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Integrating Herbicides and Re-vegetation on a Leafy Spurge Infested Pasture in the Bitterroot Valley, Montana

by

Jim Jacobs, NRCS Invasive Species Specialist
Alan Knudsen, Missoula County Weed Management Coordinator

Abstract

Leafy spurge is one of the more problematic and economically significant noxious weeds in Montana because it reduces livestock forage and because herbicidal management is costly and short term. On a cattle ranch in south western Montana, picloram or imazapic (two herbicides used to control leafy spurge) were sprayed, and five competitive, forage grass species were seeded as monocultures in a controlled, replicated study to determine the effects of these treatments on leafy spurge suppression and grass establishment. Bluebunch wheatgrass, orchard grass, and thickspike wheatgrass established where herbicides suppressed leafy spurge density. Bluebunch wheatgrass and orchard grass reduced the biomass production of leafy spurge indicating competitive suppression of leafy spurge by these grasses. Results suggest that herbicides are necessary to establish grasses and to increase forage production on degraded pastures infested with leafy spurge. Regeneration of leafy spurge where grasses established indicates that control of leafy spurge by insect, goat, or sheep herbivory, and prescribed cattle grazing will be needed for sustainable management of leafy spurge.

Introduction

Leafy spurge (*Euphorbia esula* L.) has been reported in every county in Montana making it one of the more widespread noxious weeds in Montana. It infests an estimated three million acres in 29 western states. On pasture and rangeland, livestock forage availability in leafy spurge infestations is reduced because leafy spurge suppresses the productivity of forage grasses and because cattle avoid grazing in leafy spurge infestations. On many infested pastures, perennial forage grasses have been replaced by leafy spurge and less palatable grasses such as bulbous bluegrass (*Poa bulbosa* L.), three-awn (*Aristida purpurea* Nutt.), and cheatgrass (*Bromus tectorum* L.). On these sites, controlling leafy spurge using herbicides, biological control insects, or grazing with sheep or goats may not restore forage quality or production. This technical note reports three years of data collected on a re-vegetation demonstration of a leafy spurge infested pasture in the Bitterroot Valley, Montana.

Objectives

The overall objectives of the study were to establish a demonstration of integrated management of leafy spurge that included herbicide, re-vegetation, biological, and grazing control methods,

(Disclaimer: Any mention of products in this publication does not constitute a recommendation by the NRCS. It is a violation of Federal law to use herbicides in a manner inconsistent with their labeling.)

and to use re-vegetation and herbicides to improve forage production. Specific objectives were to determine the establishment success of grass species, their competition with leafy spurge, and herbicidal control of leafy spurge for grass establishment.

Study Area

The study area is located on a privately owned cattle ranch southeast of Lolo, Montana. The area is level and the long-term (30-year) average annual precipitation ranges from 15 to 19 inches (380 to 480 mm). The soils are classified as Bigarm gravely-loam (loamy-skeletal, mixed, frigid Typic Haploxerolls) 0 to 11 inches (0-280 mm) deep, 7 to 18 percent clay, 2 to 4 percent organic matter, and a pH range of 6.6 to 7.3. The historic habitat-type is classified as Festuca *scabrella/Agropyron spicatum*. The plant community composition at the start of the study in 2002 was predominantly leafy spurge with Canada bluegrass (*Poa compressa* L.), cheatgrass, bulbous bluegrass, three awn, spotted knapweed (*Centaurea maculosa* Lam.), intermediate wheatgrass [*Thinopyrum intermedium* (Host) Barkworth & D.R. Dewey], and bluebunch wheatgrass [*Pseudoroegneria spicata* (Prush) A. Löve].

Study Design

The study was designed as a split-plot with six grass seeding treatments (including a no seeding control) as whole-plots and three herbicide treatments (including a no herbicide control) applied within the seeding treatments as sub-plots. Each grass seeding treatment plot was 14 by 45 feet divided into three 14 by 15 foot herbicide treatment plots. The herbicide treatments were randomized within each grass seeding treatment, and the grass seeding treatments were randomized within four replications on two sites. The study was first applied in 2002 and fenced with an eight-foot wildlife fence to exclude cattle and wildlife (fenced site). The study was repeated in 2003 on a second adjacent site but was not fenced (unfenced site).

