Restoring Central Oregon Rangeland from Ventenata and Medusahead to a Sustainable Bunchgrass Environment – Warm Springs and Ashwood, 2011

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Abstract

Medusahead (*Taeniatherum caput-medusae*), ventenata (*Ventenata dubia*), and downy brome or cheatgrass (*Bromus tectorum*) are annual grassy weeds that degrade range, hay and pastures of the Pacific Northwest. Trials were established in 2008 at two locations in central Oregon, one on the Warm Springs Reservation and the other near Ashwood. Two trials were conducted at each location. In one trial bunchgrasses remained despite significant populations of medusahead or Ventenata, and in a second the plant stand was completely dominated by annual grassy weeds. The objective was to evaluate the effects of strictly herbicide based programs on bunchgrass growth after removal of annual weedy grasses, and evaluate stand establishment of six bunchgrasses species following herbicide application in areas where annual weedy grasses were predominate and few bunchgrasses remained. Treatments consisted of herbicide-only and herbicide followed by planting of six different bunchgrass species. In 2009, evaluation of herbicide-only applications provided 100% control of medusahead and ventenata at both locations. A moderate stand of bunchgrass species was established at the Warm Springs location in the Plateau and Journey treated plots, but not at Ashwood. During 2010, residual efficacy for the four herbicides decreased at both locations, providing only moderate control. Stand establishment in the Landmark and Matrix treated plots planted in the fall of 2009 was strong for Sandberg's bluegrass, Sherman big bluegrass, smooth brome, and intermediate wheatgrass at the Warm Springs location. By 2011 ventenata comprised 74 to 94% of the weedy grasses in the herbicide-only treated plots at Warm Springs. This was followed by cheatgrass at 5 to 28% and medusahead at 2.5% or less. Weedy grasses in the herbicide-treated plot areas remain significantly less than untreated. Sherman big bluegrass provided the strongest stand across both planting dates. The performance of the other five species varied by planting date.

Introduction

Medusahead (*Taeniatherum caput-medusae*) is predominant on millions of acres of semi-arid rangeland in the Pacific Northwest. It is extremely competitive and crowds out all other vegetation on infested rangeland, including such undesirable species as cheatgrass, *Bromus tectorum*). Medusahead and cheatgrass often out-compete bunchgrasses that stabilize the soil and provide forage for livestock and wildlife. Furthermore, medusahead and cheatgrass dramatically increase the fuel load, therefore altering fire frequency and changing the established plant community to species more adapted to frequent fires. They also allow soil structure to deteriorate due to their reduced root structure compared to perennials. This in turn encourages an increase in soil erosion. The two objectives of this project were to evaluate the effects of strictly herbicide

based programs on bunchgrass growth after removal of medusahead and cheatgrass, and evaluate stand establishment of six bunchgrasses species following herbicide application in areas where medusahead and cheatgrass were predominate and few bunchgrasses remained.

Materials and Methods

Plots were established in the fall of 2008 at two locations on the Warm Springs Reservation north of Madras and near the town of Ashwood, Oregon. The Warm Springs location is a clay-dominated site that stays saturated in early spring, at a moderate elevation, while the Ashwood location is at a relatively high elevation near the top of a ridge with extremely shallow soil. Each location included two sites, one where bunchgrasses were coexisting with high populations of annual weedy grasses, and a second location where few to no bunchgrasses remained due to domination by grassy weed species.

Herbicide Only

During the fall of 2008, small plots were established at two locations where bunchgrasses remained. The herbicides Plateau® (imazapic), Journey® (imazapic + glyphosate), Matrix® (rimsulfuron), and Landmark® (sulfometuron + chlorsulfuron) were applied to 10-ft by 25-ft plots replicated four times. Application was on November 17, 2008 using a CO_2-pressurized hand-held boom sprayer outfitted with TeeJet 8002 nozzles on a 9-ft boom operated at 40 psi with 20 gal water/acre applied.

During June 2009, plots were evaluated visually for herbicide efficacy on ventenata, medusahead and cheatgrass. Height measurements of established bluebunch wheatgrass at the Warm Springs location and intermediate wheatgrass at the alternate Ashwood site were taken. In July, 2010 plots were evaluated for continued herbicide efficacy, with a focus on ventenata at Warm Springs. In May, 2011, composition of existing annual weedy grasses was rated for percent ventenata, medusahead, and cheatgrass. This was done to determine invasive movement of the various species by creating a baseline to determine if ventenata is becoming a more dominant portion of the weed complex in these plots.

