



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 options. Vigorous, dense-growing, and competitive forage legume stands have fewer weed problems. Thus, cultural and management practices that promote a highly competitive forage stand can 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 [prior to first cutting] or an established stand, and the crop growth stage (dormant, nondormant, between cutting). Table 1 contains herbicide products available for use on legume forage crops, and 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 2 and Table 3.

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 (eg. AAtrex, Bicep II Magnum, Degree Xtra, Harness Xtra, etc.), clomazone (eg. Command), chlorimuron ethyl (eg. Canopy, Classic), and prosulfuron (eg. 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, in fields that have a history of weeds such as large crabgrass, foxtails, or lambsquarters, fall seedings should be considered for optimum establishment of most forage crops. 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

Table 1. Herbicide products labeled for legume forage crops and permitted application times relative to legume stage of growth.

Herbicide Active Ingredient		Crops Labeled for Use					Alfalfa Stage of Crop Growth					
		Alfalfa	Alfalfa-Grass Mixtures	Clovers (Red, Alsike, Ladino)	Birdsfoot Trefoil	Lespedeza	Dormant	Semi-Dormant	Non-Dormant	Between Cuttings	Spot Spray or Wiper Application	
Products												
Before Seeding												
glyphosate	Roundup, etc.	L	L	L	L ¹	L ¹	-	-	-	-	-	-
paraquat	Gramoxone, etc.	L	L	L	L	L	-	-	-	-	-	-
New Seedlings (stands less than 1 year old or has not been through first cutting or mowing)												
2,4-DB	Butyrac 200	L	X	X	L ²	X	X	X	Y	X	X	X
bromoxynil	Maestro/Moxy	L	X	X	X	X	X	X	Y	X	X	X
clethodim	Select/Intensity	L	X	X	L	X	X	X	Y	X	Y ³	
glyphosate	Roundup, etc.	L <RR>	L <SW>	L <SW>	L ¹ <SW>	L ¹ <SW>	X	X	Y ⁴ <RR>	X	Y	
imazamox	Raptor	L	X	X	X	X	X	X	Y ⁴	Y ⁵	X	X
imazethapyr	Pursuit, etc.	L	X	L	L	X	X	X	Y ⁴	Y ⁵	X	X
imazethapyr + glyphosate	Extreme/ThunderMaster	L <RR>	X	X	X	X	X	X	Y ⁴ <RR>	X	X	X
paraquat	Gramoxone, etc.	L	X	L	L	L	Y ⁶	X	X	Y ⁶	X	X
pendimethalin	Prowl H20, etc.	L	X	X	X	X	X	X	Y ⁷	X	X	X
sethoxydim	Poast/Poast Plus	L	X	L	L	X	X	X	Y	X	Y ³	
Established Stands (>1 year old stands or forage legume that has gone through first cutting)												
2,4-DB	Butyrac 200	L	X	X	X	X	X	X	Y	X	X	X
clethodim	Select/Intensity	L	X	X	L	X	X	X	Y	X	Y ³	
flumioxazin	Chateau/Tuscany	L	X	X	X	X	Y ⁸	Y ⁸	X	Y ⁸	X	X
glyphosate	Roundup, etc.	L <RR>	L <SW>	L <SW>	L ¹ <SW>	L ¹ <SW>	X	X	Y <RR>	X	Y	
hexazinone	Velpar	L	X	X	X	X	Y ⁶	Y ⁶	X	Y ⁶	X	X
imazamox	Raptor	L	X	X	X	X	X	Y ⁵	Y ⁵	Y ⁵	X	X
imazethapyr	Pursuit, etc.	L	L	L	L	X	X	Y ⁵	Y ⁵	Y ⁵	X	X
imazethapyr + glyphosate	Extreme/ThunderMaster	L <RR>	X	X	X	X	X	Y ⁵ <RR>	Y ⁵ <RR>	Y ⁵ <RR>	X	X
metribuzin	Glory, TriCor, etc.	L	L	X	X	X	Y	Y ⁹	X	X	X	X
paraquat	Gramoxone, etc.	L	X	L	L	L	Y ⁶	X	X	Y ⁶	X	X
pendimethalin	Prowl H20, etc.	L	L	X	X	X	Y ⁷	Y ⁷	X	Y ⁷	X	X
sethoxydim	Poast/Poast Plus	L	X	L	L	X	X	Y	Y	X	Y ³	

L = Crop labeled for herbicide use.

Y = Permitted application time.

RR = Apply ONLY to varieties designated as Roundup Ready alfalfa.

SW = Apply ONLY as a Spot Spray or Wiper Application on non RR-alfalfa and other forage legume crops.

X = Indicates herbicide is not labeled for use on this crop or herbicide application is not permitted at the specified growth stage.

¹ Some glyphosate products may not be labeled for these crops.

² Apply only to new seedlings of Birdsfoot Trefoil.

³ Do not make spot treatments in addition to broadcast treatments on the same areas.

⁴ Apply when seedling alfalfa is in the 2nd trifoliolate stage or larger and weeds are 1 to 3 inches in height.

