Use of Herbicides for Control of Western Juniper (*Juniperus occidentalis*) in Early Stages of Sagebrush Community Encroachment

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Abstract

The objective of this study is to determine if herbicides can provide an effective way to control Western Juniper in sagebrush communities in the early stages of encroachment. For this purpose two field studies on a randomized complete block with four replications are been conducted near Prineville, Oregon. Each plot consists of ten trees with height no larger than six feet tall. In a first study the active ingredients picloram, fluroxypyr, aminocyclopyrachlor, metsulfuron, triclopyr, imazapyr and glyphosate were tested with a foliar coverage application. Evaluations performed 120 days after treatment (DAT), showed that picloram (98 percent), picloram + fluroxypyr (98 percent) and glyphosate + imazapyr (93 percent) were the treatments with the highest percent of Western juniper tree damage. Lower levels of damage were observed when aminocyclopyrachlorwas combined with metsulfuron (78 percent) or with triclopyr (86 percent). In the second study picloram, hexazinone, aminocyclopyrachlor and triclopyr were tested with spot and basal bark as applications methods. The highest level of tree damage was recorded with picloram when applied either as spot treatment (90 percent) or as basal bark (98 percent). Tree damage with spot application of hexazinone was 67 and 70 percent for aminocyclopyrachlor plus triclopyr when applied as a basal bark treatment. These levels of herbicide damage observed in the Western juniper trees only 120 DAT are to be considered highly satisfactory independently of active ingredient or application method. Further evaluations are programmed for next year that will provide more definitive conclusions regarding treatment performance.

Introduction

The range of Western Juniper has dramatically expanded since the late 1800's, occupying 3.7 million acres in Oregon (Miller et al. 2005). Once Western Juniper becomes established in a community, it competes with the native vegetation for space, light, and nutrients; more importantly, however, it uses a tremendous amount of water that is no longer available to the existing native plant communities. In regions of low annual precipitation such as central and eastern Oregon, water use and interception by the Western Juniper has a dramatic effect on the amount of water available for other species (Barrett, 2007). As result of the diminished supply available to the dominant plant community, the existing shrubs, grasses, and forbs are significantly reduced. The change in composition of the existing plant community has a correspondingly negative effect on the livestock and wildlife that depend on them. The encroachment of sagebrush plant communities by Western Juniper is an important factor contributing to the degradation of the sage grouse habitat. Western Juniper not only competes for water with existing plants, but also provides perches for the bird species that prey on sage grouse, further negatively affecting survival, productivity, and recruitment.

There are three distinct stages in the encroachment of juniper into sagebrush communities (Miller et al. 2005). In phase I, the Western Juniper trees are generally less than six feet tall, and shrubs and grasses persist as the dominant species. In phase II, Juniper trees are co-dominant with shrubs and grasses, and by the end of this phase the percent area cover by Western Juniper can reach 20 percent. In phase III, Western Juniper trees are dominant and dictate the ecological process affecting the plant community. This phase is characterized by dramatic decline in the species richness of the understory. Control of Western Juniper in phase I of the encroachment is critical because the negative impacts on the plant community are still minimal. The reestablishment of plant communities in phases II or III of the Western Juniper is much more costly.

Options for Western Juniper control in phase I include mechanical removal (chainsaw, machinery) prescribed fire, and herbicides (Barrett, 2007). One advantage offered by the application of herbicides is that large areas can be treated quickly, but the use of herbicides for Western Juniper control to date has been limited. Currently there is little or no information regarding the effectiveness of active ingredients such as metsulfuron, triclopyr, imazethapyr, hexazinone and aminocyclopyrachlor for Western Juniper control in central Oregon.

The objective of this study is to determine if herbicides might provide an effective way to control Western Juniper in sagebrush communities in the early stages of encroachment.

Materials and Methods

A study is being conducted 8 miles east of Prineville, Oregon, on a site currently in phase 1 of Western juniper encroachment. Foliar coverage and spot-basal bark herbicide applications techniques are been tested in two separate studies. Each study was designed as a randomized complete block design replicated four times with a total of 10 Western juniper trees in each plot. Individual trees were tagged for identification and height, trunk and foliage diameters at the base of the tree were measured. Herbicides in the foliar application study were applied with a single nozzle backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. In the spot-basal bark study, herbicides were applied using a spot gun with an adjustable graduated cylinder for the spot applications and a single nozzle backpack sprayer for the basal bark applications. In this last study mechanical removal was included as a treatment for comparison. Application dates and environmental conditions are detailed in Table 1. Active ingredients tested in the foliar application study include: picloram, fluroxypyr, aminocyclopyrachlor, metsulfuron, triclopyr, imazapyr and glyphosate, rates and adjuvants are detailed in Table 2. Active ingredients tested in the spot-basal application study include: picloram, hexazinone, aminocyclopyrachlor and triclopyr, rates and adjuvants are detailed in Table 3. Treatments were visually evaluated for foliar chlorosis 120 days after treatment (DAT) on a scale of 0 no injury to 100 total chlorosis.

