WEED CONTROL IN ALFALFA

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Weeds can be a serious problem in both seedling and established alfalfa. Weeds compete with alfalfa for water, nutrients, and sunlight, thus reducing crop yields, shortening stand life, and lowering forage quality. A stand severely thinned by weed competition can never achieve its full yield potential. Controlling weeds in alfalfa often reduces the total dry matter production from the field because weeds are eliminated from the harvest. However, weed-free alfalfa is usually higher in protein and digestibility, thereby increasing the feed value of the harvested forage (Table 1). Also, weed-free alfalfa is generally more palatable, which results in livestock consuming more forage and producing more meat or milk.

A successful weed management program in alfalfa can assist the grower in realizing both increased quality and quantity and may mean the difference between a profit or loss. Effective weed management programs in alfalfa involve both cultural and chemical control practices. Fertilizing to maintain alfalfa stand and harvesting early for high quality will help increase returns from weed control practices. However, harvesting early may reduce alfalfa vigor and invite weeds to invade the stand. To benefit economically from weed control in alfalfa, producers must take advantage of the improved forage quality by feeding their own livestock or by forage testing to receive a premium price for weed-free hay if sold.

Table 1. Influence of annual weeds on first cutting forage quality of newly established alfalfa at Torrington, WY.

Weed[1] composition in hay	Broadleaf weeds[2]			Grassy weeds[3]		
	Available protein	TDN	RFV	Available protein	TDN	RFV
%	%	%	—	%	%	—
<5	23	68	157	22	66	154
10-15	22	68	148	21	64	146
20-30	21	64	141	19	61	135
>40	19	62	136	14	56	110

[1] Values presented were averaged over four trials conducted from 1998-2001. Forage quality analysis was performed by Fas-Test Forage Lab, Inc., Eaton, CO.

[2] Broadleaf weed composition listed in order of prevalence included common lambsquarters, redroot pigweed, kochia, hairy nightshade, and common sunflower.

[3] Grassy weed composition was 80% green foxtail and 20% yellow foxtail.

When developing and implementing a weed management program in alfalfa, identify and map weed infestations, prioritize weeds by developing thresholds, list control methods available, and design the program which best fits a situation. Evaluate results and modify practices as weed shifts occur. Alfalfa weed management should be viewed as a three-phase program: pre-crop, seedling establishment, and established stands. Each phase offers unique opportunities to address specific weed problems. Attention to all three phases is the key to successful weed management in alfalfa.

Phase I (Pre-crop)

Since alfalfa seedlings are not vigorous competitors with weeds, this phase of a weed management program allows an individual the opportunity to address perennial weed problems. Every effort should be made to reduce or eliminate perennial weeds prior to seeding alfalfa. Never plant a field to alfalfa before a perennial weed problem has been made manageable. Control methods must be appropriate for the weed species concerned. Choose rotation crops preceding alfalfa which allow use of effective cultural and / or chemical weed control techniques. For example, small grains and corn are compatible with numerous selective herbicides which are effective against perennial broadleaf weeds but which are not tolerated by alfalfa. The non-selective glyphosate products *(i.e. Roundup RT®, Landmaster®, Glyphomax®, Silhouette®, Cornerstone®, or Landmaster BW®*) can be very effective against both perennial grasses and broadleaf weeds when applied in the early fall after the harvest of annual crops (Table 2). Most perennial weeds can withstand temperatures of 25 to 26°F for several hours. A treatment can often be made as late as mid-October. Be mindful of time intervals required between the application of some herbicides and the planting of alfalfa.

Phase II (Seedling Establishment)

Preventing weeds from becoming established in a field is often much easier than trying to control them later. Purchasing high quality weed-free certified seed is a vital first step. Planting a recommended alfalfa variety for the area and soil type will allow the alfalfa to form a vigorous dense stand which can compete effectively with annual weeds. Further, stands that emerge and grow rapidly are usually not as weedy as less vigorous stands. Warm temperatures, adequate soil moisture, shallow planting, firm seedbed, adequate soil fertility (especially phosphorus), and good seed inoculation with nitrogen-fixing bacteria are all essential for good seedling establishment. All management practices during the first season should focus on optimizing alfalfa establishment and survival.

