

Weed Control in Alfalfa and Other Forage Legume Crops

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Introduction

The importance of weed control in forage production should not be overlooked, especially when you consider the high investment associated with alfalfa and other legume forages. Weeds reduce forage yield by competing for water, sunlight, and nutrients. For example, yield obtained from the first cutting of alfalfa can be significantly reduced by a heavy infestation of common chickweed. In addition to yield losses, weeds can also lower forage quality, increase the incidence of disease and insect problems, cause premature stand loss, and create harvesting problems. Some weeds are unpalatable to livestock or, in some cases, may be poisonous.

Weed management strategies in forage legumes should focus first on cultural practices and then on chemical weed control practices. Vigorous, dense-growing forage legume stands have fewer weed problems. Thus, cultural and management practices that promote a highly competitive forage stand prevent many weed problems. These practices include: 1) liming and fertilizing fields based on soil test recommendations; 2) seeding well-adapted, vigorous, long-lived varieties; 3) buying weed-free seed; 4) cutting forage at proper timing intervals or growth stage; 5) timely control of insect and disease problems; and 6) rotating fields with other crops to interrupt the buildup of certain weeds.

Because of the aggressive nature of some weed species, they can become established despite preventive efforts. Therefore, herbicide treatment might be necessary to combat some weed problems. The specific herbicides and control strategies available for use will depend on the type of forage you grow (alfalfa, alfalfa/grass mixture, clovers, or other legumes), whether your stand is a new seeding or an established stand, and the crop growth stage (dormant, nondormant, between cutting). Table 1 contains a list of herbicide products available for use on legume forage crops, and Table 2 indicates permitted legume crops and application times relative to stage of growth. Before using a herbicide, always read and follow label directions. A guide to the relative response of weeds to these herbicides can be found in Table 3 and Table 4.

New Seedings

Weed control is more critical during the first year than any other period of forage production. Forage seedlings grow slowly and are easily overcome by rapidly growing weeds. Research has shown that some broadleaf weed seedlings are capable of growing five times more rapidly than certain legume seedlings. Because alfalfa stands gradually decline with age, it is important to start with a good stand. A uniform, dense stand is more likely to survive longer and have fewer weed problems than a thin stand.

Site Selection

Consider field history when you select a field for legume forage production. It might be difficult to establish and maintain a weed-free forage stand in fields known to be infested with weeds such as musk thistle, curly dock, or yellow nutsedge. In addition, some herbicides that are applied in previously grown crops have the potential to carry over and cause injury to newly seeded forages. Alfalfa and other forage crops are sensitive to low concentrations of herbicides that contain atrazine (AAtrex, Bicep II Magnum, Degree Xtra, Guardsman MAX, Harness Xtra, etc.), clomazone (Command), chlorimuron ethyl (Canopy, Classic), imazaquin (Scepter, Squadron), and prosulfuron (Exceed, Spirit). More information on herbicides that have a potential to injure alfalfa and other forages can be obtained from your county Extension office and from the labels of herbicide products used in a previous crop.

Time of Seeding

Weed control is one of many factors that will determine whether you seed your fields in the spring or fall. As a general rule, the summer complex of weeds tends to overcome spring seedings, whereas, the winter weed complex tends to out-compete forages seeded in the fall. Therefore, for optimum establishment of most forage crops, you should consider fall seedings in fields that have a history with such weeds as large crabgrass, foxtails, or lambsquarters. Consider spring seedings in fields that are potentially infested with common chickweed, henbit, and yellow rocket.

Weed-Free Seed

Using weed-free seed is the first step to prevent the introduction of weeds. You should check the seed tag to determine the purity of the seed. In the case of alfalfa, the maximum total of weed seed contamination permitted by Kentucky seed regulations is 2 percent of weed seed by weight. Such species as johnsongrass and Canada thistle are considered noxious weeds and are prohibited as contaminants in seed lots sold for sowing alfalfa fields. Annual bluegrass, buckhorn plantain, dodder, giant foxtail, quackgrass, red sorrel, and wild garlic are examples of noxious weeds that must be listed on the label if they are present and, depending on the species, must not exceed a certain limit.

Liming and Fertilization

Adjusting soil pH and nutrient levels according to soil test recommendations is important during the establishment phase and throughout the life of the forage stand. The objective is to achieve a competitive alfalfa stand that is capable of suppressing weed emergence and growth. Proper liming and fertility are not effective for eliminating weeds that have already become established, especially in areas where the forage stand is poor. Likewise, some weeds, such as chickweed, curly dock, and crabgrass, respond favorably to fertilization. Thus, other weed control methods are often needed in addition to proper fertility.

Clipping New Seedings

Clipping or mowing can be an effective option for controlling some weeds, such as common cocklebur or jimsonweed, in legume forage stands. This method controls weeds by removing the leaves and lateral buds that develop new growth. Annual broad-leaf weeds have buds that develop above the soil surface; they are more easily controlled with clipping or mowing than grasses, which have crown buds near the soil surface. Mow as low as possible to be effective. Because alfalfa plants and other legumes have crown buds, they can tolerate low clipping. When you clip new seedings, be careful not to smother forage legumes with heavy residues. Remove clipped vegetation when weed infestations are heavy.

Herbicides for New Seedings

Herbicides used for new seedings are designed to eliminate or reduce competition from rapidly growing weeds during the establishment phase. In some instances, herbicides that aid alfalfa establishment have also contributed to higher yields in subsequent years and greater longevity of stands. During seedling development, forage grasses usually are susceptible to injury from herbicides used in legume establishment. Subsequently, no herbicides are registered for new seedings of legume grass mixtures.

Maintaining Established Stands

Established forage legumes are capable of growing fairly rapidly and competing against many weed seedlings during the growing season. However, weeds gradually invade fields where forage stands decline with age. Timely mowing and the use of herbicides may aid in weed control and prolong the life of the stand. If you have a weed problem that occurs in field borders, along fence rows, or in adjacent fields, you should mow or spray to prevent production and spread of weed seed from these areas into alfalfa and other hay fields. This is particularly important for such weeds as musk thistle, which is capable of producing a large number of seeds that are easily spread to new areas.

