

ANNUAL WEED CONTROL

S1. Wild buckwheat is especially troublesome in broadleaf row crops where few chemical control options are available. Vining wild buckwheat climbs up crops similar to field bindweed. Wild buckwheat makes swathing or combining extremely difficult as it wraps itself around the crop and becomes entangled on the sides of the header. In heavily infested fields, wild buckwheat can pull crop to the ground and severely reduce yield. NDSU weed control trials have shown that several herbicides will provide good to excellent wild buckwheat control in small grains including Banvel*, Buctril*, Huskie, Python, Harmony* at small grains rates, Stinger*, WideMatch*, and Sencor*. Python, Pursuit or Pursuit Plus applied PPI or PRE, and Ignite 280 applied POST provide excellent wild buckwheat control while Roundup* may need two applications or apply with Resource for control.

S2. Foxtail is most competitive when small grains are seeded late and soil temperatures are warm for foxtail germination and rapid growth. Fields regularly chisel plowed generally have more foxtail than moldboard plowed fields. Moldboard plowing buries the foxtail seed, which prevents emergence and reduces viable seed for subsequent years.

Making a decision on whether to control foxtail in small grains is not always easy. Research from NDSU and in Canada has shown that foxtail often will not decrease wheat and barley yields; however, heavy foxtail infestations can cause harvest problems (especially when straight combining) and can cause dockage at the elevator. Herbicide treatment for foxtail may not be warranted when foxtail infestations are light - less than 30 plants/sq. ft and when foxtail emerges after the crop is in the 3- to 4-leaf stage. This is especially true for barley. Once the small grain is in the 3- to 4-leaf stage, it can usually out-compete emerging foxtail. Chemical control is warranted when the foxtail population is heavy (100 plants/sq ft or more). Foxtail also may contribute to moisture stress and cause greater yield loss under drought conditions. Foxtail emerging at the same time or before small grain is more competitive than when emerging after small grain. Some options to consider for foxtail control are:

1. If the foxtail infestation is heavy, and just emerging with the crop, consider harrowing or rotary hoeing as soon as possible. Harrowing or rotary hoeing is not effective once foxtail has 2 to 3 leaves. Small grains can be harrowed or rotary hoed until the 3- to 4-leaf stage with little effect on yield. If a harrow or rotary hoe is not an option, then consider a herbicide.
2. If the foxtail infestation is light to moderate, chemical control is optional but weed seed may contribute to weed infestations in subsequent crops. Herbicides can still be used if foxtail is a problem after small grain is in the 5- to 6-leaf stage.

S3. Kochia is an exceptionally competitive weed and a few uncontrolled plants can cause severe yield losses. Most kochia are resistant to ALS herbicides. Tank-mixing ALS herbicides with other effective broadleaf herbicides with differing modes of action is required to slow development of resistant kochia. Banvel/generics, Huskie, Starane*, and Widematch* control ALS-susceptible and -resistant kochia. Bronate* or Aim also give good control, but kochia should be small and spray coverage adequate. Tordon and Stinger are not effective on kochia and 2,4-D and MCPA no longer control kochia due to resistance from repeated use and near eradication of susceptible kochia biotypes. 2,4-D and MCPA do not translocate readily in kochia.

*Or generic equivalent.

Treat plants when small (less than 3 inches tall). Kochia seed is short-lived in soil so two or three years of excellent control can greatly reduce kochia populations. DNA herbicides do not give consistent kochia control; however, Sonalan may improve control. Soil-applied Spartan and Valor gives good to excellent kochia control. Flexstar or Reflex applied with MSO adjuvant in high water volumes of 20 gpa to small kochia may give good postemergence control.

S4. Nightshades have become a serious weed problem in North Dakota due higher rainfall and human activity associated with crop production, like moving tillage and harvesting equipment from field to field or planting crop seed contaminated with nightshade seed. Also, birds and wildlife consume nightshade berries and can transport seed through droppings.

