EFFECT OF MOWING PRIOR TO APPLICATIONS OF PICLORAM AND CLOPYRALID ON RUSSIAN KNAPWEED CONTROL

Michael Carpinelli

Summary

Russian knapweed is a perennial weed that forms dense colonies by adventitious shoots arising from an extensive root system. It infests some of the most productive pasture and hayland of the Great Basin. Fall application of a persistent, soil-active herbicide has been shown to effectively control Russian knapweed. The objective of this study was to investigate if mowing prior to a fall herbicide application improves herbicide efficacy on Russian knapweed. The Brown Brush Monitor™ mows and applies herbicide in a single pass, removing standing dead plants and allowing more herbicide to reach the soil surface. Using the Brown Brush Monitor™, two persistent, soil-active herbicides (picloram and clopyralid) were tested with and without mowing at two sites in southeast Oregon. Treatments were applied in fall 2001, and Russian knapweed control, density, and height were measured in summers 2002 and 2003. Results were inconsistent at Site 1. At Site 2, mowing increased Russian knapweed control by clopyralid in 2002 and by picloram in 2003, and reduced Russian knapweed height and density for both herbicides in 2003. Results from this study suggest that control of Russian knapweed may be improved by mowing prior to fall herbicide application, but that results may be site-specific.

Introduction

Russian knapweed, a perennial forb native to Eurasia, forms dense colonies by adventitious shoots arising from an extensive root system (Whitson 2001). It infests some of the most productive pasture and hayland of the Great Basin. Fall application of a persistent, soil-active herbicide may effectively control Russian knapweed growth the following year (Whitson et al. 1991); however, mowing as an herbicide pretreatment on other perennial weeds has produced inconsistent results (Amor and Harris 1977, Lym and Messersmith 1986, Madsen and Miller 1988, Mislevy et al. 1999, Beck and Sebastian 2000, Bradley and Hagood 2002, Wilson and Michiels 2003). The objective of this study was to investigate if mowing prior to a fall herbicide application improves herbicide efficacy on Russian knapweed. The Brown Brush Monitor™ (Fig. 1) mows and applies herbicide in a single pass, removing standing dead plants and allowing more herbicide to reach the soil surface. Using the Brown Brush Monitor™, mowing alone and two persistent, soil-active herbicides with and without mowing were tested at two sites in southeast Oregon (Fig. 2).

Materials and Methods

Twenty-four plots (6 treatments, 4 replications; plot size = 10 ft by 30 ft, Site 1; 40 ft by 40 ft, Site 2) were arranged in a randomized-complete-block design at each of 2 sites in southeast Oregon. In fall 2001, the following treatments were applied: 4 herbicide treatments (clopyralid [0.38 kg ae ha^{-1}] and picloram [0.5 kg ae ha^{-1}] with and without mowing), a mow-only treatment, and an untreated control. Application rate for each herbicide was the recommended label rate for Russian knapweed. Mow-and-herbicide treatments were made using a Brown Brush Monitor™; herbicide-only treatments were applied using a backpack sprayer (Site 1) or a Spotlyte® sprayer (Site 2). Russian knapweed control, density, and height were measured in summers 2002 and 2003. Control was measured by visually estimating percent reduction of Russian knapweed in treated plots compared to the untreated plots.

