

Control of Downy Brome (*Bromus tectorum*) and Medusahead (*Taeniatherum caput-medusae*) in Rangelands

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Introduction

Downy brome and medusahead are aggressive, exotic, annual grasses invading rangelands in the western United States. Downy brome and medusahead have large impact on plant communities and ecosystems. They had been implicated in increasing fire frequencies and intensities, which has led to its replacement of shrubs and perennial grasses. These annuals also resulted in loss and degradation of sagebrush-grassland habitat.

Objective

To evaluate three fall-applied, and one spring-applied, herbicides or combinations for controlling invasive annual grasses, without damaging perennial grasses or sagebrush in a northeastern California sagebrush community.



Methods and Materials

Study Sites: This study is conducted in 2 sites (Bull Flat (40.29 N, 120.07 W) and Bull Fire (40.31 N, 120.02 W) within the Smoke Creek region of eastern California. Four blocks (replicates) were 15 m X 30 m each for a total of 5 acres. Each block consisted of 5 herbicides plots (30 m X 30 m).

Herbicides : 1) Untreated; 2) glyphosate at 420 g ae/ha (=16 oz Roundup Pro/acr); 3) sulfometuron + chlorsulfuron at 35 g ai/ha + 17.5 g ai/ha (= 1 oz Landmark XP/ac), respectively; 4) rimsulfuron at 17.5 g ai/ha (= 1 oz Matrix/ac); 5) imazapic at 93 g ae/ha (= 5.3 oz Plateau/ac).

Treatments: Herbicides were applied by backpack sprayer in October of 2008 around the first fall rains, except for glyphosate which was applied in mid-April 2009 after all annual grass emerge and were 2 to 5 in tall.

Evaluations: Field survey was conducted in June 17, 2009. Plant species cover was estimated using point-interpret transects. Twenty biomass samples were taken in 0.1 m² quadrats in each treatment. Samples were sorted by hands and number of stems and seedheads of the two grasses were counted.

Analysis: Data were analyzed by one way ANOVA statistical software JMP (SAS; Cary, North Carolina, USA). Means were separated using Tukey-Kramer HSD (p <0.05).

Results



Table 1. Presenting frequency (%) of plant species in untreated plots in experimental sites.

Species	Frequency (%) in untreated plots	
	Bull Flat	Bull Fire
Annual grass	<i>Bromus tectorum</i>	100
	<i>Taeniatherum caput-medusae</i>	50
	<i>Agoceros retrorsa</i>	--
Perennial grass	<i>Elymus elymoides</i>	100
	<i>Agropyron repens</i>	65
	<i>Elytrigia intermedia</i>	60
	<i>Poa secunda</i>	--
Non-grass	<i>Descurainia</i> spp.	55
	<i>Amsinckia menziesii</i>	--
	<i>Crepis</i> spp.	5
	<i>Epilobium brachycarpum</i>	--
	<i>Chenopodium</i> spp.	--
<i>Lactuca</i> spp.	--	



Table 3. Perennial grass biomass (g/m²) and species richness except for downy brome and medusahead (mean/SE) between treatments in each site.

Sites	Treatments	Perennial grass biomass (g/m ²)	Species richness other than medusahead and downy brome (species/0.1 m ²)
Bull Flat	Glyphosate	10.9/2.8 a*	1.10/0.16
	Sulfometuron + Chlorsulfuron	6.4/1.5 b	1.05/0.14
	Rimsulfuron	14.8/3.1 a	0.95/0.11
	Imazapic	12.7/2.6 a	1.00/0.13
	Untreated	12.8/3.1 a	1.45/0.17
Bull Fire	Glyphosate	0/0 b	0.60/0.17 ab
	Sulfometuron + Chlorsulfuron	0/0 b	0.20/0.09 b
	Rimsulfuron	11.2/6.2 a	0.35/0.13 b
	Imazapic	5.3/3.7 a	0.30/0.13 b
	Untreated	5.2/4.4 a	1.05/0.18 a

*Mean/SE with columns followed by different letters are different significantly between each treatment at each site (Tukey-Kramer HSD, p <0.001).

Perennial grasses responses (Table 3): Landmark (sulfo + chlor) damaged resident perennial grasses and other species at both sites. In contrast, Matrix (rim) and Plateau (imaza) had no effect on perennial grasses. Glyphosate was inconsistent, damaging perennial grasses in one site but not the other.

Table 2. Vegetation cover (%), biomass (g/m²), seedhead densities (/m²) (mean/SE) of downy brome and medusahead between treatments in each site.