Four nightshade species are found in North Dakota: black nightshade, eastern black nightshade, hairy nightshade, and cutleaf nightshade. Hairy nightshade is the only species densely covered with small hairs. The berries of cutleaf and hairy nightshade remain green at maturity. Only the underneath side of black and eastern black nightshade leaves are black or dark-purple and berries turn black or dark purple at maturity. Eastern black nightshade is very difficult to distinguish from black nightshade before berry formation. Eastern black nightshade forms berries in umbrella-like clusters with berry stems arising from a common point, the calyx of eastern black nightshade is the smallest of the four, and the lobes of the calyx recurve away from the berry. Black nightshade and hairy nightshade berries connect in a racemose fashion (similar to grapes). The calyx of black nightshade is mid-size and the lobes extend outward, while the calyx of hairy nightshade is large and encloses half the berry. It has been reported that leaves from eastern black nightshade plants are translucent and leaves from black nightshade are opaque when held to sunlight.

Nightshade emergence may continue from June through September and is strongly influenced by moisture. Rain events cause multiple flushes of nightshade, so plants can emerge even after normal crop spraying is complete. Hairy nightshade emerging in early fall can produce viable seed before frost while eastern black nightshade requires a longer growing season. Nightshade can compete after crops form a shaded canopy. Consequently, growth of nightshade can accelerate after small grain harvest, which exposes nightshade to sunlight. Nightshade seeds become viable shortly after berry formation and seeds can remain viable in soil for 15 years when deeply buried. Studies show that one nightshade plant can produce 178,000 seeds under competitive situations or 800,000 without competition. Therefore, successful nightshade management requires prevention of seed production.

Nightshade plants remain green after several frosts and can cause harvest problems. Berries are poisonous and the juice from ruptured berries can stain crop seed and glue nightshade seed and dirt to harvested seed. In addition, dry nightshade berries are similar in size to soybean or field pea seed and are difficult to separate. Nightshade can be spread to other fields by equipment and contaminated seed used for planting.

Nightshade biotypes are tolerant to many classes of herbicides, including SUs (except Express). Eastern black nightshade resistance to imidazolinone herbicides has been documented in North Dakota. Thus, herbicides may remove competing broadleaf weeds allowing nightshades to proliferate.

Only a few residual soil herbicides, e.g. Balance Flexx, Extreme, Gangster, Pursuit, Python, Spartan, and Valor control nightshade flushes and may leave a residue the following year. Nightshade can be controlled in herbicide resistant crops (Clearfield, Liberty Link, and Roundup Ready). Basagran may control hairy nightshade but not eastern black nightshade. Black nightshade is more tolerant to some herbicides (Matrix) than eastern black nightshade. Flexstar/Reflex gives poor hairy nightshade control.

Refer to pages 116 to 121 for chemical control options. Other options for nightshade management include planting of uncontaminated seed, using crop rotations, multiple herbicide applications to control late flushes, and inter-row cultivation.

S5. Pigweed control requires higher rates of most herbicides than rates for wild mustard control. All ALS, PPO, and HPPD herbicides give good control. Banvel* and 2,4-D also give good control. MCPA is not as effective as 2,4-D in controlling pigweed. The esters of 2,4-D generally are more effective than the amines. Buctril* and Bronate* are generally poor on pigweed. A redroot pigweed population resistant to imidazolinone herbicides has been documented in Cass county.

Waterhemp, a related pigweed species, has biotypes that are resistance to Roundup*, ALS, PPO, and triazine herbicides in the U.S. Geographic distribution of waterhemp is across the midwest and has been documented in the Red River Valley. For more information on pigweed species refer to publications "Pigweed Identification" from Kansas State University Ext. Service, (913) 532-5776 (\$1.50) or "Waterhemp Management in Agronomic Crops" (No. X855) from University of Illinois Ext. Service, (217) 333-0005.

S6. Wild oat is difficult to eradicate because the seeds shatter before crops are harvested and because seed dormancy causes delayed germination. Wild oat is a cool season plant and seeds germinate in the spring and fall when favorable temperature and moisture conditions exist. Cultural approaches available for wild oat control in small grains include delayed small grain seeding, post seeding cultivation, and competitive crops. The most practical cultural method of wild oat control is delayed small grain seeding, which involves early soil cultivation to stimulate wild oat germination followed by tillage or chemical control to kill emerged wild oat prior to crop seeding. Delayed seeding may cause a significant wheat yield reduction when compared with early seeding.

