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WEED CONTROL FOR SMALL GRAINS, PASTURES, AND FORAGES

Good weed control is necessary for maximum production of high-quality small grains, pastures, and forages in Illinois. When properly established, these crops usually can compete effectively with weeds, so the need for herbicide applications is minimized. However, weeds can sometimes become significant problems and warrant control. For example, wild garlic is considered the worst weed problem in wheat in southern Illinois. Because its life cycle is similar to that of winter wheat, wild garlic can establish itself with the wheat, grow to maturity, and produce large quantities of aerial bulblets by wheat harvesttime. Economics often makes it necessary to control wild garlic in winter wheat to minimize dockage.

In pastures, woody and herbaceous perennials can become troublesome. Annual grasses and broadleaf weeds such as chickweed and henbit may cause problems in hay crops. By proper management, many of these weed problems can be controlled effectively.

Several herbicide labels carry the following groundwater warnings under either the environmental hazard or the groundwater advisory section: "X is a chemical that can travel (seep or leach) through soil and enter groundwater that may be used as drinking water. X has been found in groundwater as a result of its use as a herbicide. Users of this product are advised not to apply X where the soils are very permeable (that is, well-drained soils such as loamy sands) and the water table is close to the surface." Table 1 lists herbicides that carry this warning. A few labels also warn against contamination of surface water.

SMALL GRAINS

Good weed control is critical for maximum production of high-quality small grains. Often, problems

with weeds may be dealt with before the crop is established. For example, some broadleaf weeds can be controlled effectively in the late fall with **2,4-D** or dicamba (**Banvel** or **Clarity**), or with glyphosate (**Roundup Ultra**) after corn or soybean harvest, if seeding is not too late.

Tillage helps control weeds. Although generally limited to preplant or postharvest operations, tillage can destroy many annual weeds and help suppress certain perennials. Good cultural practices such as proper seeding rate, optimal soil fertility, and timely planting help to ensure the establishment of an excellent stand and a crop that is better able to compete with weeds.

Winter annual grasses such as downy brome and cheat are very competitive in winter wheat. Illinois wheat producers are often limited to preplant tillage operations for control of these species, as few herbicides have label clearances for annual grass control in winter wheat. If there is a severe infestation of downy brome or cheat, planting an alternative crop or spring crop may be best for that field.

A decision to use postemergence herbicides for broadleaf weed control in small grains should be based on several considerations:

1. *Nature of the weed problem.* Identify the species present and consider the severity of the infestation. Also note the size of the weeds. Weeds are usually best controlled while small.
2. *Stage of the crop.* Most herbicides are applied after full-tiller until the boot stage. Do not apply herbicides from the boot stage to the hard-dough stage of small grains (see Figure 1 for a description of growth stages of small grains).

The information in this chapter is provided for educational purposes only. Product trade names have been used for clarity, but reference to trade names does not imply endorsement by the University of Illinois; discrimination is not intended against any product. The reader is urged to exercise caution in making purchases or evaluating product information.

Label registrations can change at any time. Thus the recommendations in this chapter may become invalid. The user must read carefully the entire, most recent label and follow all directions and restrictions. Purchase only enough pesticide for the current growing season.

Table 1. Herbicides, formulations, and special statements

Trade name	Common name	Formulation	Restricted use	Groundwater advisory	Key word
2,4-D amine	2,4-D	3.8 lb a.e./gal ^a	—	—	Danger ^b
2,4-D ester	2,4-D	3.8 lb a.e./gal ^a	—	—	Caution
Ally 60DF	metsulfuron	60%	—	—	Caution
Balan 60DF	benefin	60%	—	—	Warning
Banvel	dicamba	4 lb a.e./gal ^a	—	—	Warning
Buctril	bromoxynil	2 lb/gal	—	—	Warning
Butyrac 200	2,4-DB	2 lb a.e./gal ^a	—	Yes	Danger ^b
Clarity	dicamba	4 lb/gal	—	Yes	Caution
Crossbow	2,4-D + triclopyr	2 + 1 lb a.e./gal ^a	—	Yes	Caution
Eptam 7E, 10G	EPTC	7 lb/gal, 10%	—	—	Caution
Fusilade DX	fluazifop	2 lb a.e./gal ^a	—	—	Caution
Gramoxone Extra	paraquat	2.5 lb/gal	Yes	—	Danger ^b
Harmony Extra 75DF	thifensulfuron + tribenuron	75%	—	—	Caution
MCPA	MCPA	several	—	—	Warning
Peak 57WG	prosulfuron	57%	—	—	Caution
Poast Plus	sethoxydim	1 lb/gal	—	—	Caution
Prowl	pendimethalin	3.3 lb/gal	—	—	Caution
Pursuit 2AS, 70DG	imazethapyr	2 lb/gal, 70%	—	—	Caution, Warning
Roundup Ultra	glyphosate	3 lb a.e./gal ^a	—	—	Caution
Sencor 75DF	metribuzin	75%	—	Yes	Caution
Sinbar 80W	terbacil	80%	—	—	Caution
Spike 20P	tebuthiuron	20%	—	Yes	Caution
Stinger	clopyralid	3 lb a.e./gal ^a	—	Yes	Caution
Select	clethodim	2 lb/gal	—	—	Warning
Treflan	trifluralin	4 lb/gal, 5 lb/gal, 10G	—	—	Warning
Velpar L	hexazinone	2 lb/gal	—	—	Danger ^b
Weedmaster	dicamba + 2,4-D	1 + 2.87 lb/gal	—	—	Danger ^b

^aa.e. = acid equivalent for these herbicides. All others are active ingredient (a.i.) formulations.

^b**Danger:** Check label for safety equipment and precautions.

- Herbicide activity.* Determine crop tolerance and weed susceptibility to herbicides by referring to Tables 2 and 3. The lower rates in Table 3 are for more easily controlled weeds and the higher rates for the more difficult-to-control species. Tank mixes may broaden the weed spectrum and thereby improve control; check the herbicide label for registered combinations.
- Presence of a legume underseeding.* Usually 2,4-D ester formulations and certain other herbicides listed in Table 3 should not be applied because they may damage the legume underseeding.