Species	Sites	Treatments	% cover	Biomass (g/m ²)	Seedhead density (/m ²)
Medusa-head	Bull Flat	Glyphosate	0/0 c*	0/0 b	0/0 b
		Sulfometuron + Chlorsulfuron	0/0 c	0/0 b	0/0 b
		Rimsulfuron	0/0 c	0/0 b	0/0 b
		Imazapic	0.05/0.05 b	0.04/0.04 b	0.5/0.5 b
		Untreated	2.2/0.8 a	2.1/0.7 a	46.0/16.1 a
	Bull Fire	Glyphosate	4.4/1.6 ab	5.2/2.3 ab	114.0/51.0 ab
		Sulfometuron + Chlorsulfuron	0/0 b	0/0 b	0/0 b
		Rimsulfuron	0.05/0.05 b	0.05/0.05 b	1.0/1.0 b
		Imazapic	0.7/0.5 b	0.8/0.7 b	8.0/6.6 b
		Untreated	11.3/3.8 a	10.8/2.4 a	221.5/45.2 a
Downy brome	Bull Flat	Glyphosate	0.7/0.39 b	0.8/0.04 b	17.0/8.3 b
		Sulfometuron + Chlorsulfuron	0/0 b	0/0 b	0/0 b
		Rimsulfuron	0/0 b	0/0 b	0/0 b
		Imazapic	0.8/0.3 b	0.5/0.2 b	9.5/3.2 b
		Untreated	11.2/1.7 a	16.6/3.0 a	395.0/62.1 a
	Bull Fire	Glyphosate	7.9/2.5 b	6.3/2.2 b	331.0/119.2 b
		Sulfometuron + Chlorsulfuron	0/0 c	0/0 c	0/0 c
		Rimsulfuron	0/0 c	0/0 c	0/0 c
		Imazapic	0.2/0.2 c	0.07/0.07 c	3.0/3.0 c
		Untreated	20.2/3.0 a	17.5/2.3 a	709.5/82.0 a

*Mean/SE within columns followed by different letters are significantly different between each treatment within each site (Tukey-Kramer HSD, p <0.0001).

Vegetative cover responses (Table 2): Landmark (sulfo + chlor) provided 100% control of the two invasive annual grasses at both sites. Matrix (rim) gave 100% control of cheatgrass and an average of 99.8% of medusahead at both site. Plateau (imaza) and glyphosate were inconsistent, providing between 61% and 100% control of the two grasses.

Table 4. Vigor, cover (%) and height (cm) (mean/SE) of *Elymus elymoides* and cover (%) of *Agropyron repens* between treatments in each site.

Sites	Treatments	<i>Elymus</i> vigor/plot June 17	<i>Elymus</i> height (cm) June 17	<i>Elymus</i> % cover		<i>Agropyron</i> % cover Sept. 30
				June 17	Sept. 30	
Bull Flat	Glyphosate	3.5/1.3 b*	29.5/4.4 ab	0.5/0	0.4/0.2 ab	6.1/1.2
	Sulfometuron + Chlorsulfuron	1.5/0.3 b	18.8/4.9 b	0.5/0	0/0 c	5.5/1.1
	Rimsulfuron	8.8/0.6 a	35.5/3.0 ab	0.6/0.1	0.6/0.2 a	6.0/1.5
	Imazapic	8.3/0.8 a	37.3/4.5 a	0.8/0.1	0.1/0.1 bc	7.3/1.6
	Untreated	7.8/0.3 a	36.3/2.0 a	0.6/0.1	0.1/0.1 bc	7.0/1.6
Bull Fire	Glyphosate	3.3/0.8 bc	22.0/2.4 bc	0.6/0.1 bc		
	Sulfometuron + Chlorsulfuron	2.0/0 c	16.8/2.0 c	0.5/0 c		
	Rimsulfuron	8.6/0.8 a	33.3/2.8 a	1.9/0.4 ab		
	Imazapic	8.3/0.6 a	30.8/0.8 ab	2.3/0.5 a		
	Untreated	5.0/0.4 b	27.0/1.7 ab	0.8/0.1 bc		

*Mean/SE within columns followed by different letters are different significantly at each site (Tukey-Kramer HSD, p <0.05).

***Elymus elymoides* and *Agropyron repens* responses (Table 4):** *Elymus elymoides* vigor, height (cm), cover (%) did not change following all treatments, except Landmark (sulfo + chlor), and increased after Matrix (rim) and Plateau (imaza) treatment. *Agropyron repens* cover (%) did not change following any herbicides treatments.

Conclusions

Results of our findings indicate that Matrix (rimsulfuron) is a very effective tool for control of both downy brome and medusahead, and provides safety to both desirable perennial grasses and sagebrush. Plateau (imazapic) was also acceptable, but glyphosate was too inconsistent in its response and Landmark (sulfometuron + chlorsulfuron) resulted in excessive damage to perennial grasses.