Herbicide Followed by Planting Bunchgrass

The same herbicide treatments were also applied where few to no bunchgrasses remained in single strips 20 ft by 288 ft at both the Warm Springs and Ashwood sites. Applications were made on December 11, 2008 at Ashwood and December 12, 2008 at Warm Springs using the same methodology as the herbicide-only plots. Application was made just prior to planting at Warm Springs and immediately following planting at Ashwood.

Six species of bunchgrasses were planted in 20 ft-wide plots replicated 3 times following application of Plateau and Journey in December 2008 and following application of Landmark

and Matrix in mid-November 2009 for crop safety reasons. Seeding rate was 15 lb/acre using an 8-ft-wide John Deere 1500 power drill planting 10 rows on 9 inch centers. Bunchgrasses included intermediate wheatgrass (*Agropyron intermedium*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Sandberg's bluegrass (*Poa sandbergii*), Sherman big bluegrass (*Poa secunda*), smooth brome (*Bromus inermis*) and crested wheatgrass (*Agropyron cristatum*). At the request of Warm Springs tribal members, squirreltail (*Elymus elymoides*) was substituted for crested wheatgrass at that location.

During December, 2010 plant counts were made for the grass species planted in the Plateau and Journey plots during 2008 and in the Landmark and Matrix plots during 2009. In 2011, stand establishment was evaluated using a line transect method to determine number of plants per plot. Four transects were randomly established in each plot and placed perpendicular to the seeded rows. Number of bunchgrass plants were counted in three $30cm^2$ frames, randomly placed along each transect for a total of twelve frames counted per plot.

Results and Discussion

Herbicide-only Plots

***2009*:** All treatments provided 100% ventenata and medusahead control at both locations in 2009 (Tables 1 and 2). Cheatgrass control at the Warm Springs location was somewhat less for Plateau and Journey. Although not statistically significant at the Ashwood location, the trend was for stunting of bunchgrass following Landmark applications at both Warm Springs and Ashwood.

***2010*:** Residual efficacy for the four herbicides decreased at both locations, providing only moderate control. The focus of efficacy at the Warm Springs location was ventenata, with control ranging from 81% for Landmark to 60% for Journey (Table 3). Medusahead control at the alternate Ashwood site ranged from 57% for Landmark to 40% for Journey (Table 4). The only statistical difference in herbicide injury to intermediate wheatgrass height at the alternate Ashwood site was between Landmark and Plateau, with no differences found between herbicide treatments and the untreated control.

***2011*:** At Warm Springs ventenata was the dominant species in both herbicide-treated and untreated plots, comprising 74 to 94% of the annual weedy grasses (Table 5). Cheatgrass ranged from 5 to 28%, while medusahead comprised 2.5% or less. Three years following treatment, the population of weedy grasses in herbicide treated plots remains less than the untreated.

At the alternate Ashwood location on the South Junction bench no residual herbicide efficacy was observed the third spring following application. That follows what has been observed at other locations. There were significant differences in plant height, with increased height of existing intermediate wheatgrass for Plateau, Journey and Matrix treated plots compared to the

untreated. This can be attributed to use of these "soft" herbicides and the competitive release from the annual grasses they provide.

Herbicide Followed by Planting Bunchgrass

***2009*:** All four herbicides provided near 100% control of medusahead and ventenata at both locations. Establishment of the six bunchgrasses was moderately successful at Warm Springs (Table 6) and unsuccessful at Ashwood. At the Warm Springs location, Sherman big bluegrass achieved the best stand establishment, followed by Sandberg's bluegrass, intermediate wheatgrass, and smooth brome. Grass establishment was not successful for bluebunch wheatgrass or squirreltail.

There was evidence that some germination occurred at Ashwood, but the southeast-facing slope evidently dried out early, preventing stand establishment. This lack of stand establishment at Ashwood may have been affected by herbicide application after planting rather than prior to planting, as is standard procedure and was followed at Warm Springs.

