

WEED CONTROL IN HIGH ELEVATION ALFALFA AND ALFALFA/GRASS MIXTURES

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ABSTRACT

High quality alfalfa and alfalfa/grass mixtures are popular in the Western U.S. due to a growing dairy industry and expanding horse-hay market. Field experiments were established in Northern California to determine the efficacy of several herbicides applied at different times for winter annual weed control in established alfalfa and alfalfa/orchardgrass. Research results indicate that in pure alfalfa, Velpar and Sencor provide the best weed control and least crop injury when applied in late winter (February) compared to applications made shortly after alfalfa dormancy (November) or soon after alfalfa resumes growing in early spring (Mid-March). Adding Gramoxone to Sencor or Karmex improved control of several emerged winter annual weeds, but applications must be made before alfalfa breaks dormancy to prevent excessive crop injury. Gramoxone alone or tank mixes of Gramoxone with Sencor or Karmex caused significant reductions in first-cutting yield when applied to alfalfa with ≥ 2 inches of spring re-growth. Raptor (a relatively new herbicide commonly used in seedling alfalfa) provided the best combination of weed control and crop safety for post-emergent weed control after alfalfa resumes growth in early spring. Weed control in mixed alfalfa/grass stands is especially problematic, as the herbicides must be safe to both species. Sencor at 0.6-1.0 lb/A plus non-ionic surfactant (NIS) or Velpar DF at 0.5 lb/A plus NIS applied in late fall or winter displayed effective weed control and acceptable selectivity to alfalfa and orchardgrass. Pursuit plus methlyated seed oil applied shortly after green-up provided good control of emerged mustards and excellent selectivity to both alfalfa and orchardgrass. Currently, Sencor is the only one of these herbicides with specific label instructions for use in mixed alfalfa/grass stands.

Key Words: alfalfa, *Medicago sativa*, weed management, winter annual weeds, application timing, alfalfa/orchardgrass

INTRODUCTION

An integrated approach combining herbicides with sound farming practices is the most effective method for successful weed control in alfalfa. Good cultural practices (proper stand establishment, irrigation, fertility, and harvest management) promote a dense, vigorous alfalfa stand that is able to suppress weeds and provides only minimal opportunity for weed encroachment during the growing season. Although a healthy alfalfa stand protects against most weed problems during the growing season, winter annual and perennial weeds can become established while the alfalfa crop is dormant. Winter annual weeds germinate in fall and late winter and become established before alfalfa growth resumes in early spring. Because competition from the alfalfa for moisture and light (shading) is minimal during dormancy, herbicides are usually needed to prevent weed establishment and assure a weed-free first cutting.

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Pre-emergent, soil active herbicides offer the best control of winter annual weeds, but herbicide selection and application timing frequently make the difference between success and failure. This paper discusses the effects of herbicides and herbicide application timing on winter annual weed control and crop safety in alfalfa and alfalfa/orchardgrass mixtures.

PROCEDURES

Experiments were conducted during 2002-2004 to evaluate herbicide efficacy for spring weed control in alfalfa and alfalfa/orchardgrass. Several herbicides were applied at different times throughout the dormant period with the goal of finding herbicides and application times that maximized weed control and minimized crop injury. Trials were established at sites with healthy alfalfa stands with good irrigation, fertility, and harvest management. Procedures used in each experiment are described below.

Winter Annual Weed Control in Established Alfalfa

Trials were established at two field sites in Lassen County, CA and one site in Siskiyou County, CA in 2002. The trial was replicated at one field site in both Lassen and Siskiyou County in 2003. All sites had sandy loam soil with an average precipitation of 12-22 inches from October to April. Three herbicide treatment timings were evaluated. The first application was made in late fall (November) shortly after the alfalfa went dormant and before most weeds emerged (except hare barley). The second application was made in late winter (February) when alfalfa was dormant and most winter annual weeds had just emerged. The third application was made in mid-March when alfalfa had 2-3 inches of spring growth and weeds were 1-3 inches tall. Herbicides were applied at a spray volume of 20 gallons per acre. Weed control was evaluated one month after the mid-March treatment (1 MAT) and shortly before the first cutting. Alfalfa height and forage yield/quality (alfalfa + weeds) was measured a couple days before the grower's first cutting harvest.