Data was subject to ANOVA using the GLM procedure from SAS. Means were separated using Fischer’s Protected LSD test at a 0.05.

Results and Discussion

Foliar coverage application: The visual evaluation performed in the fall of 2013, 120 DAT, showed that the highest percent of foliar chlorosis on Western juniper trees was recorded with applications of picloram (98 percent), picloram + fluroxypyr (98 percent) and glyphosate + imazapyr (93 percent). Lower levels of chlorosis were observed when aminocyclopyrachlorwas combined with metsulfuron (78 percent) or with triclopyr (86 percent). These levels of herbicide damage observed in the Western juniper trees only 120 DAT are to be considered highly satisfactory, even for the treatments that included aminocyclopyrachlor,which is a more slowly acting active ingredient. The need of enough spray volume to obtain a good foliar coverage, the spraying time required to ensure a good coverage and the risk of accidental exposure for the applicator are factors to be considered with this application method.

Spot-basal bark application: The highest percent of foliar chlorosis on Western juniper trees was recorded when picloram was applied either as spot treatment (90 percent) or as basal bark (98 percent). Tree chlorosis with spot application of hexazinone was 67 percent. This active ingredient requires moisture for soil incorporation and plant uptake; therefore these initial levels of chlorosis are high if we take in account the limited amount of moisture available after the application. Tree chlorosis when aminocyclopyrachlor was combined with triclopyr was 70 percent. The same consideration as the foliar treatment should be made for the basal bark application of aminocyclopyrachlor in regards to the speed on which the molecule acts. The advantages of using the spot or basal bark application method are that high volumes of spray solutions are not required, the exposure for the applicator is minimal and numerous trees can be sprayed in a relative short period of time.

Acknowledgments

The authors would like to thank the Oregon Beef Council for funding this project. We would also like to thank Dr. Tim Deboodt for his collaboration on this project.

Literature Cited

Barrett, H. 2007. Western Juniper Management: A field guide prepared for the Oregon Watershed Enhancement Board.

Miller, R. F., J. D. Bates, T. J. Svejcar, F. B. Pierson and L. E. Eddleman. 2005. Biology, Ecology and Management of Western Juniper. Oregon State University.Technical Bulletin 152.

Table 1. Application dates and environmental conditions for the herbicide applications.

	Foliar	Spot-basal
Application Date	6/22/2013	6/21/2013
Time of Day	8:00 am	10:00 am
Air Temperature (F)	49	52
Relative Humidity (%)	78	68
Wind Speed (MPH)	3	5
Wind Direction	W	NW

Table 2. Herbicides applied as foliar coverage for Western juniper control and percent chlorosis recorded 120 DAT.

	Treatment[1]	Rate	Unit	Chlorosis[2]	
1	Picloram	4	qt/100 gal	98	a
	Syl-Tac	0.5	% v/v		
2	Picloram + fluroxypyr	6	fl oz./acre	98	a
	Syl-Tac	0.5	% v/v		
3	Aminocyclopyrachlor + metsulfuron	3	qt/acre	76	c
	MSO	1	% v/v		
4	Aminocyclopyrachlor + triclopyr	3	fl oz./acre	86	b
	MSO	1	% v/v		
5	Imazapyr + Glyphosate	1 + 5	% v/v	93	ab
	COC	1	% v/v		
6	Untreated Check	1	lb./acre	0	d
	LSD (P=.05)			8	

[1]Abbreviations: methylated seed oil, MSO; crop oil concentrate, COC.
[2]Means followed by different letters are significantly different at p=0.05

Table 3. Herbicides applied as spot-basal bark applications for Western juniper control and percent chlorosis recorded 120 DAT.

	Treatment[1]	Rate	Unit	Chlorosis[2]	
1	Picloram	0.2	fl oz./ tree	90	a
2	Picloram	20	% v/v	98	a
	NIS	0.5	% v/v		
3	Hexazinone	0.13	fl oz./ ft. height	67	b
4	Aminocyclopyrachlor	5	% v/v	70	b
	Triclopyr	15	% v/v		
5	Untreated Check	1 + 5	% v/v	0	c
	LSD (P=.05)			11	

[1]Abbreviations: non-ionic surfactant, NIS.
[2]Means followed by different letters are significantly different at p=0.05