⁵ Apply in the spring, fall, or between cuttings before significant alfalfa growth or regrowth begins (less than 3 inches).

⁶ Apply in the spring before new growth or before regrowth exceeds 2 inches in height.

⁷ Apply after seedling alfalfa has reached the 2nd trifoliolate stage; applications should be made prior to seedling and established alfalfa reaches 6 inches in growth; must be applied before weeds emerge.

⁸ Apply to established alfalfa with a maximum of 6 inches or less of growth; must be applied before weeds emerge.

⁹ Apply as a Post Dormant application only when metribuzin is impregnated onto dry fertilizer.

crabgrass, respond favorably to fertilization. Thus, other weed control methods are often needed in addition to proper fertility.

Clipping New Seedlings

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 broadleaf 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 or mow new seedlings, be careful not to smother young forage legume plants with heavy residues. Remove clipped vegetation when weed infestations are heavy.

Herbicides for New Seedlings

Herbicides used for new seedlings 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 improved longevity of stands. During seedling development, forage grasses usually are highly susceptible to injury from herbicides used in legume establishment. Subsequently, no herbicides are registered for new seedlings of legume grass mixtures.

Table 2. Guide to the relative response of cool-season weeds to herbicides.¹

Herbicide Active Ingredient		Products	Labeled ² Crops (Crop Stage)	Crop Tolerance ³	Winter Annuals										Perennials					
					Chickweed, Common	Deadnettle / Henbit	Fleabane spp.	Marestail (Horseweed)	Mustard, Wild	Pennycress, Field	Rocket, Yellow	Shepherdspurse	Thistle, Musk	Dandelion	Dock, Curly	Fescue, Tall	Orchardgrass	Plantain	Sorrel, Red (sheep)	Thistle, Canada
Before Seeding																				
glyphosate	Roundup, etc.	alf, cl, bf, lsp	_	G	G	G	G ⁴	G	G	G	G	F	F	F	G	G	F	F	F	
paraquat	Gramoxone, etc.	alf, cl, bf, lsp	_	G	G	F	F	G	F	F	G	P	P	P	F	F	P	P	N	
Non-Dormant																				
2,4-DB	Butyrac 200	alf (S,E), bf (S)	1	P	P	F	F	F-G	F-G	G	F	F	F	F	N	N	F	P	N	
bromoxynil	Maestro/Moxy	alf (S)	2	F	F	P	P	G	G	F	G	P	P	N	N	N	P	P	P	
clethodim	Select/Intensity	alf (S,E), bf (E)	0	N	N	N	N	N	N	N	N	N	N	N	F-G	F-G	N	N	N	
glyphosate	Roundup, etc.	alf (S,E) <RR-alf only>	0	G	G	G	G ⁴	G	G	G	G	F	F-G	F-G	G	G	F	F	F	
imazamox ⁵	Raptor	alf (S,E)	1	F	F	*	P	G	G	G	F-G	P	F	F	N	N	P	P	F	
imazethapyr ⁵	Pursuit	alf, cl, bf (S,E)	1	G	F	*	P	G	G	G	G	P	F	F	N	N	P	P	P	
imazethapyr + glyphosate	Extreme/ ThunderMaster	alf (S,E) <RR-alf only>	1	G	F	G	G ⁴	G	*	G	G	P	F	F	F	F	F	F	F	
sethoxydim	Poast/Poast Plus	alf, cl, bf (S,E)	0	N	N	N	N	N	N	N	N	N	N	N	F	F	N	N	N	
Dormant or Semi-Dormant Season																				
metribuzin	Glory/TriCor, etc.	alf (E)	2	G	G	F	F	G	G	G	G	P	F	F	P	P	P	P	P	
flumioxazin	Chateau/Tuscany	alf (E)	3	G	G	*	F-G	F	F	F	F	P	F	N	N	N	N	P	P	
Dormant or Between Cuttings																				
hexazinone	Velpar	alf (E)	2	G	F-G	F	F	G	G	G	G	F	F	F	F	F	F	P	P	
paraquat	Gramoxone, etc.	alf (S,E)	2	G	G	F	P	G	F-G	F-G	G	P	P	P	F	F	F	P	N	
pendimethalin	Prowl H20, etc.	alf (S,E)	1	F	F-G	P	N	P	P	F	F	N	N	N	N	N	N	N	N	

Efficacy Ratings: 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 **Labeled Crops:** alf = alfalfa; cl = clover, bf = birdsfoot trefoil; lsp = lespedeza; RR = Roundup Ready varieties

Crop Stage: S = new seedlings; E = established stands

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 resistant/tolerant 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.

