Comparing Natural Area Herbicides for Residual Weed Control and Native Species Tolerance

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Abstract

Downy brome (*Bromus tectorum* L.) is a competitive winter annual grass species, and is considered one of the most problematic invasive species in natural areas. A field trial was conducted to evaluate native species tolerance to indaziflam and other currently recommended herbicides used for downy brome (*Bromus tectorum* L.) and Dalmatian toadflax (*Linaria dalmatica* L.) control. A total of 10 herbicide treatments were applied at two separate locations. For each native species, total counts were conducted1 YAT across the entire plot area and analyzed as an increase or decrease compared to the non-treated control plots. Total species richness, downy brome control, and perennial grass response were also evaluated 1 YAT. Indaziflam treatments (73 and 102 g·ai·ha^{-1}) increased native species richness and provided 95-100% downy brome control. Imazapic treatments provided limited downy brome control and failed to increase species richness in treated plots compared to non-treated plots. Aminocyclopyrachlor and picloram treatments resulted in a significant reduction in species richness, with up to a 40% decrease compared to non-treated plots.

Rationale and Objectives

- Downy brome invasions have resulted in decreased species diversity, increased fire frequency, increased soil erosion, and depleted soil moisture and nutrients.
- Current herbicides being used have been inconsistent in providing long-term downy brome control and have injured native grasses and forbs.
- The main objective of this research was to evaluate desirable native grass, forb, and shrub response to indaziflam, imazapic, picloram, and aminocyclopyrachlor.
- This research was also conducted to determine which herbicides provide long-term downy brome and Dalmatian toadflax control.

Methods

- Two sites consisting of downy brome and Dalmatian toadflax with a diverse native understory (grasses, forbs, shrubs) were established in 2015.
- 10 treatments (indaziflam, imazapic, picloram, aminocyclopyrachlor and their combinations) were applied in June while native grasses, forbs and shrubs were actively growing.
- All treatments were applied as an RCB to 3 x 6 m plots with six replications
- All treatments were applied with a CO_2 pressurized backpack sprayer using 11002LP flat fan nozzles, calibrated to deliver at 187 L·ha^{-1} at 207 kPa.
- All statistical analysis was performed in R and analyzed using a one-way ANOVA. Pairwise comparisons of means with a Tukey adjustment are represented by unique letters on the graphs.

Results

Native Species Tolerance Sites 1 and 2: Treatment combinations including picloram significantly reduced species richness (25% ± 1.2% SE to 35% ± 1% SE). Treatments containing indaziflam at 44 g·ai·ha^{-1} increased species richness (8% ± 1.2% SE) compared to the check. Treatments containing picloram also significantly reduced the density of native specie *Heterotheca villosa*

Downy Brome Control Site 2: Treatments containing indaziflam (44, 73 and 102 g·$ai^{\cdot ha-1}$) significantly reduced downy brome (56% ± 10.3% SE in the untreated plots to 1% ± 0.4% SE in the indaziflam plots) compared to the untreated check and other treatments. One YAT Site 1 had inconsistent downy brome in the check plots therefore the data was not able to be analyzed.

	Treatment	Rate
1	**Indaziflam**	44 g·ai·ha^{-1}
2	**Indaziflam**	73 g·ai·ha^{-1}
3	**Indaziflam**	102 g·ai·ha^{-1}
4	**Imazapic**	105 g·ai·ha^{-1}
5	**Picloram**	227 g·ai·ha^{-1}
6	**Aminocyclopyrachlor**	57 g·ai·ha^{-1}
7	**Indaziflam**	102 g·ai·ha^{-1}
	Picloram	227 g·ai·ha^{-1}
8	**Indaziflam**	102 g·ai·ha^{-1}
	Aminocyclopyrachlor	57 g·ai·ha^{-1}
9	**Imazapic**	105 g·ai·ha^{-1}
	Picloram	227 g·ai·ha^{-1}
10	**Imazapic**	105 g·ai·ha^{-1}
	Aminocyclopyrachlor	57 g·ai·ha^{-1}

Figure 2. List of herbicide treatments applied to study plots.

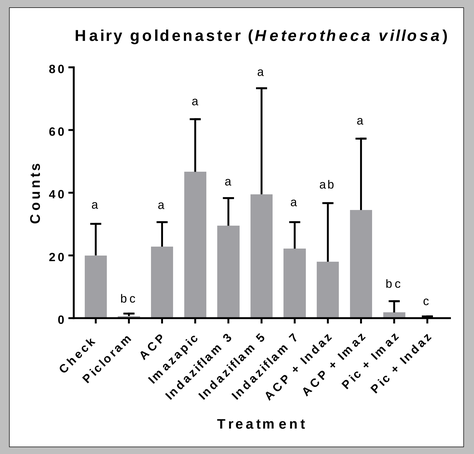

Figure 3. Response of native specie hairy goldenaster (*Heterotheca villosa*) to herbicide treatments

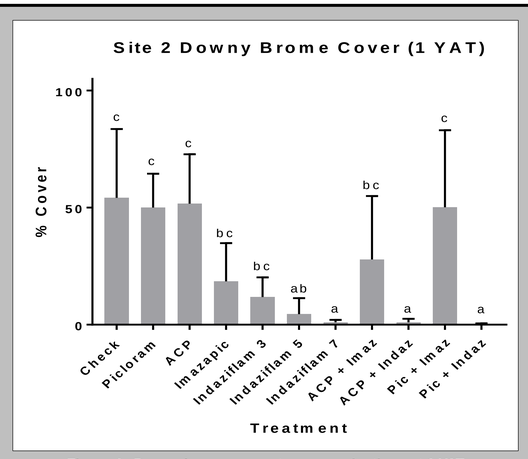

Figure 4. Downy brome percent cover evaluations at 1 YAT.

