

ABBREVIATIONS.

Several abbreviations are used in this publication

pt = pint

ae = acid equivalent

qt = quart

ai = active ingredient

gal = gallon

L = liquid

lb = pound

gpa = gallons per acre

oz = ounce

DF = dry flowable

t = teaspoon

DS = dry soluble

T = Tablespoon

DG = dispersible granule

psi = lb per square inch

WDG = water soluble powder or crystals

NIS = non-ionic surfactant

Noxious Weeds

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WATCH for NOXIOUS WEED INVADERS

Noxious weeds are non-native plant species that are a concern to South Dakota land owners and managers. They can replace native plant species and impede agriculture, recreation, and wildlife.

2015 Noxious Weed Infestations ¹	
State noxious	Acres
Canada thistle	1,420,535
Leafy spurge	329,556
Perennial sow thistle	107,857
Hoary cress	21,896
Russian knapweed	7,750
Purple loosestrife	8,027
Saltcedar	2,386
Local noxious	
Biennial thistle (musk and plumeless)	251,639
Absinth wormwood	215,645

¹Estimates from 2015 State Noxious Weed Annual Report, SD Dept. of Agriculture

LOCAL NOXIOUS WEEDS

Some of the weeds listed below may be designated as locally noxious in your county. Requirements for controlling local noxious weeds are similar for controlling state noxious weeds.

- Absinth wormwood
- Black henbane
- Bull thistle
- Chicory
- Common burdock
- Common mullein
- Common tansy
- Dalmatian toadflax
- Diffuse knapweed
- Eurasian common reed
- Field bindweed
- Giant knotweed
- Houndstongue
- Musk thistle
- Oxeye daisy
- Plumeless thistle
- Poison hemlock
- Puncturevine
- Scotch thistle
- Spotted knapweed
- St. Johnswort
- Sulphur cinquefoil
- Yellow toadflax

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Trade names for herbicides are used in this publication to aid reader recognition. The common name is also listed and is used for herbicides that are available in many labeled products. Examples of other product names are listed where possible based on information available. As patents expire and marketing agreements are formed, additional products may be marketed. Be sure crop use and application directions are followed for the product being used.

HERBICIDES for NOXIOUS WEEDS

Noxious Weed Recommendations: Herbicides for pasture, range, and non-crop areas, including roadside and other rights-of-way that may be harvested for hay or grazed, are given a priority.

Non-crop Areas. Non-cropland is defined for herbicide purposes as areas not used to produce food or feed crops during the time herbicides residue remains in the soil. Non-crop areas include parking lots, utility storage areas and some rights-of-way. Pasture, range, and hay land are cropland.

Herbicides. Herbicides are listed by trade name except where the active ingredient is available in several products. The common name (in parentheses) follows the first listing of the trade name. Product labels for the same active ingredient vary. Herbicides included are those considered for most situations and those generally available. Rights-of-way are frequently grazed or used for hay, therefore products that allow grazing or harvesting hay are given a priority.

NOXIOUS WEED MANAGEMENT

Absinth Wormwood (Wormwood sage): Absinth wormwood is a perennial species that also is a prolific seed producer, so plants may re-establish a few years after control. Just 2,4-D can be effective, but two applications (spring and fall) may be required for control. Herbicides such as Milestone, ForeFront, or Tordon may be effective with one application. Herbicides may be effective in the spring up to the end of June, but may be ineffective after early June during abnormally dry springs. In trees, apply 2,4-D after tree leaves turn color and sage is still green.

Biennial Thistles (Musk, Plumeless, Bull and Scotch): These species generally emerge as rosettes in the fall and early spring and bolt during the second year of growth. Control is most consistent when herbicides are applied at the rosette stage. Tordon or Milestone may provide some short-term residual control for plants that germinate after the herbicide application. At the rosette stage, 2,4-D may be very effective. After bolting occurs, consider using aminopyralid (Milestone or ForeFront) or metsulfuron (Escort or Cimarron). The musk thistle seed weevil (*Rhinocyllus conicus*) and the rosette weevil (*Trichosiromalus horridus*) have been released in many areas of South Dakota and can be found in most musk thistle infestations.

Black Henbane: Black henbane is an annual or biennial weed that can invade disturbed areas in pastures, roadsides, or forested areas. Henbane can be toxic to humans and livestock but livestock will generally avoid eating it if other forage is available. It is most common in the Black Hills area, but can also be found in central South Dakota.

Burdock: Common burdock is a biennial weed that is most often a problem in shelterbelts. Consequently, it can be challenging to use herbicides to control burdock without injuring the trees. Furthermore, burdock often develops a persistent seed bank so plants may appear again within a couple years after control. 2,4-D is commonly used for burdock control, but care must be taken to avoid injury to trees or nearby gardens or crops.

Canada Thistle and Perennial Sowthistle: Perennial sow thistle and Canada thistle develop extensive root systems which can make them difficult to control. Seeds can spread by wind, making it important to control the plants prior to seed production. Canada thistle seeds may become viable within 10 days after flowering. Standard programs include Tordon+2,4-D, 2,4-D (for maintenance programs), Milestone, or ForeFront. Stinger or Transline may be used for Canada thistle around trees, but follow label precautions. These herbicides may be applied from mid-June (pre-bud stage) to Sept. or early Oct. (fall regrowth while the leaves are mostly green). It is preferred to control Canada thistle before seed production in early July. Dense grass may reduce control from fall applications, so consider setting-up the site with mowing or grazing in the summer prior to fall applications. Biocontrol insects can be fairly effective on Canada thistle in some circumstances, but success rates are low. Stem mining weevils may be most effective.

Chicory: Chicory may be invasive in pastures and along roadsides in any area throughout South Dakota.

Common Mullein: Common mullein is a biennial species that grows rosettes the first year and bolt during the second year of growth. Apply herbicides at the rosette stage during periods of active growth. For common mullein, use a surfactant to help the herbicide penetrate the extremely hairy leaf surface.

Common Tansy: Common tansy is a perennial species that seems to be particularly invasive in or near wooded areas, such as the Black Hills. Common tansy may be often found in low areas or near waterways. It mainly spreads by seeds, but will also spread by creeping roots. Metsulfuron products (e.g. Escort) are commonly used for control.

Eurasian Common Reed (Phragmites): European common reed (*Phragmites australis* subsp. *australis*) is a perennial grass species that looks similar to the native common reed (*Phragmites australis* subsp. *americanus*), which is not a local noxious weed species. The fluffy plume on European common reed may be denser than the native common reed. European common reed stems may be rigid, rough, dull, and slightly ribbed whereas native common reed stems are smooth and shiny. Both reed species may be found in sunny wetland habitats including marshes, streams or lake shores, ponds, wet meadows, and road ditches or in areas where cattails may be found. Aquatic glyphosate has been very effective in some locations.

Field Bindweed: Field bindweed is a perennial species that develops an extensive root system making it difficult to control. Management programs may require several years. Apply herbicides at the beginning of flowering or to regrowth in the fall.

Giant Knotweed: As the name suggests, giant knotweed is a large plant that can get 6 to 16 ft tall with heart-shaped leaves 6-16 inches long. It has a unique bamboo-like hollow stem. It often grows near streams, so herbicide options may be limited. Aquatic glyphosate is the only herbicide registered for knotweed control. Studies in other states have indicated that foliar applications of imazapyr (e.g. Habitat) or triclopyr (e.g. Garlon) may also be effective. Giant knotweed is generally very difficult to control with herbicides.

Hoary Cress: Hoary cress is a perennial species that can develop an extensive root system. Hoary cress may be challenging to control because it flowers in early spring (late April-early May), which is the best time for herbicide applications. SDSU trials indicate metsulfuron products (e.g. Escort) are the most effective. Growth regulator herbicides such as Tordon or 2,4-D are ineffective. Hoary cress may be found in low areas, such as gullies, ditches, dry lakebeds, or near lakes or streams.

Houndstongue: Houndstongue is a biennial species that grows rosettes the first year and bolt during the second year of growth. Apply herbicides at the rosette stage during periods of active growth.

Knapweed Species (Russian, Spotted, and Diffuse): Russian knapweed is a persistent perennial species that can develop an extensive root system making it difficult to control. Spotted and diffuse knapweed are biennial or short-lived perennial species and are generally easier to control. Herbicides may be applied to Russian knapweed at the bud-flowering growth stage or in late fall (early to mid-October) after the plants appear dormant. Apply herbicides to spotted or diffuse knapweed in the spring or fall while they are in the rosette to early-bolting growth stage. Several biocontrol agents have been released for the knapweed species. The knapweed flower or seed weevil (*Larinus minutus*) has been successful, especially on spotted knapweed.

Leafy Spurge: Leafy spurge is a perennial species that develops extensive root systems making it very difficult to control. Management programs typically require several years and can be very costly. Therefore, it is strongly recommended to watch for new patches and control infestations while they are small. Standard herbicide programs include Tordon, Tordon+2,4-D, or Plateau. Apply herbicides in the spring (early June) at flowering or to regrowth in the fall (September-October or while the white sap is still flowing). Plateau may be used around trees, but follow label precautions. For large infestations, consider introducing biocontrol

agents such as leafy spurge flea beetles (*Aphthona lacertosa* or *Aphthona nigriscutis*). Contact your local county weed and pest board or the South Dakota Department of Agriculture for more information on flea beetle collection dates and procedures.

Oxeye Daisy: Oxeye daisy may be found throughout South Dakota, but it is most problematic in the Black Hills area. It mostly infests open meadows and other grassy areas. Grazing can increase oxeye daisy densities, but intensive grazing can result in some control due to trampling plants and some feeding. Thick grass can greatly suppress oxeye daisy.

Perennial sowthistle: (see Canada thistle)

Poison Hemlock: Poison hemlock is a biennial species that grows only foliage the first year and bolts and flowers the second year. Poison hemlock may be confused with wild carrot, but poison hemlock often grows taller, has purple blotches on its stems, and will have no hairs whereas wild carrot may be slightly hairy. Poison hemlock is toxic to livestock and humans. It may be found along roadsides, stream banks, waste areas, pasture edges, and occasionally in no-till fields. Control may require a multiple year effort. Escort may be the most effective herbicide option.

Puncturevine: Puncturevine is an annual weed species, but is problematic because it produces large spiny burs that can puncture vehicle tires. It may be found on roadsides or field roads where the soil is dry and compacted. It is very susceptible to 2,4-D, but new seedlings may emerge after application which can make this weed difficult to control.

Purple Loosestrife: Purple loosestrife is often found growing on the edge of lakes or streams, so be sure to use herbicide products that are registered for use on or near water. The best time to apply herbicides is at the beginning of flowering (late June to early July). Alternative control options may include repeated tillage, burning, or biocontrol insects. The *Galerucella* leaf feeding beetles have been effective biocontrol insects for purple loosestrife. Beetles reared in South Dakota are available through the South Dakota Department of Agriculture.

Saltcedar (*Tamarix* species): Saltcedar is a very persistent tree species as it can reproduce by seed, roots, or stem fragments. It is a prolific seed producer and can spread rapidly. It produces pink, red, or purple flowers in mid-summer and the cedar-like leaves will turn yellow in the fall and fall off in the winter. It can be found along the water line on the edges of streams, lakes, ponds, or dugouts. Habitat may be applied to the foliage whereas triclopyr products, such as Garlon 4, may be applied to the trunk or stems in winter.

St. Johnswort: St. Johnswort spreads by seed and creeping roots. Repeated tillage may suppress populations and repeated mowing may help reduce seed spread. Biocontrol insects have been effective for large infestations in western states.

Sulphur Cinquefoil: Sulphur cinquefoil is a perennial weed that can become invasive in grasslands, particularly in western South Dakota. For cinquefoil, follow-up applications may be needed 2-3 years after initial applications.

Toadflax (*Dalmatian and Yellow*): Dalmatian and yellow toadflax spread by seeds and creeping roots. Dalmatian toadflax is generally more sensitive to herbicides than yellow toadflax. Yellow toadflax control requires high herbicide rates and several years of application which can become very costly. Therefore, it is strongly recommended to watch for new infestations and control populations while they are small. For yellow toadflax, SDSU trials indicate that Tordon at 1-2 qt/A may be the most effective herbicide option. Applications of 2,4-D at flowering may defoliate yellow toadflax and help reduce spread by seed, but will only provide approximately 20% control the following year. Biocontrol insects have been effective on large Dalmatian toadflax infestations, but are not effective on yellow toadflax.

TORDON 22K (*picloram*) Restricted use pesticide.

0.5 pt-2 qt Tordon 2L (0.125-1 lb ae)

(\$4.75-37.80)

Tordon has foliar activity and extended soil residual. It controls top growth and translocates into roots. Rainfall is required to move the herbicide into the root zone. Trees, legumes, and broadleaf plants are very sensitive to drift and soil residues.

Tordon is registered for use in grass pasture and range, fallow cropland and non-crop areas. At high rates, Bromegrass, buffalograss, and wheatgrass may be injured; bluegrass is tolerant. Minimum carrier is 10 gpa for ground and 2 gpa for air; however for non-crop 15 gpa or more is recommended for ground and 5-20 gpa for air. For spot treatment use a minimum of 20 gpa.