- Economic justification.* Consider the treatment cost in terms of potential benefits, such as the value of increased yield, improved quality of grain, and ease of harvesting the crop.

Table 3 outlines current suggestions for weed-control options in wheat and oats, the two small grains most commonly grown in Illinois. Please refer to Table 4 for grazing-restriction information concerning herbicides used in small grains. Always consult the herbicide label for specific information about the use of a given product.

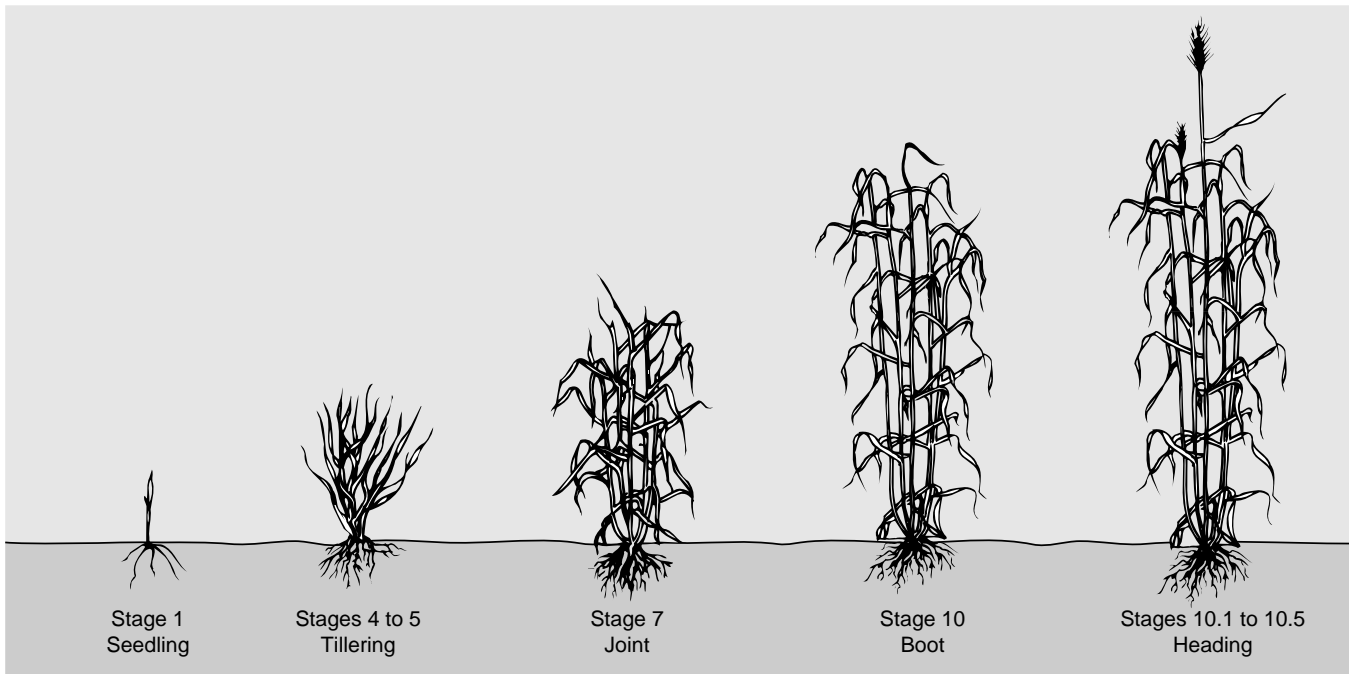


Figure 1. Growth stages of small grains.

SEEDLING

Stage 1. The coleoptile, a protective sheath that surrounds the shoot, emerges. The first leaf emerges through the coleoptile, and other leaves follow in succession from within the sheath of the previously emerging leaf.

TILLERING

Stages 2 to 3. Tillers (shoots) emerge on opposite sides of the plant from buds in the axils of the first and second leaves. The next tillers may arise from the first shoot at a point above the first and second tillers or from the tillers themselves. This process is repeated until a plant has several shoots.

Stages 4 to 5. The leaf sheaths lengthen, giving the appearance of a stem. The true stems in both the main shoot and the tillers are short and concealed within the leaf sheaths.

JOINTING

Stage 6. The stems and leaf sheaths begin to elongate rapidly, and the first node (joint) of the stem is visible at the base of the shoot.

Stage 7. The second node (joint) of the stem is visible. The next-to-last leaf is emerging from within the sheath of the previous leaf but is barely visible.

Stage 8. The last leaf, the "flag leaf," is visible but still rolled.

Stage 9. Preboot stage. The ligule of the flag leaf is visible. The head begins to enlarge within the sheath.

Stage 10. Boot stage. The sheath of the flag leaf is completely emerged and distended due to the enlarging but not yet visible head.

HEADING

Stages 10.1 to 10.5. Heads of the main stem usually emerge first, followed in turn by heads of the tillers in order of their development. Heading continues until all heads are out of their sheaths. The uppermost internode continues to lengthen until the head is raised several inches above the uppermost leaf sheath.

FLOWERING

Stages 10.5.1 to 10.5.3. Flowering progresses in order of head emergence. Unpollinated flowers result in no kernels.

Stage 10.5.4. Premilk stage. Flowering is complete. The inner fluid is abundant and clear in the developing kernels of the flowers pollinated first.

RIPENING

Stage 11.1. Milk stage. Kernel fluid is milky white from the accumulating starch.

Stage 11.2. Dough stage. Kernel contents are soft and dry (doughy) as starch accumulation continues. The plant leaves and stems are yellow.

Stage 11.3. The kernel is hard, difficult to divide with the thumbnail.

Stage 11.4. The kernel is ripe for cutting and fragments when crushed. The plant is dry and brittle.

Table 2. Effectiveness of herbicides on weeds in small grains

This table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rate and weed size or growth stage. Performance may vary due to weather and soil conditions or other variables.