Roundup Ready® Alfalfa

Alfalfa varieties are now available for planting which are resistant to foliar applications of glyphosate (eg. Roundup, etc.). These Roundup Ready alfalfa varieties can provide opportunities to produce high quality, relatively weed-free forage with excellent crop safety and minimal harvest restrictions. The Roundup Ready alfalfa system also provides an additional management tool during the first year of establishment, which is a critical time for weed control in alfalfa. During stand establishment, an initial glyphosate application is necessary at

the 3 to 5 trifoliate leaf stage to remove the small percentage of glyphosate-susceptible alfalfa plants that can be present in a new seeding. In forage production systems, such as alfalfa-grass mixtures, planting a Roundup Ready alfalfa may not be a viable option. However, glyphosate could be used during the initial establishment phase of alfalfa followed by interseeding a desirable forage grass at a later time. In this case, all glyphosate applications must be applied before any forage grass is seeded and cannot be used after forage grasses emerge and become established within the alfalfa stand.

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

Herbicide		Labeled ² Crops (Crop Stage)	Crop Tolerance ³	Summer Annuals											Perennials			
				Barnyardgrass	Crabgrass	Foxtails	Goosegrass	Cocklebur, Common	Lambsquarters, Common	Nightshade, Eastern Black	Panicum, Fall	Pigweeds/Spiny Amaranth	Ragweed, Common	Smartweed (Ladysthumb)	Johnsongrass (seedling)	Johnsongrass (rhizome)	Nutsedge, Yellow	
Active Ingredient	Products																	
Before Seeding																		
glyphosate	Roundup, etc.	alf, cl, bf, lsp	—	G	G	G	G	G	G	G	G	G	G	G	G	G	G	F-G
paraquat	Gramoxone, etc.	alf, cl, bf, lsp	—	G	F	G	G	F	F	G	F	G	G	F	F	N	P	
Non-Dormant																		
2,4-DB	Butyrac 200	alf (S,E), bf (S)	1	N	N	N	N	G	G	F	N	G	F-G	F-G	N	N	N	
bromoxynil	Maestro/Moxy	alf (S)	2	N	N	N	N	G	G	G	N	F	G	G	N	N	N	
clethodim	Select/Intensity	alf (S,E), bf (E)	0	G	G	G	G	N	N	N	G	N	N	N	G	G	N	
glyphosate	Roundup, etc.	alf (S,E) <RR-alf only>	0	G	G	G	G	G	G	G	G	G	G	G	G	G	G	F-G
imazamox ⁵	Raptor	alf (S,E)	1	G	F	G	F	G	G	G	F	G ⁴	F	G	G	F	F	
imazethapyr ⁵	Pursuit	alf, cl, bf (S,E)	1	F	F	G	F	G	F	G	F	G ⁴	F-G	G	G	P	F	
imazethapyr + glyphosate	Extreme/ ThunderMaster	alf (S,E) <RR-alf only>	1	G	G	G	G	G	G	G	G	G	G	G	G	G	F	
sethoxydim	Poast/Poast Plus	alf, cl, bf (S,E)	0	G	G	G	G	N	N	N	G	N	N	N	G	F	N	
Dormant or Semi-Dormant Season																		
metribuzin	Glory/TriCor, etc.	alf (E)	2	F	P	F	P	P	G	F	P	G	G	F	P	N	N	
flumioxazin	Chateau/Tuscany	alf (E)	3	F	F	F	F	P	G	G	F	G	F	F	N	N	N	
Dormant or Between Cuttings																		
hexazinone	Velpar	alf (E)	2	F	F	F	P	F	G	F	F	G	F	F	N	N	N	
paraquat	Gramoxone, etc.	alf (S,E)	2	F-G	F	G	G	F	F-G	G	G	F-G	G	F	F	N	N	
pendimethalin	Prowl H20, etc.	alf (S,E)	1	G	G	G	G	P	G	P	G	G	P	F	F-G	N	N	

Efficacy Ratings: 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 **Labeled Crops:** alf = alfalfa; cl = clover; bf = birdsfoot trefoil; lsp = lespedeza; RR = Roundup Ready varieties;

Crop Stage: S = new seedlings; E = established stands

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 resistant/tolerant 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.

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 and marestail (i.e. horseweed), which is capable of producing a large number of seeds that are easily spread by wind to new areas.

Clipping and Grazing Established Stands

The routine cutting of legumes for hay or mowing is sometimes effective in controlling some perennial weeds by reducing food reserves and plant vigor. Whereas, in grazed forages, livestock often selectively graze and may leave such weeds as curly dock 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. On the other hand, livestock will readily graze weeds such as johnsongrass, which can be a method to help reduce johnsongrass populations.

Herbicides for Established Stands

Several herbicide options are available for established alfalfa stands. You can use many of the same herbicides available for new seedings. Furthermore, the deep root system of established plants such as alfalfa enables them to tolerate certain herbicides that are not suitable for new seedings. 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 1); effectiveness on weed species to be controlled (Table 2 and Table 3); 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 minimum 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://ipm.ca.uky.edu/files/ipm1alf.pdf>>.

Herbicides for Use in Forage Legumes

2,4-DB

(BUTYRAC 200 and 2,4-DB 200)

BUTYRAC 200 and 2,4-DB 200 contain 2 lb ai of 2,4-DB (dimethylamine salt) per gal.