Table 1. Herbicide products, formulations, active ingredients, manufacturers, and EPA registration numbers.

Herbicide	Formulation	Active Ingredient	Manufacturer	EPA Reg. No.
Buctril 2EC	2 lb ai/gal	bromoxynil	Bayer CropScience	264-437
Butyrac 200	2 lb ai/gal	2,4-DB	Albaugh	42750-38
Eptam 7E	7 lb ai/gal	EPTC	Syngenta	10182-220
Glyfos X-TRA	4 lb ai/gal	glyphosate	Cheminova	4787-23
Glyphomax Plus	4 lb ai/gal	glyphosate	Dow AgroSciences	62719-322
Gly Star Plus	4 lb ai/gal	glyphosate	Albaugh	42750-61
Gramoxone MAX ¹	3 lb ai/gal	paraquat	Syngenta	100-1074
Poast 1.5E	1.5 lb ai/gal	sethoxydim	BASF	7969-58
Poast Plus 1E	1.0 lb ai/gal	sethoxydim	BASF	7969-88
Pursuit 70DG	70% w/w	imazethapyr	BASF	241-350
Raptor 1S	1.0 lb ai/gal	imazamox	BASF	241-379
Roundup Original	4.0 lb ai/gal	glyphosate	Monsanto	524-445
Roundup UltraDRY	71.4% w/w	glyphosate	Monsanto	524-504
Roundup UltraMAX	5.0 lb ai/gal	glyphosate	Monsanto	524-512
Roundup WeatherMAX	5.5 lb ai/gal	glyphosate	Monsanto	524-537
Select 2EC	2 lb ai/gal	clethodim	Valent	59639-3
Sencor 4F	4 lb ai/gal	metribuzin	Bayer CropScience	3125-314
Sencor 75DF	75% w/w	metribuzin	Bayer CropScience	3125-325
Sinbar 80W	80% w/w	terbacil	DuPont	352-317
Touchdown IQ	4 lb ai/gal	glyphosate	Syngenta	100-1117
Velpar 2L	2 lb ai/gal	hexazinone	DuPont	352-392
Velpar 75DF	75% w/w	hexazinone	DuPont	352-581

¹ Restricted Use Pesticide

Clipping Established Stands

The routine mowing of legumes for hay is sometimes effective in controlling some perennial weeds by reducing food reserves and plant vigor. However, in grazed forages, livestock often selectively graze and may leave such weeds as chicory or musk thistle. Mowing soon after livestock have been removed from the field can help control these weeds and prevent seed production and further spread of infestations.

Herbicides for Established Stands

Several herbicide options are available for established alfalfa stands. You can use many of the same herbicides available for new seedlings. Furthermore, the deep root system of established plants such as alfalfa enables them to tolerate certain herbicides that are not suitable for new seedlings. When selecting herbicides for forage legumes, you should consider such factors as: whether the herbicide can be applied as a dormant season, nondormant, or between cutting treatment (Table 2); effectiveness on weed species to be controlled (Table 3 and Table 4); feeding and grazing limitations; rotational crop restrictions; and cost of treatment.

Scouting Methods for Forage Crops

Scouting for weed problems early is an effective tool for finding and controlling weed problems before they develop into situations that cannot be easily managed. This requires a trained eye and the ability to identify weeds in their early growth stages. Winter annual weeds, such as common chickweed and henbit, usually germinate in late fall or winter and are present in early spring, whereas, the summer weed complex, which includes crabgrass and common ragweed, will be present after the first harvest through a killing frost in the fall.

Weed infestation levels or weed density should be determined by estimating the percentage of ground cover occupied by weeds. This can be accomplished by randomly selecting one site for every 10 acres within a field. A mini-

Table 2. Herbicide products labeled for legume forage crops and permitted application times relative to legume stage of growth.

Herbicide	Crops Labeled for Use						Stage of Crop Growth				
	Alfalfa	Alfalfa-Grass Mixtures	Clovers (Red, Alsike, Landino)	Birdsfoot Trefoil	Lespedeza	Crown Vetch	Nondormant	Dormant	Postdormant	Between Cuttings	Spot Spray
Before Seeding											
Eptam	L	X	L	L	L	X	X	X	X	X	X
Gramoxone MAX	L	X	L	L	L	L	X	X	X	X	X
Glyphosate	L	L	L	L ²	L ²	L ²	X	X	X	X	X
New Seedlings (less than 1 year old)											
Buctril	L	X	X	X	X	X	P	X	X	X	X
Butyrac 200	L	X	L ¹	L ¹	X	X	P	X	X	X	X
Gramoxone MAX	L	X	L	L	L	L	X	P	X	P ³	X
Glyphosate	L	L	L	L ²	L ²	L ²	X	X	X	X	P
Poast/ Poast Plus	L	X	L	L	X	X	P	X	P	X	P ⁴
Pursuit	L	X	X	X	X	X	P ⁵	X	P ⁶	P ⁶	X
Raptor	L	X	X	X	X	X	P ⁵	X	P ⁶	P ⁶	X
Select	L	X	X	L	X	X	P	X	P	X	P
Established Stands (1 year old or longer)											
Butyrac 200	L	X	X	X	X	X	P	X	X	X	X
Gramoxone MAX	L	X	L	L	L	L	X	P	X	P ³	X
Glyphosate	L	L	L	L ²	L ²	L ²	X	X	X	X	P
Poast/ Poast Plus	L	X	L	L	X	X	P	X	P	X	P ⁴
Pursuit	L	X	X	X	X	X	P ⁶	P ⁶	P ⁶	P ⁶	X
Raptor	L	X	X	X	X	X	P ⁶	P ⁶	P ⁶	P ⁶	X
Select	L	X	X	L	X	X	P	X	P	X	P
Sencor	L	L	X	X	X	X	X	P	P	X	X
Sinbar	L	X	X	X	X	X	X	P	X	X	X
Velpar	L	X	X	X	X	X	X	P	P ⁷	P ⁷	X

L = Crop labeled for herbicide use.

P = Permitted application time.