Weed	Susceptibility to herbicide						
	2,4-D	Banvel or Clarity	Buctril	Harmony Extra	MCPA	Peak	Stinger
Winter annual							
Buckwheat, wild	5	9	9	8	6	8	8
Chickweed, common	5	7	6	9	5	8	0
Henbit	5	8	8	9	5	7	0
Horseweed (marestail)	8	8	7	8	7	7	8
Lettuce, prickly	9	8	7	8	8	8	8
Mustard spp., annual	9	7	8	9	8	9	0
Pennycress, field	9	7	8	9	8	9	0
Shepherd's purse	9	8	9	9	8	8	0
Summer annual							
Lambsquarters, common	9	9	9	9	9	7	0
Pigweed spp.	9	9	7	9	8	7	0
Ragweed, common	9	9	9	8	9	8	8
Ragweed, giant	9	9	8	5	9	7	9
Smartweed, Pennsylvania	7	9	8	9	7	7	7
Perennial							
Dandelion	9	8	0	6	8	5	9
Garlic, wild							
Aerial bulblets	6*	5	0	9	5	9	0
Underground bulbs	0	0	0	5	0	5	0
Thistle, Canada	7	8	6	7	6	7	9

9 = 90 to 100%, 8 = 80 to 89%, 7 = 70 to 79%, 6 = 60 to 69%, 5 = 50 to 59%, 0 = less than 50% control or not labeled.
*2,4-D ester at maximum use rate.

For annual broadleaf weeds, postemergence herbicides such as **2,4-D**, **Banvel** or **Clarity**, **Buctril** (bromoxynil), and **MCPA** can provide good control of susceptible species (Table 2). Herbicides must be applied during certain growth stages of the crop to avoid crop injury and for optimal weed control. Refer to Figure 1 for a description of the growth stages of small grains.

Some perennial broadleaf weeds may not be controlled satisfactorily with the low herbicide rates used in small grains, and higher rates are not advisable because they can cause serious injury to crops. To control perennial weeds, translocated herbicides such as **2,4-D**, **Banvel**, **Clarity**, or **Roundup Ultra**, in combination with tillage after small-grain harvest or after soybean harvest but before establishing small grains, may be the best approach.

Stinger (clopyralid) may be used to control broadleaf weeds in wheat, oats, and barley. Stinger controls

Canada thistle, as well as a number of annual broadleaf weeds (Table 2).

Wild garlic continues to be a serious weed problem in winter wheat. **Harmony Extra** (thifensulfuron + tribenuron), applied in the spring at 0.3 to 0.6 ounce of 75DF per acre, effectively controls wild garlic aerial bulblets and some underground bulbs as well. Harmony Extra also helps control chickweed, henbit, common lambsquarters, smartweed, and several species of mustard. See Tables 2 and 3 for more information on controlling weeds in small grains.

Roundup Ultra may be used as a preharvest treatment in wheat for control of annual and certain perennial weed species. Applications should be made only after the hard-dough stage of the grain (30 percent or less grain moisture) and at least 7 days before harvest. Roundup Ultra may be applied at a maximum rate of 1 quart per acre using ground or aerial application.

Table 3. Weed control in small grains

Herbicide	Broadcast rate/acre	Remarks (See Table 4 for grazing restrictions.)
Oats and wheat with legume underseeding		
2,4-D amine (3.8 lb a.e.)	½ to 1½ pt	Winter wheat more tolerant than oats. Apply in spring after full tiller but before joint stage. Do not treat in the fall. Use lower rate if underseeded with legume. Some legume damage may occur. May be used as preharvest treatment at 1 to 2 pt per acre during hard-dough stage.
Buctril 2E	1 to 1.5 pt	Apply Buctril alone to fall-seeded small grains in the fall or spring before the boot stage. Weeds are best controlled before the 3- to 4-leaf stage. Buctril 2E may be applied at 1 to 1½ pt per acre to small grains underseeded with alfalfa.
MCPA amine	¼ to 1.5 pt	Less likely than 2,4-D to damage oats and legume underseeding. Apply from 4-leaf stage to joint stage. Rate varies with crop and weed size and presence of legume underseeding.
Oats and wheat without legume underseeding		
Banvel or Clarity, 4 lb a.e.	4 fl oz	<i>Do not use with legume underseeding.</i> In fall-seeded wheat, apply before jointing stage. In spring-seeded oats, apply before oats exceed 5-leaf stage. Clarity may be used as a preharvest treatment when wheat is in the hard-dough stage and the green color is gone from the nodes of the stem. It is not recommended that wheat being grown for seed be treated with Clarity because a reduction in germination or vigor may occur.
Harmony Extra 75DF	0.3 to 0.6 oz	<i>Do not use with legume underseeding.</i> Make applications to wheat after the crop is in the 2-leaf stage, but before the flag leaf is visible. For spring oats, make applications after the crop is in the 3-leaf stage but before jointing. The use rate for spring oats is 0.3 to 0.4 oz per acre. Wild garlic should be less than 12 in. tall, with 2 to 4 in. of new growth. Annual broadleaf weeds should be past the cotyledon stage, actively growing, and less than 4 in. tall or across. Nonionic surfactant at 0.25% volume per volume (v/v) should be included in the spray mixture. When liquid fertilizer is used as the carrier, use ¼% to ½% v/v surfactant. <i>Temporary stunting and yellowing may occur when Harmony Extra is applied using liquid fertilizer solution as the carrier.</i> These symptoms are intensified with the addition of surfactant. Without surfactant addition, wild garlic control may be erratic. Do not plant any crop other than wheat or oats within 60 days after application.
Peak 57WG	0.38 to 0.5 oz	<i>Do not use with legume underseeding.</i> Apply Peak to actively growing small-grain crops from the 3-leaf stage to before the second node is detectable in stem elongation. Applications made to small grains before the 3-leaf stage increase likelihood of crop injury. Do not make a foliar or soil application of an organophosphate insecticide within 15 days before or 10 days after applying Peak. Always include a COC (1 to 4 pints per acre) or NIS (1 to 2 quarts per 100 gallons) in the spray mix, and apply in at least 10 gallons of water per acre. Do not harvest grain until 60 days after application, and apply no more than 1 ounce of Peak per growing season. <i>Do not plant soybeans until 10 months after application.</i>
Stinger, 3 lb a.e.	¼ to ⅓ pt	<i>Do not use with legume underseeding.</i> Apply to small grains from the 3-leaf stage up to the early boot stage. For control of Canada thistle, ⅓ pt per acre should be used. For control of additional weeds, 2,4-D, Banvel, Buctril, Harmony Extra, MCPA, or Sencor may be tank-mixed with Stinger.