Crops: New seedlings and established alfalfa and on seedling 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: In general, an adjuvant is not required unless specified by the label or tank mix partner. A non-ionic surfactant may be included in seedling alfalfa grown in dry, low humidity areas (consult label).

Weeds Controlled: Controls and suppresses growth of broadleaf weeds, including cocklebur, common lambsquarters, pigweeds, common ragweed, field pennycress, jimsonweed, annual morningglory, wild mustard, and yellow rocket; may not adequately control overwintered field pennycress and wild mustard.

General Comments: Apply postemergence in the fall or spring when weeds are small (1 to 3 inches). Forage legumes should be healthy and actively growing for greatest selectivity. In established alfalfa, stem twisting and malformation of the leaves might be observed; under most conditions this response is usually outgrown.

Precautions: Do not spray if temperature exceeds 90°F and/or is predicted to 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. Rainfall within 7-10 days following application can cause unacceptable crop injury. Do not use on clovers or other legumes not listed on the label.

Grazing and Hay Restrictions:

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

Tank Mixes: Consult label for rates and additional comments before tank mixing with POAST or bromoxynil (eg Buctril, Maestro, Moxy).

Bromoxynil

(BROX 2EC, MAESTRO 2EC, MAESTRO 4EC, MOXY 2E)

BROX 2EC, MAESTRO 2EC and MOXY 2E contain 2 lb ai of bromoxynil per gal; MAESTRO 4EC contains 4 lb ai of bromoxynil per gal.

Crops: Seedling alfalfa only.

Use Rate: Broadcast BROX 2EC, Maestro 2EC, and Moxy 2E at 1 to 1.5 pt/A; Maestro 4EC at 0.5 to 0.75 pt/A.

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

Weeds Controlled: Controls and suppresses growth of broadleaf weeds, including cocklebur, common ragweed, jimsonweed, common lambsquarters, smartweed. Apply before weeds exceed the 4-leaf stage, 2 inches in height, or 1 inch in diameter (rosettes), whichever comes first. Bromoxynil may not adequately control over-wintered field pennycress, henbit, or wild mustard.

General Comments: Apply in the fall or in the spring to seedling alfalfa when the majority of the field has a minimum of 4 trifoliolate leaves. Crop leaf burn can occur following product application. When alfalfa stand is uneven and conditions favor leaf burn, unacceptable crop injury may occur to alfalfa in the 2 trifoliolate leaf stage or smaller stage of growth. Applications made when temperatures are expected to exceed 70°F at and 3 days following application can result in unacceptable crop injury. The total cumulative rate of bromoxynil should not exceed 0.5 lb ai per season (eg. 2 pt/A Brox 2EC or 1 pt/A Maestro 4EC).

Precautions: Warm, humid conditions following application may enhance leaf burn; however, new crop growth is less likely to be affected. 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.

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 product labels for rates and additional comments before tank mixing with BUTYRAC 200 (2,4-DB) or PURSUIT.

Clethodim

(Various Products)

INTENSITY ONE, SELECT MAX, and TAPOUT contain 0.97 lb ai clethodim per gal of product; ARROW 2EC, CLETHODIM 2EC, INTENSITY, SECTION 2EC, SELECT 2EC, SHADOW, and VOLUTEER contain 2 lb ai clethodim per gal of product; SECTION THREE and SHADOW 3EC contain 3 lb ai clethodim per gal of product.

Crops: New alfalfa seedlings and established alfalfa and birdsfoot trefoil.

Use Rate: Application rates will vary depending on the product formulation used and the specific weed species growth stage. Consult individual product labels for recommended rates.

- SELECT MAX, INTENSITY ONE, etc (0.97 lb ai/gal) apply 9 to 32 fl oz/A

- SELECT, INTENSITY, etc. (2 lb ai/gal) apply 6 to 16 fl oz/A
- SECTION THREE, SHADOW 3EC (3 lb ai/gal) apply 4 to 10.67 fl oz/A

Additives: Postemergence applications require the addition of an adjuvant. Apply Crop Oil Concentrate at 1 qt/A (a nonionic surfactant can be substituted and used with some clethodim products). Liquid fertilizer (10-34-0, 28% N, or 32% N) or ammonium sulfate (AMS) may be added to the spray solution (consult label).

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 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 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. Clethodim is rainfast after one hour.

Precautions: Do not plant rotational crops until 30 days after application. 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 application.

Tank Mixes: Consult label for allowed herbicide/insecticide tank mixtures and precautions.

Flumioxazin

(CHATEAU SW, TUSCANY, TUSCANY SC)

CHATEAU SW and TUSCANY contain 0.51 lb ai of flumioxazin per lb product; TUSCANY SC contains 4 lb ai of flumioxazin per gal.

Crops: Apply prior to weed seed germination (preemergence) on established alfalfa.

Use Rate: Apply CHATEAU SW and TUSCANY at 4 oz/A; TUSCANY SC at 4 fl oz/A.

Weeds Controlled: Common chickweed, henbit, lambsquarters, maretail (horseweed), eastern black nightshade, pigweeds, common ragweed.