Restrictions: Do not use near trees as root uptake will result in severe tree injury or death. Avoid drift to trees or sensitive broadleaf crops. For rates above 1 qt/A, do not harvest for hay within 2 weeks after treatment. Do not graze dairy animals for 2 weeks after treatment. Remove animals 3 days before slaughter if grazing within 2 weeks after spraying. Residues will remain in animal urine, so do not spread manure from cattle feeding on treated forage or grazing on broadleaf crops. Residue may remain on treated grass harvested for hay, so do not feed in areas where broadleaf crops may be planted. Do not apply into water or wetlands or on inner banks of irrigation or drainage ditches. Risk of leaching is greatest where soils have rapid permeability (such as loamy to sand) and where the underlying aquifer is near the surface. Broadcast rates above 1 qt/a are only allowed for noxious and invasive weeds; however spot treatments up to 2 qt/A may be applied to other broadleaf weeds but cannot exceed 50% of an acre.

ABSINTH WORMWOOD: 1-2 pt

Spring or Fall. Use Tordon alone or as a tank-mix with 2,4-D ester. Apply in spring before wormwood is over 12 inches. Tordon at 1 pt alone or Tordon plus 2,4-D has provided excellent results in SDSU tests. Results on larger plants have been better than for 2,4-D. Promising as a fall treatment.

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL, & SCOTCH): 0.5-0.75 pt

Fall or Spring: Apply at the seedling or rosette stage. Use Tordon at 0.5-0.75 pt for fall; use Tordon plus 2,4-D for spring application. Provides excellent control under a wide range of growing conditions. Visual effects develop more slowly than for some treatments.

BLACK HENBANE: 1-2 pt

Spring. Apply to actively growing plants in the rosette growth stage.

CANADA THISTLE AND PERENNIAL SOWTHISTLE: 2 pt (Canada thistle); 4 pt (perennial sowthistle)

Spring or Fall. Primarily for small infestations. Use a minimum of 20 gpa carrier. The 1 qt/A rate has been promising in Canada thistle tests. Stands have been reduced 85 to 90% in SDSU tests. Make spring treatments before seed forms. Make fall applications while foliage is still green. Use the high rate for maximum stand reduction, especially for fall treating areas such as fence lines. Control one year later is greater than for lower Tordon rates in tank-mixes.

COMMON MULLEIN AND HOUNDSTONGUE: 1 qt

Spring. Apply at rosette stage prior to stalk elongation. Use Tordon alone or at a lower rate in a tank-mix with 2,4-D. Treatments have exceeded 90% control in tests in western South Dakota. Surfactant improves penetration through woolly leaf surface. It is recommended to use at least 30 gallons water per acre to ensure thorough coverage. Reduction is apparent for at least 2 years.

COMMON TANSY: 2-3 pt

Spring, early summer. Apply before bloom. Results in SDSU tests show 75 to 90% control. The 2 pt/A rate is minimal; adding 1 lb ae/A 2,4-D ester is suggested with the low rate.

FIELD BINDWEED: 1-2 qt

Spring or Fall. Primarily for small patches. Rates above 1 pt/A can be used in fallow cropland if the treated areas are less than 10% of the field. The 2 qt rate will reduce the stand; however, additional Tordon or other follow-up is required. Some regrowth may be noted after application during dry seasons. Make spring treatments before seeds form. Make fall application before soil freeze-up.

KNAPWEED SPECIES: 1-4 pt

Spring or Fall. For diffuse or spotted knapweed, apply 1-2 pt/A in the spring to plants in the rosette or mid-bolting growth stage or in the fall to regrowth. Control at the 1 pt/A rate may be improved by tank mixing with 1 qt/A 2,4-D. For Russian knapweed, apply 2-4 pt/A to actively growing plants in the bud to mid-flowering growth stage or in the fall to regrowth. Some studies have demonstrated very good Russian knapweed control after late-fall applications.

LEAFY SPURGE: 1-2 qt

Spring or Fall. Spring applications generally slightly more effective. Primarily for small patches. The 2 qt rate will reduce the stand; however, additional Tordon or other follow-up is required. Some regrowth may be noted after application during dry seasons. Make spring treatments before seeds form. Make fall application before soil freeze-up.

OXEYE DAISY: 1.5-2 pt

Spring. Apply while plants are actively growing. It is recommended to use at least 30 gallons water per acre to ensure thorough coverage. May mix lower rate with 2,4-D at 1 lb ae/A.

ST. JOHNSWORT: 2-4 pt

Spring or Fall: Use Tordon alone or as a tank-mix with 2,4-D. Has provided excellent control in SDSU tests. Spring application at bud stage gave 95% control for a 2-year period. Reduce the Tordon rate to 0.5 pt/A when used with 2,4-D if conditions are favorable. Control has averaged 90 to 95% for one year.

SULPHUR CINQUEFOIL AND CHICORY: 1 pt

Spring or Fall: Apply to actively growing plants in the spring or to regrowth in the fall.

TOADFLAX (DALMATIAN AND YELLOW): 1-2 qt

Late summer (flowering) or Fall. For Dalmatian toadflax, apply 1-2 qt to actively growing plants through the full bloom stage or in late summer or fall. Use Tordon in tank-mix with 2,4-D in spring before full bloom. For yellow toadflax, Tordon at 2 qt/A may provide 60-70% control the following year. May require annual treatment for 2 to 3 years.

TORDON 22K + 2,4-D ESTER (picloram + 2,4-D) Restricted use pesticide.

0.5 pt-1 qt Tordon 2L + 1-1.5 lb ae 2,4-D ester (0.125-0.5 + 1-1.5 lb ae) (\$6.90-27.20)
1-3 qt Trooper P+D (0.135-0.405 + 0.5-1.5 lb ae)
1.25 pt - 2 qt Graslan L (0.13-0.405 + 0.47-1.5 lb ae)

The tank-mix is registered for non-crop, grass pasture, and range. Use Graslan L for CRP, range, pasture, and non-crop. Grass is usually tolerant to these Tordon rates. Some stunting, especially if applied at boot stage, may be noted. Minimum carrier is 10 gpa for ground or 2 gpa for air.

Restrictions: See individual restrictions for Tordon and 2,4-D.

ABSINTH WORMWOOD (WORMWOOD SAGE):

0.5-1 pt Tordon + 1 lb ae 2,4-D ester, 2-4 pt Trooper P+D, or 1.25-2.66 pt Graslan L

Spring or Fall. Apply in spring before wormwood is over 12 inches. Tordon alone or Tordon plus 2,4-D has provided excellent results in SDSU tests. Results on larger plants have been better than for 2,4-D. Promising as a fall treatment.

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL, & SCOTCH):

0.5-0.75 pt Tordon + 1 lb ae 2,4-D, 2-4 pt Trooper P+D, or 1.25-2.66 pt Graslan L

Spring: Apply at the seedling or rosette stage. Use Tordon at 0.5-0.75 pt plus 2,4-D at 1 lb ae/A for spring application. Provides excellent control under a wide range of growing conditions. Visual effects develop more slowly than for some treatments. Apply 2 pt Trooper P+D or 1.25 pt Graslan L to rosettes or 3-4 pt Trooper P+D or 2-2.66 pt Graslan L from bolting to bud stage.

CANADA THISTLE AND PERENNIAL SOWTHISTLE:

1 pt Tordon + 1 lb ae 2,4-D ester, 2-3 qt Trooper P+D, or 1.25-2 qt Graslan L

Spring. Intended as a multi-year program with sufficient seasonal suppression so only one application per season is required. Apply at bud stage before flowers open. Amines cause less leaf burn and are preferred if growth is lush. Some fall regrowth may be noted in wet seasons. Lower rates do not provide sufficient residual control into the fall.

CHICORY: 1 pt Tordon + 1 lb ae 2,4-D, 2-4 pt Trooper P+D, or 1.25-2.66 pt Graslan L

Spring. Apply to young and actively growing plants. Apply from the rosette to early bud stage.

COMMON MULLEIN AND HOUNDSTONGUE: 1 pt Tordon + 1 lb ae 2,4-D ester, or 2.66 pt Graslan L

Spring. Apply at rosette stage prior to stalk elongation. Treatments have exceeded 90% control in tests in western South Dakota. Surfactant improves penetration through woolly leaf surface. Reduction is apparent for at least 2 years.

FIELD BINDWEED: 1.5 pt Tordon + 1 lb ae 2,4-D ester, 2-3 qt Trooper P+D, or 1.25-2 qt Graslan L

Spring. Amine formulation of 2,4-D may be used if site limitations preclude ester formulations. Intended as one application per year; some regrowth may be noted. Follow-up treatments may be required after 1 year.

LEAFY SPURGE: 1.5 pt Tordon + 1 lb ae 2,4-D ester

Spring. Tank-mix. Intended as a 4 to 5 year program. Apply in late bud stage. Amine formulation of 2,4-D may be used if site limitations preclude ester formulations. Intended as one application per year; some regrowth may be noted in wet seasons. Treatment has provided 75 to 80% leafy spurge stand reduction after 4 years.

OXEYE DAISY: 1.5 pt + 1 lb ae 2,4-D, 3-4 pt Trooper P+D, or 2-2.66 pt Graslan L

Spring. Apply while plants are actively growing. It is recommended to use at least 30 gallons water per acre to ensure thorough coverage. May mix lower rate with 2,4-D at 1 lb ae/A.

POISON HEMLOCK: 1.25-2.66 pt Graslan L

Spring or Fall. Apply to rosette stage up to 36 inches.

ST. JOHNSWORT: 0.5-1 pt Tordon + 1 lb ae 2,4-D

Spring or Fall. Has provided excellent control in SDSU tests. Spring application at bud stage gave 95% control for a 2-year period. Reduce the Tordon rate to 0.5 pt/A when used with 2,4-D if conditions are favorable. Control has averaged 90 to 95% for one year.

TOADFLAX (DALMATIAN): 1 qt Tordon + 1.5 lb ae 2,4-D ester

Late summer (flowering) or Fall. For Dalmatian toadflax, apply to actively growing plants through the full bloom stage or in late summer or fall. Use Tordon in tank-mix with 2,4-D in spring before full bloom.

PLATEAU (*imazapic*)

8-12 oz Plateau 2L (0.13-0.19 lb ai)

(\$9.65-14.45)

Plateau is an imidazolinone herbicide used in pasture, range, non-crop areas, and CRP plantings. Minimum carrier is 10 gpa for conventional ground equipment or 2 gpa for low volume equipment.

Several tree and shrub species listed on the label are known to have acceptable tolerance when applied under the canopy and/or to the foliage. Tolerance is based upon trees with a minimum of 2 inch DBH (diameter at breast height). Some species may exhibit tip chlorosis and minor necrosis. Foliar contact on some species may increase injury, defoliation, and terminal death.

Restrictions: Treated areas may be grazed. Do not harvest hay for 7 days after treatment. Plateau at rates greater than 8 oz/A may suppress growth of switchgrass and cool season grass species, such as smooth brome and wheatgrass.

COMMON MULLEIN & HOUNDSTONGUE: 8-12 oz

Spring. Apply at the rosette stage while plants are actively growing. Plateau may also partially control common mullein, although it is only registered for houndstongue control. Add MSO (1.5-2 pt/A) or NIS (0.25% v/v) and a nitrogen-based liquid fertilizer such as 28% N may also be added at 2-3 pt/A.

FIELD BINDWEED: 8-12 oz

Fall. Use the higher rate for dense infestations that have been established for longer periods of time. Add MSO (1.5-2 pt/A) or NIS (0.25% v/v) and a nitrogen-based liquid fertilizer such as 28% N may also be added at 2-3 pt/A.

HOARY CRESS: 8-12 oz

Spring. For hoary cress suppression. Add MSO (1.5-2 pt/A) or NIS (0.25% v/v) and a nitrogen-based liquid fertilizer such as 28% N may also be added at 2-3 pt/A.

KNAPWEED SPECIES: 12 oz

Fall. For Russian knapweed only. Apply in the fall after leaves begin to die back (senescence). Control may improve as senescence progresses and may still be obtained after full senescence. Apply with MSO at 1 qt/A. A NIS (0.25% v/v) may be used instead of a MSO to improve grass tolerance, but weed control may decline. In addition to MSO or NIS, UAN or AMS may be added at 2-3 pt/A to increase activity.

LEAFY SPURGE: 8-12 oz

Fall. Use the higher rate for dense infestations that have been established for longer periods of time. The lower rate has been used in most SDSU tests. Field plot data suggest follow-up control programs are required to prevent new infestations. Add MSO at 2 pt plus 2 pt/A 28% N. Results have been promising in SDSU tests; 70 to 90% control has been reported the year after application. Fall treatment to active growth has been more effective than spring applications. If a light frost has occurred, check for milky sap before application.

TOADFLAX (DALMATIAN): 8-12 oz

Late summer (flowering). Label recommends 12 oz/A of Plateau plus 2 pt/A MSO for control of dalmatian toadflax. In addition to MSO, UAN or AMS may be added at 2-3 pt/A. For best results, apply to the basal growth in the fall, after the first hard frost. The plant can have the top 25% showing necrotic tissue; however, there should be green stem and leaf tissue remaining. Applications made prior to this timing will result in poor control.