The six grass seeding treatments consisted of five grass species and a no seeding control. Grass species and seeding rates are listed in Table 1. All grass species are cool season, drought tolerant, long-lived perennial grasses that, with the exception of orchard grass, are native to North America. These species were chosen because they are adapted to the moisture and soil conditions of the site and because of their livestock forage value.

The herbicide treatments included a no herbicide control, picloram applied at one quart product/acre (0.56 kg a.e./ha), and imazapic applied at ten-ounce product/acre (0.03 kg a.i./ha) in solution with one quart/acre methylated seed oil. The herbicides were applied in September before the first hard frost, which is one of the optimum times recommended for herbicidal control of leafy spurge. Grasses were seeded using a rangeland no-till drill on November 11, 2002, in the fenced site and on October 27, 2003, in the unfenced site.

Table 1. The common and scientific names, seeding rates, and characteristics of the grass species seeded in the study.

Common name	Scientific name	rate lb/acre	Origin	habit
Bluebunch wheatgrass	*Pseudoroegneria spicata*	10-14	Washington	bunchgrass
Big bluegrass	*Poa ampla*	2-4	Oregon	bunchgrass
Great basin wild rye	*Leymus cinereus*	6-11	Saskatchewan	short rhizomes
Orchard grass	*Dactylis glomerata*	2-4	Turkey	bunchgrass
Thickspike wheatgrass	*Elymus lanceolatus*	6-11	OR,WA,ID,CA	rhizomatous

Sampling

The sites were sampled in mid-summer beginning in the summer following seeding in 2003, 2004, and 2005. The densities of the seeded grasses and leafy spurge were counted in 0.2 by 0.5 m frames (Daubenmire) placed at random in each treatment plot. Biomass production was sampled within one 1.0 by 1.0 m frame placed at random in each treatment plot. All leafy spurge and seeded grasses were clipped to ground level (3 cm) within the frame. The clipped material was oven dried to constant weight and weighed. Analysis of variance was used to determine significant seeding and herbicide treatment effects on the densities and biomass of seeded grass and leafy spurge.