General Comments: Apply to established alfalfa with a maximum amount of growth of 6 inches or less for preemergence (soil-residual) control of weeds. Established alfalfa is defined as alfalfa that has gone through a first cutting/mowing. Application to alfalfa with greater than 6 inches of growth may result in unacceptable crop injury. For control of winter annual weeds, the best timing for preemergence control is in the fall after the last cutting. For control of summer annual weeds, the best timing for preemergence control is in the spring prior to alfalfa growth (before 6 inches of new growth).

Precautions: Applications should be made as soon as possible after cutting and removing alfalfa to minimize injury to alfalfa growth. Some burning of treated leaves and stems (users should understand and be willing to accept this risk before using on alfalfa). Do not apply more than 4 oz/A of Chateau/Tuscany (4 fl oz/A Tuscany SC) during a single application or more than 8 oz/A of Chateau/Tuscany (4 fl oz/A Tuscany SC) during a single growing season. Do not use on intended mixed alfalfa-grass stands.

Grazing and Hay Restrictions: Do not apply within 25 days of harvest or grazing alfalfa.

Tank Mixes: Application with paraquat can be used to burn-down winter annuals prior to winter dormant period.

Glyphosate

(Various Products)

Glyphosate is the active ingredient contained in ROUNDUP and various other products (Table 4). Examples include: ABUNDIT EDGE, BUCCANEER, CORNERSTONE, CREDIT, DURAMAX, ENVY, GLYFOS X-TRA, GLY STAR, HELOSATE, MAD DOG, ROUNDUP POWERMAX, ROUNDUP WEATHERMAX. The formulations of some products differ in the concentration of glyphosate (lb of acid equivalents per gal 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.

Crops: Roundup Ready® alfalfa varieties and for use as a pre-plant foliar treatment to burn down existing vegetation for establishment of legumes, such as alfalfa, clovers, birdsfoot trefoil, and lespedeza; 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 4. 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. An equivalent amount of liquid formulation of ammonium sulfate may also be used. Recommendations for use of additional surfactant (if needed) will vary depending on the products (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 if glyphosate-resistant biotypes are present or when weeds are growing under poor conditions, such as drought stress or low temperatures. Rainfall soon after application may reduce effectiveness.

Table 4. General guidelines for applying glyphosate products in-crop on Roundup Ready alfalfa or preplant as a foliar burndown treatment prior to crop emergence.¹

Glyphosate Product	Concentration	Weed Size	Rate/A	lb acid equivalent/A
Glyphosate 4S ² [various products]	3 lb ae/gal	Annuals <6" tall	1.5 to 2 pt	0.56 to 0.75 lb ae
		Annuals >6" tall	2 to 4 pt	0.75 to 1.5 lb ae
		Perennials	1.5 to 2 qt	1.1 to 1.5 lb ae
Cornerstone 5 Plus Extra Credit 5 GlyStar 5 Extra	4 lb ae/gal	Annuals <6" tall	18 to 24 fl oz	0.56 to 0.75 lb ae
		Annuals >6" tall	24 to 48 fl oz	0.75 to 1.5 lb ae
		Perennials	36 to 48 fl oz	1.1 to 1.5 lb ae
Roundup PowerMAX (5.5S) Roundup WeatherMAX Abundit Edge Credit Xtreme	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	32 to 44 fl oz	1.1 to 1.5 lb ae

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

² Examples of glyphosate products (3 lb ae/gal) include: Abundit Extra, Buccaneer, Cornerstone Plus, Credit 41, Envy, Glyfos X-tra, Gly Star Original, Gly Star Plus, Helosate Plus, Honcho, Mad Dog, Makaze.

- **Roundup Ready Alfalfa:** May be applied before, during, or after planting Roundup Ready alfalfa. Glyphosate products may be applied over-the-top of Roundup Ready alfalfa (in-crop) from emergence until 5 days prior to cutting. Best results occur when applied after weeds emerge, but before alfalfa growth interferes with spray coverage of target weeds. NOTE: During the seeding year with new stand establishment up to 10 percent of alfalfa seedlings might not contain a Roundup Ready gene and will not survive after the first application of this product (consult label).
- **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 Glyphosate 4S (3 lb ae/gal formulations) at 0.6 to 2.5 oz per gal; and ROUNDUP POWERMAX (4.5 lb ae/gal formulations) at 0.5 to 1.9 oz per gal 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 wick, or sponge applicator. Consult individual product label for specific guidelines on mixing the herbicide concentration and for use on selected weed species.
- **Preharvest:** Some glyphosate products may be applied as a broadcast spray prior to harvest in declining stands of alfalfa and other forage legumes where severe crop injury or destruction is acceptable, or to remove established stands of forage legumes (consult labels). Applications may be made at any time of year to aid in control of annual and perennial weeds such as johnsongrass. Consult label for maximum use rates allowed depending on product used.

Grazing and Hay Restrictions:

- **Roundup Ready Alfalfa:** Remove domestic livestock before application. Wait a minimum of 5 days after application before grazing, or cutting and feeding forage or hay.
- **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 can be harvested and fed to livestock after 36 hours; and allow a minimum of 36 hours between application and harvest. For all other forage legumes allow 3 days between application and harvest or livestock grazing.