Table 2. Perennial weed control after harvest of annual crops with fall applications of Roundup or Landmaster BW. Powell Research and Extension Center, 1993-94.

		Weed Control	
	Rate	Canada thistle	Quackgrass
	qt / A		
Roundup RT	1	85	90
Roundup RT	1½	95	97
Landmaster BW	2	90	—

Alfalfa seedlings freed from weed competition during their first few weeks of growth will produce higher yields and maintain longer-lived stands. This period is the most critical time to control weeds in alfalfa. Once established, a healthy, dense stand of alfalfa is very effective by itself in keeping out many weeds.

Traditionally alfalfa is seeded with a companion or nurse crop such as a small grain. The two crops grow together, and the vigorous growth of the companion crop helps suppress weeds and prevents injury from blowing soil. However, small grain seedlings compete with alfalfa seedlings for moisture, nutrients, and light, much the same as grassy weeds do. Further forage quality of cereal grain-alfalfa mixtures is considerably less than pure alfalfa (Table 3). Although adequate quality for beef operations, it will preclude receiving premium prices in the competitive dairy and horse market. The loss in alfalfa production the first year from competition with the small grain nurse crop can never be regained (Table 4). Further, a 1.5 to 2 times higher seeding rate is recommended when utilizing a nurse crop compared to seeding alfalfa alone. The practice of using a nurse crop is discouraged except in cases where soil crusting or wind erosion make alfalfa establishment difficult. An alter-

Table 3. Influence of an oat cover crop on first cutting forage quality of newly established alfalfa at Torrington, WY.

	Alfalfa quality		
Oat[1] composition in hay	Available protein	TDN	RFV
%	%	%	—
0	23	68	162
10-15	22	64	150
30-40	18	60	139
45-50	15	60	126
80	11	58	110

[1] Values presented were averaged over three trials conducted from 1999-2001. Forage quality analysis was performed by Fas-Test Forage Lab, Inc., Eaton, CO.

Table 4. Alfalfa yield with and without a nurse crop. Torrington, WY.

	Yield (year)[1]				
	1	2	3	4	Total
	T / A				
None-Eptam (PPI)	4.2	8.8	7.9	8.1	29.0
None-Pursuit (Post)	4.7	9.3	8.0	8.0	30.0
Nurse (Oat)	1.2	8.4	7.7	7.6	24.6
Nurse (Oat)-Butyrac (Post)	1.3	8.7	7.5	7.4	24.9

[1] Alfalfa yields in treatments applied in 1989 were followed for three additional years.

native which has worked in southern Wyoming is seeding alfalfa in August into oat or barley stubble. This has greatly reduced problems with wind erosion, crusting, or competition from nurse crops as well as weeds.

Several herbicides are available for use in establishing alfalfa. These herbicides are generally grouped into two categories, those applied to direct-seeded alfalfa without a nurse or companion crop (Table 5) and those applied to alfalfa with a companion crop (Table 6).

Table 5. Summary of herbicides for use in direct-seeded alfalfa. (Phase II)

Herbicide	Active ingredient lb./A and formulation/A	Remarks
PREPLANT		
Glyphosate (Roundup RT 3L) (Roundup Ultra 4L)	0.19-3.0 (0.5-8 pt.) (6-96 oz.)	Provides control of annual and perennial weeds prior to seeding alfalfa. For annual weeds, allow at least three days after application before tillage. For perennials, allow seven or more days.
PREPLANT OR PREEMERGENCE		
Paraquat (Gramoxone Extra 2.5L)	0.63-0.94 (2-3 pt.)	Controls annual weeds prior to emergence of alfalfa seedlings. When applying before alfalfa planting, seedbed preparation should be completed as far ahead as possible to permit maximum weed emergence. Always add 1 to 2 pt. of nonionic surfactant per 100 gallons of spray mix.
PREPLANT INCORPORATED		
Benefin (Balan 1.5 EC) (Balan 60 DF)	1.12-1.5 (6-8 pt.) (2-2.5 lbs.)	Provides control of annual grasses and several broadleaf weeds. Not effective on mustard species. Balan (1.5 EC) can be impregnated or applied in liquid fertilizer.
EPTC (Eptam 7 EC)	2-4 (2.25-4.5 pt.)	Provides control of annual grasses and some broadleaf weeds. Weak on mustard species. Incorporate immediately after application. May be impregnated or applied in liquid fertilizer.