X = Indicates either the crop is not labeled for herbicide product use or herbicide application not permitted at the specified legume growth stage.

¹ Apply to new seedlings only.

² Some glyphosate products are not labeled for these crops.

³ Apply immediately after forage legume has been removed for hay and before regrowth has reached 2 inches.

⁴ Do not make spot treatments in addition to broadcast treatments.

⁵ Apply when seedling alfalfa is in the 2nd trifoliate stage or larger and weeds are 1 to 3 inches in height.

⁶ Apply in the spring, fall, or between cuttings before significant alfalfa growth or regrowth (3 inches) begins.

⁷ Apply in the spring before new growth or before regrowth following a cutting exceeds 2 inches in height.

imum of three sites should be selected in fields with fewer than 20 acres. At each field site, an area approximately 30 feet by 30 feet should be used to determine the percentage of weeds present. Keep in mind that fields that appear almost weed free could have a 5% weed density. Only in extremely poor alfalfa stands will weed infestations in excess of 50% occur. At each site, record the predominant species and its size at the time of sampling. For additional information on field scouting, refer to the *Kentucky Integrated Crop Management Manual for Alfalfa* on the Web at <<http://www.uky.edu/agriculture/IPM/manuals.htm>>.

Table 3. Guide to the relative response of cool-season weeds to herbicides.¹

Herbicide	Annuals										Perennials ²						
	Legume Tolerance ³	Chickweed, Common	Fleabane spp.	Henbit/Purple Deadnettle	Marestail (Horseweed)	Mustard, Wild	Pennycress, Field	Rocket, Yellow ⁴	Shepherdspurse	Thistle, Musk ⁴	Dock, Curly	Fescue, Tall	Orchardgrass	Plantain	Quackgrass	Sorrel, Red (sheep)	Thistle, Canada
Before Seeding																	
Gramoxone MAX	-	G	F	G	F	G	F	F	G	P	P	F	F	P	P	P	N
Glyphosate	-	G	G	G	G	G	G	G	G	F	F	G	G	F	G	F	F
Nondormant																	
Buctril	2	F	P	F	P	G	G	F	F	P	N	N	N	P	N	P	F
Butyrac 200	1	P	F	P	P	F	F	G	F	F	F	N	N	F	N	P	N
Poast/Poast Plus	0	N	N	N	N	N	N	N	N	N	N	F	F	N	F	N	N
Select	0	N	N	N	N	N	N	N	N	N	N	G	G	N	F	N	N
Pursuit ⁵	1	G	*	F	*	G	G	F	G	P	P	*	*	*	P	*	P
Raptor ⁵	1	G	*	F	*	F	G	*	G	P	P	*	*	*	P	*	P
Dormant Season																	
Sencor	2	G	F	G	P	G	G	G	G	P	F	P	F	F	P	P	N
Sinbar	1	G	*	G	P	G	G	G	G	P	P	P	F	F	F	F	N
Dormant or Between Cuttings																	
Gramoxone MAX	2	G	F	G	P	G	F	F	G	P	P	F	F	F	P	P	N
Velpar	2	G	F	F	F	G	G	G	G	F	F	*	F	G	F	F	N
Spot Treatment																	
Glyphosate	8	G	G	G	G	G	G	G	G	F	G	G	G	G	G	F	F

G = Good F = Fair P = Poor N = None * = Data Not Available

¹ This table should be used only as a guide for comparing the relative effectiveness of herbicides to a particular weed. A herbicide may perform better or worse than indicated, depending on weed size and/or extreme weather conditions. If a farmer is getting satisfactory results under his conditions, he should not necessarily change products as a result of the information in the table.

² Repeated herbicide applications over several years may be necessary for control of perennial weeds.

³ Based on a scale from 0 to 9. A crop response of 3 or less will not result in a crop yield loss when treatments are applied under normal conditions.

⁴ Biennial plant that emerges in late fall or early spring.

⁵ May also be applied between cuttings or in the fall after last cutting or in the early spring.

Herbicides for Use in Forage Legumes

BUCTRIL 2EC

BUCTRIL 2EC contains 2 lb ai of bromoxynil per gallon. **For use on seedling alfalfa only.**

Use Rate: Broadcast Buctril 2EC at 1 to 1.5 pt/A.

Additives: Do not apply BUCTRIL 2EC with a spray adjuvant (Crop Oil Concentrate or Non-Ionic Surfactant) unless specified by the label or tank mixture combination because increased alfalfa injury may occur.

Weeds Controlled: Controls and suppresses growth of broadleaf weeds, including cocklebur, common ragweed, jimsonweed, common lambsquarters, smartweed, wild mustard, and field pennycress.

General Comments: Apply in the fall or in the spring to seedling alfalfa when the majority of the field has a minimum of four trifoliate leaves and before weeds exceed the four-leaf stage, 2 inches in height, or 1 inch in diameter, whichever comes first. Warm, humid conditions following application may enhance leaf burn; however, new crop growth is less likely to be affected. The total cumulative rate of BUCTRIL should not exceed 2 pt/A per season.

Precautions: Do not apply when alfalfa is under moisture, temperature, insect, or disease stress or has been stressed by carry-over from another pesticide or application. When alfalfa stand is uneven and conditions favor leaf burn, unacceptable crop injury may occur to alfalfa in the two trifoliate or smaller stage of growth. BUCTRIL applications made when temperatures are expected to be low (less than 50°F) or exceed 70°F for three days following application can result in unacceptable crop injury.