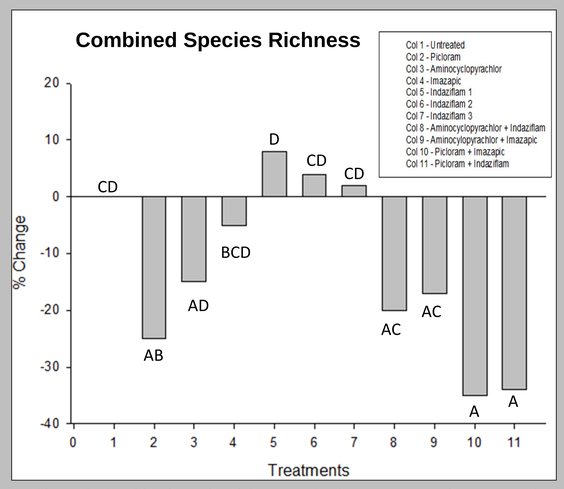

Figure 5. Combined species richness as % change compared to untreated check. Calculated by totaling unique species found in each treatment.

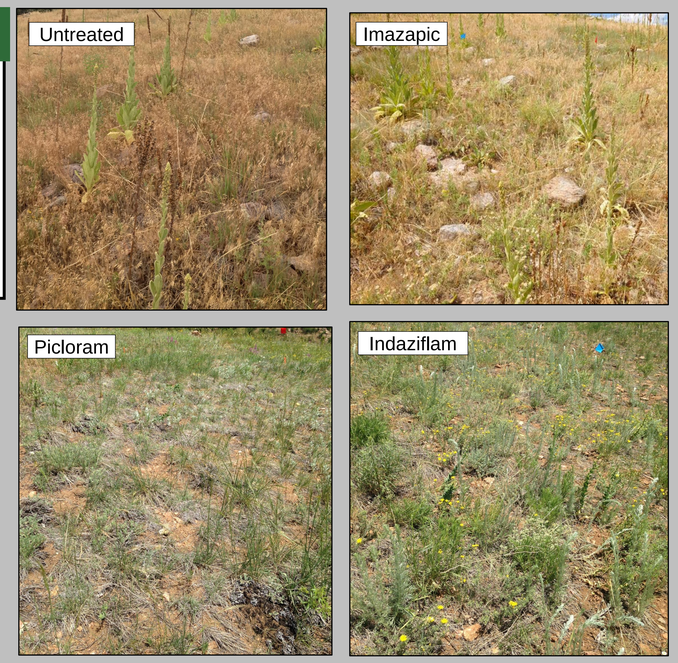

Figure 7. Species richness in untreated, imazapic, picloram, and indaziflam plots

Conclusions/Implications

- Indaziflam alone was the only herbicide treatment to increase native species richness.
- Only treatments including indaziflam at 73 and 102 g·$ai^{\cdot ha-1}$ provided significant control of downy brome compared to the untreated plots.
- Treatments containing picloram had a significant negative impact on species richness.
- With over 50 million acres in the western U.S. infested by downy brome, indaziflam could be used as a tool by land managers to restore invaded sites without harming native species.
- Long-term control of downy brome could be key to the release of native species at invaded sites and in turn a transformation back to a native species dominated site.
- Depletion of the soil seed bank may be key to long-term downy brome control.

Future Research

- Following this study for additional years
- Conducting tolerance studies at sites where native species are grown in a production setting
- Determining impact of residue accumulation and burning to the native species community
- Evaluating management options and native tolerance to indaziflam at high elevation sites

Figure 1. Downy brome control 1 YAT with imazapic and indaziflam compared to untreated plot –Site 2

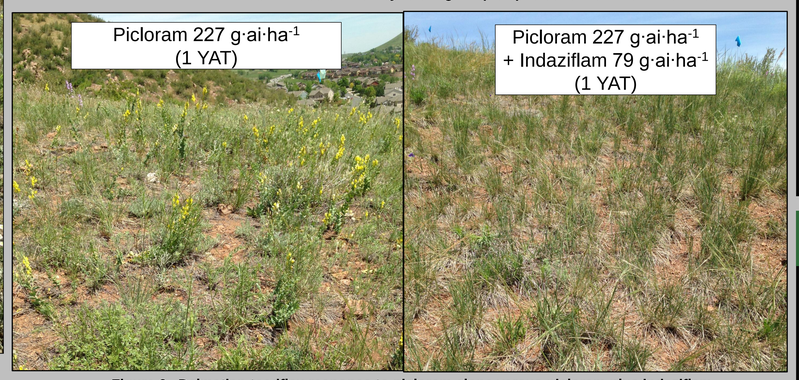

Figure 6. Dalmatian toadflax response to picloram alone versus picloram plus indaziflam

Acknowledgements

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