POSTEMERGENCE		
Bromoxynil (Buctril 2EC) (Buctril Gel)	0.25-0.38 (1.0-1.5 pt.) (2-3 packs / 10A)	Provides control of annual broadleaf weeds only. Should be applied when alfalfa has 4 trifoliate leaves and weeds are less than 2 inches in height. Alfalfa injury can occur, especially if warm weather follows treatment.
Clethodim (Select 2EC)	0.094-0.125 (6-8 oz.)	Provides control of annual and many perennial grasses. Should be applied when weeds are actively growing. Always include a crop oil concentrate (containing at least 15% emulsifier) at 1% v / v.
Imazamox (Raptor 1S)	(0.032-0.047 (4-6 oz.)	Provides control of both annual grasses and broadleaf weeds. Should be applied when alfalfa has 2 trifoliolate leaves and weeds are less than 3 inches in height. Always add a nonionic surfactant or crop oil.
Imazethapyr (Pursuit 2S) (Pursuit 70DG)	0.047-0.094 (3-6 oz.) (1.08-2.16 oz.)	Provides control of annual broadleaf and several grassy weeds. Should be applied when alfalfa has 2 trifoliate leaves and weeds are less than 3 inches in height. Always add a nonionic surfactant or crop oil.
Pronamide (Kerb 50 W)	0.5-2.0 (1-4 lb.)	Provides control of annual and perennial grasses. Should be applied in the fall to new fall or spring-planted alfalfa that has at least one trifoliolate leaf and soil temperatures are 55°F or less.
Sethoxydim (Poast 1.5EC) (Poast Plus 1.0EC)	0.09-0.47 (0.5-2.5 pt.) (0.75-4.75 pt.)	Provides control of annual grasses and suppresses growth of several perennial grasses. Repeat applications are required for perennial grass suppression. Always add 2 pt. / A crop oil concentrate or Dash HC additive.
2,4-DB amine (Butyrac 200)	0.5-1.5 (2-6 pt.)	Provides control of small annual broadleaf weeds. Application to weeds more than 3 inches tall will result in unsatisfactory control. May temporarily suppress certain perennial broadleaf plants such as field bindweed.

Table 6. Summary of herbicides for use in companion seeding of alfalfa. (Phase II)

Herbicide	Active ingredient lb. / A and formulation / A	Remarks
PREPLANT		
Glyphosate (Roundup RT 3L) (Roundup Ultra 4L)	0.19-3.0 (0.5-8 pt.) (6-96 oz.)	Provides control of annual and perennial weeds prior to a companion seeding of alfalfa. See Table 5 for additional remarks.
PREPLANT OR PREEMERGENCE		
Paraquat (Gramoxone Extra 2.5L)	0.63-0.94 (2-3 pt.)	Controls annual weeds prior to emergence of companion crop and / or alfalfa seedlings. See Table 5 for additional remarks.
POSTEMERGENCE		
Bromoxynil (Buctril 2E) (Buctril Gel)	0.25-0.38 1.0-1.5 pt.) (2-3 packs / 10A)	Provides control of annual broadleaf weeds in alfalfa underseeded in oats, barley, wheat, rye, and triticale. Much safer option than MCPA or 2,4-D amine.
MCPA (several formulations)	0.12-0.25 (0.25-0.5 pt. / A of 4 lb. ae / gal.)	Use the amine or sodium salt formulation only. Alfalfa may be injured. Use only as a rescue treatment to control heavy stands of broadleaf weeds. Alfalfa injury may be reduced by lowering spray pressure and volume.
2,4-D amine (several formulations)	0.12-0.25 (0.25-0.5 pt. / A of 3.8 lb. ae / gal.)	Use the amine formulation only. Will cause more injury than MCPA. Use only as a rescue treatment to control heavy weed stands. A canopy of grain that shields alfalfa seedlings from spray droplets will reduce injury.