PERSPECTIVE (aminocyclopyrachlor + chlorsulfuron)

3-11 oz Perspective (0.07-0.27 + 0.03-0.11 lb ai)

(\$21.45-78.65)

Add an adjuvant such as NIS (0.25-0.5% v/v), COC (1-2% v/v), or MSO (0.5-1% v/v). Using NIS rather than MSO or COC may help minimize the risk of grass injury. May be applied by ground equipment or helicopter (right-of-way only).

May injure some cool-season perennial grass species such as smooth brome and wheatgrass species. May also injure annual grasses such as foxtails or barnyardgrass. Spring applications may slightly reduce the risk of grass injury. Stressed grass (from drought, disease, insects, etc.) may be more susceptible to injury. In areas recently planted to grasses, do not make applications until grasses have developed a secondary root system and show good vigor. Do not use treated grass for mulch or compost.

Although several tree species may tolerate Perspective applications over the tree root zone, the label is not specific on this issue so it would be best to avoid applications near trees until specific tolerance information is available.

Restrictions: Non-crop use only (do not use in areas to be grazed or hayed). Treated areas may not be grazed or hayed after application. May be applied to the edge of surface water, but not above surface water. Do not plant crops in treated areas for at least one year after application. It may be best to avoid planting soybeans or other broadleaf crops for at least 3 years after application. A bioassay is required before planting any crop in subsequent years after an application (see label for more details). Do not apply more than 11 oz/A per year at one location.

BIENNIAL THISTLES (MUSK, BULL, & SCOTCH): 3-4.5 oz (musk) 4.75-11 oz (bull or scotch)

Spring or Fall. Apply prior to flowering in the spring (May to early June) or to rosettes in the fall (September).

CANADA THISTLE AND PERENNIAL SOWTHISTLE: 4.75-11 oz

Spring, Summer or Fall. Mainly for Canada thistle. Perennial sowthistle is currently not on the label, but would likely also be controlled. Slightly more effective if applied in spring or summer than fall. SDSU research indicates that Perspective may be effective if applied any time from mid-June (flower bud stage) until the end of September.

COMMON MULLEIN & HOUNDSTONGUE: 4.75-11 oz

Spring or Fall. Apply to rosettes in the spring (May to early June) or fall (Sept. – Oct.). For houndstongue, avoid application around trees, particularly conifers such as spruce and some pine species.

COMMON TANSY: 4.75-11 oz

Spring, early summer. Apply to actively growing plants.

FIELD BINDWEED: 4.75-11 oz

Summer or Fall. Apply at flowering (June) or in the fall (Sept. – Oct.).

HOARY CRESS: 3-4.5 oz

Spring. Apply in the spring (late April to early May) at the bud to early flowering growth stage.

KNAPWEED SPECIES: 4.75-11 oz

Spring or Fall. Effective on spotted, diffuse, and Russian knapweed. For Russian knapweed, the label recommends fall applications to rosettes in the Western US, which may also apply to South Dakota.

LEAFY SPURGE: 4.75-11 oz

Spring or Fall. Slightly more effective if applied in spring than fall. SDSU research indicates that spring applications of 2,4-D followed by fall applications of Perspective may increase the duration of control.

PUNCTUREVINE: 4.75-11 oz

Spring or early summer. Apply to actively growing plants.

TOADFLAX (DALMATIAN AND YELLOW): 4.75-11 oz

Late summer (flowering) or Fall. Apply to actively growing plants.

METHOD (*aminocyclopyrachlor*)

8-18 oz Method 240SL (0.125-0.28 lb ae)

4-9 oz Method 50SG

Labeled for use in non-crop, roadsides and right-of ways. Apply to actively growing weeds. Recommended minimum carrier is 10 gpa for ground or 15-25 gpa for aerial application. May add MSO at 1% v/v or NIS at 0.25% v/v.

May injure some cool-season perennial grass species such as smooth brome and wheatgrass species. Spring applications may slightly reduce the risk of grass injury. Stressed grass (from drought, disease, insects, etc.) may be more susceptible to injury.

Restrictions: Do not apply to areas where roots of desirable trees may extend unless injury or loss is acceptable. Do not apply more than 0.28 lb ai per acre per year. Do not graze or feed forage, hay, or straw from treated areas. Do not use treated plant material for mulch or compost. For areas to be converted to crops, do not plant for at least one year after application (with a field bioassay).

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL, & SCOTCH): 8-18 oz L or 4-9 oz SG

Spring or Fall. For Musk thistle. Apply prior to flowering in the spring (May to early June) or to rosettes in the fall (September).

CANADA THISTLE: 8-18 oz L or 4-9 oz SG

Spring, summer or Fall. Mainly for Canada thistle. Perennial sowthistle is currently not on the label, but would likely also be controlled. Slightly more effective if applied in spring or summer than fall.

FIELD BINDWEED: 12-18 oz L or 6-9 oz SG

Summer or Fall. Apply at flowering (June) or in the fall (Sept. – Oct.).

KNAPWEED SPECIES: 8-18 oz L or 4-9 oz SG

Spring or Fall. Effective on spotted, diffuse, and Russian knapweed.

LEAFY SPURGE: 8-18 oz L or 4-9 oz SG

Spring or Fall. Slightly more effective if applied in spring than fall.

POISON HEMLOCK: 12-18 oz L or 6-9 oz SG

Spring or Fall. Apply to actively growing plants.

SULPHUR CINQUEFOIL: 12-18 oz L or 6-9 oz SG

Spring. Apply to actively growing plants.

TOADFLAX (DALMATIAN): 8-18 oz L or 4-9 oz SG

Late summer (flowering) or Fall. Apply to actively growing plants.

2,4-D ESTER OR AMINE

1-3 lb ae 2,4-D ester or amine 4L

(\$5.20-16.40)

Selective, foliage applied, translocated herbicide. Uses for 2,4-D include grass pasture, range, and non-crop areas. Low-volatility ester formulations are preferred for grass pasture and roadsides. Use amine formulations near trees or where vapor-drift risk is critical for sensitive plants. Minimum carrier is 10 gpa for ground or 2 gpa for air. Apply when expected high temperature is to exceed 65o F.

FORMULATION CONVERSIONS

Rates for 2,4-D are stated as acid equivalent (ae) per acre. The amount of product for several rates is listed for each formulation.

2,4-D RATE Product Per Acre				
Lb/A Required	3.8L*	5.7L*	FORMULATION	
			80% WSP	90% WSP
0.5	1 pt	0.66 pt	0.66 lb	0.6 lb
1.0	2 pt	1.33 pt	1.25 lb	1.1 lb
1.5	3 pt	2 pt	1.9 lb	1.7 lb
2.0	4 pt	2.66 pt	2.5 lb	2.2 lb
*2,4-D showing 3.8 lb/gal is the same as 4 lb/gal; and 5.7 lb/gal is the same as 6 lb/gal acid equivalent.				

Restrictions: Avoid drift to trees and sensitive crops. Not suggested for use in trees. Even products that claim “low volatility” still have the potential to volatilize. Volatilization may be slightly reduced if applied when temperatures are less than 85o F. Do not graze lactating dairy animals for 7 days after application. Labels for 2,4-D allow harvesting hay 7 days after application and require a 3 day removal period before slaughter. Note other label precautions. Several amine formulations may be registered for use in water, but ester formulations usually are not. Labels for 2,4-D products vary, so always verify appropriate registrations on the product labels before applying in water. See “2,4-D Label Registrations and Non-crop Labeling” table in this guide for more information.

ABSINTH WORMWOOD (WORMWOOD SAGE): 2 lb ae ester or amine

Spring or Fall. Apply when wormwood is 8 to 10 inches tall. Rate is 2 lb ae/A. Control is variable. Good coverage improves control.

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL, & SCOTCH): 1.5-2 lb ae ester or amine

Spring. Apply at rosette stage. May be used in fall or spring; however, other fall treatments with soil residual activity may be more effective. The low rate has been satisfactory under ideal conditions; 2 lb/A is most consistent. Esters are preferred for pastures; use amines when spraying near trees. Control is reduced after flower stalks elongate (bolt).

BURDOCK: 1 lb ae amine

Spring or Fall: Apply while burdock is in the rosette stage and actively growing. Consider making applications to rosettes in the fall to avoid tree injury.

CANADA THISTLE AND PERENNIAL SOWTHISTLE: 1.5-3 lb ae ester or amine

Late Fall 2-3 lb ae amine: Apply a high rate in late fall before leaves are damaged by frost. Rates to 2 lb ae/A may be used in pasture and range; higher rates are allowed in non-crop and fallow. Data indicate 50 to 60% stand reduction if there is considerable new growth and if weeds have been weakened by previous control practices. Light frost before application does not reduce control; temperatures of 60o F after application improve results.

Spring and Fall 1.5 lb ae amine or ester: Requires a spring and fall application each year. Make spring applications at bud stage. Retreat in September or early October after new fall growth reaches 6 inches. Results can be variable. One spraying prevents seed production. Two applications provided 10 to 25% stand reduction the first year in SDSU tests. Reductions of 70 to 80% may be achieved after 3 years. This is a popular program for large infestations in pasture and roadsides. However, several years are required to reach high levels of eradication. Amine formulations are suggested for spring treatments when growth is lush. Esters may be used for fall spraying or if plants are stressed. Fall retreating is critical.

COMMON MULLEIN & HOUNDSTONGUE: 2 lb ae ester

Spring. Apply while plants are actively growing but before bloom.

FIELD BINDWEED: 1.5-2 lb ae ester

Spring and Fall. Spring and fall application required each year. Selective, foliage applied, translocated herbicide. Apply 2,4-D ester at 1.5 lb ae/A. Apply in spring at flowering and retreat in September or early October when new fall growth is 4 to 6 inches. Results can be variable.

Spring or Fall. Single application each year. Rates to 2 lb/A may be used in pasture and range; higher rates are allowed in non-crop and fallow. Control is less than for two applications of 1.5 lb/A each. Best for inaccessible areas where the labor cost for a second application is prohibitive.

KNAPWEED SPECIES: 2 lb ae ester

Spring. Apply at rosette stage. Rate of 2 lb ae/A has provided 95 to 99% control in several SDSU tests. Lower rates may be adequate under ideal conditions.

LEAFY SPURGE: 1.5-2 lb ae ester

Spring and Fall. Spring and fall application required each year. Apply 2,4-D ester at 1.5 lb ae/A. This treatment has been popular for large infestations; however, several years are required to achieve significant stand reduction. Apply in spring at late bud stage when bracts begin to yellow. Retreat in September or early October when new fall growth is 4 to 6 inches. Results can be variable. One treatment per year prevents seed production. Stands have been reduced 50% in 3 years. Complete eradication is difficult even after 10 years. Surfactant or fuel additives increase leaf burn but seldom increase stand reduction.

Spring or Fall. Single application each year. Rates to 2 lb/A may be used in pasture and range; higher rates are allowed in non-crop and fallow. Control is less than for two applications of 1.5 lb/A each. Best for inaccessible areas where the labor cost for a second application is prohibitive.

PUNCTUREVINE: 2 lb ae amine or ester

Spring. Apply when new seedlings appear. Tank-mixes with non-selective herbicides in non-crop areas will improve year-long control.

SULPHUR CINQUEFOIL AND CHICORY: 2 lb ae ester or amine

Spring. Apply to young and actively growing plants.

MILESTONE (*aminopyralid*)

3-7 oz Milestone (0.05-0.11 lb ai)

(\$8.50-19.90)

May be used in pastures, rangeland, CRP, and non-crop areas. Avoid mowing for 14 days after application to allow for herbicide translocation in the weeds. Recommended minimum carrier volume is at least 10 gpa for ground application or at least 2 gpa for aerial application. Greater carrier volumes may improve coverage and control. Use a non-ionic surfactant (NIS) at 0.25-0.5% under adverse growing conditions or advanced weed growth stages.

Restrictions: Do not apply Milestone at more than 7 fl oz (0.11 lb ae) per acre per year for broadcast applications or 14 fl oz (0.22 lb ae) for spot treatments (less than ½ acre areas). See label for off farm distribution/sale of hay. There are no grazing restrictions, but allow animals to graze for 3 days on an untreated pasture before moving to areas with sensitive broadleaf crops as aminopyralid may be transferred in manure from livestock. Do not spread manure on areas used for broadleaf crops if animals have grazed treated areas or consumed aminopyralid treated forage or hay. A field bioassay is required before a broadleaf crop can be planted on areas that were treated the previous year with manure from animals that have grazed or eaten treated hay. Do not rotate to cropland for at least one year after application (may require at least 2 years for broadleaf crops).

Milestone may be applied to non-irrigation ditch banks and seasonally dry wetlands, but may not be applied over water or to areas where surface water is present. After grass planting, wait until perennial grasses are well established with a secondary root system before applying Milestone. Some grasses, such as smooth brome, may be suppressed under adverse growing conditions.

Although Milestone may be applied around some mature tree species, some species are sensitive. The table below lists trees that are sensitive or tolerant to Milestone. However, even tolerant trees may be susceptible to injury if excessive rates are applied

over the roots, exposed roots at the soil surface become exposed to Milestone, or Milestone is exposed to leaves or thin bark. **Milestone should never be applied over the top of any tree species.** In general, Stinger or Transline are often safer around trees than Milestone. The trees listed below are not listed on the Milestone label, but are listed on the Dow "Invasive Plant Management Guide" which may be found on the Dow website. Therefore, this is not an official recommendation. Applicators are responsible for any tree injury that may occur.