Table 4. Guide to the relative response of warm-season weeds to herbicides.¹

Herbicide	Annuals											Perennials ²					
	Legume Tolerance ³	Barryardgrass	Cocklebur, Common	Crabgrass	Foxtails	Goosegrass	Jimsonweed	Johnsongrass (seedling)	Lambsquarters, Common	Nightshade, Eastern Black	Panicum, Fall	Pigweeds/Spiny Amaranth	Ragweed, Common	Ragweed, Giant	Smartweed (Ladysthumb)	Johnsongrass (rhizome)	Nutsedge, Yellow
Before Seeding																	
Eptam (PPI only)	1	G	P	G	G	G	P	F	F	G	G	F	P	P	P	P	F
Gramoxone MAX	-	G	F	F	G	G	G	F	F	G	F	G	G	F	F	N	P
Glyphosate	-	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	F
Nondormant																	
Buctril	2	N	G	N	N	N	G	N	G	G	N	F	G	F	G	N	N
Butyrac 200	1	N	G	N	N	N	F	N	G	P	N	G	G	F	F	N	N
Poast/Poast Plus	0	G	N	G	G	G	N	G	N	N	G	N	N	N	N	F	N
Select	0	G	N	G	G	G	N	G	N	N	G	N	N	N	N	G	N
Pursuit ⁵	1	F	G	F	G	F	F	G	F	G	F	G ⁴	F	G	G	P	P
Raptor ⁵	1	G	G	F	G	F	*	G	G	G	F	G ⁴	F	G	G	F	P
Dormant or Between Cuttings																	
Gramoxone MAX	2	F	F	F	G	F	G	F	F	G	G	F	G	F	F	N	F
Velpar	2	G	F	G	G	F	G	*	G	F	F	G	F	P	F	*	P
Spot Treatment																	
Glyphosate	8	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	F

G = Good F = Fair P = Poor N = None * = Data Not Available PPI = Preplant Incorporated only

- ¹ This table should be used only as a guide for comparing the relative effectiveness of herbicides to a particular weed. A herbicide may perform better or worse than indicated, depending on weed size and/or extreme weather conditions. If a farmer is getting satisfactory results under his conditions, he should not necessarily change products as a result of the information in the table.
- ² Repeated herbicide applications over several years may be necessary for complete control of perennial weeds.
- ³ Based on a scale from 0 to 9. A crop response of 3 or less will not result in a crop yield loss when treatments are applied under normal conditions.
- ⁴ Will not control biotypes tolerant/resistant to the class of chemistry associated with this herbicide.
- ⁵ May also be applied between cuttings or in the fall after last cutting or in the early spring.

Grazing and Hay Restrictions: Do not cut for feed or graze spring-treated alfalfa within 30 days following treatment. Do not cut for feed or graze fall- or winter-treated alfalfa until spring, or at least 60 days following treatment.

Tank Mixes: Consult BUCTRIL label for rates and additional comments before tank mixing with BUTYRAC 200 and PURSUIT.

BUTYRAC 200

BUTYRAC 200 contains 2 lb ai of 2,4-DB (dimethylamine salt) per gallon. **For use on new seedlings and established alfalfa and on seedling clover and birdsfoot trefoil.**

Use Rate: Broadcast at 1 to 2 qt/A for weed species less than 1 inch. Broadcast at 2 to 3 qt/A for weed species up to 3 inches.

Additives: Do not apply BUTYRAC with a spray adjuvant (Crop Oil Concentrate or Non-Ionic Surfactant) unless specified by the label or tank mix partner.

Weeds Controlled: Controls and suppresses growth of broadleaf weeds, including cocklebur, common lambsquarters,

pigweeds, common ragweed, field pennycress, jimsonweed, morningglory, wild mustard, and yellow rocket.

General Comments: Apply in the fall or spring when weeds are small (1 to 3 inches). In established alfalfa, stem twisting and malformation of the leaves might be observed.

Precautions: Do not spray if temperature is expected to be less than 40°F or exceed 90°F during the three days following application. Do not apply when crop is stressed from lack of moisture. Do not add wetting agents or other additives to the spray solutions unless specified on the label.

Grazing and Hay Restrictions:

- **Seedling:** Do not graze or feed seedling legumes within 60 days of application.
- **Established:** Do not graze established legumes or feed straw or hay from treated established legumes to livestock within 30 days of application.

Tank Mixes: Consult BUTYRAC 200 label for rates and additional comments before tank mixing with BUCTRIL and POAST.

EPTAM 7E

EPTAM 7E contains 7 lbs ai of EPTC per gallon of product. **For use as a preplant incorporated treatment prior to seeding alfalfa, clover, birdsfoot trefoil, and lespedeza.**

Use Rate: Broadcast EPTAM 7E at 3.5 to 4.5 pt/A.

Weeds Controlled: Controls and suppresses growth of grasses and selected broadleaf weeds, including chickweed, common lambsquarters, johnsongrass (seedling), Italian ryegrass, crabgrass, fall panicum, foxtails, and pigweeds.

General Comments: Apply and incorporate into soil immediately before seeding. See label for incorporation directions.

Precautions: Do not use if a grass or small-grain nurse crop is to be planted with the legumes. Temporary stunting may result if conditions are not favorable for germination or growth.

Grazing and Hay Restrictions: None.

GLYPHOSATE

(Various Products)

Glyphosate is the active ingredient contained in ROUNDUP and various other products. Examples include: GLYFOS X-TRA, GLYPHOMAX PLUS, GLY STAR PLUS, ROUNDUP ORIGINAL, ROUNDUP ULTRADRY, ROUNDUP ULTRAMAX, ROUNDUP WEATHERMAX, and TOUCHDOWN. The formulations of some products differ in the concentration of glyphosate (lb of acid equivalents per gallon of product) and whether additional surfactant is required. Therefore, it is important to consult the glyphosate product label for specific herbicide rate, use of additives, and other directions. **For use as a preplant foliar treatment to burn down existing vegetation for establishment of legumes, such as alfalfa, clovers, birdsfoot trefoil, lespedeza, and crown vetch, or for use as a spot treatment or wiper application in seedling or established stands of alfalfa and clover.**

Use Rate: General guidelines for various glyphosate product formulations are listed in Table 5. Application rates for specific weed species will vary depending on the product formulation used.

Additives: Dry ammonium sulfate (AMS) 1 to 2% by weight (8.5 to 17 lb/100 gal) may be included with glyphosate products to enhance weed control. Recommendations for use of additional surfactant (if needed) will vary depending on the products. Some products, such as ROUNDUP ULTRAMAX and ROUNDUP WEATHERMAX, indicate no additional surfactant should be added (consult label).