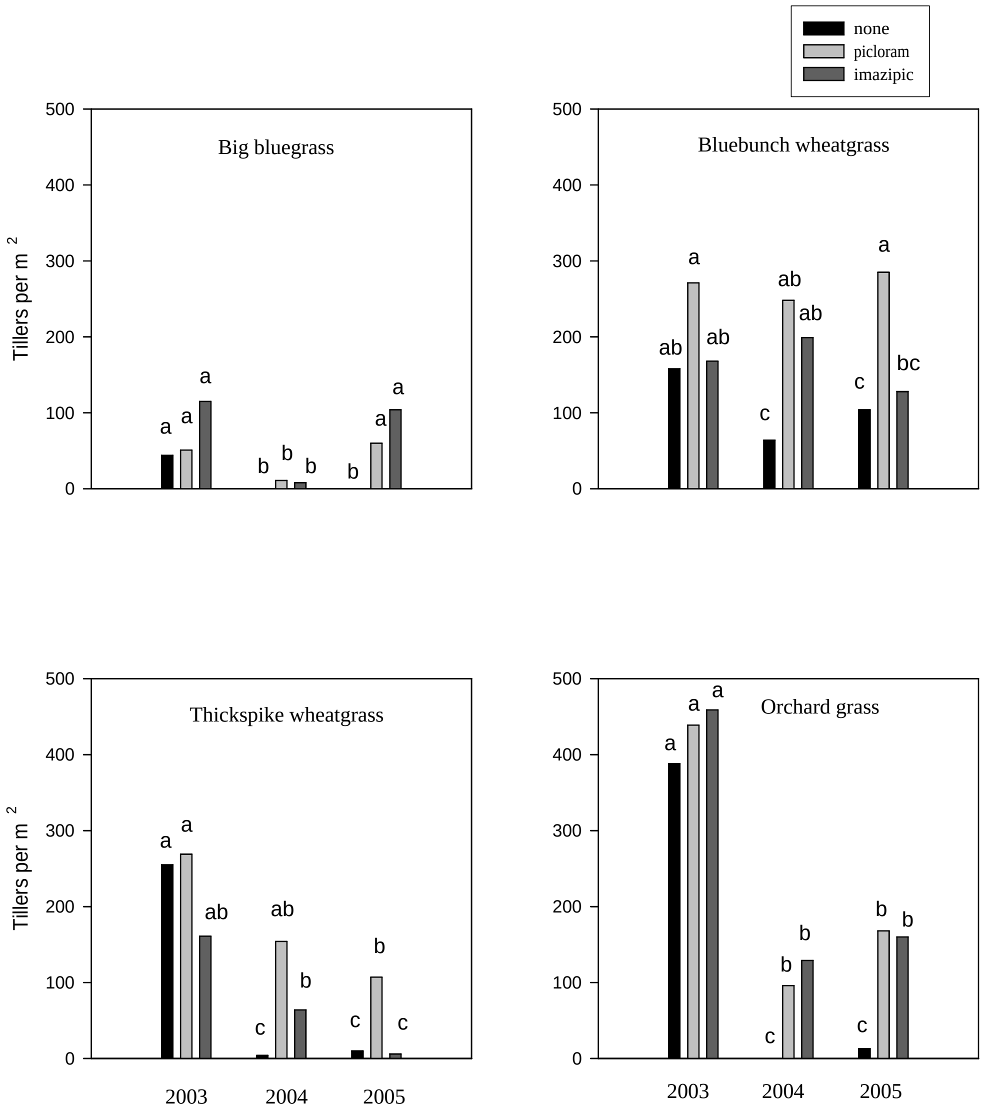
Results

Grass density. Grass establishment as measured by density was improved by fencing to exclude grazing animals. While there was no statistical comparison, grass density was observed to be nearly ten times greater on the study inside the fence than outside the fence (see Figures 1 and 2). Protecting establishing grasses from grazing during the first year will improve establishment because it takes one year for the rooting system to develop and prevent the plants from being up-rooted by grazing animals.

Grass establishment differed depending on the species seeded regardless of grazing during establishment. Orchard grass, thickspike wheatgrass, and bluebunch wheatgrass established well at both sites (see Figures 1 and 2). Big bluegrass had better establishment on the unfenced site than the fenced site. This difference may be due to differences in the temperature or precipitation associated with the year of seeding rather than a grazing effect. Great Basin wild rye did not establish consistently on either site. Establishment of Great Basin wild rye may have been greater if it had been seeded in the spring, as opposed to fall.

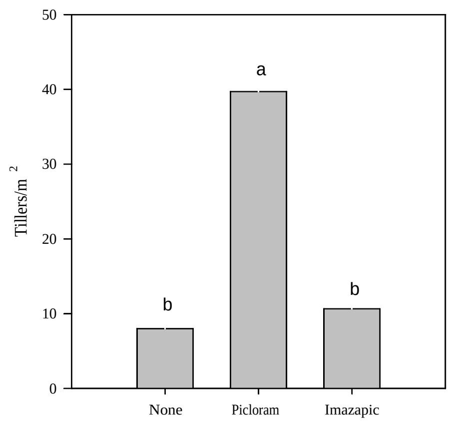
The densities of grasses that did establish were greater where herbicides suppressed leafy spurge compared to the no herbicide control at both sites. The result was the same for picloram and imazapic. Clearly, herbicidal suppression of leafy spurge is a requirement for consistent establishment of forage grasses in leafy spurge infested pastures.

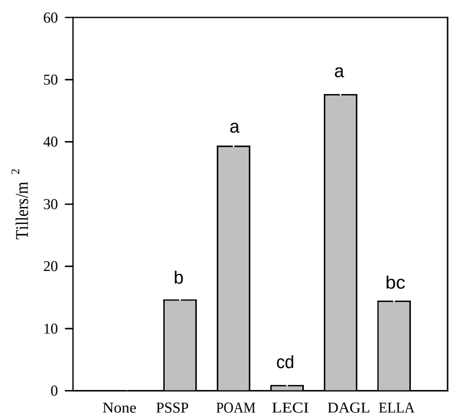
Figure 1. The density of grasses that established on the fenced site measured from 2003 through 2005 following various herbicide treatments. Bars with the same letters are not significantly different.