Tree species tolerance to Milestone		
Tolerant trees	Semi-tolerant trees	Sensitive trees
Ash	Birch	Black or Honey locust
Aspen	Douglas fir	Caragana
Black cherry	Fir	Cedar (<i>Thuja</i> spp.)
Cottonwood	Hackberry	Junipers
Dogwood	Lodgepole pine	Lilac
Eastern Red Cedar	Ponderosa pine	Mimosa
Eastern white pine		Pinyon pine
Elm		Redbud
Maple		Rose
Oaks		Spruce (<i>Picea</i> spp.)
Willow		
Yellow poplar		

ABSINTH WORMWOOD (WORMWOOD SAGE): 6-7 oz

Spring or Fall: Apply at 6-7 fl oz/A before wormwood is 12 inches tall. May see reduced control with later applications, particularly in drought stressed conditions. Removal of old grass litter by mowing or burning may improve coverage and wormwood control.

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL, & SCOTCH): 3-7 oz

Spring or Fall. Apply in the spring or summer to plants in the rosette or bolting stages of growth or in the fall to seedlings or rosettes. Use 3-5 oz for musk, plumeless or bull thistle and 5-7 oz for scotch thistle. Use higher rates when plants are in the late bolting through early flowering growth stages. Milestone control after the late bud stage may be improved by tank-mixing 2,4-D at 1 lb ai/A.

CANADA THISTLE AND PERENNIAL SOWTHISTLE: 3-7 oz

Spring or Fall. Apply at 5-7 oz/A for Canada thistle or 3-5 oz/A for perennial sowthistle. Make applications in early summer at the bud stage or early flowering or in fall prior to a killing frost. Use higher rates for advanced weed growth stages, dense stands, or under adverse growing conditions, such as drought. SDSU studies have demonstrated excellent control that may last two or more years.

COMMON MULLEIN: 7 oz

Spring: Apply at the rosette stage. Full coverage and use of a surfactant is necessary for best results. Control has been very good in SDSU trials.

KNAPWEED SPECIES: 5-7 oz

Spring or Fall. Apply to diffuse or spotted knapweed that is actively growing in the rosette to bolting stage or in the fall. Apply to Russian knapweed in the spring and summer when plants are in the bud to flower growth stage.

OXEYE DAISY: 4-6 oz

Spring. Apply in the spring at the bud growth stage.

ST. JOHNSWORT: 5-7 oz

Spring or Fall. Apply in the spring at the bud growth stage or in the fall to regrowth.

SULPHUR CINQUEFOIL AND CHICORY: 4-7 oz

Spring: Apply to actively growing plants in the pre-bud growth stage.

FOREFRONT HL OR GRAZONNEXT HL (aminopyralid+2,4-D)

1.2-2.1 pt ForeFront HL or GrazonNext HL (0.06-0.11 + 0.5-0.87 lb ae)

(\$7.35-18.85)

Use a non-ionic surfactant (NIS) at 0.25-0.5% under adverse growing conditions or advanced weed growth stages. Recommended minimum carrier volume is at least 10 gpa for ground application or at least 2 gpa for aerial application. Greater carrier volumes may improve coverage and control.

Restrictions: Do not mow or harvest forage for hay within 7 days after application, allow 14 days for herbicide translocation in the weeds. Treatment may increase palatability of poisonous plants; do not graze until plants are dry and no longer palatable to livestock. See label for off farm distribution/sale of hay. Do not apply more than 2.1 pt/A in a growing season. Allow 30 days between applications. Do not apply around trees unless injury due to root uptake is acceptable. Do not apply over the top of trees and avoid leaf contact. There are no grazing restrictions, but allow animals to graze for 3 days on an untreated pasture before moving to areas with sensitive broadleaf crops as aminopyralid may be transferred in manure from livestock. Do not spread manure on areas used for broadleaf crops if animals have grazed treated areas or consumed aminopyralid treated forage or hay. A field bioassay is required before a broadleaf crop can be planted on areas that were treated the previous year with manure from animals that have grazed or eaten treated hay. Do not rotate to cropland for at least one year after application (may require at least 2 years for broadleaf crops).

ABSINTH WORMWOOD (WORMWOOD SAGE): 1.2-1.5 pt

Spring or Fall: Apply before wormwood is 12 inches tall. May see reduced control with later applications, particularly in drought stressed conditions. Removal of old grass litter by mowing or burning may improve coverage and wormwood control.

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL, & SCOTCH): 1.2-2.1 pt

Spring or Fall. Apply in the spring or summer to plants in the rosette or bolting stages of growth or in the fall to seedlings or rosettes. Apply 1.2-1.5 pt for musk, plumeless, or bull thistle and 1.5-2.1 pt for scotch thistle. Use higher rates when plants are in the late bolting through early flowering growth stages.

CANADA THISTLE AND PERENNIAL SOWTHISTLE: 1.5-2.1 pt

Spring or Fall. Apply at 1.5-2.1 pt/A for either species. Make applications in early summer at the bud stage or early flowering or in fall prior to a killing frost. Use higher rates for advanced weed growth stages, dense stands, or under adverse growing conditions, such as drought. SDSU studies have demonstrated excellent control that may last two or more years.

COMMON MULLEIN: 1.5-2.1 pt

Spring. Apply at the rosette stage. Full coverage and use of a surfactant is necessary for best results. Control has been very good in SDSU trials.

KNAPWEED SPECIES: 1.5-2.1 pt

Spring or Fall. Apply to diffuse or spotted knapweed that is actively growing in the rosette to bolting stage or in the fall. Apply to Russian knapweed in the spring and summer when plants are in the bud to flower growth stage.

OXEYE DAISY: 1.2-1.5 pt

Spring. Apply in the spring at the bud growth stage.

ST. JOHNSWORT: 1.5-2.1 pt

Spring or Fall. Apply in the spring at the bud growth stage or in the fall to regrowth.

SULPHUR CINQUEFOIL AND CHICORY: 1.2-1.5 pt (cinquefoil), 1.5-2.1 pt (chicory)

Spring. Apply to actively growing plants in the pre-bud growth stage.

CHAPARRAL OR OPENSIGHT (aminopyralid+metsulfuron)

1-3.3 oz Chaparral or Opensight (0.03-0.11 lb ae + 0.006-0.02 lb ai)

(\$5.65-18.65)

Recommended minimum carrier volume is at least 10 gpa for ground application or at least 2 gpa for aerial application. Greater carrier volumes may improve coverage and control. Add NIS (0.25-0.5% v/v), COC (1-2% v/v), or MSO (0.5% v/v). May also add UAN (2-4 qt/A) or AMS (2-4 lb/A).

Restrictions: If possible, do not hay until 14 days after application to allow the herbicide to become active in the weed. Do not apply more than 3.3 oz per acre per year for broadcast applications or 6.6 oz for spot treatments (less than ½ acre areas). See label for off farm distribution/sale of hay. There are no grazing restrictions, but allow animals to graze for 3 days on an untreated pasture before moving to areas with sensitive broadleaf crops as aminopyralid may be transferred in manure from livestock. Do not spread manure on areas used for broadleaf crops if animals have grazed treated areas or consumed aminopyralid treated forage or hay. A field bioassay is required before a broadleaf crop can be planted on areas that were treated the previous year with manure from animals that have grazed or eaten treated hay. Do not rotate to cropland for at least one year after application (may require at least 2 years for broadleaf crops). Not as safe around trees as Stinger. Do not apply around trees unless injury due to root uptake is acceptable. Do not apply over the top of trees and avoid leaf contact. Risk of tree injury is less for large trees. Sensitive trees include some conifers (pine, fir, spruce), legume trees such as locust, birch, lilacs, and possibly hackberry. Do not apply near young trees.

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL, & SCOTCH): 1-2.5 oz

Spring or Fall. Apply 1-2 oz in the spring or summer to plants in the rosette or bolting stages of growth or in the fall to seedlings or rosettes. Use 2-2.5 oz plus 0.5 lb ae 2,4-D when plants are in the late bolting through early flowering growth stages.

BLACK HENBANE: 2.5-3 oz

Spring. Apply to actively growing plants in the rosette growth stage.

BURDOCK: 2-2.5 oz

Spring or Fall: Apply while burdock is in the rosette stage and actively growing. Chaparral will not volatilize, but there is risk of tree root uptake if tree roots are exposed or excessive rates used.

COMMON MULLEIN & HOUNDSTONGUE: 2-3.3 oz (common mullein), 2.5-3.3 oz (houndstongue)

Spring. Apply at the rosette stage. Full coverage and use of a surfactant is necessary for best results. Control has been very good in SDSU trials.

KNAPWEED SPECIES: 2.5-3.3 oz

Spring or Fall. Apply to diffuse or spotted knapweed that is actively growing in the rosette to bolting stage or in the fall. Apply to Russian knapweed in the spring or summer when plants are in the bud to flower growth stage or to dormant plants in the fall.

OXEYE DAISY: 2.5-3.3 oz

Spring. Apply in the spring at the bud growth stage.

ST. JOHNSWORT: 2.5-3 oz

Spring or Fall. Apply in the spring at the bud growth stage or in the fall to regrowth.

SULPHUR CINQUEFOIL AND CHICORY: 2-2.5 oz (cinquefoil), 1.5-2 oz (chicory)

Spring. Apply to actively growing plants in the pre-bud growth stage.

STINGER OR TRANSLINE (*clopyralid*)

0.25-1.33 pt Stinger or Transline 3L (0.09-0.5 lb ae)

(\$6.20-82.00)

Stinger is labeled for use in grass pasture, rangeland, CRP, fallow, fencerows, and other non-crop areas. Transline is labeled for non-crop areas, pasture, rangeland, and rights-of-way. Stinger or Transline have potential in sites where grass cannot be damaged or where trees limit use of herbicides with harmful soil residual, such as Tordon (picloram), Milestone (aminopyralid), or Perspective (aminocyclopyrachlor + chlorsulfuron). Minimum carrier is 2 gpa; use at least 10 gpa for most ground applications.

Restrictions: Do not contaminate irrigation ditches. No grazing or haying restrictions. Do not apply over the top of deciduous trees and avoid leaf contact. Risk of tree injury is less for large trees. Avoid spray contact on the bark of young trees. There are no grazing restrictions, but allow animals to graze for 7 days on an untreated pasture before moving to areas with sensitive broadleaf crops as clopyralid may be transferred in manure from livestock. Do not spread manure on areas used for broadleaf crops if animals have grazed treated areas or consumed clopyralid treated forage or hay.

BIENNIAL THISTLES (MUSK & BULL): 0.33-1 pt

Spring. Apply from rosette to early bolt stage. Results have been very good in SDSU tests. Use the high rate for late bolt stage.

BURDOCK: 0.5-0.66 pt

Spring or Fall. Apply while burdock is in the rosette stage and actively growing. Stinger will not volatilize, but there is risk of tree root uptake if tree roots are exposed or excessive rates used.

CANADA THISTLE AND PERENNIAL SOWTHISTLE: 0.66-1.33 pt

Spring. For Canada thistle. Perennial sow thistle suppression. Apply from rosette to bud stage when plants are actively growing. Use 1 to 1.33 pt/A to achieve maximum stand reduction. Data suggest 90 to 95% reduction can be expected.

KNAPWEED SPECIES: 0.5-1.3 pt

Spring. Apply from mid bolt to late bud stage. For spotted and diffuse knapweed, apply 0.5-0.67 pt/A. For Russian knapweed, apply 0.67-1.3 pt/A. Use the high rate for most situations.

OXEYE DAISY: 0.25-1.33 pt

Spring. Apply while plants are actively growing. Lower rate is intended if conditions are ideal for active plant growth.

CURTAIL (*clopyralid + 2,4-D*)

1-4 qt Curtail 2.38L (0.095-0.38 + 0.5-2 lb ae)

(\$15.30-61.15)

Curtail is a premix containing 0.38 lb clopyralid (Stinger) plus 2 lb 2,4-D amine per gallon. Curtail is labeled for use in non-crop areas, rangeland, grass pasture, and CRP grass and fence lines. Minimum carrier is 2 gpa; use at least 10 gpa for most ground applications.

Restrictions: Do not graze lactating dairy cattle in treated areas for 14 days after application. Remove meat animal 7 days before slaughter if grazing within 2 weeks after application. Do not harvest hay within 7 days after application. Note use restriction for clopyralid (Stinger) and 2,4-D.

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL, & SCOTCH): 1-2 qt

Spring: Apply at rosette to bud stage. Reduced rate of 1 qt/A is frequently used under favorable conditions.

CANADA THISTLE AND PERENNIAL SOWTHISTLE: 2 qt

Spring. For Canada thistle control and perennial sowthistle suppression. Apply before bud stage when plants are actively growing. Reduced rate of 1 qt/A is frequently used for seasonal suppression. The 2 qt/A rate has provided excellent control and 60 to 70% stand reduction.