Other cultural control practices are planting competitive crops like barley and rye. Wild oat eradication is not practical or economically sound; therefore, a combination of cultural and chemical control methods should be used to manage wild oat populations and minimize yield losses.

Apply POST wild oat herbicides to wild oat and crops at precise leaf stages. Early application may result in better yield because of less competition with the crop, but later flush of wild oat may require a second application. In general, any population warrants chemical control to prevent yield losses and reduce seed production. Wheat yield reduction from foxtail and wild oat competition in NDSU research follows.

Grass Weed Competition in Wheat		
Weeds/sq. yard	Foxtail	Wild oats
% wheat yield reduction		
10	0	8-9%
50	4-5%	18%
75	6-7%	25%
100	8-9%	34%
150	15%	40%

*Or generic equivalent.

S7. Wormwood (annual or biennial) plants in ND emerge throughout the year, behave like an annual species, and produce up to 1 million seeds/plant. B. wormwood seeds are very small and can be dispersed easily by wind, water, and all human-related operations. B. wormwood thrives in undisturbed (no- or minimum-till) areas, low areas, and areas where soil may remain wet for extended periods of time. Consequently, with every rain event a new flush of wormwood seedlings may appear.

Biennial wormwood survives most PPI, PRE, and POST herbicides and is misidentified as common ragweed. Also, biennial wormwood can emerge late after most POST herbicides have been applied. Rescue treatments with herbicides that control common ragweed, such as Ultra Blazer and FirstRate, have little or no effect on wormwood. Wormwood plants can grow six feet tall with a woody stem that averages 1 to 2 inches in diameter and can impede grain harvest, including damage to harvesting equipment.

Biennial wormwood is difficult to control because of an extended emergence period and tolerance to many PPI, PRE (Harness*/Surpass*, Dual*, Prowl, Sonalan, and Treflan*) and POST (most ALS herbicides, Cobra, Flexstar/Reflex, and Ultra Blazer) herbicides used in row crops. Sencor*, Huskie, Python, Spartan, Valor, and Wolverine provide residual biennial wormwood control. Growth regulator herbicides of 2,4-D, Banvel*, Curtail*/M*, Hornet, Status, Stinger*, Widematch* and the non-selective herbicides Ignite 280 and Roundup* control wormwood. However, biennial wormwood can emerge after most non-residual POST herbicides have been applied and produce seed the same season.

Basagran may not control wormwood with one application. Wormwood becomes tolerant to herbicides as plant size increases requiring application to small plants. Basagran applied as split applications will improve control. Refer to paragraphs E3 and F6 for additional information on Basagran.

S8. Common ragweed is an annual, composite weed species that is becoming more prevalent in North Dakota as soybean and dry bean production increases. Common ragweed biotypes have developed resistance to Roundup*, ALS and PPO inhibiting herbicides. Therefore, special management of common ragweed in all crops is necessary to maintain effective control with herbicides into the future.

A sequential application of PRE herbicides followed by POST herbicides should provide the most consistent and effective common ragweed control in any crop. In soybean, Gangster, Valor plus Sencor*, Valor, or Sencor* followed by Roundup* in RR soybean or Ignite 280 in LibertyLink soybean should provide the most effective common ragweed control. In dry bean, Prowl plus Permit followed by the NDSU micro-rate program or Basagran plus Reflex should provide the most effective common ragweed control.

In corn, Surestart or Harness*/Surpass* plus Balance or Callisto applied PRE followed by Roundup* plus Status or Halex GT in RR corn, Ignite plus atrazine* or Laudis/Impact in LibertyLink corn, Status, Impact or Laudis plus atrazine, or Buctril* plus Impact or Laudis should provide the most effective common ragweed control.

Huskie and any product containing 2,4-D, Banvel*, Buctril*, MCPA, or Stinger* should effectively control common ragweed in wheat and barley. If sugarbeet is grown in the rotation many of the herbicides listed above can only be used two seasons prior to sugarbeet or not at all.

*Or generic equivalent.