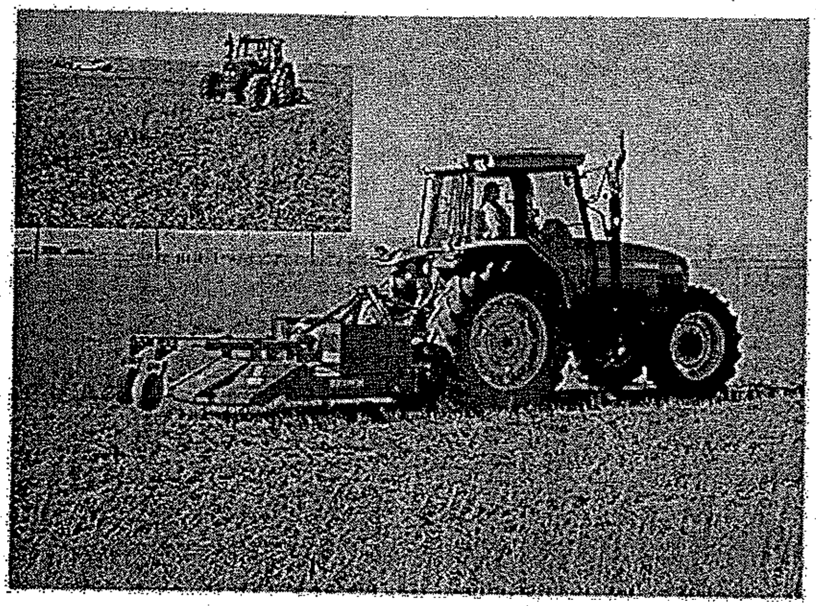

Figure 1. The Brown Brush Monitor ™ mows and applies herbicide in a single pass.

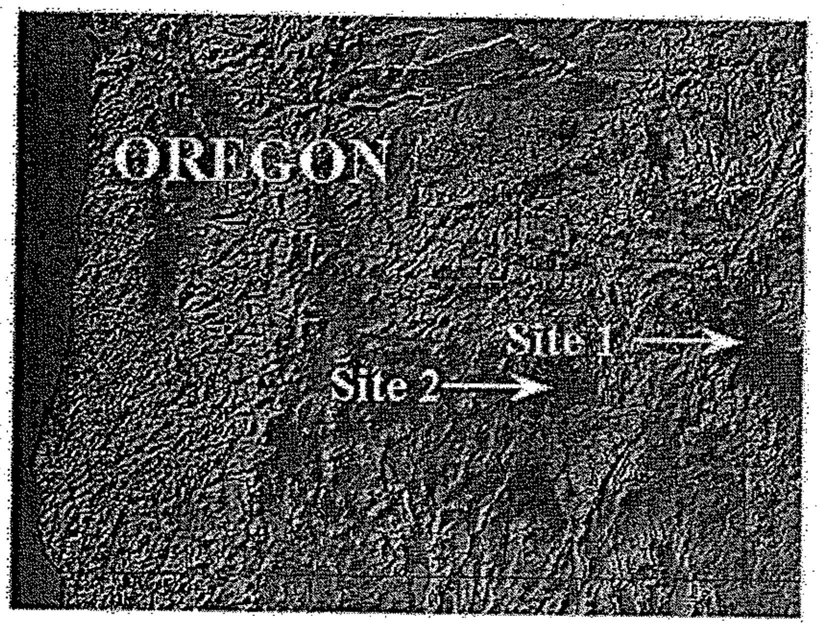

Figure 2. Site 1 was near Adrian, Oregon; Site 2 was near Burns, Oregon.

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Results and Discussion

At Site 1, mowing decreased Russian knapweed control by clopyralid in 2002 and had no effect on control by using either herbicide in 2003 (Fig. 3). Russian knapweed density was not influenced by mowing in either year (Fig. 4). In 2002, Russian knapweed height was lower where clopyralid was combined with mowing than where clopyralid was applied alone, but mowing did not affect Russian knapweed height using picloram in either year (Fig. 5).

At Site 2, mowing increased control by clopyralid in 2002 and by picloram in 2003 (Fig. 3). Herbicide effects on Russian knapweed density and height were not influenced by mowing in 2002 (Figs. 4 and 5). In 2003, Russian knapweed height and density were lower where mowing was combined with picloram or clopyralid than where either herbicide was applied alone (Figs. 4 and 5).

While results from Site 1 were inconsistent, results from Site 2 suggest that mowing immediately prior to applying a soil-active herbicide in the fall increases Russian knapweed control and reduces Russian knapweed density and height in subsequent years. At Site 1, herbicide had an overall greater effect, regardless of mowing, than at Site 2. This may be because the Site 1 soil has proportionately more sand and less clay than the Site 2 soil (data not shown), thus facilitating herbicide movement into the rooting zone at Site 1. Perhaps if lower rates of herbicide were used, the effects of mowing on herbicide efficacy would have been more evident at Site 1.

Conclusions

Mowing immediately prior to applying a soil-active herbicide in the fall may increase Russian knapweed control and reduce Russian knapweed density and height in subsequent years, but results may be site-specific.

Future research should investigate how the relationship between mowing and efficacy of fall-applied herbicides is affected by site conditions and by the physiologies and phonologies of different weed species.