Phase III (Established Alfalfa)

Waiting until a stand is several years old and full of weeds is not the time to initiate a weed control program in alfalfa. Weed control operations in this phase should be preemptive in nature and intended to preserve or improve on the level of weed control achieved in Phases I and II.

Weeds in established alfalfa are often indicative of other problems such as inadequate soil fertility, poor soil drainage, disease and nematode infestations, or poor stand-management practices. Maintaining proper soil fertility and drainage will increase forage yields while increasing alfalfa growth and vigor for better competition with weeds. Many annual weeds common in established alfalfa may be effectively controlled by harvesting the crop early before weed seed formation and dispersal occur.

Weed-control practices in established alfalfa often do not increase total dry matter production since only a fixed level of tonnage can be produced per acre whether composed of pure alfalfa or an alfalfa weed mix. First-cut alfalfa yield could actually be lowered if alfalfa populations are low. Since weeds are often less palatable and lower in protein than alfalfa, controlling weeds can improve forage quality by increasing protein content and digestibility (Table 7). Further, certain grassy weeds with barbed awns can also injure livestock (lumpy jaw).

Many of the weeds present in established alfalfa have similar growth habits to alfalfa, which makes control difficult in many situations. Weed problems in established alfalfa include winter annual (i.e. downy brome, mustard spp., and shepherdspurse) or perennial weeds (i.e. quackgrass, hoary cress, foxtail barley, and dandelion). Herbicide treatments in established alfalfa may be applied as dormant fall or spring treatments, between cuttings before regrowth occurs, or postemergence before weeds or alfalfa get too large (Table 8).

The response of common weeds in alfalfa with the various herbicides is compared in Table 9. Raptor®, a newly registered herbicide developed by BASF, is one herbicide option with an excellent weed spectrum that can be applied postemergence in seedling as well as in established alfalfa.

Table 7. Influence of annual weeds on first cutting forage quality of newly established alfalfa, Huntley, WY.

Weed[1] composition in hay	Downy brome			Mustards[2]		
	Available protein	TDN	RFV	Available protein	TDN	RFV
%	%	%	—	%	%	—
<5	22	67	165	24	66	154
10-15	20	65	153	19	64	140
25-30	17	59	140	18	58	129
31-35	16	57	127	15	56	110
>40%	16	56	112	14	53	102

[1] Values presented are based on two trials conducted in 2000 and 2001. Forage quality analysis was performed by Fas-Test Forage Lab, Inc., Eaton, CO.

[2] Mustards consisted of tansymustard, blue mustard, and flixweed.

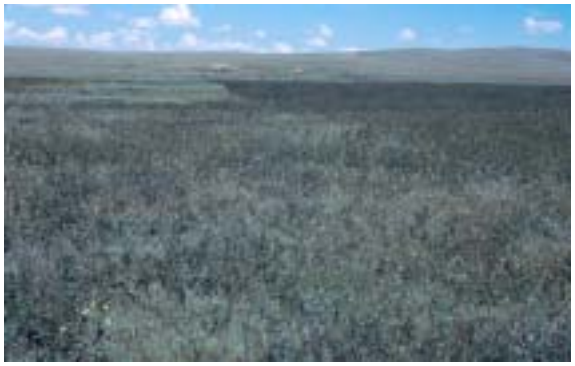
Table 8. Summary of herbicides for use in established alfalfa. (Phase III)