Tank Mixes: With in-crop glyphosate applications tank mixtures include clethodim [Select]; imazamox [Raptor]; imazethapyr [Pursuit, Thunder]; sethoxydim [Poast] (consult label and use of adjuvants when tank mixing).

Hexazinone

(VELPAR L CU, VELPAR DF CU)

VELPAR L CU contains 2 lb ai hexazinone per gal of product. VELPAR DF CU contains 0.75 lb ai hexazinone per lb of product.

Crops: Established (>1 year old stand) alfalfa as a dormant, postdormant, or between cutting treatment.

Use Rate: Broadcast VELPAR L CU at 3 to 6 pt/A; Broadcast VELPAR DF CU at 1 to 2 lb/A. VELPAR may be impregnated on dry bulk fertilizer (consult label guidelines).

Additives: Use surfactant when weeds have emerged. Do not add a surfactant when treating non-dormant 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: Treat only stands of alfalfa established for more than one year or well established after one growing season.

- **Established** (Non-Dormant or Semi-Dormant Varieties): Make a single application in the spring before new growth exceed 2 inches in height or to alfalfa stubble after cutting, following hay removal but before regrowth exceeds 2 inches in height. Severe alfalfa injury may result following application if alfalfa growth in the spring or regrowth after hay removal exceeds 2 inches, or the air temperature is above 90°F.
- **Established** (Dormant Varieties): Make a single application in late fall or winter after plants become dormant and before new growth exceeds 2 inch in height in the spring. Where weeds have emerged, use a surfactant at 0.25% v/v.

Precautions: Do not add a surfactant when applying to non-dormant alfalfa. Temporary yellowing of alfalfa may occur following applications. Crop injury to alfalfa can be influence by a variety of factors including alfalfa variety, soil conditions, uniformity of application, environmental conditions, etc. Do not apply to snow-covered or frozen ground. Do not use on gravelly or rocky soils, exposed subsoils, hardpan, sand, poorly drained soil, or alkali soils. Do not use VELPAR on alfalfa seedlings or alfalfa-grass mixtures.

Crop Rotation Guidelines: Corn may be planted 12 months after the last application. 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.

Tank Mixes: Consult labels.

Imazamox (RAPTOR)

RAPTOR contains 1 lb ai imazamox per gal of product. Other imazamox products include VULTURE.

Crops: New seedlings and established alfalfa.

Use Rate: Broadcast RAPTOR [imazamox] at 5 oz/A. For some weeds apply at 4 to 6 oz/A depending on weed species and growth stage.

Additives: Postemergence applications 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 qt of Non-Ionic Surfactant (>80% active ingredient) per 100 gal of spray solution PLUS 2.5 gal 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 lb 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 [consult label for maximum weed sizes and use rates recommended].

General Comments:

- **New Seedings:** RAPTOR [imazamox] must be applied postemergence to seedling alfalfa. Apply when seedling alfalfa is in the second trifoliolate 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. When applied to seedling alfalfa, there may be a temporary reduction in growth.
- **Established:** Apply to established alfalfa in the fall following the last cutting, in the spring to dormant or semi-dormant alfalfa, or between cuttings. Apply before significant alfalfa growth or regrowth (less than 3 inches), to allow RAPTOR [imazamo] to reach target weeds.

Precautions: Do not make more than one application per year (growing season). A maximum of 6 oz/A of RAPTOR [imazamox] may be applied to alfalfa per year. Do not make sequential applications of PURSUIT (imazathapyr) followed by RAPTOR (or Raptor followed by Pursuit) within a 60-day time interval because of increased potential for alfalfa crop response. Grazing and Hay Restrictions: Do not feed, graze, or harvest alfalfa for 20 days following an application.

Tank Mixes: On alfalfa and clover may be tank mixed with other approved herbicides. Consult the respective labels for specific details. Always follow the more restrictive labeled tank mix partner.

Imazethapyr (PURSUIT (2S), THUNDER)

PURSUIT (2S) and THUNDER contain 2 lb ae of imazethapyr per gal of product. Other imazethapyr products include IMAZETHAPYR 2SL, PRAXIS.

Crops: New seedlings and established alfalfa, clover, and birdsfoot trefoil.

Use Rate: Broadcast PURSUIT or THUNDER at 4 oz/A. For alfalfa and clover apply at 3 to 6 oz/A, depending on weed species and stage of weed growth.

Additives: Postemergence applications on alfalfa and clover 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 lb per 100 gal of spray. Consult label for only using nonionic surfactant (NIS) plus UAN or AMS as additives

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 [consult labels for maximum weed sizes and use rates recommended].