KNAPWEED SPECIES: 2-4 qt

Spring. For spotted or diffuse knapweed, apply 2 qt/A. For Russian knapweed, apply 4 qt/A. Apply at rosette stage for spotted or diffuse knapweed.

DICAMBA PRODUCTS (*dicamba*)

1-4 pt dicamba 4L (0.5-2 lb ae)

(\$11.00-54.95)

Dicamba is a selective, translocated herbicide. It has foliar activity. Favorable growing conditions improve results. Dicamba products are registered for use in pasture, range, and non-crop areas. Dicamba is available in several brandname products. Banvel is an example of a dimethylamine salt and Clarity is a diglycolamine salt. Diglycolamine products have less temperature and humidity restrictions for application near sensitive crops. At high rates, bromegrass may be severely stunted; bluegrass and several other grasses are tolerant. Trees, legumes, and broadleaved plants are sensitive to drift and soil residues. Minimum carrier is 3 gpa for ground or 2 gpa for air.

Restrictions: Dicamba labeling for 1 to 2 pt/A restricts grazing lactating dairy for 21 days or haying for 51 days after application. If more than 1 qt/A, do not graze lactating dairy for 40 days or harvest hay for 70 days after application. Note other label restrictions for higher rates. Slaughter animals must be removed for 30 days after last application. Do not contaminate water.

BLACK HENBANE: 1 pt

Spring. Apply to actively growing plants in the rosette growth stage.

CANADA THISTLE AND PERENNIAL SOWTHISTLE: 1-4 pt

Spring or Fall. Make spring application at early bud stage. Apply in fall before a killing frost while leaves are still green. Apply 1-2 pt/A for suppression or 2-4 pt/A for greater control (50-70%).

FIELD BINDWEED: 1-4 pt

Spring or Fall. Make spring application at flowering or a fall application before a killing frost. Apply 1-2 pt for suppression or 2-4 pt for control.

DICAMBA + 2,4-D (*dicamba + 2,4-D*)

1-2 pt dicamba 4L + 1 lb ae 2,4-D (0.5-1 + 1 lb ae) (\$4.20-32.95)

1-6 pt Brush, Weedmaster, Range Star, Rifle-D 3.87L (0.125-0.75 + 0.36-2.15 lb ae)

0.66-3.25 pt Brush-Rhap, Latigo 4.2L (0.14-0.73 + 0.2-0.98 lb ae)

Dicamba plus 2,4-D is labeled for use in grass pasture, range, and non-crop areas. Grass is usually tolerant to these rates; some stunting may be noted, especially if applied at boot stage. Brush, Weedmaster, Range Star and Rifle-D contain 1 lb ae dicamba and 2.87 lb ae 2,4-D per gallon. Brush-Rhap and Latigo contain 1.8 lb ae dicamba and 2.4 lb ae 2,4-D per gallon. Check individual label for carrier volume.

Restrictions: Refer to product labels and individual dicamba and 2,4-D restrictions.

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL, & SCOTCH):

1 pt dicamba + 1 lb ae 2,4-D, 1.5-2 pt 3.87L, or 1-1.125 pt 4.2L

Spring or Fall: Apply at the rosette stage. Use dicamba 4L at 1 pt plus 2,4-D at 1 lb ae/A. Rates as low as 0.5 pt/A dicamba have been successful under ideal conditions. Use the high rate for large rosettes, dense stands, or dry conditions. Apply 1-1.125 pt 4.2L or 1.5-2 pt 3.87L for bull and plumeless thistle from rosette to bolting. For musk thistle, apply 1.125 pt 4.2L or 2 pt 3.87L.

CANADA THISTLE AND PERENNIAL SOWTHISTLE:

2 pt dicamba + 1 lb ae 2,4-D, 4-6 pt 3.87L, or 2-3.25 pt 4.2L

Spring. Intended as a multi-year program. Apply at bud stage. Amines cause less leaf burn and are preferred if growth is lush. Lower dicamba rates may not provide sufficient residual control into the fall, especially in wet seasons.

CHICORY:

1 pt dicamba + 1 lb ae 2,4-D ester or amine, 3 pt 3.87L, or 1.66 pt 4.2L

Spring. Apply to young and actively growing plants.

POISON HEMLOCK: 1 pt dicamba + 1 lb ae 2,4-D ester

Fall or Early Spring. Apply at fall rosette stage or to new growth in early spring.

OVERDRIVE (*diflufenzopyr + dicamba*)

4-8 oz Overdrive 70DF (0.05-0.10 + 0.125-0.25 lb ae) (\$11.90-23.75)

Overdrive contains dicamba. Follow drift and vapor movement restrictions as for other dicamba products. A maximum of 10 oz/A can be applied per season in non-cropland sites and a maximum of 8 ounces per acre in pasture, hay, and rangeland. Use 1 qt NIS per 100 gal or MSO at the rate of 1.5 to 2 pt/A. Do not use less than 3 gallons of spray volume per acre for ground. Minimum carrier is 2 gpa for air. Rainfast 4 hours after application. Overdrive may be tank-mixed with several labeled tank-mix partners to improve control.

Restrictions: Do not plant crops for 30 days after last application. Pasture or rangeland grass treated with Overdrive can be grazed or harvested for livestock feed immediately after application. Do not apply to newly seeded grasses or small grains.

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL): 4-8 oz

Spring or Fall. Use rate is 4 to 8 oz/A based on weed species and maturity. Best results if applied at rosette stage. Use higher rates if plants are beginning to bolt.

FIELD BINDWEED: 4-8 oz

Spring or Fall. Rate is 4 to 8 ounces per acre based on weed maturity.

KNAPWEED SPECIES: 6-8 oz

Spring or Fall. For diffuse and spotted knapweed only. Rate is 6 to 8 ounces per acre based on weed species and maturity.

TELAR (*chlorsulfuron*)

0.5-2.6 oz Telar 75XP (0.023-0.12 lb ai)

(\$11.75-61.15)

Registered for use on non-crop, right-of-way, pasture, range, and CRP. The maximum rate for pasture/range and CRP is 1.3 oz/A per year. Bluestem, buffalograss, green needlegrass, Indiangrass, and switchgrass may be tolerant to Telar rates up to 0.5 oz/A whereas several wheatgrass varieties, bluegrass, and smooth brome grass may be tolerant to rates up to 1 oz/A. Minimum carrier is 10 gpa. Add NIS at 0.25% v/v. May be mixed with 2,4-D, dicamba, or other labeled tank-mix partners for Canada thistle, biennial thistles, common mullein, houndstongue, and common tansy.

Restrictions: There are no grazing or hay harvest restrictions for rates less than 1.3 oz/A. Do not apply to water, such as lakes, streams, or areas where runoff flows into such areas.

BIENNIAL THISTLES (MUSK, BULL, & SCOTCH): 0.5-2.6 oz

Spring: Apply at rosette stage. Use 0.5 to 1 oz for musk thistle and 1 to 2.6 oz/A for bull and Scotch thistle.

CANADA THISTLE: 1-2.6 oz

Spring or Fall: Apply at bud to bloom or in fall at rosette stage. Spring application preferred.

COMMON MULLEIN & HOUNDSTONGUE: 1-2.6 oz

Spring. Apply at rosette stage. Full coverage is very important for best results.

COMMON TANSY: 1-2.6 oz

Spring, early summer. Apply to actively growing plants.

HOARY CRESS: 0.5-1 oz

Spring or Fall. Apply at bud to bloom stage in spring or in fall at rosette stage. The low rate (0.5 oz) has been very effective in SDSU trials.

KNAPWEED SPECIES: 1-2.6 oz

Spring or Fall: For Russian knapweed only. Apply at the bud to bloom growth stage in early summer or to rosettes in the fall.

POISON HEMLOCK: 1-2.6 oz

Spring. Apply in spring while plants are actively growing.

PUNCTUREVINE: 1-2.6 oz

Preemergence or Foliar applications. SDSU results have indicated greater control from PRE compared to POST applications. For PRE applications, apply in the late fall or very early spring before spring growth. Moisture is required to activate in soil. For POST applications, add NIS (0.25% v/v) or COC (1% v/v). May be used with other selective or bare ground herbicides.

TOADFLAX (DALMATIAN AND YELLOW): 1.5-2.6 oz

Late summer (flowering). Fall applications may provide more consistent control. For yellow toadflax, apply a minimum of 1.5 oz/A. For Dalmatian apply 2-2.6 oz/A. Telar (1.25 oz/A) is sometimes tank-mixed with Tordon (1 qt/A) as some yellow toadflax populations may be more sensitive to Telar than Tordon (or vice versa) or Telar may be more effective at earlier timings whereas Tordon may be more effective at later timings.

ESCORT (*metsulfuron*)

0.5-2 oz Escort 60XP (0.019-0.075 lb ai)

(\$4.45-17.70)

Escort is for western range, rights-of-way, and non-crop areas. Minimum of 10 gpa carrier is suggested. Add NIS at 0.25% v/v.

Restrictions: Do not apply to lakes, streams, or areas where runoff flows into such areas. If applying more than 1.67 oz/A, do not harvest grasses for hay or forage until at least 3 days after application. Tolerance of grass species varies; limit first time use to a small area to evaluate tolerance and check label for specific information. Bluegrass, bluestem, bromegrass, grama and timothy have shown good tolerance in SDSU studies.

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL, & SCOTCH): 0.5-2 oz

Spring: Apply 0.5-1 oz/A at rosette to bud growth stage to control bull, musk, or plumeless thistle or 1-2 oz/A for Scotch thistle. Control in SDSU tests has been very good with metsulfuron tank-mixed with 0.5 to 1 lb/A 2,4-D. Cold, dry conditions reduce activity. Legumes will be injured. May tank-mix 1-2 pt/A 2,4-D 3.8L.

BLACK HENBANE: 0.5-1 oz

Spring. Apply to actively growing plants in the rosette growth stage.

COMMON MULLEIN & HOUNDSTONGUE: 1-2 oz

Spring. Apply at rosette stage. Full coverage is very important. Escort at 0.5 to 1 oz/A has been effective in SDSU trials.

COMMON TANSY: 1-2 oz

Spring, early summer. Apply to actively growing plants. Good spot treatment option. Results have been very good. May be tank-mixed with 2,4-D or dicamba.

HOARY CRESS: 1-2 oz

Spring. For hoary cress control in grassland. Apply to actively growing weeds at rosette stage. Low rate (1 oz/A) has been very effective in SDSU trials.

OXEYE DAISY: 0.5-1 oz

Spring. Apply in spring while plants are actively growing or are in flower.

POISON HEMLOCK: 1-2 oz

Spring. Apply 1-2 oz/A in spring while plants are actively growing.

ST. JOHNSWORT: 1-2 oz

Spring or Fall: Apply at the bud to bloom stage; may also be applied to fall regrowth. Results from spot treatments have been excellent. May be tank-mixed with 2,4-D, dicamba, picloram, triclopyr, and clopyralid.

SULPHUR CINQUEFOIL & CHICORY: 1-2 oz (cinquefoil), 0.33-0.5 oz (chicory)

Spring. May be applied up to the flowering growth stage.

TOADFLAX (DALMATIAN): 2 oz

Late summer (flowering). Apply to actively growing plants. Good spot treatment option; spray to wet entire plant.

CIMARRON MAX (metsulfuron + dicamba + 2,4-D)

20-5 Acres/0.5 oz Part A + 2.5 gal Part B (0.01-0.038 + 0.12-0.5 + 0.38-1.5 lb ae)

Cimarron Max herbicide is a twin-pak combination. Part A contains metsulfuron (Escort). Part B contains 1 lb dicamba (Banvel) plus 2.87 lb ae 2,4-D amine per gallon. The use ratio is 0.5 oz Part A to 2.5 gal of Part B to treat 5 to 20 acres. The Rate II or 10 acre rate provides equivalent of 0.5 oz Ally 60DF + 0.5 pt Banvel 4L + 1.5 pt 2,4-D 3.8L per acre. Refer to following rate table for acres treated.

Cimarron Max Rate	Part A Rate (oz/A)	Part B Rate (pt/A)	Acres Treated with 0.5 oz Part A + 2.5 gal Part B
Rate I	0.25	1	20A
Rate II	0.5	2	10A
Rate III	1	4	5A

Add either a NIS (0.25-0.5% v/v) or COC (1-2% v/v). Use higher adjuvant rates during dry conditions. May be applied by ground or air.

Restrictions: No restrictions or waiting period between treatment and grazing for non-lactating animals. Remove meat animals 30 days prior to slaughter. Do not graze lactating dairy within 7 days of treatment. Do not harvest hay for 37 days after treatment. Do not apply more than the equivalent of 1.66 oz/A Cimarron Max Part A per year.

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL, & SCOTCH):

Use Rate I for musk and Scotch thistle and Rate II for plumeless and bull thistle. Rates are based on weed species and weeds less than 4 inches tall.

COMMON MULLEIN & HOUNDSTONGUE:

Common mullein may be controlled at the low rate (20 acres per pack) and houndstongue may be controlled at the high rate (5 acres per pack).

COMMON TANSY:

Common tansy may be controlled at the high rate (5 acres per pack).