***2010*:** At the Warm Springs location residual efficacy for the four herbicides on ventenata ranged from 95% for Landmark and 90% for Matrix, to 60% for Journey and Plateau (Table 3). Stand establishment following the 2009 fall planting of the Landmark and Matrix plots was highest for Sandberg's bluegrass followed by Sherman big bluegrass, smooth brome, and intermediate wheatgrass. Very few bluebunch wheatgrass or squirreltail plants were observed (Table 7).

Bunchgrass stands appeared to be significantly reduced in the Journey and Plateau plots from 2009 to 2010. Cattle were in the plot area in the fall of 2009 and again from early spring to summer of 2010. Due to this high level of cattle use at the site, it appeared that the established plants may have been significantly reduced during that time (Table 6, 7). However, bunchgrasses planted in the Landmark and Matrix plots in the fall of 2009 appeared to be largely unaffected by the cattle. This may have been due to their small size during the time the cattle were present, making them inaccessible as feed.

It seems from informal observations at the Warm Springs site that the population of ventenata has spread significantly since plots were established in the fall of 2008. Ventenata was largely in the wetter areas along a draw that drains seasonal water. It is along the edge of this drainage area that the herbicide plus planting plots were placed. Ventenata appears to have spread up into the scabland areas that surround the draw where medusahead has been dominant. It is unclear whether this was an opportunistic expansion due to two wet springs, or a more natural invasive progression as ventenata expands into areas previously dominated by medusahead or cheatgrass.

No germination of bunchgrasses was observed at the Ashwood location following planting of the Landmark- and Matrix-treated plots in the fall of 2009 or from planting of the Journey and Plateau plots in the fall of 2008. It is still unclear whether this continued lack of stand

establishment at Ashwood may have been caused by herbicide application after planting rather than prior to planting, as is standard procedure.

***2011*:** At Warm Springs Sherman big bluegrass provided a vigorous stand across both the Plateau and Journey plots planted in 2008 and the Landmark and Matrix plots planted in 2009. There were no statistical differences between the remaining species in the Plateau and Journey plots, but the trend from strongest to weakest stand was intermediate wheatgrass, Sandberg's bluegrass, bluebunch wheatgrass, squirreltail and smooth brome. In the Landmark and Matrix plots Sherman big bluegrass was statistically the same as Sandberg's bluegrass, smooth brome and intermediate wheatgrass, while bluebunch wheatgrass and squirreltail provided statistically weaker stands.

Table 1. 2009 evaluation of herbicides applied on November 19, 2008 to herbicide-only plots for control of ventenata, cheatgrass, and medusahead at Warm Springs, Oregon.

Treatments[1]	Product /acre	Ventenata control (%)	Cheatgrass control (%)	Medusahead control (%)	Bluebunch wheatgrass height (in)[3]
Plateau	6 oz	100	93	100	23.7 a
Journey	1 pt	100	96	100	22.5 a
Matrix[2]	4 oz	100	100	100	23.0 a
Landmark[2]	0.75 oz	100	100	100	21.7 a
Control	---	0	0	0	23.8 a

[1]Plateau = imazapic 2 lb ai/gal, Journey = imazapic 0.75 lb ai/gal + glyphosate 1.5 lb ai/gal, Matrix = rimsulfuron 25%, Landmark = sulfometuron 50% + chlorsulfuron 25%.
[2]Treatment included a silicon surfactant at 0.25% v/v.
[3]Mean separation with Least Significant Difference (LSD) at $P \leq 0.05$

Table 2. 2009 evaluation of herbicides applied on November 19, 2008 to herbicide-only plots for control of cheatgrass and medusahead at the alternate Ashwood, Oregon, location.

Treatments[1]	Product /acre	Cheatgrass/Medusahead control (%)	Intermediate wheatgrass height (in)[3]
Plateau	6 oz	100	24.7 a
Journey	1 pt	100	25.4 a
Matrix[2]	4 oz	100	26.2 a
Landmark[2]	0.75 oz	100	20.7 b
Control	---	0	25.0 a

[1]Plateau = imazapic 2 lb ai/gal, Journey = imazapic 0.75 lb ai/gal + glyphosate 1.5 lb ai/gal, Matrix = rimsulfuron 25%, Landmark = sulfometuron 50% + chlorsulfuron 25%.
[2]Treatment included a silicon surfactant at 0.25% v/v.
[3]Mean separation with Least Significant Difference (LSD) at $P \leq 0.05$

Table 3. 2010 evaluation of 2008 herbicide applications to herbicide-only and herbicide followed by planting plots for ventenata and medusahead control at Warm Springs, Oregon.