PERENNIAL WEED CONTROL

T1. Field bindweed. Paramount (quinclorac) at 0.33 lb DF/A controls field bindweed in fallow, postharvest, or preplant in spring prior to seeding wheat, including durum. Apply with MSO adjuvant at 1.5 pt/A to bindweed at least 4 inches long. Apply after harvest but prior to frost. Use in a 3-year program by applying 0.33 lb DF/A the first year and 0.17 to 0.33 lb DF/A in following years. Paramount also may control foxtails, barnyardgrass, and volunteer flax. Multi-state field research show excellent field bindweed control at rates of 0.33 to 0.5 lb/A. Yearly applications are required when rates less than 0.37 lb ai/A are used.

T2. Canada thistle is a major problem in ND due to reduced tillage, wet weather, lack of persistent control strategies, and expense of control. NDSU research has shown that Stinger* and Curtail* provide the best long-term Canada thistle control in crop. Roundup* alone or with 2,4-D gives good control applied pre- and post-harvest. However, control is reduced under dry conditions. Banvel* and Express* give only season-long control. In small grains, applying Express* plus 2,4-D* and Banvel* enhances control. 2,4-D applied at jointing followed by Curtail* applied post-harvest to rosette thistle provides good long-term control. Pre-harvest Roundup* treatments also give good control. Roundup* applied alone is similar in control to Curtail* but provides less control than Roundup* plus 2,4-D.

Stinger*, Curtail*, Roundup*, and 2,4-D have the greatest activity on Canada thistle in annual cropping systems. Highest rates should be used without interfering with next years cropping pattern. Apply high rates of herbicides to patches before thistle infestations increase. Timing is a critical factor. Herbicides applied after a light frost may enhance control but application to leaf tissue destroyed by frost may result in less control due to lack of herbicide uptake.

Tillage can be a critical factor. Delaying tillage 1 to 2 weeks after application in late fall increases control and may add an additional 30 to 40% control for herbicide treatments that gave 30 to 50% control without tillage. If lower herbicide rates or less effective herbicides are used, tillage is very important. If tillage is not planned, implement a program of multiple applications of the most effective herbicides at the highest rates practical. Spray rosettes of actively growing plants using the rosette technique described below.

Milestone effectively controls Canada thistle, but is labeled only on noncropland, such as pastures, rangeland, and CRP. Milestone is generally safe around most tree species except those in the legume family and can be used near but not in streams and ditches with flowing water.

*Or generic equivalent.

Rosette Technique. The rosette technique maximizes long-term Canada thistle control by encouraging root buds to break dormancy but not initiate flowering. These vegetative shoots provide better absorption, translocation, and activity than flowering shoots. Greatest control occurs when herbicides are applied in the fall to new growth of Canada thistle in the rosette stage. Periodic tillage in fallow controls Canada thistle shoots and other weeds until mid July when the day-length is less than 15 hours. Canada thistle shoots that emerge when day-length is less than 15 hours do not bolt but remain in the rosette growth stage. Apply Roundup*, Stinger*, Curtail*, or WideMatch* to rosettes in late September or early October. For in-crop control, use herbicides and between-row tillage to prevent bolting. Continue cultivation until canopy closure in soybean and until early July in corn. Effective herbicides can be applied post-harvest until early October. Herbicides fall-applied to rosette Canada thistle provide greater control and root kill compared with treating bolted Canada thistle .

T3. Common milkweed has become a weed problem in cultivated cropland due to an extensive deep root system, insulating winter snow, moist to wet summer conditions, tolerance to many commonly used herbicides, reduced tillage, and lack of human persistence in control measures. Common milkweed is tolerant to most labeled herbicides. Control requires multiple herbicide applications. Preventing establishment and spread of milkweed patches requires continuous scouting and persistent control efforts. Prevent seed production. Milkweed seed is highly viable and will germinate readily. Pappus on seeds allows long-distance travel and is responsible for establishment. Common milkweed seedlings becomes perennial (capable of reproducing from underground roots) approximately 3 weeks after emergence. New shoots develop from established roots and begin emerging in late April and grow more rapidly than spring seeded crops.

Milkweed control is expensive. Individual plants and small patches are easier and less expensive to treat than entire fields. Patch spraying covers only a fraction of the area of a broadcast application. Patch spraying allows use of higher herbicide rates with less expense than broadcast spraying.

Common milkweed control and management.
NDSU Research. Herbicides applied in June.