Weeds Controlled: Controls annual and perennial grasses and broadleaf plants. Consult label for specific weeds controlled, application rates, and relative weed sizes for optimum results.

General Comments: Glyphosate is a nonselective, translocated herbicide with no soil residual activity. Weeds may not be effectively controlled when growing under poor conditions, such as drought stress or low temperatures. Rainfall soon after application may reduce effectiveness.

- **Preplant Burndown:** For establishment of alfalfa, clovers, and other labeled legumes, apply as a preplant foliar treatment before or at time of planting but prior to crop emergence.
- **Spot Spray/Wiper Applications (Alfalfa and Clover ONLY):** For use in alfalfa or clover after crop establishment. Apply in areas where the movement of domestic livestock can be controlled. No more than one-tenth of an acre should be treated at one time. The crop will be killed in the area that has been treated with spot spray applications. Mix ROUNDUP or other Glyphosate 4S formulations at 0.6 to 2.5 oz per gallon; ROUNDUP WEATHERMAX at 0.5 to 1.9 oz per gallon; and ROUNDUP ULTRADRY at 0.4 to 1.5 oz per gallon of spray solution. Treat undesirable plants on a spray-to-wet basis. For wiper, rope wick, and sponge applications, make sure the selected weeds are above the desirable vegetation to avoid contact with the crop. In general, mix a 33 to 50% solution in water for use in a wiper, rope

Table 5. General guidelines for glyphosate products applied preplant as a foliar burndown treatment prior to crop emergence.¹

Glyphosate Product	Weed Size	Rate/A	(lb acid equivalent/A)
Glyphosate 4S ² (3 lb ae/gal)	Annuals <6" tall	1.5 to 2 pt	(0.56 to 0.75 lb ae)
	Annuals >6" tall	2 to 3 pt	(0.75 to 1.1 lb ae)
	Perennials	1.5 to 3 qt	(1.1 to 2.25 lb ae)
Roundup UltraMAX 5S (3.73 lb ae/gal)	Annuals <6" tall	20 to 26 fl.oz	(0.58 to 0.76 lb ae)
	Annuals >6" tall	26 to 40 fl.oz	(0.76 to 1.2 lb ae)
	Perennials	1.25 to 2.5 qt	(1.2 to 2.3 lb ae)
Roundup WeatherMAX 5.5S (4.5 lb ae/gal)	Annuals <6" tall	16 to 22 fl.oz	(0.56 to 0.77 lb ae)
	Annuals 6-12" tall	22 to 32 fl.oz	(0.77 to 1.1 lb ae)
	Annuals >12" tall	32 to 44 fl.oz	(1.1 to 1.5 lb ae)
	Perennials	1 to 2 qt	(1.1 to 2.25 lb ae)
Roundup UltraDRY 71.4WDG (64.9% ae)	Annuals <6" tall	14 to 19 oz	(0.56 to 0.77 lb ae)
	Annuals >6" tall	19 to 28 oz	(0.77 to 1.1 lb ae)
	Perennials	1.8 to 3.6 lb	(1.2 to 2.3 lb ae)

¹ Consult label for specific recommendations on growth stage and timing of herbicide application.

² Examples of Glyphosate 4S products include: Glyfos X-tra, Glyphomax Plus, Glyphosate Original, Gly Star Original, Gly Star Plus, Roundup Original, Roundup Ultra, Touchdown.

wick, or sponge applicator. Consult individual product label for specific guidelines on mixing the herbicide concentration and for use on selected weed species.

- **Preharvest (Alfalfa ONLY):** Some glyphosate products may be applied as a broadcast spray to declining alfalfa stands or to any stand of alfalfa where crop destruction is acceptable. When applied prior to alfalfa harvest, this treatment can be used to control annual and perennial weeds such as johnsongrass. Consult label for maximum use rates allowed depending on product used. Applications may be made at any time of year.

Grazing and Hay Restrictions:

- **Preplant Burndown:** Remove domestic livestock before application, and wait eight weeks after application before grazing or harvesting.
- **Spot Spray/Wiper Applications (Alfalfa and Clover ONLY):** Remove domestic livestock before application, and wait 14 days after application before grazing livestock or harvesting.
- **Preharvest (Alfalfa ONLY):** The treated crop and weeds can be harvested and fed to livestock after 36 hours. Allow a minimum of 36 hours between application and harvest.

GRAMOXONE MAX 3S

GRAMOXONE MAX 3S contains 3 lb ai of paraquat per gal of product. GRAMOXONE MAX 3S is a RESTRICTED USE pesticide. **Use GRAMOXONE MAX as a preplant foliar treatment to burn down existing vegetation for establishment of legumes, such as alfalfa, clovers, birdsfoot trefoil, lespedeza, and crown vetch, or for use on new seedlings and established legumes as a dormant season treatment. GRAMOXONE MAX can also be used on alfalfa as a between cutting treatment.**

Use Rate:

- **Preplant Foliar Burndown or at Planting:** Apply 1.7 to 2.7 pt/A before seeding or prior to crop emergence.
- **New Seedlings (Dormant <1 year old):** Apply 0.7 to 1.3 pt/A.
- **Established (Dormant):** Apply 1.5 to 2 pt/A.
- **Between Cuttings (Alfalfa ONLY):** Apply 0.7 pt/A.

Additives: Add Non-Ionic Surfactant containing 75% or more surface-active agents at 0.125% v/v (1 pt/100 gal) of the finished spray volume OR add a nonphytotoxic Crop Oil Concentrate containing 15% to 20% approved emulsifier at 1% v/v (1 gal/100 gal) of the finished spray volume.

Weeds Controlled: Controls and suppresses growth of many annual grasses and broadleaf weeds. Established weeds and the stubble of weeds cut off during harvest will be less affected by this treatment, compared with smaller weed seedlings.