CIMARRON PLUS OR CIMARRON X-TRA (metsulfuron + chlorsulfuron)

0.25-1.25 oz/A Cimarron Plus (0.0075-0.038 + 0.0023-0.012 lb ai) (\$4.45-22.15)

0.5-2 oz/A Cimarron X-tra (0.009-0.038 + 0.012-0.047 lb ai) (\$8.15-32.70)

For use in pastures, rangeland, or CRP or non-crop land adjacent to these areas. Cimarron Plus contains 48% metsulfuron + 15% chlorsulfuron whereas Cimarron X-tra contains 30% metsulfuron + 37.5% chlorsulfuron. Add either a NIS (0.25-0.5% v/v) or COC (1-2% v/v). Use higher adjuvant rates during dry conditions. Minimum carrier is 10 gpa for ground applications or 3 gpa for aerial applications.

Restrictions: No grazing or haying restrictions.

BIENNIAL THISTLES (MUSK, PLUMELESS, BULL, & SCOTCH):

Spring. Apply in the spring (preferred) prior to flowering or to fall rosettes. For Cimarron Plus, apply 0.25 oz/A for musk or Scotch thistle, 0.625 oz/A for plumeless thistle, or 1.25 oz/A for bull thistle. For Cimarron X-tra, apply 0.5 oz/A for bull, musk, or Scotch thistle or 1 oz/A for plumeless thistle. May tank mix growth regulator herbicides such as 2,4-D, dicamba, Tordon, or Remedy.

COMMON MULLEIN & HOUNDSTONGUE:

Spring. For Cimarron Plus, apply 0.375-0.625 oz/A for common mullein or 1.25 oz/A for houndstongue. For Cimarron X-tra, apply 0.5 oz/A for common mullein or 2 oz/A for houndstongue.

COMMON TANSY:

Spring, early summer. Common tansy may be controlled with Cimarron Plus at 1.25 oz/A, or with Cimarron X-tra at 2 oz/A.

STALKER (*imazapyr*)

1-2 pt Stalker 2EC (0.25-0.5 lb ai)

(\$48.35-96.65)

Stalker is an emulsifiable concentrate that can be mixed with water, diesel oil, recommended seed oils, and penetrating oils.

Restrictions: There are no grazing restrictions. Do not cut for hay for 7 days after application.

SALT CEDAR (TAMARIX SPECIES): 1-2 pt

Basal or Cut Stump: Mix 8 to 12 oz Stalker with one gallon water, diesel oil, or penetrating oil. May be applied as a spray to cut stump and frilling cuts, when mixed with water or penetrating oil. Basal treatments should be mixed with penetrating oil. Cut stubble treatments need to be applied within 2 weeks after mowing or cutting.

GARLON 4 OR GARLON 4 ULTRA (*triclopyr*)

1-8 qt Garlon 4L (1-8 lb ae)

(\$30.05-240.35)

For use in non-crop, roadsides and right-of-ways. Garlon is recommended for the control of unwanted woody plants and broadleaf weeds. Basal bark or cut stump treatments are most effective.

Restrictions: No grazing restrictions for non-lactating animals. Do not allow lactating dairy animals to graze treated areas until the next growing season. Do not harvest hay for 14 days. Do not exceed 8 qt/A per year. Do not apply in ditches or canals used to transport irrigation water. Do not apply where runoff water may flow onto agricultural land. May be applied to seasonally dry wetlands where surface water is not present.

SALT CEDAR (TAMARIX SPECIES):

Cut Stump: Apply undiluted solution throughout the year. Control may decline during periods of moisture stress. Cut stumps should be treated immediately (less than 1 hour) after cutting. The outer 2 inches of the stump should be sprayed. Coverage is essential for root kill.

Basal Bark: Use a sprayer with the nozzle adjusted to deliver a narrow, cone shaped spray. Apply the Garlon solution lightly but evenly on the plant stem or trunk up to 12 to 15 inches from the ground. Apply to all sides of every stem. Do not apply to the point where runoff causes pooling at the crown or root collar. Older plants with rougher bark may require stems to be treated higher (15 to 18 inches). Mix 1-5% solutions of Garlon Ultra in oil for basal bark treatments, 20-30% solutions for low volume stem bark band applications, or 50-75% solutions for thin line basal bark treatments.

REMEDY ULTRA (*triclopyr*)

1-2 pt Remedy Ultra 4L (0.5-1 lb ae)

(\$9.35-18.70)

Restrictions: Do not allow lactating dairy animals to graze treated areas until the season following application. Do not harvest hay for 14 days after application. Withdraw livestock from treated areas at least 3 days prior to slaughter.

SULPHUR CINQUEFOIL & CHICORY: 1-2 pt

Spring. Apply to young plants in the rosette stage.

FACET OR QUINSTAR (*quinclorac*)

22-32 oz Facet 1.5L (0.25-0.38 lb ai)

(\$21.00-30.55)

0.5-0.75 pt QuinStar 4L

Labeled for use in pasture, rangeland, rights-of-way, and CRP. Controls annual grass but does not cause permanent damage to most perennial grasses. Apply with ground or air equipment (note restrictions). Add 2 pt COC or 1-2 pt MSO; may also add 0.5 to 1 gal 28% N or 2.5 lb AMS per acre.

Restrictions: There are no grazing restrictions. Do not harvest hay or forage for 7 days. Follow crop rotation restrictions for fallow

application. Aerial applications not allowed in Bennett, Brookings, Brown, Clay, Codington, Day, Deuel, Grant, Lincoln, Minnehaha, Moody, Roberts, Todd, Turner, Union, or Yankton counties.

FIELD BINDWEED: 22-32 oz Facet or 0.5-0.75 pt QuinStar 4L

Fall. Primarily for field bindweed. Also suppresses leafy spurge and perennial thistle. Most effective if applied in fall to regrowth at least 4 inches long. Make follow-up applications the next year if necessary. Apply to active weed growth. Use higher rate for dense populations or large weeds.

GLYPHOSATE PRODUCTS

32 oz glyphosate 3 lb ae (0.75 lb ae)

(\$3.25-4.20)

Restrictions: Will kill or severely injure all green vegetation contacted by the herbicide. Avoid spray contact on bark of young trees.

BURDOCK:

Spring or Fall. Apply while burdock is in the rosette stage and actively growing.

Refer to the glyphosate formulation table below to determine product rate for other formulations.

GLYPHOSATE PRODUCTS – Equivalent Rates					
Formulation		Amount of Product for lb ae			
		0.38 ae	0.75 ae	1.5 ae	3 ae
3 lb ae (4 lb ai)	L	16 oz	32 oz	64 oz	128 oz
3.75 lb ae (5 lb ai)	L	13 oz	26 oz	51 oz	102 oz
4 lb ae (5.4 lb ai)	L	12 oz	24 oz	48 oz	96 oz
4.17 lb ae (-----)	L	12 oz	23 oz	46 oz	92 oz
4.5 lb ae (5.5 lb ai)	L	11 oz	21 oz	43 oz	85 oz

SHELTERBELTS

(Does not include fruit trees)

GLYPHOSATE PRODUCTS

2-4 qt glyphosate 3 lb ae (1.5-3 lb ae)

(\$6.50-16.70)

Glyphosate is formulated in different salts and different concentrations. Rates for formulations are listed according to acid equivalent content. Check specific product labeling. Roundup Pro or Touchdown Pro labeling includes tree plantings and non-crop sites. Other products limit use to trees and non-crop areas associated with agricultural sites. Product concentration also varies. Glyphosate is a nonselective, foliar, translocated herbicide. There is no soil residual activity.

Restrictions: Avoid spray or drift contact on green leaves, stems, or new bark. Note other label precautions.

Spring or fall. Apply when weeds are actively growing and at boot or bud to bloom stage. Fall application is more effective than spring. Canada thistle is reduced 75 to 85%; field bindweed 50 to 75%. Field bindweed control is more variable. Apply in 10 to 40 gpa carrier. Rates are 3 qt for Canada thistle, and 4 qt of 3L ae/A for field bindweed. Adjust rates for other formulations.

2,4-D AMINE

1-1.5 lb ae 2,4-D

(\$5.20-7.75)

Spring or fall. Selective, translocated herbicide for broadleaf weeds. This herbicide is useful to reduce stands of perennial weeds including field bindweed, Canada thistle, or leafy spurge. Labeling is for non-crop areas; tree uses are not listed. Apply when weeds are actively growing and at bud stage. Requires retreatment in fall. Apply 1 to 1.5 lb ae 2,4-D amine/A. Suggested carrier is 40 gpa. Use no more than 20 psi pressure to produce coarse droplets and reduce risk of drift. Spray when it's calm and expected high temperature is below 75o F.

Restrictions: Very small amounts of herbicide from vapor or droplet drift can seriously damage or kill deciduous trees. Some leaf burn may be noted. Conifers are somewhat less sensitive, especially when not actively growing. Avoid heavy application over tree root zone. Suggested use is limited to special situations where risk of exposure to trees can be assumed. Labelers will not be responsible for damage to trees.

PLATEAU (*imazapic*)

8-12 oz Plateau 2L (0.12-0.19 lb ai)

(\$9.65-14.45)

Preemergence and foliar applications. Labeled for use in approved brush and tree species. Not intended for use on nursery, orchard, ornamental plantings, new plantings, or seedling trees. Plateau controls mustard, smartweed, crabgrass, foxtail, pigweed, lambsquarters, leafy spurge, woodsorrel, foxtail barley, bedstraw, and several other grasses and broadleaved weeds.

Early post-emergence suggested for most weeds; however there is residual activity for preemergence effect. Always add (MSO) at 1.5 to 2 pt when using less than 30 gpa carrier. For carrier over 30 gpa, use MSO or COC at 1 gal/100 gal. UAN or AMS may also be added at 2 – 3 pt/A. NIS may be used in place of seed oil in some situations to reduce grass injury, but weed control may also decline. Apply Plateau as a directed spray below the foliage for best selectivity. Some chlorosis may be noted. Plateau may be mixed with Pendulum or other herbicides approved for use.

Restrictions: Suggest use on a limited basis to determine tolerance. Labeled species for directed application include green ash, boxelder, red cedar, cottonwood, hackberry, juniper, locust, sugar maple, oak, white pine, serviceberry, and walnut.

Several tree and shrub species listed on the label are known to have acceptable tolerance when applied under the canopy and/or to the foliage. Tolerance is based upon trees with a minimum of 2 inch DBH (diameter at breast height). Some species may exhibit tip chlorosis and minor necrosis. Foliar contact on some species may increase injury, defoliation, and terminal death.

STINGER OR TRANSLINE (*clopyralid*)**0.25-0.66 pt Stinger or Transline 3L (0.09-0.25 lb ae)****(\$6.20-40.70)**

Foliar applications. Labeled for over-the-top application on certain species of Christmas tree plantings, including Douglas, Fraser, grand, balsam and noble fir; blue spruce; and lodgepole, Ponderosa, and white pine. Useful to control emerged broadleaves such as Canada thistle, knapweeds, and some annuals. Very effective on Canada thistle. Use the high rate for perennials. Maximum for blue spruce is 0.5 pt/A. Reports indicate good tree tolerance. Do not apply to first-year transplants. Do not use additives.

AQUATIC

AQUATIC GLYPHOSATE PRODUCT (*glyphosate*)

4-6 pt aquatic glyphosate 4L (2-3 lb ae)

(\$15.70-23.50)

Aquatic glyphosate is available in several products that are approved for use on aquatic sites. Examples of products include Rodeo, AquaMaster, AquaNeat, Cinco, Glyphos Aquatic, and several others. Glyphosate is a non-selective, translocated, foliage-applied herbicide, both grasses and broadleaf plants are affected.

Aquatic glyphosate is approved for aquatic uses in lakes, streams, ponds, irrigation ditches, and reservoirs. Limit treatment to individual plants if possible. Rates for aquatic and non-crop site weeds are based on specific weeds species on the label. Use water carrier rate of 3-40 gpa. Use NIS (2 qt/100 gal) approved for aquatic use. Use a 1.5% solution (4 T/gal) for hand-held equipment.

Restrictions: Do not apply within ½ mile upstream of a potable water intake, in moving water, or within a half mile of a potable water intake in streams, ponds, or reservoirs. Allow a minimum of 7 days after treatment before reintroducing water if applying in dry ditches. There is no restriction on the use of treated water for irrigation, recreation, or domestic purposes.

EURASIAN COMMON REED (PHRAGMITES): 4-6 pt

Summer: For suppression only. Apply in late summer or fall when the plants are actively growing and in full bloom. Complete coverage is important. If old residue is inhibiting coverage, reapplication may be necessary. Visual control symptoms may be slow to develop. For hand-held sprayers, use 0.75% solution in water.

GIANT KNOTWEED:

Stem injection: Inject 5 ml of the glyphosate product into stems between the second and third internodes above the ground.

Cut stem: Cut stems just below the second or third node above the ground. Immediately apply 0.36 fl oz (10 ml) of a 50% solution of the glyphosate product and water into the "well" or the exposed internode. Do not apply more than 8 qt/A, which would be about 1,500 stems if using the 50% solution. Remove the cut giant knotweed stems so that they do not develop roots and grow.