Herbicide	Rate	Months after application	
		3 mo.	12 mo.
	pt/A	--- % control ---	
2,4-D ester*	4	36	48
Banvel*	2	71	61
Banvel* + 2,4-D	0.5+2	26	15
Stinger* + 2,4-D	4	13	6
Roundup*	6	56	99

Express* + 2,4-D + Banvel* controls only top-growth.

Roundup* at 1.5 lb ae/A applied preharvest will reduce milkweed densities 85 to 95% compared to in-crop applications, which reduce milkweed densities by less than 40%. Apply herbicides when milkweed is in the late-bud to flowering stage and actively growing. Control patches when small. Patch-spray Roundup* at 6 to 8 pt/A (up to 10 pt/A is allowed). Apply Roundup* with AMS at 4 to 8.5 lb/100 gallons of water.

*Or generic equivalent.

T4. Fall-applied herbicides can be effective for controlling perennial weeds provided most stem and leaf tissue has not been killed by frost. Weeds such as field bindweed, leafy spurge and Canada thistle should have 6 to 12 inches or more of stem or rosette tissue before treatment for adequate leaf area to absorb the herbicide. Good leafy spurge control can be expected through mid-October with auxin herbicides even after several light frosts when the leaves are green or red and still firmly attached to the stem. Milestone provides superior control to Tordon when applied in late fall (October).

T5. Mowing or tillage is a good means of reducing perennial weed seed production. If fall herbicide applications are planned, mowing or tillage should be discontinued early enough to allow adequate plant regrowth. Post-harvest treatments can be applied when weed growth is about 1 foot tall. Preharvest herbicide treatment should precede harvest by at least 5 days to allow adequate herbicide translocation in perennial weeds. Fortunately the minimum PHI for many preharvest treatments meets or exceeds this guideline.

PERENNIAL WEEDS IN CROPS

T6. Perennial weed control systems in crops should include in-crop (conventional and particularly Roundup Ready crops if available), preharvest, and postharvest herbicide applications. Regardless of application, retreatment once or twice per year will be required for successful control of perennial weeds. Once large patches are controlled, seedlings will require treatment annually with registered in-crop herbicides. Roundup* use in Roundup Ready corn, soybean, canola, and sugarbeet is a very effective system to control perennial weeds. NDSU research has shown good control of established Canada thistle patches with Roundup* applied preharvest. For postharvest herbicide applications to be effective, treatment of new plant growth is required. Tillage combined with any herbicide treatment enhances control. Tables for each crop or perennial weed listed in this guide gives most effective herbicide choices, rates, and application information.

T7. Roundup* (glyphosate) at 0.75 to 1.5 lb ae/A applied as a spot treatment will give season-long control of most perennial weeds in wheat, barley, oat, corn, and soybean. Roundup* is non-selective and will kill crop in the treated area. Avoid drift outside the target area. Roundup* is non-residual so plants may emerge after treatment and unaffected rhizomes or roots from perennials will continue to grow. See label or tables for application stage and rates. Roundup* at 0.75 lb ae/A applied preharvest gives good Canada thistle and quackgrass control. When tillage is used after harvest, Roundup* will give greater Canada thistle control when applied preharvest than post-harvest.

PERENNIAL WEEDS IN PASTURES (See Z1 for haying and grazing restrictions)

T8. 2,4-D ester or amine at 2 to 4 pt/A controls many perennial weeds in pastures. Some perennials such as fringed sagebrush and western snowberry (buckbrush) are controlled with one application and perennials such as Canada thistle, field bindweed, and leafy spurge require retreatment annually. 2,4-D can be used where Tordon cannot, but avoid drift onto susceptible plants. Hi-Dep allows use at spray volumes as low as 1 gpa by ground or 0.5 gpa by air.

*Or generic equivalent.

2,4-D formulations registered for use in water include Agrilience "AgriSolutions 2,4-D Amine 4", UAP "Savage" and "Amine 4 2,4-D Weed Killer", Nufarm "Weedar 64", Van Diest "Cornbelt 4 lb Amine" and "Cornbelt Navigate", and Helena "Opti-Amine". Use only 2,4-D formulations registered for use near or in water. Refer to 2,4-D labels for registered use and information.