Table 3. Weed control in small grains (cont.)

Herbicide	Broadcast rate/acre	Remarks (See Table 4 for grazing restrictions.)
Wheat only 2,4-D ester, 3.8 lb a.e.	½ to 1 pt	<i>Do not use with legume underseeding.</i> Apply in the spring after full-tiller but before joint stage. For preharvest treatment, apply 1 to 2 pt per acre during hard-dough stage. For control of wild garlic or wild onion, apply 1 to 2 pt in the spring when wheat is 4 to 8 in. tall, after tillering but before jointing. <i>These rates may injure the crop and only suppress wild garlic.</i>
Roundup Ultra 3 lb a.e./gal	1 to 2 pt	<i>Do not use with legume underseeding.</i> Apply as a <i>preharvest treatment only</i> after the hard-dough stage of grain (30% or less moisture) and at least 7 days before harvest. It is not recommended that wheat being grown for seed be treated with Roundup Ultra because a reduction in germination or vigor may occur.

Table 4. Grazing restrictions for small-grain herbicides

Herbicide name		Crops	Applied	Days after treatment before use			
Trade	Common			Graze green		Feed straw	Withdraw for meat
Banvel or Clarity	dicamba	wheat, oats, barley	Prejoint	0	7	37	30
Buctril	bromoxynil	wheat, oats, rye, barley	Preboot	30	30	30	30
Harmony Extra	2:1 mixture of thifensulfuron + tribenuron	triticale	Before flag leaf	No	No	Yes	0
Many	2,4-D	wheat, barley, spring oats	Prejoint				
Many	2,4-D, late	wheat, oats, rye, barley	Prejoint	14	14	0	14
Many	MCPA	wheat, oats, rye, barley	Before harvest	No	No	No	...*
Peak	prosulfuron	wheat, oats, rye, barley	Prejoint	7	7	0	7
		wheat, oats, rye, barley	Prior to second node	30	30	30	...*
Roundup Ultra	glyphosate	wheat	Before harvest	14	14	14	...*
Stinger	clpyralid	wheat, oats, barley	Preboot	7	7	No	7

*No withdrawal information available.

GRASS PASTURES

Unless properly managed, broadleaf weeds can become a serious problem in grass pastures. They can compete directly with forage grasses and reduce the nutritional value and longevity of the pasture. Certain species, such as white snakeroot and poison hemlock, are also poisonous to livestock and may require special consideration.

Perennial weeds are of great concern in pasture management. They can exist for many years, reproducing from both seed and underground parent rootstocks. Occasional mowing or grazing helps control certain annual weeds, but perennials can grow back from underground root reserves unless long-term control strategies are implemented.

Certain biennials can also flourish in grass pastures. The first year, they exist as a prostrate rosette, so that even close mowing does little to control their growth. The second year, biennials produce a seed stalk and a deep taproot. If these weeds are grazed or mowed at this stage, root reserves can enable the plant to grow again, thereby increasing its chance of surviving to maturity.

In general, the use of good cultural practices such as maintaining optimal soil fertility, rotational grazing, and periodic mowing can help keep grass pastures in good condition and more competitive with weeds. Where broadleaf weeds become troublesome, however, **2,4-D**, **Banvel**, **Clarity**, **Stinger**, or **Weed-master** (dicamba + 2,4-D) may be used. **Roundup Ultra** also may be used as a spot treatment, and **Crossbow** (2,4-D + triclopyr) and **Ally** (metsulfuron methyl) are labeled for control of broadleaf and woody plant species in grass pastures. **Spike 20P** (tebuthiuron) also may be used in grass pastures for control of brush and woody plants (see Tables 5 and 6 for additional information).

Proper identification of target weed species is important. As shown in Table 5, weeds vary in their susceptibility to herbicides. Timing of herbicide application also may affect the degree of weed control. Annuals and biennials are most easily controlled while young and relatively small. A fall or early spring herbicide application works best if biennials or winter annuals are the main weed problem. Summer annuals are most easily controlled in the spring or early summer. Apply translocated herbicides to control established perennials when the weeds are in the bud-to-bloom stage. Perennials are most susceptible at this reproductive stage because translocated herbicides can move downward with food reserves to the roots, thus killing the entire plant.

For control of woody brush, apply **2,4-D**, **Banvel/Clarity**, or **Crossbow** when the plants are fully leafed and actively growing. Where regrowth occurs, a second treatment may be needed in the fall. During the dormant season, oil-soluble formulations of **2,4-D**, **Banvel**, **Clarity**, or **Crossbow** may be applied in fuel oil to the trunk. **Spike** controls many woody perennials and should be applied to the soil in the spring. **Spike** requires rainfall to move it into the root zone of target species. **Ally** as a spot treatment controls multiflora rose, Canada thistle, and blackberry (*Rubus* spp.) and controls several annual broadleaf weeds when applied as a broadcast treatment at the lower rate range.

The weed-control options in grass pastures are shown in Table 6. Refer to Table 7 for information concerning grazing restrictions for herbicides used in grass pastures. Be cautious with any pesticide, and always consult the herbicide label for specific information about the use of a given product.

FORAGE LEGUMES

Weed control is important in managing forage legumes. Weeds can reduce the vigor of legume stands, reducing yield and forage quality. Good management begins with weed control that prevents weeds from becoming serious problems.

ESTABLISHMENT

To minimize problems, prepare the seedbed properly so that it is firm and weed free. Select an appropriate legume variety. If you use high-quality seed and follow the recommendations for liming and fertility, the legume crop may compete well with many weeds and reduce the need for herbicides.