Winter Annual Weed Control in Established Alfalfa/Orchardgrass

Herbicide trials were established at sites in Lassen and Siskiyou County in 2003. The number of treatments was expanded in 2004, and additional trials were conducted in Lassen and Siskiyou County. Soils ranged from sandy loam to heavy clay loam. Herbicide treatments were applied in the fall shortly after alfalfa and orchardgrass dormancy or in mid-March when alfalfa and orchardgrass had 1-3 inches spring growth. At the mid-March application, most weeds had emerged and were 1-3 inches tall. Weed control and visual crop injury was evaluated one month after the mid-March treatment (1 MAT). Weed control ratings and crop height were measured before the first-cutting harvest.

RESULTS

Winter Annual Weed Control in Established Alfalfa. The effectiveness of herbicides varied depending on herbicide application time and weed species present in the field. In general, Sencor, Velpar, and Karmex provided the best weed control when applied in late winter (February) compared to applications in late fall or early spring (Table 1). Late-winter applications of Velpar, Sencor, or Karmex controlled shepherdspurse, tansy mustard, prickly lettuce, and redstem filaree, but all three herbicides failed to provide adequate control of hare barley (Table 1). Combining Gramoxone with Sencor or Karmex at the late winter or early spring application timing significantly improved control of hare barley. The best suppression of

dandelion was achieved with an early-spring application of Raptor, Gramoxone + Sencor, or Gramoxone + Karmex (Table 1).

Herbicide application timing affected alfalfa yield and forage quality. Late-fall or winter applications of Velpar and Sencor caused less alfalfa injury compared to applications in mid-March (Table 1). Mid-March applications of Velpar, Sencor, Sencor + Gramoxone, and Karmex + Gramoxone caused more than a 1/2 ton decrease in first cutting hay yield compared to untreated plots (Table 1). Acid Detergent Fiber (ADF) content of forage samples in herbicide-treated plots was 4 to 6 % lower than in samples from untreated plots indicating weeds significantly reduced forage quality (Table 1).

Winter Annual Weed Control in Established Alfalfa-Orchardgrass.

All fall and spring-applied herbicide treatments controlled shepherdspurse (Table 2). A fall application of Sencor at 1.0 lb/A or Velpar DF at rates ≥ 0.5 lb/A provided excellent control of downy brome (Table 2). As noted earlier, crop safety is critical and difficult to achieve with alfalfa/orchardgrass because herbicides must be safe to both species. Acceptable safety to both alfalfa and orchardgrass occurred with the following treatments: fall-applied Sencor at 0.6 -1.0 lb/A, fall-applied Velpar DF at 0.5- 0.67 lb/A, spring-applied Pursuit DG at 1.44 oz/A + methylated seed oil (MSO), spring-applied Sencor at 0.6 lb/A + NIS, and spring-applied Velpar DF at 0.5 lb/A + NIS (Table 2). In contrast, unacceptable injury and reduction in orchardgrass height at the first cutting harvest occurred with spring-applied Raptor, spring-applied Gramoxone Max, and spring-applied Sencor or Velpar DF at 1.0 lb/A + NIS (Table 2).