PURPLE LOOSESTRIFE: 4 pt

Summer or fall. Apply to actively growing plants at full to late flower. Apply as a broadcast treatment at 4 pt/A or as a spot treatment using hand-held equipment with a 1% aquatic glyphosate solution (1 gal/100 gal or 3 tablespoons/gal) to thoroughly wet foliage. Late summer or fall treatments are best. Apply before killing frost. Rate is minimum required for 65 to 85% control. This plant is a perennial capable of producing new shoots from buds in the crown areas. Wild types also produce seed. Individual plants can be dug if all small crown pieces are removed. The plant is especially aggressive in wetlands.

2,4-D

1-2 lb ae 2,4-D

(\$5.20-10.95)

Certain products are labeled for aquatic sites, including areas around marshes, ponds, irrigation ditches, streams, and lakes. Some products are labeled for aerial application in aquatic sites. Check labels for correct labeling. See 2,4-D table in this guide for more information. Do not apply to more than 1/3 to 1/2 of a lake or pond in any one month because excessive decaying vegetation may deplete oxygen control in water and kill fish. Do not contaminate water used for irrigation or domestic purposes. Useful for controlling Canada thistle, perennial sow thistle, leafy spurge, or other broadleaf weeds.

HABITAT OR POLARIS (*imazapyr*)

1-6 pt Habitat or Polaris 2L (0.25-1.5 lb ai)

(\$17.00-101.90)

Habitat is an aqueous solution to be mixed with water and surfactant approved for aquatic use. Applications of 1 to 6 pt/A may only be made to control undesirable emergent and floating aquatic vegetation in or around standing and flowing water, including

estuarine and marine sites. Rates are based on aquatic weed species on the label. Applications may be made to private waters that are still, such as ponds, lakes, and drainage ditches where there is minimal or no outflow to public waters. Applications may be made to public waters such as ponds, lakes, reservoirs, marshes, drainage ditches, canals, streams, rivers, and other slow-moving or quiescent bodies of water.

Restrictions: Do not apply more than 6 pt/A per year. Aerial application is restricted to helicopter only. May be applied to surface water, but do not apply directly to water within ½ mile upstream of an active potable water intake in flowing water or within ½ mile of an active potable water intake in a standing body of water such as lakes, ponds, or reservoirs. Habitat can only be applied by federal or state government entities or applicators who are licensed or certified applicators making applications under a program sponsored by federal or state government entities. There are no restrictions on livestock consumption of water from a treated area. Polaris has no grazing restrictions; allow 7 days after application to cut for hay.

EURASIAN COMMON REED (PHRAGMITES): 4-6 pt

Summer: Apply to actively growing foliage after full leaf elongation. Full spray coverage is important. If old plant residue is inhibiting herbicide interception, consider removing this residue by mowing or burning and wait for approximately 5 foot tall regrowth before applying the herbicide. Apply with an adjuvant such as NIS (0.25% v/v), MSO (1.5-2 pt/A or 1% v/v), or silicone-based surfactant. Be sure to use adjuvants approved for aquatic use.

PURPLE LOOSESTRIFE: 1 pt

Apply to actively growing foliage of purple loosestrife in and around standing and flowing water, including estuarine and marine sites. Apply with an adjuvant such as NIS (0.25% v/v), MSO (1.5-2 pt/A or 1% v/v), or silicone-based surfactant. Be sure to use adjuvants approved for aquatic use.

SALT CEDAR (TAMARIX SPECIES): 2 qt

Foliar: For aerial application (helicopter only), apply 2 qt/A + 0.25% v/v NIS to actively growing foliage during flowering. For spot spraying use 1% solution + 0.25% v/v NIS and spray to wet foliage. Wait at least 2 years after application before disturbing treated saltcedar. Earlier disturbance can reduce overall control. Can also be applied as cut stump, cut stem, and frill or girdle treatments.

GARLON 3A (*triclopyr*)

6-8 qt Garlon 3A (2.25-3 lb ae)

Garlon 3A may be used within production forests and industrial non-crop sites to control target vegetation in and around standing water sites, such as marshes, wetlands, and banks of ponds and lakes and transition areas between upland and lowland sites. Rates are based on broadleaf and woody plant species on the label. Use enough water to give uniform and complete coverage for best results. NIS is recommended for all foliar applications. Minimum carrier is 50 gallons for ground.

Restrictions: Do not apply directly to un-impounded rivers or streams. Do not apply in ditches or canals used to transport irrigation water. Do not apply where runoff water may flow onto agricultural land. Minimize overspray to open water when making applications to banks or shorelines of moving water sites. There are no restrictions on use of water in treatment area for recreational purposes including swimming and fishing or for livestock consumption. The maximum rate is 3 gal/A per year for all terrestrial use sites other than range, pasture, forestry sites, and grazed areas. Refer to grazing and haying restriction section of this guide for restrictions.

PURPLE LOOSESTRIFE: 6-8 qt

Apply from bud to mid-flowering stage. Increased control requires another application the following year to regrowth.

2,4-D LABEL RESTRICTIONS and NONCROP LABELING							
PRODUCT: SD Registration or by Labeler	EPA Reg. #	2,4-D Acid Equiv.	Lbs. acid/ gal	Non-crop	Right-of- Way	Aerial Application	Aquatic
Winfield Solutions (1387)							
Shredder Amine 4	1381-103	39.3%	3.8	Y	Y	Y	Y
Shredder 2,4-D LV4	1381-102	44.0%	3.8	Y	Y	Y	N
Shredder 2,4-D LV6	1381-250	59.1%	5.6	Y	Y	Y	N
Rugged	1381-247	----	3.49	Y	Y	Y	Y
Shredder E-99	1381-195	60.1%	6.0	Y	Y	Y	N
Albaugh (42750)							
AgriStar 2,4-D Amine 4	42750-19	38.9%	3.8	Y	Y	Y	Y
AgriStar 2,4-D LV 4	42750-15	42.5%	3.8	Y	Y	Y	N
AgriStar 2,4-D LV 6	42750-20	57.4%	5.5	Y	Y	Y	N
AgriStar Solve 2,4-D	42750-22	40.9%	3.76	Y	Y	Y	N
AgriStar Five Star	42750-49	54.2%	5.0	N	N	Y	N
Helena Chemical Co. (5905)							
Barrage H.F. (ester)	5905-529	51.8%	4.7	Y	Y	Y	N
Opti-Amine/Weed Rhap A-4D	5905-501	38.8%	3.8	Y	Y	Y	Y
Hardball	5905-549	19.6%	1.7	Y	Y	Y	Y
Unison	5905-542	19.6%	1.7	N	Y	N	Y
NuFarm America's & NuFarm Turf and Specialty (71368)							
Weedar 64	71368-1	38.9%	3.8	Y	Y	Y	Y
Weedone 638	71368-3	30.8%	2.8	Y	Y	Y	N
Weedone LV4 EC	228-139-71368	44.6%	3.8	Y	Y	Y	N
Weedone LV4 Solventless	71368-14	41.5%	3.8	Y	Y	Y	N
Weedone LV6 EC	71368-11	57.9%	5.5	Y	Y	Y	N
WEEDestroy AM-40 Amine Salt	228-145	39.3%	3.8	Y	Y	Y	Y
Turret Solventless	228-95-71368	57.9%	5.5	Y	Y	N	N
PBI Gordon (2217)							
Hi-Dep Broadleaf Herbicide	2217-703	38.6%	3.8	Y	Y	Y	N
TenKoz (55467)							
Amine 4 2,4-D Herbicide	42750-19-55467	38.9%	3.8	Y	Y	Y	Y
Lo-Vol 4	42750-15-55467	42.5%	3.8	Y	Y	Y	N
Lo-Vol 6	42750-20-55467	57.5%	5.5	Y	Y	Y	N
Loveland Chemical (34704)							
Clean Amine 4 2,4-D	34704-120	38.6%	3.74	Y	Y	Y	Y
Low Vol 4 Ester	34704-124	43.4%	3.8	Y	N	Y	N
Low Vol 6 Ester	34704-125	58.9%	5.6	Y	Y	Y	N
Saber	34704-803	38.7%	3.8	Y	Y	Y	N
Salvo Low Volatile Weed Killer	34704-609	54.2%	5.0	Y	Y	N	N
Savage Dry Soluble	34704-606	78.9%	DS	Y	Y	Y	Y
Van Diest Supply (11773)							
Cornbelt 4# Amine	11773-2	38.4%	3.8	Y	Y	Y	Y
Cornbelt 4# LV Ester	11773-3	43.9%	3.8	Y	Y	Y	N
Cornbelt 6# LV Ester	11773-4	58.3%	5.6	Y	Y	Y	N
Cornbelt Salvan	11773-16	54.2%	5.0	N	N	Y	N
Wilbur-Ellis (2935)							
Base Camp Amine 4	71368-1-2935	38.9%	3.8	Y	Y	Y	Y
Base Camp LV 6	2935-553	57.4%	5.5	Y	Y	N	N
Broadrange 55	2217-813-2935	47.17%	5.03	Y	Y	Y	N

Summary Site and Use Restrictions					
	Grazing Restrictions	Haying Restrictions	Right-of-Way	Aquatic Use	Aerial Application
2,4-D ester/amine	Lactating dairy-7 dy Slaughter interval-3 dy	7 dy	Yes	Some ^{2/}	Some ^{2/}
Chaparral/Opensight <i>(aminopyralid+metsulfuron)</i>	None	None ^{7/}	Yes	No	Yes
Cimarron Max <i>(metsulfuron+dicamba+2,4-D)</i>	Lactating dairy-7 dy Slaughter interval-30 dy	Lactating dairy-37 dy	No	No	Yes
Cimarron Plus <i>(metsulfuron+chlorsulfuron)</i>	None	None	Yes	No	Yes
Cimarron X-tra <i>(metsulfuron+chlorsulfuron)</i>	None	None	Yes	No	Yes
Curtail <i>(clopyralid+2,4-D)</i>	Lactating dairy-14 dy Non-lactating dairy-none Slaughter interval-7 dy ^{3/}	7 dy	No	No	Yes
Dicamba products <i>(dicamba)</i>	Lactating dairy: 1 pt/A-7 dy 1-2 pt/A-21 dy 1-2 qt/A-40 dy Non-lactating dairy & beef – none Slaughter interval-30 dy	Lactating dairy: 1 pt/A-37 dy 1-2 pt/A-51 dy 1-2 qt/A-70 dy	Some ^{2/}	No	Some ^{2/}
Escort <i>(metsulfuron)</i>	<1.66 oz-None >1.66 oz-3 dy	<1.66 oz-None >1.66 oz-3 dy	Yes	No	Yes
Facet/Quinstar <i>(quinclorac)</i>	None	7 dy	Yes	No	Yes ^{8/}
ForeFront HL/GrazonNext HL <i>(aminopyralid+2,4-D)</i>	None	7 dy ^{7/}	Yes	No	Yes
Garlon 3A <i>(triclopyr)</i>	Slaughter interval-3 dy Do not graze lactating dairy until next growing season	Do not harvest-14 dy	Yes	Label restricted areas	Yes
Garlon 4L <i>(triclopyr)</i>	Slaughter interval-3 dy Do not graze lactating dairy until next growing season	Do not harvest-14 dy	Yes	No	Yes
Glyphosate Products	Spot treatment - 7 or 14 dy ^{6/} Broadcast treatment–Up to 8 weeks ^{5/}	Spot treatment-7 or 14 dy ^{6/} Broadcast treatment–Up to 8 weeks ^{5/}	Some ^{2/}	Some ^{2/}	Yes
Rodeo <i>(glyphosate)</i>	---	---	Yes	Yes	Yes
Roundup Pro/Touchdown Pro <i>(glyphosate)</i>	Do not graze	Do not harvest	Yes	No	Yes
Graslan L/Trooper P+D <i>(picloram+2,4-D amine)</i>	Lactating dairy-7 dy Other livestock-none Slaughter interval-3 dy	30 dy	Yes	No	Yes
Habitat <i>(imazapyr)</i>	Do not graze	Do not harvest	Yes	Yes	Helicopter Only
Milestone <i>(aminopyralid)</i>	None	None ^{7/}	Yes	No	Yes
Overdrive <i>(dicamba+diflufenzopyr)</i>	None	None	Yes	No	Yes
Plateau/Imazapic 2SL <i>(imazapic)</i>	None	7 dy	Yes	No	Yes

Summary Site and Use Restrictions					
	Grazing Restrictions	Haying Restrictions	Right-of-Way	Aquatic Use	Aerial Application
Polaris <i>(imazapyr)</i>	None	7 dy	Yes	Yes	Helicopter Only
Remedy Ultra <i>(triclopyr ester)</i>	Lactating dairy: next season Other livestock: none Slaughter interval-3 dy	14 dy	No	No	Yes
Stalker <i>(imazapyr)</i>	None	7 dy	No	No	Yes
Stinger <i>(clopyralid)</i>	None	None	^{9/}	No	No
Transline <i>(clopyralid)</i>	None	None	Yes	No	Yes
Telar <i>(chlorsulfuron)</i>	<1.3 oz-None	<1.3 oz-None	Yes	No	Yes
Tordon/Triumph/ Trooper <i>(picloram)</i>	Lactating dairy-14 dy Non-lactating dairy & beef –none ^{1/} Slaughter interval-3 dy	1 qt/A or more – 14 dy	Yes	No	Yes

^{1/} Remove livestock to untreated grass pasture for 7 days before transferring livestock to broadleaf or broadleaf-mixed pasture areas. Otherwise, urine may contain enough product to cause injury to sensitive broadleaf plants.