General Comments:

- **Seedling Alfalfa or Clover:** Must be applied postemergence to seedling alfalfa or clover. 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.
- **Established Alfalfa or Clover:** Can be applied to alfalfa or clover in the fall following the last cutting or in the spring to dormant or semi-dormant alfalfa or clover, or between cuttings (remove hay from the field and apply before excessive alfalfa or clover regrowth). Make any application before significant alfalfa or clover growth or regrowth occurs (less than 3 inches) to allow PURSUIT [imazethapyr] to reach target weeds.
- **Seedling and Established Birdsfoot Trefoil:** Apply only 4 fl oz/A when seedling birdsfoot trefoil is in the third trifoliate stage or larger. When applied to seedling birdsfoot trefoil, there may be a temporary reduction in growth. On established birdsfoot trefoil apply only 4 fl oz/A in the fall, in the spring to dormant or semi-dormant plants, or between cuttings. Make any application before significant birdsfoot trefoil growth or regrowth occurs (3 inches) to allow PURSUIT [imazethapyr] to reach target weeds.

Precautions: Minor height reduction or slight leaf yellowing may occur soon after application. If applied under cool conditions (40°F or less), temporary stunting and yellowing of the crop may occur. Weeds under stress are less susceptible to control in cold or drought stress conditions. If present, growth of perennial grasses, such as orchardgrass, fescues, bromes, or timothy, might be suppressed. Do not apply more than 4 oz/A of PURSUIT [imazethapyr] during the last year of the stand.

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

Tank Mixes: On alfalfa and clover may be tank mixed with other approved herbicides. Consult the respective labels for specific details. Always follow the more restrictive labeled tank mix partner.

Imazethapyr + Glyphosate (EXTREME, THUNDER MASTER)

EXTREME and THUNDER MASTER contain 2.17 lb active ingredient per gal (0.17 lb ai of imazethapyr + 2 lb ai of glyphosate as the isopropylamine salt) [1.48 lb ae of glyphosate].

Crops: Roundup Ready® alfalfa varieties only.

Use Rate: Apply postemergence only at a broadcast rate of 2.2 to 4.4 pt/A to seedling or established Roundup Ready alfalfa varieties.

Weeds Controlled: Provides contact and residual control of many broadleaf and grass weeds, including barnyardgrass,

common chickweed, cocklebur, crabgrass, fleabane, foxtail, goosegrass, jimsonweed, johnsongrass, lambsquarters, morningglory, mustard spp., fall panicum, pigweeds, common ragweed, giant ragweed, shepherdspurse, smartweed.

General Comments: Can be applied postemergence to seedling and established Roundup Ready alfalfa or to dormant or semi-dormant established Roundup Ready alfalfa. If applied to non-Roundup Ready alfalfa, will cause severe crop injury and crop loss. On seedling alfalfa apply when alfalfa is in the second trifoliate stage or larger and when the majority of the weeds are 1 to 3 inches. For low growing weeds (eg. mustards) apply before the rosette exceed 3 inches. On established alfalfa apply in the fall, in the spring to dormant or semi-dormant alfalfa (less than 3 inches of regrowth), or between cuttings (after cutting and hay harvest apply before significant alfalfa growth or regrowth [less than 3 inches] to allow herbicide to reach target weeds).

Precautions: Do not apply more than 3 pt/A during the last year of the alfalfa stand. A maximum of 0.094 lb ae of imazethapyr per year may be applied. For crop rotation guidelines consult label.

Grazing and Hay Restrictions: Do not feed, graze, or harvest for 30 days following application of EXTREME or THUNDER MASTER on Roundup Ready alfalfa.

Tank Mixes: None.

Metribuzin (Various Products)

GLORY 4L and TRICOR 4F contain 4 lb ai metribuzin per gal of product; DIMETRIC DF, GLORY, METRIBUZIN 75DF contain 0.75 lb ai metribuzin per lb of product.

Crops: Established (>1 year old stand) alfalfa and alfalfa-grass mixtures.

Use Rate:

- **Alfalfa:** Broadcast GLORY 4L or TRICOR at 1.0 to 2 pt/A. DIMETRIC DF, GLORY, METRIBUZIN 75DF at 0.67 to 1.33 lb/A.
- **Alfalfa-Grass Mixtures:** GLORY 4L or TRICOR at 1.0 to 1.5 pt/A. DIMETRIC DF, GLORY, METRIBUZIN 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 (rosettes).

- **Established** (Postdormant): When impregnated on a dry bulk fertilizer, 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): With some metribuzin products when applying impregnated on dry bulk fertilizer, do not graze or harvest treated alfalfa for 60 days after application (consult label of product used).

Paraquat

(Various Products)

GRAMOXONE SL 2.0 contains 2 lb ai of paraquat per gal; FIRESTORM, HELMQUAT, PARAZONE 3SL contain 3 lb ai of paraquat per gal of product. Paraquat products are classified as RESTRICTED USE pesticides.

Crops: Apply as a preplant foliar treatment to burn down existing vegetation for establishment of legumes, such as alfalfa, clovers, birdsfoot trefoil, and lespedeza, or for use on new seedlings and established legumes as a dormant season treatment. Paraquat can also be applied on alfalfa as a between cutting treatment.