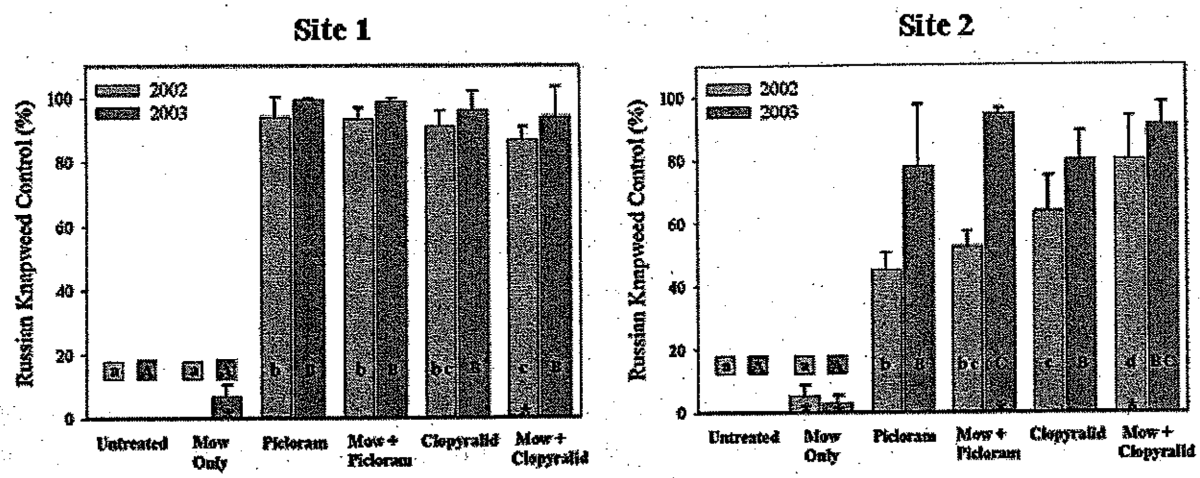

Fig. 3. At Site 1 in 2002, mowing decreased the effect of clopyralid on Russian knapweed control. At Site 2, mowing increased Russian knapweed control with clopyralid in 2002 and with picloram in 2003. By definition, untreated plots have 0% control.

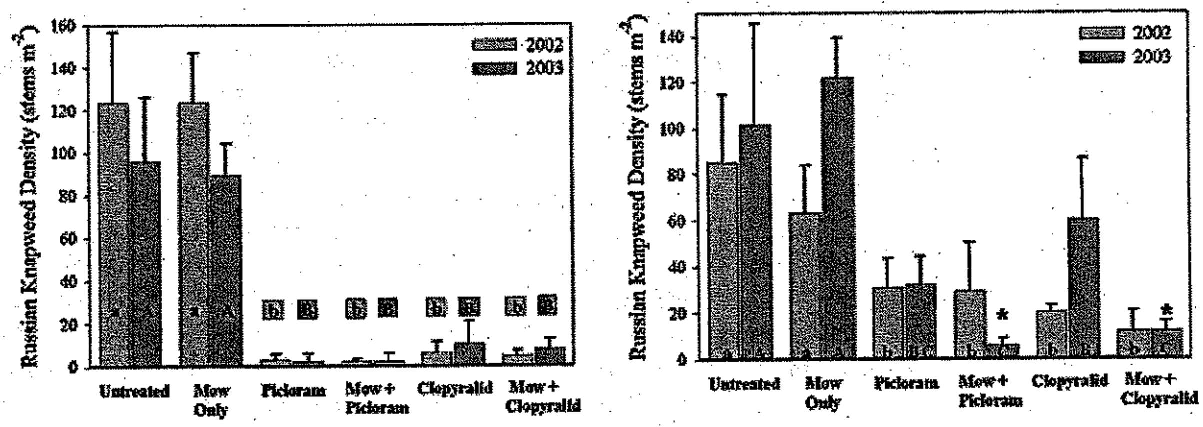

Fig. 4. Mowing had no effect on Russian knapweed density at Site 1; however, mowing increased the effect of picloram and clopyralid on Russian knapweed density at Site 2 in 2003.