T9. Crossbow (triclopyr & 2,4-D) at 1 to 6 qt/A can be applied to grass pastures for broadleaf weed and brush control. Crossbow plus 2,4-D generally provides better musk thistle and brush control than 2,4-D alone. Do not graze lactating dairy animals or harvest hay from treated areas for 1 year after application. Do not graze beef animals within 3 days of slaughter during the first year after treatment.

T10. Banvel* (dicamba) at 1 to 2 pt/A will suppress some perennials, especially field bindweed and weeds resistant to 2,4-D. Banvel* can be applied in 1 to 5 gpa in pasture, rangeland, and fallow. When applying Banvel* at 2 pt/A or less, use 0.5% v/v surfactant or AMS at 2 to 6 lb/100 gal of spray solution. Long-term control generally is achieved with 4 to 16 pt/A but the high rates are economical only for spot treatment. Banvel* has a shorter soil residual than Tordon, but should not be applied where desirable plants may be damaged by herbicide leached to the root system. The label indicates the required delay between treatment and grazing of dairy animals or cutting for hay but varies with rate from 7 to 90 days.

T11. Escort* (metsulfuron) at 0.1 to 0.3 oz 75DF/A or **Finesse*** (metsulfuron & chlorsulfuron) can be applied in rangeland, grass pastures, and non-cropland for control of noxious and troublesome weeds. Spot treat at higher rates when practical. Spray foliage for thorough coverage but not to run-off. Add a NIS at 0.25 to 0.5% v/v or PO at 1% v/v. Use of NIS may cause temporary yellowing, stunting, and suppression of head development in annual and perennial grasses. To avoid grass injury, do not apply to desirable grasses under stress, nor to grasses grown for seed. Products with 2,4-D, Banvel*, and many other herbicides increase control and reduce risk of resistant weeds. Some brands of Ally* at 1 to 1.5 oz DF/A can be applied by air (helicopter and fixed wing) for weed control to utility and pipeline right-of-ways, military installations, and rangeland and pasture.

T12. Milestone (aminopyralid) at rates up to 14 oz/A per annual growing season may be applied as a spot treatment to not more than 50% of an area. Milestone has no grazing or haying restrictions but allow 3 days for animals to graze in untreated areas before transferring them to areas with sensitive broadleaf plants. May be applied to waters edge and in seasonally dry wetlands. Do not apply directly to water or to areas where surface water is present. Milestone can be applied to the soil under the canopy of several trees. Refer to label for list of tree species. Apply only as a directed spray under the canopy. Do not apply Milestone over-the-top of any tree. Legume plant and tree species are very susceptible to Milestone.

T13. Plateau (imazapic) with MSO adjuvant at 1 qt/A and UAN at 1 qt/A applied from early September to mid-October controls many grass and broadleaf weeds, including foxtail and leafy spurge in right-of-ways, pasture, rangeland, and CRP. Warm-season grasses are more tolerant than cool-season grasses. Highest rate provides longer control but increases grass injury. Plateau does not control absinth wormwood. Plateau does not injure desirable forage grasses or some broadleaf species including lead plant (*Amorpha canescens*), purple prairie clover (*Dalea purpurea*), prairie wild rose (*Rosa arkansana*), willow, (*Salix species*), and wild raspberry (*Rubus species*).

*Or generic equivalent.

T14-16 - PERENNIAL WEED CONTROL

T14. Tordon (picloram) at 4 to 8 pt/A applied as a spot treatment controls broadleaf perennial weeds such as leafy spurge, common milkweed, field bindweed, Canada thistle, and Russian knapweed on rangelands and permanent grass pastures. Tordon at 1 to 2 pt/A applied POST will suppress growth of perennial broadleaf weeds. Retreatment at the same rates is necessary the following year. The most cost-effective broadcast spring-applied treatment for leafy spurge control is Tordon at 1 pt/A plus 2,4-D* at 2 pt/A applied annually for 3 to 5 years. Do not apply Tordon with dry fertilizers.

Tordon is a restricted pesticide because it is toxic to most broadleaf plants. Spray drift will damage broadleaf crops and plants. Tordon is water soluble and may leach in the soil; consequently, do not apply in areas where a sandy porous surface and substrata overlay ground water 10 feet or less below the surface. Tordon must not be allowed to drift into surface water (including wells), irrigation water and drainage ditches or near shelterbelts, shrubs, or trees.