Use Rate:

- **Preplant Foliar Burndown or at Planting** (apply prior to crop emergence): Gramoxone SL 2.0 – apply 2.5 to 4 pt/A; Paraquat (3SL) – apply 1.7 to 2.7 pt/A
- **New Seedlings** (dormant fall-seeded legumes <1 year old): Gramoxone SL 2.0 – apply 1 to 2 pt/A; Paraquat (3SL) - apply 0.7 to 1.3 pt/A.
- **Established** (Dormant season): Gramoxone SL 2.0 – apply 2 to 3 pt/A; Paraquat (3SL) - apply 1.3 to 2 pt/A.
- **Between Cuttings** (Alfalfa ONLY): Gramoxone SL 2.0 – apply 1 pt/A; Paraquat (3SL) - 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 fall-seeded legumes <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 season): 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 or grazing 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 make more than one application per year.
- **Between Cuttings** (Alfalfa ONLY): 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. Weeds beyond the seedling stage and the stubble of weeds cut off during harvest will be less affected by this treatment.

Grazing and Hay Restrictions:

- **New Seedlings** (Dormant fall-seeded legumes <1 year old): Do not cut or harvest within 60 days of application.
- **Established** (Dormant season): Do not cut or harvest alfalfa within 42 days of application; do not harvest other legumes within 60 days of application.
- **Between Cuttings** (Alfalfa ONLY): Do not cut or harvest within 30 days of application.

Tank Mixes: Metribuzin and Velpar L (dormant season Alfalfa ONLY). Do not tank mix metribuzin or Velpar with paraquat 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.

Pendimethalin

(PROWL H20, SATELLITE HYDROCAP)

PROWL H20 and SATELLITE HYDROCAP contain 3.8 lb ai pendimethalin per gal. Other pendimethalin products include STEALTH (3.3 lb ai/gal).

Crops: Apply prior to weed seed germination (preemergence) on seedling and established alfalfa and mixed stands of established cool-season forage grasses with alfalfa.

Use Rate:

- **Seedling Alfalfa:** Apply PROWL H20 or SATELLITE HYDROCAP at 1.1 to 2.1 pt/A; STEALTH at 1.2 to 2.4 pt/A.
- **Established Alfalfa:** Apply PROWL H20 or SATELLITE HYDROCAP at 2.2 to 4.2 pt/A (1.1 to 2.1 qt/A) [for certain weeds may be applied up to 4.2 qt/A]; STEALTH at 2.4 to 4.8 pt/A (1.2 to 2.4 qt/A).

Weeds Controlled: Barnyardgrass, crabgrass, foxtails, johnsongrass (seedlings), and other annual grasses and certain small-seeded broadleaf weeds such as pigweed and common lambsquarters.

General Comments: Apply prior to weed seed germination.

- **Seedling Alfalfa:** For seedling alfalfa grown for forage or hay (defined as alfalfa planted in the fall or spring which has not gone through a cutting/mowing) applications can be made when seedling alfalfa has reached the second trifoliate stage of growth, but prior to alfalfa reaching 6 inches in growth.
- **Established Alfalfa:** On established alfalfa (defined as alfalfa which has gone through a first cutting/mowing) applications can be made in the fall after the last mowing/cutting, during winter dormancy, in the spring, or in-season between cuttings. Applications should be made prior to alfalfa reaching 6 inches in regrowth. Prowl H2O and Satellite Hydrocap can also be applied to mixed stands of established cool-season forage grasses and alfalfa (consult supplemental label for cool-season forage grasses for guidelines).

Precautions: Some stunting and chlorosis of alfalfa may occur with postemergence applications. Applications made after alfalfa exceeds 6 inches in height may result in poor weed control because of possible reduced spray coverage to soil. In any one crop season do not exceed a cumulative total of 4.2 quarts/A of Prowl H2O or Satellite Hydrocap; 4.8 qt/A of Stealth.

Grazing and Hay Restrictions: Do not harvest alfalfa for hay or forage less than 28 days after applying 2.1 qt/A or less of Prowl H2O or Satellite Hydrocap. When more than 2.1 qt/A has been applied wait 50 days before harvest. Consult Stealth label for Preharvest Interval.

Tank Mixes: None indicated on label.

Sethoxydim

(POAST PLUS 1E, POAST 1.5E)

POAST PLUS 1E contains 1.0 lb ai sethoxydim per gal. POAST 1.5E contains 1.5 lb ai sethoxydim per gal.

Crops: New seedlings 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 regard-

ing 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. For annual grasses apply as early in the season as possible following grass germination in the spring, summer or fall.

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 and Birdsfoot Trefoil:** Wait 14 days following application before cutting for (dry) hay. Treated fields can be grazed, cut, or fed as green-chop (undried) forage within 7 days after application.
- **Clover:** Wait 20 days following application before cutting for (dry) hay. Treated fields can be grazed, cut, or fed as green-chop (undried) forage within 7 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. For applications on clover do not tank mix Poast or Poast Plus with 2,4-DB.

Trade names are used to simplify information in this publication. No endorsement is intended, nor is criticism implied of similar products that are not named.