General Comments:

- **Preplant Foliar Burndown or At Planting:** Seeding should be done with minimal soil disturbance. Apply prior to the emergence of the crop. Crop plants that are emerged at the time of application will be killed.
- **New Seedlings (Dormant <1 year old):** For fall-seeded, newly established stands less than 1 year old. Apply when crop is dormant during late fall or winter months after last fall cutting. Applications to legume crops that are not yet dormant or have broken dormancy may result in stand loss and/or yield reduction. Green-crop foliage present at the time of application will be burned. Do not apply more than once per season.
- **Established (Dormant):** Apply when crop is dormant during late fall or winter months after last fall cutting and before first spring cutting. Do not apply if fall regrowth following last fall cutting is greater than 6 inches for alfalfa (2 inches for clover and other legumes) or if spring regrowth is more than 2 inches. Applications to legume crops that are not yet dormant or have broken dormancy may result in stand loss and/or yield reduction. Green-crop foliage present at the time of application will be burned. Do not apply more than once per season.
- **Between Cuttings (Alfalfa ONLY):** Weeds beyond the seedling stage and the stubble of weeds cut off during harvest will be less affected by this treatment. Apply immediately after alfalfa has been removed for hay or silage. Do not treat more than five days after cutting. For first-year alfalfa, do not apply more than two applications per growing season.

Grazing and Hay Restrictions:

- **New Seedlings (Dormant <1 year old):** Do not cut or harvest within 60 days of application.
- **Established (Dormant):** Do not cut or harvest within 42 days of application.
- **Between Cuttings (Alfalfa ONLY):** Do not cut or harvest within 30 days of application.

Tank Mixes: SENCOR and VELPAR. *Do not tank mix metribuzin (SENCOR) with GRAMOXONE MAX on newly established alfalfa (<1-year-old stands).* Consult the product labels for specific tank mixing details. Always follow the more restrictive label for the tank mix partner.

POAST PLUS 1E or POAST 1.5 E

POAST PLUS 1E contains 1.0 lb ai sethoxydim per gallon. POAST 1.5E contains 1.5 lb ai sethoxydim per gallon. **For use on new seedings and established alfalfa, clovers, and birdsfoot trefoil.**

Use Rate: Broadcast POAST PLUS at 1.5 to 2.25 pt/A for annual and perennial grasses. Broadcast POAST at 1.0 to 1.5 pt/A for annual and perennial grasses. For spot treatments, prepare a 1.0 to 1.5 % v/v solution of POAST or 1.5 to 2.25% v/v solution of POAST PLUS. Consult POAST or POAST PLUS label regarding specific spray adjuvant concentrations, weed sizes, and product dilution rates for spot treatments.

Additives: Add Crop Oil Concentrate, Dash HC, Sundance HC, or Methylated Seed Oil. In addition, urea ammonium nitrate (UAN) or ammonium sulfate (AMS) may be used when applied on alfalfa to enhance POAST PLUS or POAST activity on certain grass species. Consult POAST PLUS and POAST label for specific rates and guidelines on adjuvants.

Weeds Controlled: Controls and suppresses growth of annual and perennial grasses, including crabgrass, fall panicum, foxtails, shattercane, and johnsongrass. For rhizome johnsongrass, more than one application may be required. The first application should be applied when johnsongrass plants are less than 25 inches tall. If regrowth occurs or new plants emerge, make the second application to plants when they are less than 12 inches tall.

General Comments: For best results, apply to grasses that are actively growing and within their optimum plant heights. For a given application, do not apply more than 3.75 pt/A POAST PLUS and 2.5 pt/A POAST. Do not apply more than 9.75 pt/A POAST PLUS and 6.5 pt/A POAST in a season. POAST PLUS and POAST are rainfast one hour after application.

Precautions: Avoid applications when grasses are stressed by lack of moisture, mechanical injury, or other factors. POAST PLUS or POAST plus adjuvants should be used with caution due to potential crop leaf injury when the temperature exceeds 90°F and 60% relative humidity or anytime the temperature exceeds 100°F, regardless of humidity.

Grazing and Hay Restrictions:

- **Alfalfa:** Wait 14 days following application before cutting for (dry) hay. Treated fields can be grazed, cut, or fed as green-chop (undried) forage within seven days after application.
- **Clover and Other Forage Legumes:** Wait 20 days following application before cutting for (dry) hay. Treated fields can be grazed, cut, or fed as green-chop (undried) forage within seven days after application.

Tank Mixes: Consult the labels of POAST PLUS or POAST before tank mixing with BUTYRAC 200 (2,4-DB). Do not add UAN or AMS to a tank mix of POAST or POAST PLUS plus 2,4-DB.

PURSUIT 70DG

PURSUIT 70DG contains 0.7 lb ai of imazethapyr per lb of product. **For use on new seedings and established alfalfa.**

Use Rate: Apply PURSUIT 70DG at 1.44 oz/A. For some weed species apply PURSUIT 70DG at 1.08 to 2.16 oz/A, depending on weed species and stage of weed growth.

Additives: Postemergence applications of PURSUIT on alfalfa require the addition of an adjuvant plus a fertilizer solution. Add Crop Oil Concentrate at 1.25 gal per 100 gal spray solution or Methylated Seed Oil at 1 gal per 100 gal spray solution or Non-Ionic Surfactant (>80% active ingredient) at 1 qt per 100 gal of spray solution PLUS a liquid fertilizer solution, such as 28% N, 32% N or 10-34-0, at a rate of 1.25 to 2.5 gal per 100 gal of spray solution. Instead of liquid fertilizer, spray-grade ammonium sulfate (AMS) may be used at a rate of 12 to 15 lbs per 100 gal of spray.

Weeds Controlled: Controls and suppresses growth of many broadleaf and grass weeds, including cocklebur, common chickweed, foxtails, johnsongrass (seedling), field pennycress, pigweeds, giant ragweed, shepherdspurse, smartweed, and wild mustard.

General Comments:

- **New Seedings:** PURSUIT must be applied postemergence to seedling alfalfa. Apply in the spring, summer, or fall when seedling alfalfa is in the second trifoliate stage or larger and when the majority of the weeds are 1 to 3 inches tall and actively growing. For low-growing weeds such as mustards, apply before rosette exceeds 3 inches. Weeds under stress are less susceptible to control in cold or drought stress conditions. A maximum of 2.16 oz/A of PURSUIT can be applied per year.
- **Established:** PURSUIT may be applied to alfalfa in the fall following the last cutting or in the spring to dormant or semi-dormant alfalfa. Spring treatments should be applied prior to excessive alfalfa growth (less than 3 inches of new growth) to reduce spray interference.
- **Established (Between Cuttings):** For weed control during the season, apply PURSUIT following alfalfa cutting. Remove hay from the field and apply PURSUIT prior to excessive alfalfa regrowth.