Herbicide	Active ingredient lb./A and formulation/A	Remarks
DORMANT		
Hexazinone (Velpar 90W) (Velpar 2L)	0.5-1.0 (0.55-1.11 lb.) (1-2 qt.)	Apply in the fall or spring when alfalfa is dormant. Provides control of many annual grasses and certain broadleaf weeds. The higher rate gives partial control of dandelion, quackgrass, prickly lettuce, and curly dock.
Terbacil (Sinbar 80W)	0.4-1.2 (0.5-1.5 lb.)	Apply in the fall or spring when alfalfa is dormant. Controls many annual grasses and broadleaf weeds. Potential for injury on sandy, low-organic-matter soils.
Diuron (Karmex80W)	1.2-2.4 (1.5-3.0 lb.)	Apply to dormant alfalfa in March or early April before spring growth begins. Precipitation or irrigation required following application. Has not been effective on downy brome in Wyoming trials.
Metribuzin (Sencor 4F/Lexone 4L) (Sencor/Lexone 75DF)	0.38-1.0 (0.75-2.0 pt.) (0.5-1.33 lb.)	Apply in fall after alfalfa becomes dormant or in spring before new growth starts. Controls many annual grass and broadleaf weeds. The high rate may give partial control of dandelion and curly dock.
Pronamide (Kerb 50W)	0.5-2.0 (1.0-4.0 lb.)	Apply in the fall after last cutting but before soil freeze-up. Apply when soil temperatures are less than 55°F. Good activity on foxtail barley and quackgrass. Needs adequate moisture for activation.

DORMANT AND BETWEEN CUTTINGS

Trifluralin (Trelan 4EC,MTF) (Treflan 10G)	0.75-2.0 (1.5-2 pt.) (20 lb.)	Apply liquid or TR-10 formulations to established alfalfa during dormancy or semidormancy in the fall or spring before weeds emerge or apply liquid formulations during the growing season immediately after cutting. Herbicide should be incorporated, and incorporation can be accomplished mechanically or with overhead irrigation of 0.5 inch or more.
Paraquat (Gramoxone Extra 2.5L)	0.25-0.75 (0.8-2.4 pt.)	Apply to dormant alfalfa fall or spring or apply between cuttings. Use 0.8 pt. between cuttings and 1.5 to 2.4 pt. for dormant applications. Most effective on small weed seedlings. Always add 1 to 2 pt. of surfactant per 100 gal. of spray mixture.
Imazamox (Raptor 1S)	0.032-0.047 (4-6 oz.)	Apply postemergence in the fall or spring or between cuttings when weeds are less than 3 inches. Controls many annual weeds including downy brome and supresses several perennial weeds including common dandelion, Canada thistle, and curly dock. Always add a nonionic surfactant or crop oil.
Imazethapyr (Pursuit 2L) (Pursuit 70 DG)	0.047-0.094 (3-6 oz.) (1.08-1.16 oz.)	Apply postemergence in the fall or spring or between cuttings. Controls most annual weeds and suppresses several perennial weeds. Good weed coverage is essential for postemergence applications in established alfalfa. Always add a nonionic surfactant or crop oil.

POSTEMERGENCE		
Clethodim (Select 2EC)	0.094-0.125 (6-8 oz.)	Apply postemergence to control annual and perennial grasses. Should be applied when weeds are actively growing. Always include a crop oil (containing at a least 15% emulsifier) at 1% v/v.
Sethoxydim (Poast 1.5 EC) (Poast Plus 1.0EC)	0.09-0.47 (0.5-2.5 pt.) (0.75-4.75 pt.)	Apply postemergence to control annual grasses and suppress perennial weeds. Repeat applications are required for perennial grass suppression. Always add 2 pt./A crop oil concentrate or Dash HC additive.
2,4-DB amine (Butyrac 200)	0.5-1.5 (2-6 pt.)	Apply when annual broadleaf weeds are 1 to 3 inches tall or rosettes are less than 2 inches across. Late fall treatments are more effective on winter annuals than spring treatments. May temporarily stunt established alfalfa.



Weeds in established alfalfa have been removed to the right.

Nurse crop removal in seedling alfalfa.

Broadleaf weed control with 6 oz. Pursuit in seedling alfalfa.

Broadleaf weed control with Buctril in seedling alfalfa.