		Herbicide-only plots	Herbicide & planting plots
Treatments[1]	Product /acre	Ventenata control (%)	Ventenata control (%)
Plateau	6 oz	68	60
Journey	1 pt	60	60
Matrix[2]	4 oz	73	90
Landmark[2]	0.75 oz	81	95
Control	---		

[1]Plateau = imazapic 2 lb ai/gal, Journey = imazapic 0.75 lb ai/gal + glyphosate 1.5 lb ai/gal, Matrix = rimsulfuron 25%, Landmark = sulfometuron 50% + chlorsulfuron 25%.
[2]Treatment included a silicon surfactant at 0.25% v/v.

Table 4. 2010 evaluation of 2008 herbicide applications to herbicide-only plots for control of medusahead at the alternate Ashwood, Oregon, location.

Treatments[1]	Product /acre	Medusahead control (%)	Intermediate wheatgrass height (in)[3]
Plateau	6 oz	45	31.9 a
Journey	1 pt	40	31.0 ab
Matrix[2]	4 oz	48	30.2 ab
Landmark[2]	0.75 oz	57	29.3 b
Control	---	0	30.6 ab

[1]Plateau = imazapic 2 lb ai/gal, Journey = imazapic 0.75 lb ai/gal + glyphosate 1.5 lb ai/gal, Matrix = rimsulfuron 25%, Landmark = sulfometuron 50% + chlorsulfuron 25%.
[2]Treatment included a silicon surfactant at 0.25% v/v.
[3]Mean separation with Least Significant Difference (LSD) at $P \leq 0.05$.

Table 5. 2011 evaluation of herbicide-only plots for ventenata and medusahead control at Warm Springs, Oregon and at the alternate Ashwood, Oregon, location.

		Warm Springs			Alternate Ashwood
Treatments[1]	Product /acre	Ventenata (% Plot)	Cheatgrass (% Plot)	Medusahead (% Plot)	Intermediate wheatgrass height (in)[3]
Plateau	6 oz	85	15	0.0	27.6 a
Journey	1 pt	81	19	0.0	27.3 a
Matrix[2]	4 oz	94	5	1.3	27.2 a
Landmark[2]	0.75 oz	84	28	1.3	27.0 ab
Control	---	74	24	2.5	25.5 b

[1]Plateau = imazapic 2 lb ai/gal, Journey = imazapic 0.75 lb ai/gal + glyphosate 1.5 lb ai/gal, Matrix = rimsulfuron 25%, Landmark = sulfometuron 50% + chlorsulfuron 25%.
[2]Treatment included a silicon surfactant at 0.25% v/v.
[3]Mean separation with Least Significant Difference (LSD) at $P \leq 0.05$.

Table 6. 2009 stand establishment of bunchgrass varieties planted at Warm Springs, Oregon, following herbicide application on December 12, 2008.

Varieties	Plateau & Journey Plants/plot
Squirreltail	14
Intermediate wheatgrass	250
Bluebunch wheatgrass	76
Sandberg's bluegrass	350
Sherman big bluegrass	644
Smooth brome	214

Table 7. 2010 stand establishment of bunchgrass varieties planted at Warm Springs, Oregon, following herbicide application on December 12, 2008.

Varieties	Plateau & Journey Plants/plot	Matrix & Landmark Plants/plot
Squirreltail	0.7	1
Intermediate wheatgrass	4.0	426
Bluebunch wheatgrass	0.3	5
Sandberg's bluegrass	2.0	1402
Sherman big bluegrass	2.3	1189
Smooth brome	2.3	922

Table 8. 2011 stand establishment of bunchgrass varieties planted at Warm Springs, Oregon, following herbicide application on December 12, 2008.

Varieties	Plateau & Journey Plants/plot[1]		Matrix & Landmark Plants/plot[1]	
Squirreltail	110	b	18	b
Intermediate wheatgrass	220	b	1026	a
Bluebunch wheatgrass	110	b	55	b
Sandberg's bluegrass	129	b	1265	a
Sherman big bluegrass	330	a	1723	a
Smooth brome	92	b	1081	a

[1]Mean separation with Least Significant Difference (LSD) at $P \leq 0.05$.