Precautions: If applied to alfalfa under cool conditions (< 40°F), temporary stunting or slight leaf-yellowing may occur after an application of PURSUIT. Growth of perennial grasses, such as orchardgrass, fescues, bromes, or timothy, might be suppressed. Do not apply more than 1.44 oz/A of PURSUIT during the last year of the stand.

Grazing and Hay Restrictions: Do not feed, graze, or harvest alfalfa for 30 days following an application of PURSUIT.

Tank Mixes: BUCTRIL, 2,4-DB, POAST, POAST PLUS, or SELECT. Consult the respective labels for specific details. Always follow the more restrictive labeled tank mix partner.

Crop Rotation Guidelines: The following rotational crops may be planted after applying PURSUIT: soybeans anytime; alfalfa, rye, or wheat after four months; field corn after eight and a half months; barley or tobacco after nine and a half months; and oats, popcorn, sorghum, sunflowers, or sweet corn after 18 months. Other crops not listed on the label require a minimum 40-month waiting period and a successful field bioassay before planting.

RAPTOR

RAPTOR contains 1 lb ai imazamox per gal of product. **For use on new seedlings and established alfalfa.**

Use Rate: Apply RAPTOR at 5 oz/A. For some weeds broadcast RAPTOR at 4 to 6 oz/A depending on weed species and growth stage.

Additives: Postemergence applications of RAPTOR require the addition of an adjuvant plus a nitrogen fertilizer solution. Add Crop Oil Concentrate or Methylated Seed Oil at 1 to 2 gal per 100 gal of spray solution or 1 to 2 qts of Non-Ionic Surfactant (>80% active ingredient) per 100 gal of spray solution PLUS 2.5 gals of liquid fertilizer, such as 28% N, 32% N, or 10-34-0, per 100 gal of spray solution. Spray-grade ammonium sulfate (AMS) may be used at a rate of 12 to 15 lbs per 100 gal of spray solution instead of a liquid N fertilizer solution.

Weeds Controlled: Controls and suppresses growth of many broadleaf and grass weeds, including cocklebur, common chickweed, foxtails, johnsongrass (seedlings), field pennycress, pigweeds, giant ragweed, shepherdspurse, smartweed, and wild mustard.

General Comments:

- **New Seedlings:** RAPTOR must be applied postemergence to seedling alfalfa. Apply in the spring, summer, or fall when seedling alfalfa is in the second trifoliate stage or larger and when the majority of the weeds are 1 to 3 inches tall and actively growing. For low-growing weeds, such as mustards, apply before rosette exceeds 3 inches. A maximum of 6 oz/A of RAPTOR per season may be applied to alfalfa.
- **Established:** RAPTOR may be applied to alfalfa in the fall following the last cutting or in the spring to dormant or semi-dormant alfalfa. Spring treatments should be applied before excessive alfalfa growth (less than 3 inches of new growth), to reduce spray interference.
- **Established (Between Cuttings):** For weed control during the season, apply RAPTOR after alfalfa has been removed but before excessive regrowth (less than 3 inches of new growth) to allow RAPTOR to reach the target weeds.

Precautions: When RAPTOR is applied to seedling alfalfa, there may be a temporary reduction in growth.

Grazing and Hay Restrictions: Do not feed, graze, or harvest alfalfa for 20 days following an application of RAPTOR.

Tank Mixes: BUCTRIL (seedling alfalfa only), 2,4-DB, POAST, POAST PLUS, or SELECT. Consult the respective labels for specific details. Always follow the more labeled tank mix partner.

Crop Rotation Guidelines: The following rotational crops may be planted after applying RAPTOR: soybeans anytime; alfalfa and wheat after three months; barley and rye after four months; corn (popcorn, field, seed, sweet, Clearfield, and non-Clearfield hybrids) after eight and a half months; and grain sorghum, oats, sunflowers, and tobacco after nine months. All other crops not listed in the rotational section require a minimum 18-month waiting period.

SELECT 2EC

SELECT 2EC contains 2 lb ai clethodim per gal of product. **For use on new seedlings and established alfalfa and birdsfoot trefoil.**

Use Rate: Broadcast 6 to 8 oz/A for annual grass weed control in seedling legumes. Apply a minimum of 8 oz/A for annual grass weeds in established alfalfa; 8 to 16 oz/A for perennial grass control.

Additives: Postemergence applications of SELECT require the addition of an adjuvant. Apply Crop Oil Concentrate at 1 qt/A. Liquid fertilizer (10-34-0, 28% N, or 32% N) may be added to the spray solution at a rate 1 to 2 qts/A. The addition of ammonium sulfate (AMS) may improve grass control for difficult species, including quackgrass, johnsongrass (rhizome), and volunteer corn.

Weeds Controlled: Controls and suppresses growth of many annual and perennial grass weeds, including crabgrass, fall panicum, foxtails, shattercane, and johnsongrass. For rhizome johnsongrass, more than one application may be required. The first application (8 to 16 oz/A) should be applied when johnsongrass plants are less than 25 inches tall. If regrowth occurs or new plants emerge, make the second application (6 to 8 oz/A) to plants when they are less than 18 inches tall.

General Comments: Apply to grasses that are actively growing and within their optimum plant heights for best results. Apply before legume canopy covers the target weeds and interferes with spray coverage. SELECT is rainfast after one hour.

Precautions: Do not plant rotational crops until 30 days after application of SELECT. Minor leaf spotting may occur on treated plants under certain environmental conditions.

Grazing and Hay Restrictions: Do not harvest, feed, or graze treated legumes within 15 days of SELECT treatment.