In fields where companion crops such as oats are used to reduce weed competition, seed the small grain at half the rate for grain production to ensure that the legumes become established with minimum stress. If the legume is seeded without a companion crop (direct-seeded), the use of an appropriate herbicide is suggested.

PREPLANT-INCORPORATED HERBICIDES

Balan (benefin), **Eptam** (EPTC), and **Treflan** (trifluralin) are registered for preplant incorporation for legumes that are not seeded with grass or small-grain companion crops. These herbicides control most annual grasses and some broadleaf weeds. In fall plantings, the weeds controlled include winter annuals such as downy brome and cheat. In spring

Table 5. Effectiveness of herbicides on weeds in grass pastures

This table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rate and weed size or growth stage. Performance may vary due to weather and soil conditions or other variables.

Weed	Susceptibility to herbicide					
	2,4-D	Ally	Banvel or Clarity	Crossbow	Roundup ^a	Stinger
Winter annual						
Horseweed (marestail)	9	9	9	9	9	8
Pennycress, field	9	8	8	9	9	0
Summer annual						
Ragweed, common	9	7	9	9	9	9
Ragweed, giant	9	8	9	9	9	9
Biennial						
Burdock, common	9	0	9	9	8	8
Hemlock, poison	8	0	9	8	8	0
Thistle, bull	9	8	9	9	9	9
Thistle, musk	8	9	9	9	9	8
Perennial^b						
Daisy, oxeye	8	0	9	9	8	8
Dandelion	9	0	8	9	7	8
Dock, curly	7	9	9	9	8	7
Goldenrod spp.	8	5	9	8	9	5
Hemlock, spotted water	8	0	9	9	8	5
Ironweed	8	5	8	8	9	5
Milkweed, common	6	0	7	7	7	0
Nettle, stinging	8	0	8	8	8	7
Plantain spp.	9	9	8	9	9	0
Rose, multiflora ^c	7	8	8	9	8	0
Snakeroot, white	8	0	9	9	8	0
Sorrel, red	5	9	9	9	8	7
Sowthistle, perennial	8	0	9	9	8	7
Thistle, Canada	7	8	9	9	8	9

9 = 90 to 100%, 8 = 80 to 89%, 7 = 70 to 79%, 6 = 60 to 69%, 5 = 50 to 59%, 0 = less than 50% control or not labeled.

^aSpot treatment only.

^bPerennial weeds may require more than one application.

^cSpike also is an effective herbicide for multiflora rose control (weed susceptibility = 9).

plantings of legumes, the summer annual weeds controlled include foxtails, pigweeds, lambsquarters, crabgrass, and fall panicum. **Eptam** can help suppress johnsongrass, quackgrass, yellow nutsedge, and shattercane, in addition to controlling many annual grasses and some broadleaf weeds. These herbicides do not effectively control mustards, smartweed, or established perennials.

Balan, **Eptam**, and **Treflan** *must* be thoroughly incorporated soon after application to avoid herbicide loss. They should be applied shortly before the legume is seeded to remain effective as long as possible into the growing season.

Weeds that emerge during crop establishment should be evaluated for their potential as problems. If they do not reduce the nutritional value of the forage or if they can be controlled by mowing, they should not be the primary focus of a postemergence herbicide application. For example, winter annual weeds do not compete vigorously with the crop after the first cutting in the spring. Unless they are unusually dense or production of weed seed becomes a concern, these weeds may not be a significant problem. Some weeds such as dandelions are palatable and may not require control if the overall legume stand is dense and healthy, but undesirable weeds must be controlled early to prevent their establishment.

Table 6. Broadleaf weed control in grass pastures

Herbicide	Rate/acre	Remarks (See Table 7 for grazing restrictions.)
2,4-D, 3.8 lb a.e. (amine or low-volatile ester)	2 to 4 pt	Broadleaf weeds should be actively growing. Higher rates may be needed for less-susceptible weeds and some perennials. Spray bull or musk thistles in the rosette stage (spring or fall) while they are actively growing. Spray perennials such as Canada thistle in the bud stage or the fall regrowth stage. Spray susceptible woody species in the spring when leaves are fully expanded. <i>Do not apply to newly seeded areas or to grass when it is in boot-to-milk stage.</i> Be cautious of spray drift.
Ally 60DF	0.1 to 0.3 oz	Apply in the spring or early summer before annual broadleaf weeds are 4 in. tall. As a spot application for control of multiflora rose, blackberry, or Canada thistle, apply Ally at 1 oz per 100 gal of water and spray foliage to runoff. Include a nonionic surfactant of at least 80% active ingredient at 1 pt to 1 qt per 100 gal spray solution ($\frac{1}{8}$ to $\frac{1}{4}$ % v/v). Bluegrass, bromegrass, orchardgrass, timothy, and native grasses such as bluestem and grama have demonstrated good tolerance. Bluegrass, bromegrass, orchardgrass, and timothy should be established for at least 6 months and fescue for 24 months at the time of application, or injury may result. <i>Application to fescue may result in stunting and seed head suppression.</i> Do not apply to ryegrass or pastures containing desirable alfalfa or clovers. Ally is persistent in soil, and crop rotation guidelines on the label must be followed.
Banvel or Clarity, 4 lb a.e.	Annuals: 0.5 to 1½ pt Biennials: ½ to 3 pt Perennials: 2 to 4 pt	Use lower rates for susceptible annuals when they are small and actively growing and for susceptible biennials in the early rosette stage. Use higher rates for larger weeds, for less susceptible weeds, for established perennials in dense stands, and for certain woody brush species. Be cautious of spray drift.
Crossbow	Annuals: 1 to 2 qt Biennials and herbaceous perennials: 2 to 4 qt Woody perennials: 6 qt	Apply to foliage during warm weather when brush and broadleaf weeds are actively growing. When applying as a spot spray, thoroughly wet all foliage. See herbicide label for more specific rate recommendations. Be cautious of spray drift. Best control of multiflora rose occurs when application is made during early to mid-flowering stage.
Roundup Ultra	1 to 2% solution (spot treatment)	Controls a variety of herbaceous and woody brush species, such as multiflora rose, brambles, poison ivy, and quackgrass. Spray foliage of target vegetation completely and uniformly, but not to point of runoff. Avoid contact with desirable nontarget vegetation. Consult label for recommended timing of application for maximum effectiveness on target species. <i>No more than $\frac{1}{10}$ of any acre should be treated at one time.</i> Further applications may be made in the same area at 30-day intervals. Use only where livestock movement can be controlled to prevent grazing for 14 days. Treated areas may be reseeded after 14 days.