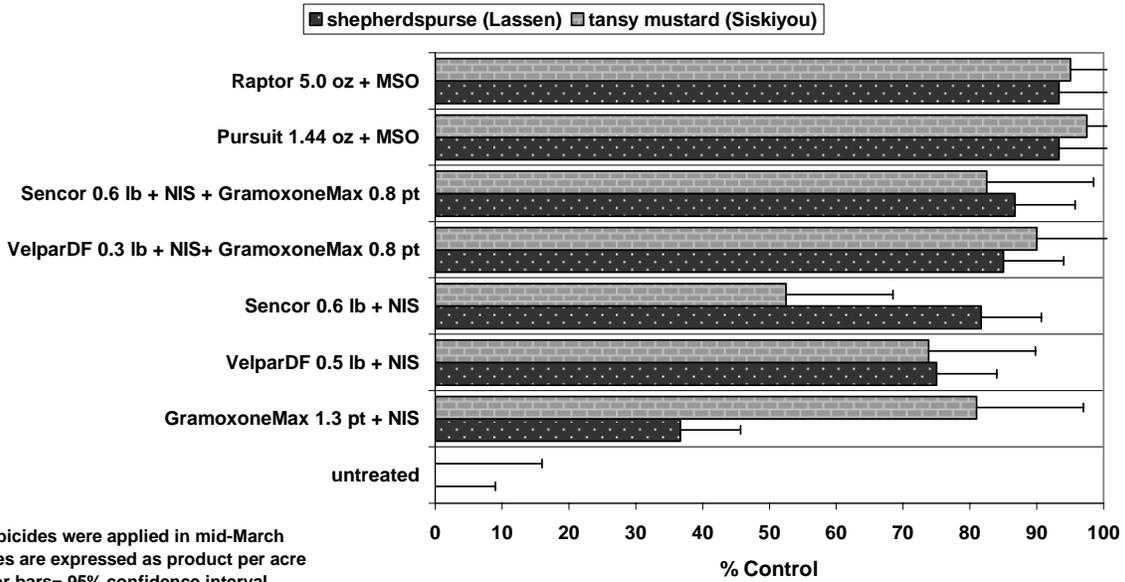
CONCLUSIONS

Results clearly showed that regardless of herbicide, applications at spring green-up caused more injury to alfalfa than applications made to dormant alfalfa in late fall (November) or late winter (February). However, it is still relatively common in high-elevation areas to apply herbicides in mid to late March. These results suggest this timing should be avoided to prevent excessive crop injury. Although both late-fall and late-winter applications offer adequate crop safety, late-winter applications provided the best weed control. The reason for improved control with a late-winter application compared with a late-fall application is unclear, but it is likely related to two factors. There is minimal leaching and degradation of the herbicide between application and weed emergence with a late-winter application. The second advantage of a late-winter application is winter grazing and/or winter harrowing removes crop residues allowing better herbicide coverage and less herbicide tie-up to above-ground organic matter. If weeds emerge before herbicide application, adding Gramoxone to Sencor, Karmex, or Velpar can significantly improve control of several weeds, especially hare barley and dandelion.

In mixed stands of alfalfa and orchardgrass, Velpar, Sencor, and Pursuit provided effective winter annual weed control without reducing alfalfa and orchardgrass yield. Of the three herbicides, Sencor is currently the only product with specific label instructions for use in mixed alfalfa/grass stands. Gramoxone Max provided inconsistent weed control and caused unacceptable injury to orchardgrass when applied to alfalfa/orchardgrass with spring re-growth.

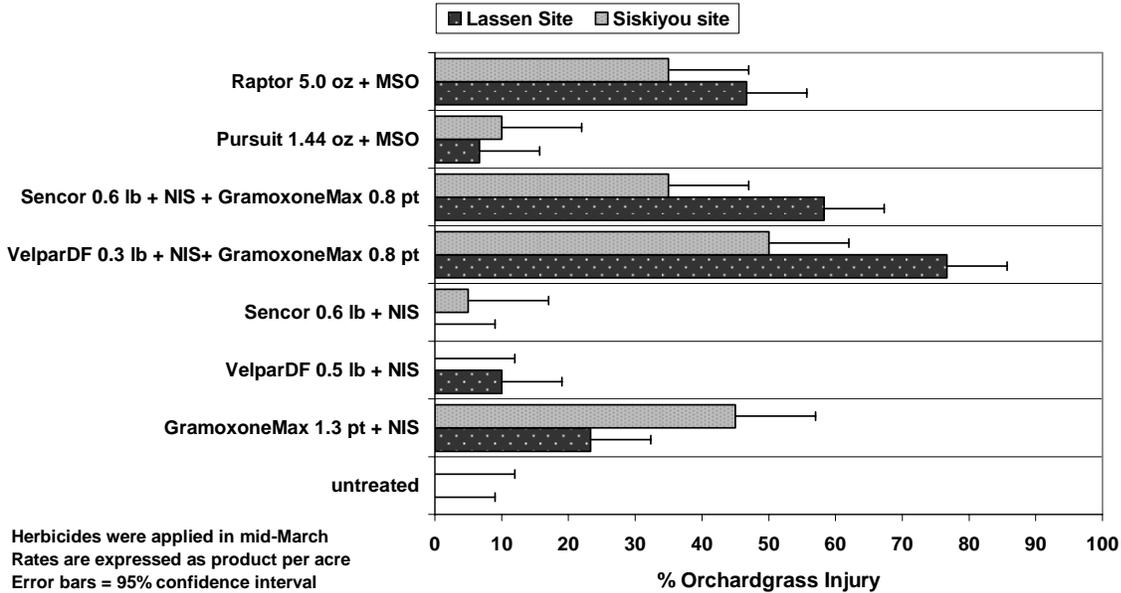
Herbicides Applied in Early Spring (March) 2003 in Alfalfa/Orchardgrass

2003 Weed Control in Alfalfa/Orchardgrass (2 months after treatment)



Herbicides were applied in mid-March
 Rates are expressed as product per acre
 Error bars= 95% confidence interval
 NIS= non-ionic surfactant applied at 0.25 % v/v
 MSO= methylated seed oil at 1pt/A

