Milogard (Ciba-Geigy)	80% WP
Pyrazon	Pyran-in (BASF)	80% WP
Pyrazon and dalapon	Pyramin Plus (BASF)	27% pyrazon 18.5% dalapon WP
Simazine	Princep (Ciba-Geigy)	80% WP 4% G
TCA	TCA (various)	4.76 lb/gal L 79.3% WSP
Triallate	Far-go (Monsanto)	4 lb/gal L 10% G
Trifluralin	Treflan (Elanco)	4 lb/gal L 5% G
2,4-D	Severol (various)	L, G Various
2,4-DB	Butyrac (Amchem) Butoxone (Chipman)	L Various

^{1/} "Severol" means there are numerous trade names for the chemical. The mention of trade names does not imply that they are endorsed or recommended over those of similar nature not listed.

^{2/} G—granular, L—liquid, WP—wetable powder, WSP—water soluble powder.