Tank Mixes: 2,4-DB and PURSUIT. A tank mixture of SELECT plus 2,4-DB may increase the risk of crop injury. Legume plants will generally outgrow this temporary injury within a few weeks. Do not feed, graze, or harvest treated alfalfa for 30

days following an application of SELECT plus PURSUIT. The following insecticides may be tank mixed with SELECT: Baythroid, Dimethoate, Lorsban, Pounce, or Warrior. Certain insecticides may cause temporary phytotoxic symptoms on legume foliage. Refer to the insecticide label for further information.

SENCOR 4F or SENCOR 75DF

SENCOR 4F contains 4 lb ai metribuzin per gal of product. SENCOR 75DF contains 0.75 lb ai metribuzin per lb of product. **For use on established (> 1 year old stand) alfalfa and alfalfa-grass mixtures.**

Use Rate: Broadcast SENCOR 4F at 1.0 to 1.5 pt/A. Broadcast SENCOR 75DF at 0.67 to 1.0 lb/A.

Weeds Controlled: Controls and suppresses growth of many broadleaf and grass weeds, including common chickweed, dandelion, henbit, purple deadnettle, common lambsquarters, wild mustard, pepperweed, pigweeds, shepherdspurse, and yellow rocket.

General Comments:

- **Established (Dormant):** Apply when alfalfa growth ceases in late fall or in the spring before new growth begins. Crop injury may occur if, at the time of application, crop is under stress caused by diseases, drought, winter injury, or other factors. For best results, apply to weeds that are less than 2 inches tall or before weeds exceed 2 inches in diameter.
- **Established (Postdormant):** When impregnated on a dry bulk fertilizer, SENCOR may be applied after dormancy has broken but prior to 3 inches of new alfalfa shoot growth. Apply when alfalfa foliage is dry or crop injury may occur.

Precautions: Do not apply within the first growing season (12 months after seeding). For postdormant applications, only apply with an impregnated dry bulk fertilizer mixture.

Grazing and Hay Restrictions:

- **Established (Dormant):** Do not graze or harvest treated alfalfa within 28 days of treatment.
- **Established (Postdormant):** When applying SENCOR impregnated on dry bulk fertilizer, do not graze or harvest treated alfalfa for 60 days after application.

SINBAR 80W

SINBAR 80W contains 0.8 lb ai of terbacil per lb of product. **For use on established (> 1 year old stand) alfalfa.**

Use Rate: Broadcast at 1.0 to 1.5 lb/A.

Weeds Controlled: Controls and suppresses growth of many broadleaf and grass weeds, including common chickweed, foxtails, henbit, purple deadnettle, common lambsquarters, pepperweed, prickly lettuce, shepherdspurse, and yellow rocket.

General Comments: Apply in a single application in the fall after the plants have become dormant or in the spring before new growth starts. For semi-dormant and nondormant varieties, apply in the fall or winter after the last cutting or in the spring before new growth starts. Apply before or after emergence of weeds but before they are 2 inches in height or width.

Precautions: Do not apply to alfalfa stands after new growth starts in the spring, as injury to crop may result. Applications made to plants under stress and/or cold temperatures (< 40°F) may result in reduced or no weed control. Avoid overlap, as severe crop injury may result. Do not apply on snow-covered or frozen ground, as injury to the crop or poor weed control may result. Do not replant treated areas with any crop within two years after last application as injury to subsequent crops may result.

Grazing and Hay Restrictions: None indicated on the label.

Tank Mixes: SINBAR may be applied in a program involving tank mixes with other herbicides, fungicides, or insecticides registered for use on alfalfa. Consult both the SINBAR and tank mix partner labels for specific details on rates and timings.

VELPAR 2L or VELPAR 75DF

VELPAR 2L contains 2 lbs ai hexazinone per gal of product. VELPAR 75DF contains 0.75 lb ai hexazinone per lb of product. **For use on established (> 1 year old stand) alfalfa as a dormant, postdormant, or between cutting treatment.**

Use Rate: Broadcast VELPAR 2L at 2 to 6 pt/A. Broadcast VELPAR 75DF at 1 to 2 lb/A. VELPAR 2L may be impregnated on dry bulk fertilizer (consult label guidelines).

Additives: Use surfactant when weeds have emerged. Do not add a surfactant when treating nondormant alfalfa varieties. Consult label for specific details.

Weeds Controlled: Controls and suppresses growth of many broadleaf and grass weeds, including common chickweed, crabgrass, foxtails, jimsonweed, common lambsquarters, wild mustard, field pennycress, pigweeds, shepherdspurse, yellow rocket, and downy brome depending when treatment is applied.

General Comments:

- **Established (Dormant):** Make a single application in late fall or winter after plants become dormant and before growth begins in the spring. Where weeds have emerged, use a surfactant. Treat only stands of alfalfa established for more than one year or well established after one growing season.
- **Established (Postdormant):** Apply in the spring before new growth exceeds 2 inches in height. Treat only stands of alfalfa established for more than one year or well established after one growing season.
- **Established (Between Cuttings):** Apply to stubble following hay removal but before regrowth exceeds 2 inches in height. Treat only stands of alfalfa established for more than one year or well established after one growing season.

Precautions:

- **Established (Dormant):** Do not apply to snow-covered or frozen ground. Do not use VELPAR on gravelly or rocky soils, exposed subsoils, hardpan, sand, poorly drained soil, or alkali soils.
- **Established (Postdormant and Between Cuttings):** Severe alfalfa injury may result following application if alfalfa growth in the spring or regrowth after hay removal exceeds 2 inches. Do not apply if air temperature exceeds 90°F.

Crop Rotation Guidelines: Corn may be planted within 12 months after last treatment. Do not plant any other crops within two years after application.

Grazing and Hay Restrictions: Do not graze or feed forage or hay to livestock within 30 days following application of VELPAR. Do not graze or harvest within 42 days of application of VELPAR plus GRAMOXONE MAX.

Tank Mixes: GRAMOXONE MAX. Consult the respective labels for specific details. Always follow the more restrictive labeled tank mix partner. Temporary chlorosis may occur on alfalfa regrowth.

Listing of pesticide products implies no endorsement by the University of Kentucky or its representatives. Criticism is neither implied nor intended for products not listed.