Mechanical control of yellow starthistle: impacts on target and non-target vegetation

Virginia Matzek, Dept of Environmental Studies & Sciences, Santa Clara University
Shannon Hill, Dept of Environmental Studies, California State University-Sacramento

Background

Photo courtesy WA State Noxious Weed Control Board

Yellow starthistle (*Centaurea solstitialis*) is a widespread, non-native pest of California rangelands. Yellow starthistle costs California cattle ranchers $7.65 million per year in lost forage, plus $9.45 million per year to control the invasion's spread (Eagle et al. 2007).

Though a prolific seeder, yellow starthistle has a relatively short-lived seedbank, and control methods have focused on preventing or reducing seedset. Herbicides, prescribed fire, and biological control agents have all been shown to be effective against yellow starthistle, but all have drawbacks. The method favored by ranchers is the herbicide clopyralid (Aslan et al. 2009), but clopyralid kills leguminous forage species like clover, can harm non-target native species (Morghan et al. 2003), and--like any pesticide--may induce resistance with repeated use.

Mechanical methods of control (i.e., mowing) may be an important component of an integrated pest management strategy, alternating with herbicide use. Previous studies have shown mowing to be effective when applied late in the season, when starthistle is in bloom (Benefield et al. 1999). *Here our objective is to explore additional methods of mechanical control that may render mowing more effective, and to test their effects on non-target vegetation, i.e., native perennials and the annual herbs that make up most cattle forage.*

Methods

Study area: grazing lands in Ten Mile Creek watershed, Mendocino County
Study sites: 24 plots with 100% yellow starthistle cover

Treatments (n=6):

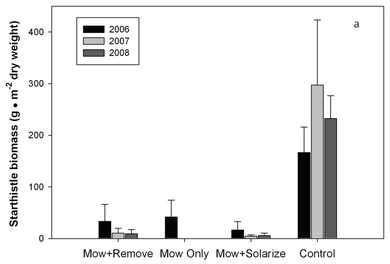
Mow Only	mowed when 25% of stems were in flower
Mow + Solarize	4-mil black solarization tarp added for 6 wks
Mow + Remove	mown biomass bagged and removed from site
Control	no treatment applied

Duration: 3 years
Data collected: Aboveground biomass and seedbank size of annuals, perennials, and yellow starthistle

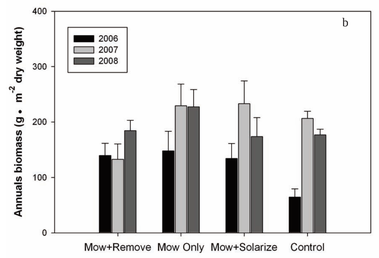
Questions

- How effective a method of control is late-season mowing?
- Can mowing reduce starthistle more effectively if combined with solarization (to kill achenes) or removal of the harvested biomass (to prevent post-mowing seed rain)?
- What effect do these treatments have on non-target vegetation, like native perennials or annual forage species?

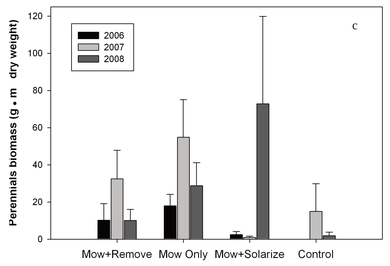
Results



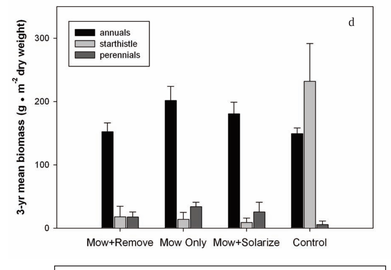
a: All mowing treatments significantly reduced starthistle biomass in all three years, but mowing treatments were not different from each other.



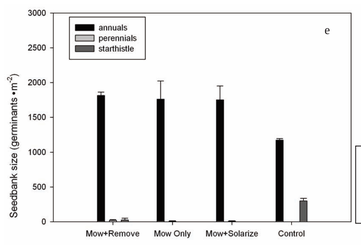
b: Biomass of annuals was not significantly affected by any treatment, but varied significantly from year to year.



c: Perennial biomass increased significantly over control in the Mow Only treatment; perennials were patchily distributed.



d: Three-year averages show mowing treatments have more perennial biomass and less starthistle biomass compared to control.



e: Mowing treatments reduced starthistle seedbank to zero or near-zero levels; perennials and annuals were not diminished by mowing.

Acknowledgements

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Discussion

Late-season mowing proved to be very effective at controlling yellow starthistle, reducing the invader to zero or near-zero levels, both in aboveground biomass and the seedbank.

The "plus treatments" (+solarization and +biomass removal) were not significantly better at reducing starthistle than mowing alone.

For annual species, biomass and seedbanks were not significantly affected by either starthistle itself or the treatments. Instead, significant differences in annual biomass were observed from year-to-year, suggesting that interannual differences in rainfall drive the pattern.

Photo courtesy: Kurt Stueber

Photo courtesy: Landscape Resource

Perennials seemed to benefit from the mowing treatments, but variability was high between years and treatments, perhaps due to the patchiness of clump-forming perennial monocots in this system.

Recommendations

Managers should consider adopting late-season mowing as part of an IPM strategy, especially where repeated herbicide use risks selecting for resistance, or where prescribed burns are not feasible. Our mowing strategy was more effective than others previously described in the literature, perhaps because we repeated mowing for three consecutive years.

References

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