Herbicide Injury to Orchardgrass (2 months after treatment)



Herbicides were applied in mid-March
 Rates are expressed as product per acre
 Error bars = 95% confidence interval
 NIS = non-ionic surfactant at 0.25 % v/v
 MSO = methylated seed oil at 1pt/A

Table 1. The Effect of Herbicides and Application Timing on Spring Weed Control and 1st Cutting Forage Yield/Quality in Pure Alfalfa (data averaged across sites)

Herbicide Treatment (Product Rate per Acre)	Time of Trt	% Weed Control at 1st Cutting (0-100 scale) 0=no control; 100=perfect control				% Alfalfa Injury 1MAT	1st Cutting Yield ton/A	Forage Quality % ADF
		Shepher dspurse	Hare barley	Redstem Filaree	Dandelion Suppression			
Untreated	--	0	0	0	0	1	2.69***	30.5
Sencor 0.67 lb + NIS*	Nov.	76	62	63	52	4	2.39	25.7
Sencor 0.67 lb + NIS	Feb.	88	67	90	41	7	2.37	24.9
Sencor 0.67 lb + NIS	Mar.	78	54	58	52	12	2.10	26.7
VelparDF 0.67 lb + NIS	Nov.	74	48	54	43	3	2.37	25.3
VelparDF 0.67 lb + NIS	Feb.	88	77	89	61	4	2.26	26.5
VelparDF 0.67 lb + NIS	Mar.	79	62	75	50	14	2.21	25.8
Karmex 1.75 lb + NIS	Nov.	82	58	66	31	7	2.75	27.1
Karmex 1.75 lb + NIS	Feb.	88	60	90	42	8	2.49	26.3
Sencor 0.6 lb + NIS + GramoxoneMax 0.8 pt	Feb.	88	88	90	64	8	2.38	25.5
Sencor 0.6 lb + NIS + GramoxoneMax 0.8 pt	Mar.	86	87	73	82	21	2.05	24.9
Karmex 1.75 lb+ NIS + GramoxoneMax 0.8 pt	Mar.	87	86	75	73	23	1.95	26.1
GramoxoneMax 1.67 pt +NIS	Mar.	63	70	44	30	23	2.71	24.6
Raptor 5.0 oz + MSO**	Mar.	89	88	84	84	9	2.24	25.4
<p>* = non-ionic surfactant at 0.25 % v/v ** = methylated seed oil (Hasten) at 1.0 pt/A ***= treatment yields that differed > 0.3 tons/acre are significantly different with a 95% confidence interval.</p>								

Table 2. The Effect of Herbicides and Application Timing on Spring Weed Control and 1st Cutting Forage Height in Alfalfa/Orchardgrass (data averaged across 2004 sites)

Herbicide Treatment (Product Rate per Acre)	Time of Trt	% Weed Control at 1st Cutting (0-100 scale) 0=no control; 100=perfect control			Reduction in 1st-Cutting Alfalfa Height (inches)***	Reduction in 1st-Cutting Orchardgrass Height (inches)***
		Shepherds- purse	Downy brome	Dandelion suppression		
Untreated	--	0	0	0	0****	0****
Sencor 0.67 lb + NIS*	Nov.	98	82	22	0	0
Sencor 1.00 lb + NIS	Nov.	98	100	47	0	0.3
Sencor 0.67 lb + NIS	Mar.	89	72	24	0	0.9
VelparDF 0.50 lb + NIS	Nov.	97	100	14	0	0.4
VelparDF 0.67 lb + NIS	Nov.	88	98	32	0	0
VelparDF 0.50 lb + NIS	Mar.	88	67	22	1.3	4.9
Sencor 0.6 lb + NIS + GramoxoneMax 0.8 pt	Mar.	95	100	45	1.4	5.7
VelparDF 0.3 lb+ NIS+ GramoxoneMax 0.8 pt	Mar.	89	100	34	0.7	7.3
GramoxoneMax 1.3 pt +NIS	Mar.	53	90	10	0.8	6.2
PursuitDF 1.44 oz + MSO**	Mar.	100	0	67	0.6	2.4
Raptor 5.0 oz + MSO	Mar.	100	86	68	0.7	7.7
MCPA 0.5 pt + NIS	Mar.	82	0	39	3.7	0

* = non-ionic surfactant at 0.25 % v/v
** = methylated seed oil (Hasten) at 1.0 pt/A
*** = reduction in plant height was compared to plant height of untreated plots
**** = reduction in alfalfa or orchardgrass height > 3.3 inches is significant from zero with a 95% confidence interval.