Table 6. Broadleaf weed control in grass pastures (cont.)

Herbicide	Rate/acre	Remarks (See Table 7 for grazing restrictions.)
Spike 20P	10 to 20 lb	For control of brush and woody plants in rangeland and grass pastures. Requires sufficient rainfall to move herbicide into root zone. May kill or injure desirable legumes and grasses where contact is made. Injury is minimized by applying when grasses are dormant. Do not apply on or near field crops or other desirable vegetation. <i>Do not apply where soil movement is likely.</i> Refer to product label for additional restrictions.
Stinger, 3 lb a.e.	2/3 to 1 1/3 pt	Apply when weeds are young and actively growing. Grasses are tolerant, but new grass seedlings may be injured. For Canada thistle, apply to thistle at least 4 in. tall but before thistle reaches bud stage. <i>Do not spray pastures containing desirable forbs, such as alfalfa or clover, unless injury can be tolerated.</i> Do not use hay or straw from treated areas for composting or mulching on susceptible broadleaf crops. Refer to product label for additional precautions.

Table 7. Restrictions on herbicides used in permanent grass pastures

Herbicide name		Days after treatment before use				Slaughter withdrawal
		Grazing		Grass hay		
Trade	Common	Beef	Dairy	Beef	Dairy	
Ally	metsulfuron	0	0	0	0	0
Banvel or Clarity < 4 pt	dicamba	0	7 to 40 ^a	0	37 to 70 ^a	30
Crossbow	triclopyr + 2,4-D	0	14	7	365	3
Many	2,4-D	0	7 to 14 ^b	30	30	3 to 7 ^b
Stinger ^c	clopyralid	0	0	0	0	0
Roundup	glyphosate					
Spot-treat		14	14	14	14	... ^d
Renovation		56	56	56	56	... ^d
Spike 20P	tebuthiuron	(spot treatment)				
< 20 lb/acre		0	0	365	365	... ^d
> 20 lb/acre	 Do not use for livestock for 1 year.				
Weedmaster	dicamba + 2,4-D	0		37	37	30

^aVaries with rate used per acre—see label.

^bLabels vary (withdrawal unnecessary if more than 14 days after treatment).

^cDo not transfer livestock onto a broadleaf crop area within 7 days of grazing treated area.

^dNo information available.

POSTEMERGENCE HERBICIDES

Poast Plus (sethoxydim) or **Select** (clethodim) may be applied to seedling alfalfa for control of annual and some perennial grass weeds after weed emergence. Grasses are more easily controlled when small.

Butyrac (2,4-DB) controls many broadleaf weeds and may be applied postemergence in many seedling forage legumes. **Pursuit** (imazethapyr) may be applied postemergence to seedling alfalfa for control of sev-

eral broadleaf and grass weed species. **Buctril** (bromoxynil) may be used to control broadleaf weeds in seedling alfalfa. Be sure to apply Buctril while weeds are small, and use precautions to avoid an adverse effect on the crop. (See Table 8 for specific weed-control ratings and Table 9 for rates and remarks.)

ESTABLISHED LEGUMES

The best weed-control practice in established forage legumes is maintenance of a dense, healthy stand

Table 8. Effectiveness of herbicides on weeds in legume and legume–grass forages

This table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rate and weed size or growth stage. Performance may vary due to weather and soil conditions or other variables.

Weed	Gramoxon		Poast		Round-		Select	Sencor	Sinbar	Treflan	Velpar	
	Balan	Buctril	Butyrac	Eptam	Extra	Plus						Pursuit
Winter annual												
Brome, downy	9	0	0	9	8	9	8	9	9	8	9	9
Chickweed, common	8	7	6	7	9	8	0	9	0	9	9	<6
Henbit	5	8	6	9	9	8	0	8	0	9	9	0
Mustard, wild	0	8	8	6	8	5	0	9	0	9	9	0
Pennycress, field	0	9	8	6	7	5	0	9	0	9	9	0
Shepherd's purse	0	9	8	7	7	5	0	9	0	9	9	0
Yellow rocket	0	7	7	6	8	0	0	9	0	9	9	0
Summer annual												
Barnyardgrass	9	0	0	9	8	8	9	9	9	8	7	9
Crabgrass spp.	9	0	0	9	6	8	9	9	9	7	7	8+
Foxtail spp.	9	0	0	9	9	8	9	9	9	6	7	9
Lambsquarters, common	9	9	8	9	8	7	0	9	0	9	9	8
Nightshade spp. ^c	0	9	8	8	9	6	0	9	0	5	8	<6
Panicum, fall	9	0	0	9	9	6	9	9	9	6	6	9
Pigweed spp.	9	8	8	9	8	6	0	9	0	9	8	8
Ragweed, common	0	9	9	5	9	5	0	9	0	8	8	<6
Smartweed, Pennsylvania	0	9	6	5	8	5	0	9	0	8	8	<6
Perennial												
Canada thistle	0	5	5	0	0	0	0	9	0	0	0	0
Dandelion	0	0	7	0	0	0	0	8	0	7	6	0
Dock, curly	0	0	5	0	0	0	0	9	0	6	6	0
Nutsedge, yellow	0	0	0	8	0	0	0	7	0	0	0	0
Orchardgrass	5	0	0	6	5	7	6	8	7	5	5	<6
Quackgrass	6	0	0	8	5	8	7	9	8	5	6	7

9 = 90 to 100%, 8 = 80 to 89%, 7 = 70 to 79%, 6 = 60 to 69%, 5 = 50 to 59%, 0 = less than 50% control or not labeled.

