Impact of Herbicide Applications for Exotic Annual Grass Control on Fuel Load Production

Gustavo Sbatella and Sasha Twelker

Abstract

Exotic annual grasses such as downy brome, medusahead, and Ventenata can produce fine fuel loads that create favorable conditions for wild fire. This study assesses the effectiveness of imazapic (Plateau®) and propoxicarbazone sodium (Canter R+P®) in various application timings in reducing annual grass fuel load production. The study was conducted near South Junction, Oregon, in two sites with a reported invasive annual grass infestation – one site was burned, and one site unburned. Preliminary results suggest that herbicides have the potential to reduce fuel loads from annual weedy grasses, particularly in recently burned fields. The total biomass at the burned site (929 pounds per acre) in the beginning of the study was 40 percent less than the unburned site (1527 pounds per acre). The fire had a major impact in reducing the amount of litter available with 191 pounds per acre in the burned site against 1243 pounds per acre in the unburned. Treatment effects differed between locations. Six months after the initial applications, at the burned site, total biomass was reduced 53 percent with Plateau® at 6 oz/acre and 44 percent with Canter R+P® at 1.2 oz/acre with spring application. Litter was reduced with Plateau® applied in spring of 2012 by 86 percent while a 92 percent reduction was achieved with a spring and fall application of Plateau®. The vegetation sampling performed in the unburned site six and twelve months after the applications indicated that herbicides helped control annual weedy grasses; although, the effect on the produced biomass was not significant enough to reduce the production of litter or total biomass. These results suggest that herbicides can be used as tools to reduce the production of fine fuels, although the magnitude in the reduction is going to be determined by the history of previous wildfires.

Introduction

Exotic annual grasses such as downy brome (*Bromus tectorum*), medusahead (*Taeniatherum caput-medusae*), and Ventenata (*Ventenata dubia*) can produce large amounts of fine fuel loads creating favorable conditions for wild fires. These fuel loads change the fire regime and help perpetuate invasive grasses dominance in plant communities. One way to alter this cycle is by reducing the amount of fine fuel which can be achieved by mowing or grazing, however these practices have their limitations. For instance, mowing is restricted by terrain conditions and grazing is limited by the rapid loss of the palatability of the grasses. Herbicides imazapic and propoxicarbazone sodium have been particularly effective in controlling or suppressing exotic annual grasses, depending on rates and time of application. The main limitation for extensive use of these herbicides, particularly in rangelands, is the cost. However, if the fuel load from exotic annual grasses is reduced, the risk of wild fires will also decrease as the result of herbicide applications. This could help create lower fire risk sections or corridors in order to protect more sensitive areas such as installations, roadsides, buildings, animal shelters, etc. The cost of herbicide application for these areas would be compensated by the value of the saved resources and reduction in the cost of controlling frequent wild fires. The use of herbicides would only be justified if a significant reduction of the fuel load is achieved. The objective of this study was to quantify the impact of herbicides and application timings on invasive annual grass fuel load production.

Materials and Methods

The study was conducted near South Junction, Oregon, in two sites with a reported invasive annual grass infestation. In the first site, from this point forward referred to as the “non-burned site,” no fires had been recorded during the last four years. In the second site, fire was recorded in the summer of 2011, from this point forward referred to as “burned site.” The study design was a randomized complete block design replicated four times with a plot size of 10 ft by 60 ft. Herbicides were applied with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. Application dates and environmental conditions are detailed in Table 1. Herbicide treatments consisted of imazapic (Plateau®) and propoxicarbazone sodium (Canter R+P®) applied at different rates and timings (Table 5). An electrical fence was built around the perimeter of the studied area to avoid grazing. The impact of the treatments on fuel load production were determined by sampling the vegetation of a 5.4 ft^2 area in each plot, during the spring and fall of 2012, and spring 2013. The harvested vegetation was separated into three categories: actively growing grasses (annual and perennial), forbs and fuel load (laying dead plant matter). Samples were then oven dried and weighed.

Results and Discussion

The effect of the fire on the plant community was evident by the differences in biomass for all plant categories recorded at the beginning of the study (Table 2). The total biomass at the burned site (929 pounds per acre) was 40 percent less than the non-burned site (1527 pounds per acre). The fire had a major impact in reducing the amount of litter available with 191 pounds per acre at the burned site against 1243 pounds per acre at the non-burned. The effects of the fire were also evident on both annual and perennial grasses, where biomass at the burned site was 2.5 times higher than the non-burned.

Six months after the spring application, the impact of the herbicide treatments differed between sites. A significant reduction in total biomass when compared to the non-treated was observed with the use of Plateau® at 6 ounces per acre, or Canter R+P® at 1.2 ounces per acre in the burned site (Table 3). Although every treatment had an impact on the produced litter, the most significant biomass reduction, 53 percent, was observed with the application of Plateau®. The control of annual weedy grasses was also more effective with Plateau®, as suggested by the lowest recorded biomass among treatments. All tested treatments reduced the biomass of the perennial grasses. A possible explanation for this is that a significant portion of the perennial grass biomass came from Bulbous bluegrass (*Poa bulbosa*), a species that has shown to be affected by the tested herbicides.

At the non-burned site, treatments affected both perennial and annual weedy grasses but impacts were not significant enough to affect litter and total biomass production (Table 4). At this site, annual weedy grass control was more effective with Plateau® at 6 ounces per acre, and Canter R+P® at 0.6 ounces per acre, as indicated by the harvested biomass. The main perennial grass species at the non-burned site was intermediate wheatgrass (*Thinopyrumintermedium*) and was only affected by Canter R+P® at 1.2 ounces per acre. No forbs were recorded at this site.