Table 9. Weed response to alfalfa herbicides.

Weed	Glyphosate	Paraquat	Benefin	EPTC	Bromoxynil	Imazethapyr	Imazamox	Pronamide	Sethoxydim	Clethodim	2,4 DB	MCPA	2,4-D	Hexazinone	Terbacil	Diuron	Trifluralin	Metribuzin
barnyardgrass	E	G	G	E	N	G	E	E	E	E	N	N	N	F	E	G	E	G
brome, downy	E	G-E	F-G	G	N	P-F	E	E	P	G-E	N	N	N	E	E	F	E	G
foxtail, green	E	G-E	G	E	N	G-E	E	E	E	E	N	N	N	E	E	G	E	G
grain, volunteer	E	F	P	E	N	P	G-E	G	G	E	N	N	N	E	F-G	P-F	F-G	P-F
oats, wild	E	F	P	G	N	F	G	F-G	G	E	N	N	N	G	P-F	P	F	F-G
quackgrass	G	P	P	F	N	P	F	G	F	G	N	N	N	F-G	F	P	P	F
sandbur	G	G	F-G	G-E	N	G	G-E	E	G	E	N	N	N	G	G	G	G	F-G
stinkgrass	E	F	G	G	N	P	F-G	E	E	E	N	N	N	F-G	G	F	G	F
chickweed, common	E	G	F-G	G	E	E	E	G	N	N	F	F	F-G	E	E	E	G	E
cocklebur	E	G	P	P	E	E	E	P	N	N	G	G	G	E	G	F	P	F-G
dandelion, common	P	P-F	P	P	P-F	P	F-G	P	N	N	F	P-F	G	F	F	P	P	P-F
dodder	G-E	F	F	N	G	N	N	F	N	N	N	N	N	N	N	N	F-G	N
hemlock, spp.	F	P	P	P	F	P	P	P	N	N	F	F	G	G	F-G	P	P	P
knotweed, spp.	G-E	G	F-G	F	E	G	G-E	F	N	N	G	G	G	G	E	F	G	F-G
kochia	F-G	G	G	P	E	G-E	G-E	F	N	N	G	F-G	GF	G	G	E	G-E	F-G
lambsquarters, common	E	E	G	G	E	F	F-G	G	N	N	G	E	E	E	E	E	G-E	E
lettuce, prickly	G	F-G	P	P	F-G	F-G	G	P	N	N	G-E	G	E	E	E	E	P	E
mustard, blue	G	F-G	P	P	P-F	G	E	F	N	N	P	F	F-G	E	P	G	P	F-G
mustard, tansy	G	F-G	P	P	P-F	E	E	F	N	N	E	E	E	E	E	G	P	G
mustard, tumble	G	E	P	F	F-G	E	E	F-G	N	N	E	E	E	E	E	G	P	E
mustard, wild	G	G	P	P	F-G	E	E	F	N	N	E	E	E	E	E	G	P	E
nightshade, spp.	E	E	P	G	E	E	E	F-G	N	N	G	G	E	E	E	G	P	F
pennycress, field	G-E	G	P	P	F	G-E	E	F-G	N	N	G	G	E	E	E	E	P	E
pigweed, redroot	E	E	E	G	E	E	E	G	N	N	E	G-E	E	E	G-E	P	E	E
purslane, common	E	E	G	G	E	E	E	G	N	N	E	E	E	G	G-E	G	G	G
shepherdspurse	E	E	P	F	F-G	G-E	E	G	N	N	E	E	E	E	E	G	P	E
sowthistle, spp.	G	G	P	P	P-F	G	G-E	P	N	N	N	N	F	N	E	G	P	G
sunflower, wild	E	E	P	P	E	E	E	P	N	N	G	G	E	P	G	F	N	F
thistle, Russian	F-G	F	G	P	E	G	G-E	G	N	N	G	G	G-E	G	G	G	G-E	F-G

E = excellent 91 to 100%, G = good 81 to 90%, F = fair 71 to 80%, P = poor < 70% and N = none.