Grass biomass. Grass biomass production per square meter depended on the species seeded and the herbicide treatment. Where grasses established, their biomass production was increased in the herbicide treatments (data not shown). Combining herbicide suppression of leafy spurge and seeding forage grass species increased livestock forage production.

Figure 2. The effect of herbicide treatment and grass seed treatment on seeded grass density on the site that was not fenced. The grass seeding treatments are no grass seeded (none), bluebunch wheatgrass (PSSP) big bluegrass (POAM), Great Basin wild rye (LECI), orchard grass (DAGL), and thickspike wheatgrass (ELLA). Bars with the same letters are not significantly different.





Leafy spurge density. Picloram and imazapic reduced leafy spurge density similarly on the fenced site (see Figure 3). On the unfenced site, leafy spurge density was significantly lower in the picloram treatment than the imazapic treatment, and both herbicide treatments resulted in lower leafy spurge density than the control two years after application (see Figure 4). It is more likely that the difference between sites is the result of environmental differences between years of application than grazing. On the fenced site, leafy spurge density increased from 2003 to 2004 indicating a recovery of leafy spurge two years after treatment (see Figure 3). Also on the fenced site, the grass seeding treatment did not affect leafy spurge density indicating that where grass established, an expected decrease in leafy spurge density from increased competition with the grasses was not detected (data not shown).

Figure 3. The density of leafy spurge in herbicide treatments on the fenced site from 2003 through 2005. Bars with the same letter are not significantly different.

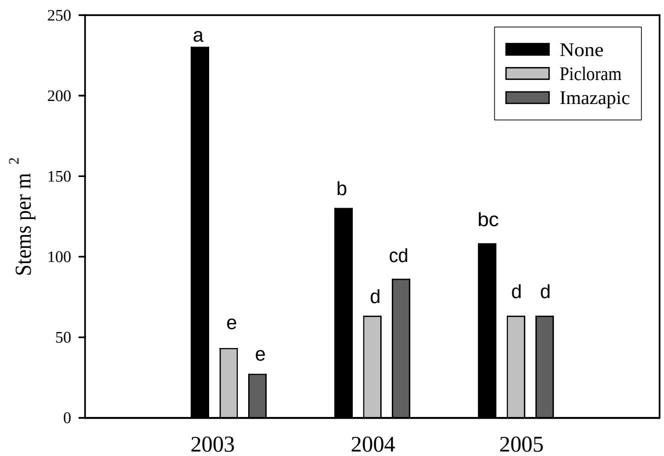
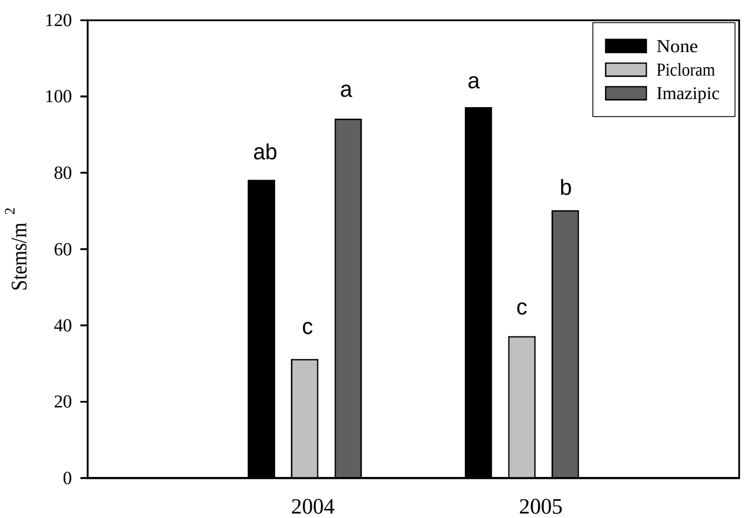


Figure 4. The density of leafy spurge in the herbicide treatments on the fenced site in 2004 and 2005. Letters above bars indicate differences among herbicide treatments and years.