The impacts on the plant community differed between sites again in spring of 2013, and were dependent upon herbicide and time of application. For instance, in the burned site total biomass was affected by Plateau® at 6 oz/acre when applied in spring and with a sequential spring and fall application of Plateau® at the same rate (Table 4). Total biomass was reduced because in these two treatments the amount of litter was 83 and 46 pounds per acre, a significantly less amount when compared to the other treatments and the non-treated check. All herbicides affected perennial grass biomass production and the same consideration regarding bulbous bluegrass being the most abundant species applies also for this period. Regarding annual grass control again was Plateau® at 6 oz/acre most effective treatment, but when applied in fall of 2013 and in sequential spring and fall applications. The impact of the treatments on forbs at the burn site deserves a special mention because forbs biomass was always higher when Plateau® was sprayed. Alfalfa was the main forb species at this site, and since Plateau® has no activity on this species, the weed control provided by this herbicide favored alfalfa growth. Meanwhile, the application of Canter R + P ®affected alfalfa growth resulting in less forb biomass when this herbicide was used.

At the non-burned site, although the treatments impacted perennial and weedy grass biomass, the effects did not result in changes in the amount of litter or total biomass produced (Table 6). At this site, the application of Plateau® at 6 oz/acre applied in spring and fall resulted in a substantial increase in the perennial grass biomass (495 lb/acre) when compared to the non-treated check (285 lb/acre). Similarly to the burned site weedy grass was most effectively controlled with Plateau® at 6 oz/acre when applied in fall of 2013 and in sequential spring and fall applications. No forbs were recorded at this site. These results suggest that herbicides have the potential to be used to reduce fuel loads from annual weedy grasses in recently burned fields. Meanwhile, the tested herbicides will have no impact when a significant fuel load is present before the application. Plateau® was in general more effective than Canter R + P® in reducing weedy grass biomass and the impacts on perennial grasses were determined by grass species.

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Table 1. Application dates and environmental conditions.

	A		B	
	Non-burned	Burned	Non-burned	Burned
Application Date	4/7/12	4/7/12	11/5/12	11/5/12
Time of Day	10 am	12 pm	8 am	12 pm
Air temperature (F)	49	51	50	65
Relative Humidity (%)	63	48	84	55
Wind Speed (MPH)	2	5	2	4
Wind Direction	NNW	N	SE	NE

Table 2. Average biomass (lb/acre) by category for both sites at the beginning of the study in the spring of 2012.

	Biomass lb/acre[1]							
Site	Weedy Grass		Perennial Grass		Litter		Total	
Burned	352	a	330	a	191	a	929	a
Non-burned	137	b	132	b	1243	b	1527	b

[1]Means among columns followed by the same letter are not different at P=0.05.

Table 3. Average biomass (lb/acre) by category for the burned site in the fall of 2012.

		Biomass lb/acre							
Treatment	Rate (oz/acre)	Weedy Grass		Perennial Grass		Litter		Total	
Plateau®	6	21	b	6	b	607	b	679	b
Canter R+P®	1.2	60	a	17	b	743	ab	854	b
Canter R+P®	0.6	72	a	27	b	964	ab	1064	ab
Untreated		97	a	150	a	1292	a	1565	a

[1]Means among columns followed by the same letter are not different at P=0.05

Table 4. Average biomass (lb/acre) by category for the non-burned site in the fall of 2012.

		Biomass lb/a[1]							
Treatment	Rate (oz/acre)	Weedy Grass		Perennial Grass		Litter		Total	
Plateau®	6	12	b	518	ab	843	a	1386	a
Canter R+P®	1.2	26	ab	389	b	707	a	1140	a
Canter R+P®	0.6	9	b	577	a	882	a	1476	a
Untreated		39	a	476	ab	840	a	1372	a

[1]Means among columns followed by the same letter are not different at P=0.05

Table 5. Average biomass (lb/acre) by category for the burned site in the spring of 2013.

Treatment	Rate (oz/acre)	Time[2]	Biomass lb/acre									
			Litter		Perennial Grass		Weedy Grass		Forbs		Total	
Plateau®	6	A	83	c	35	a	66	ab	87	ab	271	bc
Plateau®	6	B	455	a	59	a	21	bc	91	ab	627	ab
Plateau®	6	A-B	46	c	27	a	3	c	50	abc	127	c
Canter R+P®	1.2	A	463	a	18	a	103	ab	13	bc	596	ab
Canter R+P®	1.2	B	426	a	34	a	85	ab	8	bc	553	ab
Canter R+P®	0.6	A-B	365	ab	8	a	83	ab	2	c	458	ab
Untreated			567	a	152	b	163	a	10	bc	893	a

[1]Means among columns followed by the same letter are not different at P=0.05
[2]Abbreviations: A= spring 2012, B= fall 2012

Table 6. Average biomass (lb/acre) by category for the non-burned site in the spring of 2013.

Treatment	Rate (oz/acre)	Time[2]	Biomass lb/acre[1]							
			Litter		Perennial Grass		Weedy Grass		Total	
Plateau®	6	A	327	a	451	ab	25	ab	803	a
Plateau®	6	B	266	a	458	ab	16	b	740	a
Plateau®	6	A-B	356	a	495	a	2	c	853	a
Canter R+P®	1.2	A	406	a	428	ab	41	ab	875	a
Canter R+P®	1.2	B	411	a	396	ab	25	ab	832	a
Canter R+P®	0.6	A-B	377	a	434	ab	29	ab	840	a
Untreated			533	a	285	b	59	b	877	a

[1]Means among columns followed by the same letter are not different at P=0.05
[2]Abbreviations: A= spring 2012, B= fall 2012