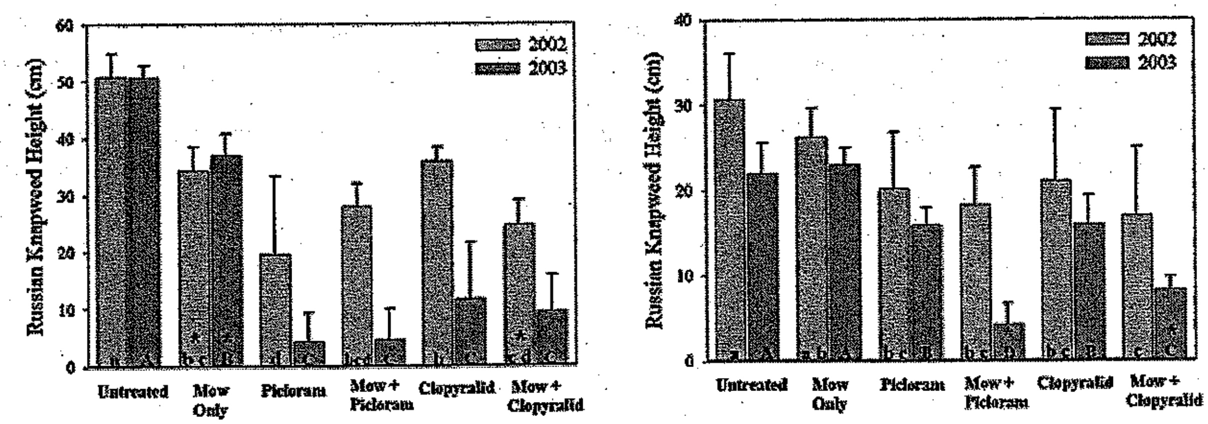

Fig 5. Mowing increased the effect of clopyralid on Russian knapweed height at Site 1 in 2002, and of both herbicides at Site 2 in 2003.

Figures 3–5. Within-year means sharing the same letter (lower case, 2002; upper case, 2003) are similar (LSD). Asterisk denotes significant mow X herbicide interaction within herbicide and within year. Error bars = SE.

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Use of trade names is for the benefit of the reader and does not constitute endorsement by the USDA–ARS or Oregon State University.

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EFFECT OF RUMINAL INCUBATION ON GERMINATION OF PERENNIAL PEPPERWEED SEED

Michael Carpinelli

Summary

Perennial pepperweed invades productive habitats such as flood meadows, riparian areas, and wetlands in most western states, where it displaces desirable forage species. Where chemical or mechanical control is inappropriate, it may be possible to control perennial pepperweed by grazing. However, there is a concern that livestock may ingest seeds that may then be spread to uninfested areas. The goal of this study was to determine the effect of grazing on the viability of perennial pepperweed seeds. Prior to performing a standard germination test, perennial pepperweed seeds were subjected to one of three treatments: incubated in a steer rumen for 48 hours, soaked in water for 48 hours, or kept dry. Ruminal incubation or soaking in water greatly increased germination compared to seeds that were kept dry. These results suggest that if livestock are used to control mature pepperweed, they should be held on weed-free forage for about 1 week prior to being moved to uninfested areas. These results also suggest that spread of pepperweed may be reduced by controlling it in areas where its seeds may eventually be transported by water.

Introduction

Perennial pepperweed (*Lepidium latifolium*) is a perennial weed that spreads from seed, as well as from new stems arising from its creeping root system. It invades productive habitats such as flood meadows, riparian areas, and wetlands in most western states, where it displaces desirable forage species.

It is possible that grazing may be used to control perennial pepperweed. Livestock may be especially effective in areas that are inappropriate for chemical or mechanical control, such as riparian areas. If livestock are used in control efforts, there is a concern that the animals may ingest seeds that may then be spread to uninfested areas. The goal of this study was to determine the effect of grazing on the viability of perennial pepperweed seeds.

Materials and Methods

In fall 2001, perennial pepperweed fruits were collected from the Malheur Wildlife Refuge, about 30 miles south-southeast of Burns, Oregon. Seeds were removed from fruits and were subjected to one of three treatments: 1) incubated in the rumen of a fistulated steer for 48 hours; 2) soaked in water for 48 hours, or; 3) untreated (not incubated or soaked). All treatments were replicated 5 times, and each replicate contained 150 seeds. After incubation or soaking, seeds were rinsed in water and air dried for 3 days. All seeds were then put on sterile, moist media and placed in a germination chamber for 23 consecutive days: the first 14 days at 37° F and the remaining 9 days at 72° F. Seeds were checked daily for germination. It was assumed that seeds that did not germinate within 23 days were not viable. Mean comparisons were made using two-tailed t-tests ($P = 0.05$).