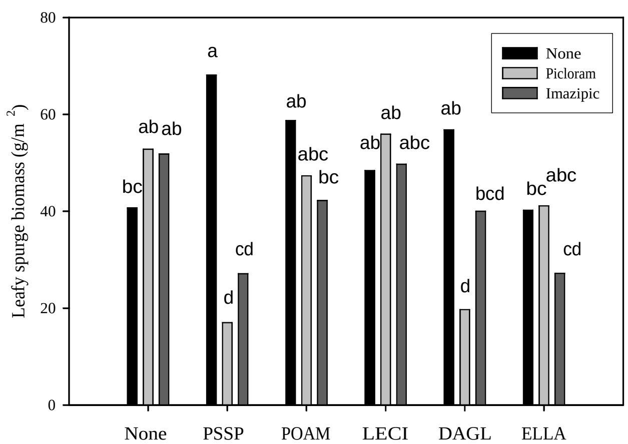


Leafy spurge biomass. On the fenced site, herbicide treatment reduced leafy spurge biomass but the reduction depended on the grass seeding treatment (see Figure 5). Neither picloram nor imazapic reduced leafy spurge biomass production per square meter compared to the no herbicide control where no grass was seeded, or where big bluegrass, Great Basin wild rye, or thickspike wheatgrass was seeded. Big bluegrass and Great Basin wild rye had poor establishment on this site. It was expected that thickspike wheatgrass would reduce leafy spurge production where herbicides were applied because this grass established well in those plots and because it has a rhizomatous root system which one would expect to compete more directly with leafy spurge than bunchgrasses. Perhaps over time the root system of thickspike wheatgrass will increase and this grass may become more competitive with leafy spurge.

Where bluebunch wheatgrass was seeded, imazapic reduced leafy spurge production compared to the control, and picloram resulted in the lowest leafy spurge production (see Figure 5). Where orchard grass was seeded, picloram, but not imazapic, reduced leafy spurge production compared to the no herbicide control (see Figure 5). The reduction in leafy spurge biomass in these grass treatments suggests a competitive effect of the grasses on leafy spurge. The difference in the herbicide treatments within grass seeding treatments suggests an herbicide effect on the competitiveness of the grass with leafy spurge either through subtle differences in the density reduction of spurge or herbicide injury to the grass.

The results of herbicide and seeding treatments on leafy spurge biomass on the site that was not fenced was highly variable most likely because the grass establishment was not consistent (data not shown).

Figure 5. Leafy spurge biomass in grass seeding and herbicide treatment plots on the unfenced site. The grass seeding treatments are no grass seeded (none), bluebunch wheatgrass (PSSP) big bluegrass (POAM), Great Basin wild rye (LECI), orchard grass (DAGL), and thickspike wheatgrass (ELLA). Bars with the same letters are not significantly different.



Management Implications

The results of this study demonstrate the difficulties of managing leafy spurge and the importance of integrated management of this weed. Herbicidal suppression of leafy spurge can be variable as was seen in the difference between sites in this study. On the fenced site, both herbicides reduced leafy spurge by about 80 percent, whereas on the unfenced site only picloram reduced leafy spurge, and the reduction was only about 66 percent (see Figures 3 and 4). In addition, results indicate herbicidal suppression will only be short term. On the fenced site where herbicidal suppression of leafy spurge was 80 percent one year after application, suppression was only about 50 percent in the second and third years after treatment (see Figure 3). Using herbicides to improve the establishment of competitive grasses will increase the suppression of leafy spurge. Where bluebunch wheatgrass and orchard grass established using picloram, leafy spurge production was reduced compared to most of the other treatments (see Figure 5). Using herbicides to establish perennial grasses in leafy spurge infestations will also increase forage production for livestock. Where herbicides were applied, seeded grass biomass production was greater than where no herbicides were applied on this degraded site.

Leafy spurge was observed to regenerate where herbicides were applied and where grasses established (see Figure 6). This suggests that sustainable management of leafy spurge in many situations will require more than herbicidal and competitive suppression. *Aphthona* flea beetles have been released on this site. *Aphthona* larvae feed in the leafy spurge roots and rhizomes and have reduced densities of leafy spurge on many infested sites. In addition to *Aphthona*, goat grazing is being used to target leafy spurge. Long-term data from this demonstration will be used to document the integration of herbicidal, re-vegetation, biological, and grazing control of leafy spurge.

Figure 6. Leafy spurge regeneration in a plot treated with picloram and seeded with bluebunch wheatgrass. Sustainable suppression of leafy spurge will require biological control insects or sheep or goat grazing to suppress the regenerating spurge.

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