^{2/} Refer to specific label.

^{3/} Winthdrawal not needed if 2 weeks or more time elapsed since application.

^{4/} Maximum rate 20 lb if >20 in rainfall or 10 lb/A if <20 in rainfall.

^{5/} Depending on application rate, see individual label for specific rate limits.

^{6/} Do not treat more than 1/10 of any given acre at one time with spot or wiper applications. Remove livestock before application.

^{7/} See supplemental label for off farm distribution/sale of hay.

^{8/} See label for restricted county list.

^{9/} Fence rows, around farm buildings, and equipment pathways.

Spot Treatment for Noxious Weeds (Spray to Wet)						
	Leafy Spurge	Canada & P. Sow Thistle	Field Bindweed	R. Knapweed Hoary Cress	Biennial Thistle	Wormwood Sage
Amount for 1 gallon...						
Tordon 22K 2L	2.5 T	2.5 T	2.5 T	2.5 T	1 t	2 t
Dicamba Product 4L	---	2.5 T	2.5 T	---	3 t	4 t
Glyphosate Product 3L	---	4 T	4 T	5 T	---	3 T
Stinger/Transline 3L	---	2 t	---	2 t	2 t	2.5 T
2,4-D 4L	4 T	3 T	3 T	4 T	3 T	3 T
Milestone	---	0.8 t	---	0.8 t	0.66 t	0.8 t
ForeFront HL/GrazonNext	---	1.4 T	---	1.4 T	1 T	1.4 T
Tordon+2,4-D	3+4 t	2+4 t	2+4 t	3+4 t	1+4 t	1+4 t
Dicamba+2,4-D	---	4+4 t	4+4 t	---	2+4 t	2+4 t
Curtail 2.38L	---	2.5 T	---	2.5 T	2 T	2 t
Plateau 2L	1.5 t	---	---	---	---	---
Amount for 10 gallons...						
Tordon 22K 2L	1.6 C	1.6 C	1.6 C	1.6 C	0.2 C	0.4 C
Dicamba Product 4L	---	1.6 C	1.6 C	---	0.6 C	0.8 C
Glyphosate Product 3L	---	2.5 C	2.5 C	3 C	---	1.9 C
Stinger/Transline 3L	---	0.4 C	---	0.4 C	0.4 C	1.6 C
2,4-D 4L	2.5 C	1.9 C	1.9 C	2.5 C	1.9 C	1.9 C
Milestone	---	2.8 T	---	2.8 T	2 T	2.8 T
ForeFront HL/GrazonNext	---	0.8 C	---	0.8 C	0.7 C	0.8 C
Tordon+2,4-D	0.6+0.8 C	0.4+0.8 C	0.4+0.8 C	0.6+0.8 C	0.2+0.8 C	0.2+0.8 C
Dicamba Product 4L+2,4-D	---	0.8+0.8 C	0.8+0.8 C	---	0.4+0.8 C	0.4+0.8 C
Curtail 2.38L	---	1.6 C	---	1.6 C	1.2 C	0.4 C
Plateau 2L	0.3 C	---	---	---	---	---

Select product based on labeling for the site or crop.

t = teaspoon
 T = Tablespoon
 C = Cup

1 tablespoon = 15 ml
 1 fl oz = 2 Tablespoons
 1 fl oz = 6 teaspoons
 8 fl oz = 1 cup
 1 fl oz = 30 ml

CHEMICAL, PHYSICAL and SAFETY CHARACTERISTICS of HERBICIDES

Properties of the most commonly used herbicides to control noxious weeds are listed in the table below. Formulation and other local conditions will affect values for most properties. Solubility is affected by formulation, temperature and soil pH.

Half-life refers to the days required for the herbicide level in the soil to be reduced to half the original amount applied. Rainfall, temperature, and soil pH are important factors affecting half-life.

Toxicity for oral ingestion and dermal exposure are expressed as the quantity required for a lethal dose for 50% of a population. The LD50 value may be multiplied by .003 to determine ounces of active ingredient that would be lethal for half a population of 180 lb subjects.

Leaching (LE) rating refers to risk of herbicide movement through the soil profile into groundwater. Chemical properties of the herbicide, soil properties and rainfall are important factors affecting leaching potential. Herbicide movement in runoff solution (SL) is a rating for risk of movement in surface water. Rainfall amount and intensity, soil properties, surface characteristics, and herbicide rate are important variables affecting runoff solution.

Special safety equipment is based on label statements. All herbicides should be handled according to label safety guidelines using equipment and precautions that minimize risk of exposure.

Herbicide	Solubility (ppm)	Half Life (days)	Surface and Groundwater Risk		LD ₅₀ (mg/kg)	
			Leaching (LE)	Runoff Sol. (SL)	Oral	Dermal
Tordon 22K (picloram)	200,000	90	High	High	8200	>2000
Milestone (aminopyralid)	2,480	35	Low	Low	>5000	>5000
2,4-D ester	8	7	Low	Low	375	800
2,4-D amine	796,000	10	Low	Low	375	800
Banvel (dicamba)	400,000	14	Low to Medium	Low	1707	>2000
Stinger (clopyralid)	300,000	30	Moderate Potential	Low	>5000	>2000
Roundup (glyphosate)	400,000	47	Low	Low	4300	>940
Habitat (imazapyr)	11,000	90	Low	Low	>5000	>2148
Garlon (triclopyr ester)	23	46	Medium	Medium	630	2140
Escort/Ally (metsulfuron)	9500	120	Moderate@high pH	Medium	>5000	>2000
Telar (chlorsulfuron)	7000	160	Moderate@high pH	Medium	5545	>3400
Plateau (imazapic)	2232	120	Low	Low	>5000	>5000

Data base: National Water Quality Technology Staff and other references.

BIOCONTROL of NOXIOUS WEEDS in SOUTH DAKOTA

Biocontrol offers another IPM tool for noxious weed control. The basic idea behind biocontrol is utilizing the weed's natural enemies as a means of weakening or killing the host plant. The natural enemies may include several options; however insects have been the more common choice. Insects used as biological agents for noxious weeds include: 1) seed attackers; 2) gall formers; 3) defoliators; 4) sapsuckers; 5) stem miners; 6) crown and root borers; and 7) root feeders.

Biocontrol of noxious weeds may not be the best choice in all situations. If the noxious weed infestation can be controlled by a more efficient means, such as chemical control, then that should be the option of choice. Biocontrol can work well when combined with other control tactics for an integrated approach to controlling a noxious weed. There are potential economic benefits as well as advantages where environmental situations or site restrictions limit or preclude other control options.

Biocontrol usually requires at least 3 to 5 years investment for significant results. It is important to realize that a biological control program will not eradicate noxious weeds. A residual level of the weed population is to be expected even under the best conditions.

Survival of the biocontrol agent is dependent on the density of the host noxious weeds. This is a natural cycle and should be expected so a resurgence of the weed population may occur from 1) seed bank in the soil; 2) missed plants; or 3) lagging populations of the biocontrol agent.

South Dakota continues to consider the use of new biological control agents on noxious weeds. Prior to the initial release by USDA-APHIS biocontrol agents go through a rigorous testing program to ensure they are host specific for the weed targeted. USDA-APHIS and the South Dakota Department of Agriculture are involved with the initial introductions and monitoring of the releases. These release sites are monitored for a period of time to determine that the agents will establish in the state, and will provide acceptable control of the target weed. Then the oversight responsibility for future collection and redistribution is typically passed on to the affected agencies. These may include county weed and pest boards, or state and federal land managing agencies.

Approved biological control agents are available through several reputable insectory businesses located in neighboring states. Prices and availability for specific biocontrol agents may vary from year to year. Many of the biological control agents released in South Dakota may be available for collection and redistribution at no cost. Please contact your county weed and pest control board for more information.

Common noxious weed biocontrol options in South Dakota:

Leafy spurge: Several insects were evaluated as a potential biocontrol agent in South Dakota. Of these, the leafy spurge flea beetle became the agent of choice over time. Of the flea beetle group, the black leaf beetles (*Aphthona lacertosa* and *Aphthona czwalinae*) and the brown flea beetle (*Aphthona nigricutis*) have shown the best results. This insect is quite adaptable to much of the state's diverse climate and environmental conditions. Flea beetles are sun-loving insects that prefer day sites; however *A. lacertosa* can tolerate cooler, shadier, and wetter sites.

Another approved bioagent for leafy spurge that shows limited success is a stem boring larvae (*Oberea erythrocephala*). This insect feeds on the leafy spurge leaves, bracts, and girdles the stems.

Currently, the South Dakota Department of Agriculture coordinates the redistribution program for the leafy spurge flea beetles. The county weed and pest boards is the local contact point for landowners or land managers considering the use of flea beetles in the leafy spurge management program. South Dakota

landowners can collect the flea beetles, free of charge, at state supervised collection days in mid to late June. Many county weed and pest programs also have their own organized flea beetle collections as well.

Musk thistle: The musk thistle seed head weevil (*Rhinocyllus conicus*) was the first major biocontrol program for noxious weeds in South Dakota. Introductions were made in the late 1970's to early 1980's. Currently this seed weevil can be found throughout the state in musk thistle infestations as well as the native thistle. Further releases are not recommended. A rosette weevil (*Trichosirocalus horridus*) has been released in some counties of the state and has shown some success.

Canada thistle: Two insect biocontrol agents currently being used in the state include a stem mining weevil (*Hadroplatus litura*) and a thistle stem gall fly (*Urophora cardui*). Damage from the developing stem mining weevil larvae to the plant comes from the mining of the thistle stem as the shoot elongates. The thistle stem gall fly adult lays eggs and when they hatch the developing larvae stimulate the plant to form a hard woody stem gall. The gall directs the nutrients away from the plant's metabolic and reproductive functions thus affecting seed production.

Purple loosestrife: A leaf feeding beetle (*Galerucella californiensis* and *Galerucella pusilla*) has been introduced in wetland sites invaded by this noxious weed. The *Galerucella* species has been used in South Dakota and Nebraska in a special project coordinated by these two states. An insectory was developed to rear this biocontrol agent for use in this special project and has yielded thousands of insects that have led to the decline of purple loosestrife in the release areas. A root boring insect, *Hylobius transversovittatus*, has also been released. Larvae feed on the root hairs and mine into roots and crown affecting the plant's ability to move nutrients and water throughout the plant.

Spotted knapweed: The primary bioagent released for the control of spotted knapweed is the knapweed flower head weevil (*Larinus minutus*). A root boring weevil (*Cyphocleonus achates*) has also been released and an insectory is being set up by the South Dakota Department of Agriculture to rear this insect for distribution through a special weed management project involving South Dakota and Nebraska.

Dalmatian toadflax: A stem boring weevil (*Mecinus janthinus*) has been a successful option for controlling Dalmatian toadflax. Adult weevils feed externally on the foliage and the larvae feed on the plants vascular tissue reducing or eliminating flower and seed production.

LEAFY SPURGE BIOAGENTS



Fig. 1 *Aphthona nigriscutis* adult (brown flea beetle)



Fig. 2 *Aphthona lacertosa* (black flea beetle)



Fig. 3 *Aphthona lacertosa* beetles on leafy spurge



Fig. 4 SD flea beetle collection/beetle trap



Fig. 5 *Oberea erythrocephala* on leafy spurge

CANADATHISTLE BIOAGENTS



Fig. 6 *Hadroplatus litura* (Canada thistle stem mining weevil)



Fig. 7 *Hadroplatus litura* larvae and damage to Canada thistle stems



Fig. 8 *Urophora cardui* (Canada thistle gall fly and gall on Canada thistle stem)



MUSKTHISTLE BIOAGENTS



Fig. 9 *Rhinocyllus Conicus* adult (musk thistle seed weevil)



Fig. 10 Left: Normal musk thistle seed head. Right: infested seed head.

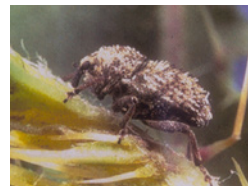


Fig. 11 *Trichosivocalus horridus* adult (musk thistle Rosette weevil)

DALMATIAN TOADFLAX BIOAGENTS

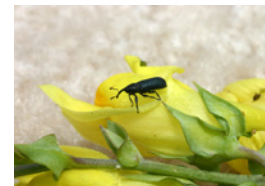
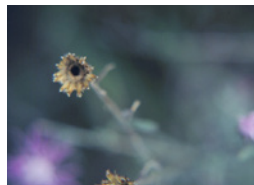


Fig. 12 Stem boring weevil (*Mecinus Janthinus*) on Dalmatian toadflax

SPOTTED KNAPWEED BIOAGENTS



Fig. 13 *Larinus minutus* adult (flower-head weevil) and emergence hole in a knapweed seed head.



PURPLE LOSESTRIFE BIOAGENTS



Fig. 14 *Galerucella* sp. defoliating beetle and rearing buckets and tents



Photo credits: USDA/ARS (Figs. 1, 2, 5, 6, and 7), Eric Coombs (Fig. 13).