^aRoundup and Sencor are labeled for use in mixed legume–grass forages. No other herbicides are cleared for this use.

^bSpot treatment only.

^cControl of different species may vary.

with proper management techniques. Chemical weed control in established forage legumes is often limited to late fall or early spring applications of herbicide.

Sencor (metribuzin), **Sinbar** (terbacil), and **Velpar** (hexazinone) are applied after the last cutting in the fall or in the early spring. These herbicides control many broadleaf weeds and some grasses, too. The herbicide **2,4-DB** controls many broadleaf weeds in established alfalfa; it should be applied when the weeds are small and actively growing. **Pursuit** may be applied postemergence to established alfalfa stands to control certain broadleaf and grass weed

species. Refer to Tables 8 and 9 for additional remarks and weed-control suggestions.

Once grass weeds have emerged, they are particularly difficult to control in established alfalfa. **Poast Plus** or **Select** may be used in established alfalfa for postemergence control of annual and some perennial grasses. Optimal grass control is achieved if **Poast Plus** is applied when grasses are small and before the weeds are mowed.

Table 8 outlines current suggestions for weed-control options in legume forages. The degree of control often varies with weed size, application rate, and en-

Table 9. Weed control in legume forages

Herbicide	Legume	Time of application	Broadcast rate/acre	Remarks (See Table 10 for haying restrictions.)
Seedling year				
Balan 60DF	Alfalfa, birdsfoot trefoil, red clover, ladino clover, alsike clover	Preplant incorporated	2 to 2.5 lb	Apply shortly before seeding. Do not use with any companion crop of small grains.
Buctril 2E	Alfalfa only	Postemergence	1 to 1.5 pt	Apply in the fall or spring to seedling alfalfa with at least 4 trifoliolate leaves. Apply to weeds at or before the 4-leaf stage or 2 in. in height (whichever is first). May be tank-mixed with 2,4-DB for improved control of pigweed; however, crop burn may occur from this mixture, especially under warm, humid conditions. Eptam, previously used, may enhance Buctril burn to alfalfa. <i>Do not apply when temperatures are likely to exceed 70°F during or for 3 days following application or when the crop is stressed. Do not add a surfactant or crop oil.</i>
Butyrac 200 or Butoxone 200	Alfalfa, birdsfoot trefoil, ladino clover, red clover, alsike clover, white clover	Postemergence	1 to 3 qt (amine)	Use when weeds are less than 3 in. tall or less than 3 in. across if rosettes. Use higher rates for seedling smartweed or curly dock. May be tank-mixed with Poast Plus. <i>Do not use on sweet clover.</i>
Eptam 7E, 20G	Alfalfa, birdsfoot trefoil, lespedeza, clovers	Preplant incorporated	3½ to 4½ pt (7E) 15 lb (20G)	Apply shortly before seeding. Do not use with any companion crop of small grains.
Gramoxone Extra	Alfalfa only	Between cuttings	12.8 fl oz	Apply within 5 days after cutting and before alfalfa regrowth is 2 in. Add surfactant according to label instructions. Do not apply more than twice during seedling year. <i>Gramoxone Extra is a restricted-use pesticide.</i>
Poast Plus	Alfalfa, birdsfoot trefoil	Postemergence	1⅛ to 2¼ pt	Best grass control is achieved when applications are made prior to mowing. If tank-mixed with 2,4-DB, follow 2,4-DB harvest and grazing restrictions and add no additives with this tank mix. Do not apply more than a total of 9.75 pt of Poast Plus per acre in 1 season.
Pursuit 2AS or 70DG	Alfalfa	Postemergence	3 to 6 fl oz (2AS) 1.08 to 2.16 oz (70DG) 3 to 6 fl oz (2AS) 1.08 to 2.16 oz (70DG)	Apply when seedling alfalfa is in the second-trifoliolate stage or larger and when the majority of weeds are 1 to 3 in. tall. For low-growing weeds, apply before the rosette exceeds 3 in. in diameter. Always include a nonionic surfactant or crop-oil concentrate and a liquid nitrogen fertilizer solution, and apply in 10 or more gallons of water per acre. When applied to seedling alfalfa, Pursuit may cause a temporary reduction in growth. Do not apply more than 6 fl oz or 2.16 oz per acre per year. <i>If applied under cool conditions (≤40°F), temporary stunting and yellowing of alfalfa may occur.</i>

Table 9. Weed control in legume forages (cont.)

Herbicide	Legume	Time of application	Broadcast rate/acre	Remarks (See Table 10 for haying restrictions.)
Seedling year (cont.)				
Select 2EC	Alfalfa	Postemergence	6 to 8 fl oz	May be applied to seedling or established alfalfa grown for seed, hay, silage, green chop, or direct grazing. If tank-mixed with 2,4-DB, follow 2,4-DB grazing and harvest restrictions. Do not plant rotational crops until 30 days after Select application.
Treflan HFP, TR-10	Alfalfa only	Preplant incorporated	1 to 1.5 pt (HFP) 5 to 7.5 lb (TR-10)	May be applied as a preplant-incorporated treatment for preemergence control of certain grass and small-seeded broadleaf species. <i>Some crop-stand reduction and stunting may occur.</i>
Established stands				
Butyrac 200 or Butoxone 200	Alfalfa only	Growing	1 to 3 qt (amine)	Spray when weeds are less than 3 in. tall or less than 3 in. wide if rosettes. Fall treatment of fall-emerged weeds may be better than spring treatment. May be tank-mixed with Poast Plus.
Gramoxone Extra	Alfalfa only	Between cuttings	12.8 fl oz	Between cuttings, treatments should be applied immediately after hay removal, within 5 days after cutting and with less than 2 in. of growth. Weeds germinating after treatment are not controlled. <i>Gramoxone Extra is a restricted-use pesticide.</i>
Gramoxone Extra	Alfalfa, clover	Dormant	13 to 24 fl oz	For dormant season, apply after last fall cutting or before spring growth is 2 in. tall. Weeds should be succulent and growing at the time of application. Do not apply if fall regrowth is more than 6 in. <i>Gramoxone Extra is a restricted-use pesticide.</i>
Poast Plus 1E	Alfalfa	Postemergence	1 $\frac{1}{8}$ to 2 $\frac{1}{4}$ pt	Best grass control is achieved when applications are made prior to mowing. If tank-mixed with 2,4-DB, follow 2,4-DB grazing and harvest restrictions. Do not apply more than a total of 9.75 pt of Poast Plus per acre in 1 season.
Pursuit 2AS or 70DG	Alfalfa only		3 to 6 fl oz (2 AS); 1.08 to 2.16 oz (70DG)	Apply in the fall or spring to dormant or semi-dormant alfalfa (less than 3 in. of regrowth), or between cuttings. Do not apply Pursuit to alfalfa during the last year of the stand. Always include a nonionic surfactant or crop-oil concentrate and a liquid nitrogen fertilizer solution, and apply in 10 or more gallons of water per acre. <i>Applications made under cool conditions ($\leq 40^{\circ}\text{F}$) may cause temporary stunting and yellowing to alfalfa.</i>
Roundup	Alfalfa Alfalfa, clover, and alfalfa or clover-grass mixtures	Postemergence Growing	1 to 2% solution (spot treatment)	No more than $\frac{1}{10}$ of any acre should be treated at one time. Further applications may be made in the same area at 30-day intervals. Avoid contact with desirable, nontarget vegetation because damage may occur. Refer to label for recommended timing of application for maximum effectiveness on target species.