Do not cut grass for feed within 2 weeks after treatment at Tordon rates greater than 2 pt/A. Tordon is excreted in the urine which restricts transfer of livestock from treated grass areas onto sensitive broadleaf crop areas for 12 months after application without first allowing 7 days of grazing on untreated grass. When the Tordon rate exceeds 2 pt/A, the total area treated should not exceed 25% of a land owner's acreage found in any particular watershed.

T15. Mixture of Tordon + Plateau applied in June has provided greater leafy spurge control than Tordon + 2,4-D. Use of 2,4-D with Tordon + Plateau is not necessary but will increase the spectrum of broadleaf weeds controlled. Research by NDSU has shown improved leafy spurge control both in-season and the season following application when Tordon and Plateau are used.

Treatment	Product/A	Months after application		
		3	12	15
----- % control -----				

Tordon + 2,4-D	1 pt + 1qt	75	48	0
Tordon + 2,4-D + Plateau + MSO	1 pt+1 qt + 4 oz+1 qt	92	83	75

MSO adjuvant is required.

Do not apply after July 1.

Bromegrass species occasionally have shown short-term injury.

*Or generic equivalent.

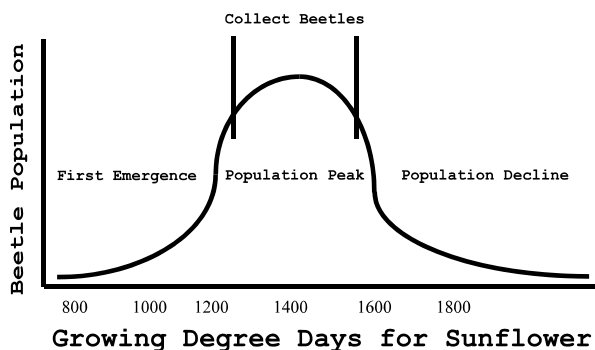
T16. NRCS Policy on Noxious Weed Control in CRP.

Taken from ND NRCS Exhibit 3, 2-CRP Manual, para. 210.

Established CRP Stands: Policy requires that no clipping or spraying of entire fields should be done during the primary nesting period (April 15 to August 1) for normal weed control. If noxious weeds are present and the critical control period for the weed falls in the primary nesting period, spot treatment of weeds is allowed. Herbicides chosen should maintain the grass and legume mixture. If this is not possible, control of the noxious weeds is a priority over maintaining legumes in the mix. Always notify your local USDA Service Center before making any herbicide applications.

New CRP Stands: Policy requires that weeds (noxious, common, volunteer grain, etc.) be controlled in CRP. Clipping and/or spraying during establishment should be used to control weed growth and reduce competition for the new seedlings. Clipping and/or spraying may be done at any time during the establishment period. If noxious weeds are present, control of noxious weeds is a priority over maintaining legumes in the mix. If the legume is killed after spraying and before the grass/alfalfa stand is established then a legume must be reseeded. Once the stand is established follow the above guidelines for established CRP stands. Always notify your local USDA Service Center before making any herbicide applications.

T18. Leafy spurge. Eight insect species have been released in North Dakota for biological control of leafy spurge. **Flea beetles** (*Aphthona* spp.) have been the most effective insects due to root feeding by larvae, rapid establishment, and increase after introduction, and ease in capture to transport to additional locations. Flea beetles are distributed through the ND Biological Control Program. Contact your county weed officer or board member for information. Release flea beetles on a well-drained south-facing slope with a moderate density of leafy spurge (60 to 90 plants/square yard) with minimal grass cover. Do not collect or move flea beetles, cultivate, burn site, or apply insecticide within 0.25 mile of release site for 3 to 5 years to allow establishment. During establishment, landowners should prevent expansion of the leafy spurge infestation by treating uninfested perimeters with herbicides. The best time to collect and distribute flea beetles is between 1000 to 1500 accumulated growing degree days (AGDD) for sunflower. Scout for establishment when the total AGDD for sunflower reaches 1100 to 1200. Flea beetle density prior to 1200 and after 1600 AGDD is low.