Table 9. Weed control in legume forages (cont.)

Herbicide	Legume	Time of application	Broadcast rate/acre	Remarks (See Table 10 for haying restrictions.)
Established stands (cont.)				
Roundup	Alfalfa	Last cutting	1 to 2 pt	For use in declining alfalfa stands prior to crop rotation. Apply before last cutting in fall or spring for control of certain perennial grass and broadleaf weed species. <i>Do not use for alfalfa grown for seed.</i>
Select 2EC	Alfalfa	Postemergence	8 fl oz	For control of annual grasses in established alfalfa, use a minimum of 8 fl oz/acre. If tank-mixed with 2,4-DB, follow 2,4-DB grazing and harvest restrictions.
Sencor 750F	Alfalfa and alfalfa-grass mixtures	Dormant	½ to 1½ lb	Apply once in the fall or spring before new growth starts. Rate is based on soil type and organic-matter content. Higher rates may injure grass component. Do not use on sandy soils or soils with pH greater than 7.5.
Sencor 75DF	Alfalfa	Postdormant	1 to 1½ lb	May be applied postdormant but prior to 3 in. of alfalfa top growth when impregnated on dry fertilizer.
Sinbar 80W	Alfalfa only	Dormant	½ to 1½ lb	Apply once in the fall or spring before new growth starts. Use lower rates for coarser soils. Do not use on sandy soils with less than 1% organic matter. Do not plant any crop for 2 years after application.
Treflan TR-10 4EC	Alfalfa	Dormant or after a cutting during the growing season	20 lb 4pt	A single rainfall or overhead sprinkler irrigation of 0.5 in. or more, flood irrigation, or furrow irrigation after application is required to activate the herbicide. If activation does not occur within 3 days after application, incorporate using equipment that provides thorough soil mixing with minimum damage to the established alfalfa. Treflan 4EC may be surface-applied or applied by chemigation. Do not apply Treflan TR-10 by chemigation.
Velpar L	Alfalfa only	Dormant	1 to 3 qt	Apply in the fall or spring before new growth exceeds 2 in. in height. May also be applied to stubble after hay crop removal but before regrowth exceeds 2 in. Do not plant any crop except corn within 2 years of treatment. Corn may be planted 12 months after treatment, provided deep tillage is used.

Table 10. Herbicides used in forage legumes and restrictions

Herbicide name		Applied on/at		Days before use	
Trade	Common	Forage ^a	When ^a	Graze	Hay
Seedling legumes					
Balan	benefin	AL, CL, BT	PPI	0	0
Eptam	EPTC	AL, CL, BT	PPI	... ^b	... ^b
Treflan	trifluralin	AL	PPI	21	21
Butyrac 200, Butoxone	2,4-DB	AL, CL, BT	Post	60	60
Buctril	bromoxynil	AL	Postfall	60	60
		AL	Postspring	30	30
Gramoxone Extra	paraquat	AL	After cut ^c	30	30
Poast Plus	sethoxydim	AL	Post	7	14
Pursuit	imazethapyr	AL	Post	30	30
Select	clethodim	AL, BT	Post	15	15
Established legumes					
Many	2,4-DB	AL	Post	30	30
Gramoxone Extra	paraquat	AL	After cut ^c	30	30
Poast Plus	sethoxydim	AL	Post	7	14
Pursuit	imazethapyr	AL	Post	30	30
Roundup Ultra	glyphosate	AL, CL, BT	Spot-treat	14	14
Roundup Ultra	glyphosate	AL, CL, BT	Renovate	56	56
Roundup Ultra	glyphosate	AL	Last cutting	7	7
Gramoxone Extra	paraquat	AL	Dormant	60	60
Sencor	metribuzin	AL	Dormant	28	28
Sencor	metribuzin	AL	Predormant/ postdormant ^d	60	60
Select	clethodim	AL, BT	Post	15	15
Sinbar	terbacil	AL	Dormant	... ^b	0
Treflan	trifluralin	AL	Dormant or after cutting	21	21
Velpar	hexazinone	AL	Dormant	30	30

^aAL = alfalfa, CL = clover (red, alsike, or ladino), BT = birdsfoot trefoil, PPI = preplant-incorporated.

^bNo grazing information on label.

^cBetween cuttings (less than 5 days after cut, with less than 2 in. regrowth).

^dIf impregnated on dry fertilizer.

environmental conditions. Select the correct herbicide for the specific weeds to be controlled (Table 8). Refer to Table 10 for grazing and harvesting restrictions for forage legumes. Always consult the herbicide label for specific information about using a given product.

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