Use an insect sweep net to collect beetles to estimate density. Collect beetles from 10:00 am to 3:00 pm, greater than 70 F, little or no wind, sunny skies, and when leafy spurge foliage is dry. Sweep 5 times over an area of 1 m². Count the number of flea beetles by removing excess trash and non-flea beetle insects and pour beetles into a graduated container. Every 10 ml of flea beetles is approximately 1000 individuals.

Redistribute flea beetles to other leafy spurge infestations when 500 to 1000 beetles per 5 minute sweeping period are collected. Over-harvest of beetles is not possible because many flea beetles fall to the ground prior to being swept or are on the soil surface laying eggs. Redistribute flea beetles in a small area of 10 ft² or less. A successful release should result in 50 or more flea beetles in 5 sweeps the summer following release. If densities are less than 50 flea beetles per 5 sweeps then re-infest the site with additional flea beetles. A portion of the release area can be treated with Tordon (picloram) plus 2,4-D (2 pt + 2 pt) from early to mid-September to reduce leafy spurge stem density and increase insect establishment.

Research at North Dakota University has shown greater leafy spurge control when herbicides are combined with flea beetles compared to either used alone. Contact your county weed officer for date, time, and location of flea beetle collection in your area and information on purchasing collection equipment. An instructional video is available from the North Dakota Department of Agriculture, "[How To Raise Leafy Spurge Flea Beetles](#), North Dakota's Biological Control Program".

Leafy spurge gall midge (*Spurgia esulae*) prevents galled stems from flowering, thereby decreasing seed production. The gall midge generally infests only part of a leafy spurge population so seed production is reduced but not eliminated. A second control method is needed to reduce the original infestation and prevent spread by roots and seeds of plants not galled.

Research at NDSU has shown that the leafy spurge gall midge is compatible with herbicide treatment in an integrated leafy spurge management program. Herbicides such as Tordon or 2,4-D should be applied at the optimum growth stage for leafy spurge control. Some of the area (perhaps 15 to 25%) must be left untreated to sustain the insect population. This integrated program may be most useful near wooded areas or rough terrain. Consult NDSU Ext. Service Circulars W-866, Integrated Management of Leafy Spurge; W-1088 Leafy Spurge Biology, Ecology, and Management W-1183; and Leafy Spurge Control Using Flea Beetles, for further details.

Grazing. Sheep and goats provide an alternative to herbicides for controlling leafy spurge top-growth in pasture and rangeland with large infestations or along waterways and tree areas. Grazing alone reduces but does not eliminate leafy spurge infestation. Grazing slows the spread and allows grasses to be grazed by livestock. Grazing should be started in spring when plants first emerge. Divide infested areas into sections so animals can repeatedly graze new growth. NDSU research has shown that grazing leafy spurge with goats followed by a fall-applied herbicide treatment provided more rapid and better long-term leafy spurge control than either method used alone. Consult NDSU Ext. Service Circular W-866, Integrated Management of Leafy Spurge, for details.

Recommended stocking rates vary with terrain, leafy spurge density, and rainfall during the growing season. Sheep should be grazed at about 3 to 6 head/A/month or 1 to 2 ewes/A. Angora goats should be grazed at 12 to 16 goats/A/month or 3 to 4 goats/A. Grazing with goats controls leafy spurge with little utilization of the grass species. The stocking rate will decline over time as the leafy spurge infestation is reduced. Animals should be contained for 3 to 5 days so viable seed can pass through the digestive system before they are moved to non-infested areas. Which animal to utilize will depend on a land manager's specific conditions, such as fencing, availability of animals, need to overwinter, and prevailing markets at the time. Consult NDSU Extension Service Circular R-1093, Controlling Leafy Spurge Using Goats and Sheep, for further details.

T19. Purple loosestrife. Three insect species have been released into North Dakota for purple loosestrife control. The insects and plant parts attacked are:

Galerucella pusilla - a leaf-feeding beetle

Galerucella californiensis - a leaf-feeding beetle

Hylobius transversovittatus - a root-mining weevil

Biological agents hold promise for large infestations, thereby reducing the spread from neighboring states. However, purple loosestrife infestations in North Dakota are very small and isolated and **should be controlled by chemical and/or mechanical methods**. Biological control agents for purple loosestrife may not work well in urban areas because mosquito spraying severely reduces populations of biocontrol agents.