

Residual efficacy of PPO-inhibiting herbicides

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In the spring of 2025, a field trial was established to evaluate the efficacy of PPO-inhibiting herbicides in controlling weeds under bare ground conditions in Eastern Washington. Weed control is critical for optimizing crop yields, and herbicides that provide residual activity provide longer-term weed control that may reduce early-season competition. These group 14 herbicides inhibit the PPO enzyme, which blocks the production of chlorophyll, as well as destroying cell membranes, leading to cell death. The objective of this study was to evaluate (1) the overall weed control efficacy of different herbicide treatments, and (2) the residual weed control.

Initial herbicide treatments of Reviton (tiafenacil) at 1 and 2 oz/A, Sharpen (saflufenacil) at 1 and 2 oz/A, Flumi FX (flumioxazin) at 1 and 2 oz/A, Rapidicil (epyrifenacil) at 5 and 10 oz/A, Voraxor (saflufenacil) at 1.5 oz/A, Goal (oxyfluorfen) at 1 pt/A, and a “nontreated” plot that was treated with glyphosate only occurred in the spring. The plots were divided into three subplots: (A) main treatment alone, (B) main treatment with glyphosate applied 14 DAT, and (C) main treatment with glyphosate applied 42 DAT. This trial was located at the Palouse Conservation Field Station near Pullman, WA. Plots were 10 ft wide by 30 ft long - with each subplot (A-C) measuring 10 ft by 10 ft - and arranged in a randomized complete block design with four replications. All herbicide treatments were applied with a CO₂ powered backpack sprayer (Table 1). The spray boom had four Teejet® 11002VS nozzles with 20-inch spacing and spray output was calibrated to deliver 15 gallons per acre at 3 mph. Treatments were visually assessed for weed control, by species, at 14 and 28 days after the last treatment. Weed density and biomass was taken by species in each subplot at the end of the growing season using two ½ m² quadrats.

Table 1. Application details for all herbicide treatments.

	Main Application	Glyphosate Reset 1	Glyphosate Reset 2
Date	5/9/2025	5/30/2025	6/30/2025
Air temperature (°F)	66	70	66
Soil temperature (°F)	51	53	53
Wind velocity (mph, direction)	6, SE	2, SE	5, ESE
Relative humidity (%)	42	41	52

RStudio (R version 4.5.1) was used to analyze and visualize data. Fixed effects included treatment, subplot, species, and the interaction between treatment and subplot. Random effects included replication. A negative binomial distribution was applied to model density data.

Flumi FX at the low rate had the most significant overall weed density reduction compared to the nontreated ($p = 0.04$). The majority of rainfall occurred before we started this trial (Table 2/Figure 3), which could have affected the activation of some of the herbicides.

Common lambsquarters was not completely controlled by any of the treatments (Figure 1), however, Reviton and Flumi FX at the high rate, and Voraxor had lower densities than other plots. Lambsquarters biomass was significantly lower in the ‘B’ subplots compared to the ‘A’ plots (Figure 2), suggesting that all treatments provide some residual control. Prickly lettuce was controlled by Rapidicil at the high rate, and to lesser extent, by Rapidicil at the low rate (Figure 1). There was no residual control with the Flumi

FX or Voraxor treatments (Figure 3). Mayweed chamomile was controlled by Flumi FX at both low and high rates, as well as Rapidicil at the high rate (Figure 1). Mayweed biomass follows the same trends as lambsquarters biomass – lower biomass in the ‘B’ plots suggest some residual control.

Growers have five PPO herbicide options to manage broadleaf weeds in wheat - Rapidicil is not yet available in Washington. The data presented here indicates that Flumi FX may be best utilized for lambsquarters and Mayweed control, while Sharpen and Rapidicil show more activity on prickly lettuce. More seasons are needed to determine best timing of application, and for individual species management recommendations.

We continue to recommend the use of herbicide systems that utilize multiple effective modes of action on each weed every season, and do not advocate for the use of two different PPO inhibitors in the same season.

Off-Label or Experimental-Use Disclaimer

Some of the pesticides discussed in this presentation were tested under an experimental use permit granted by WSDA. Application of a pesticide to a crop or site that is not on the label is a violation of pesticide law and may subject the applicator to civil penalties up to \$7,500. In addition, such an application may also result in illegal residues that could subject the crop to seizure or embargo action by WSDA and/or the U.S. Food and Drug Administration. It is your responsibility to check the label before using the product to ensure lawful use and obtain all necessary permits in advance.

Figure 1. Mean weed density per subplot. ‘L’ represents the low rate and ‘H’ represents the high rate.

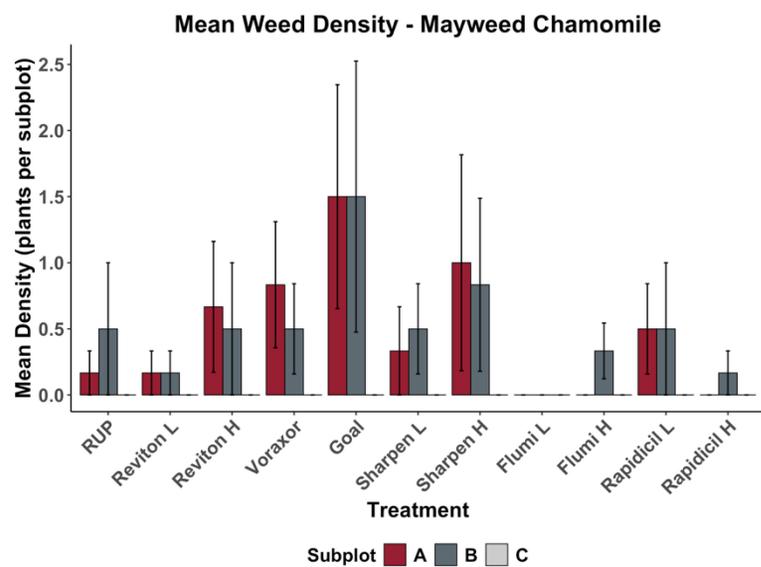
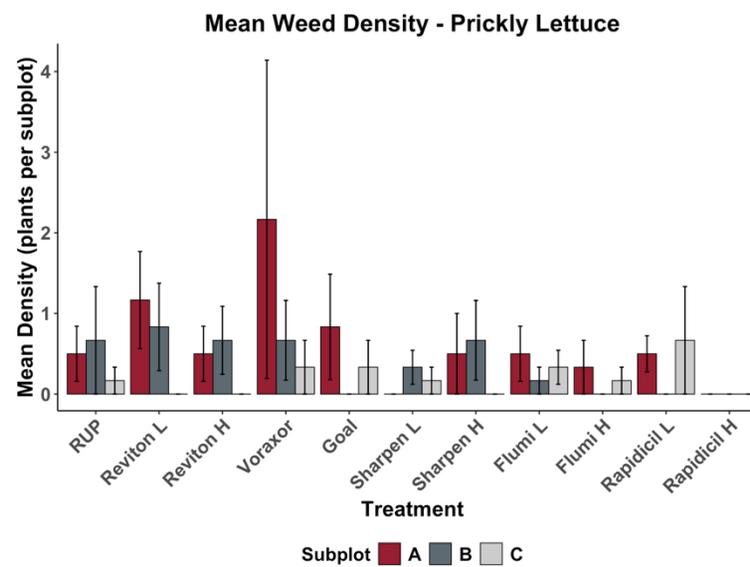
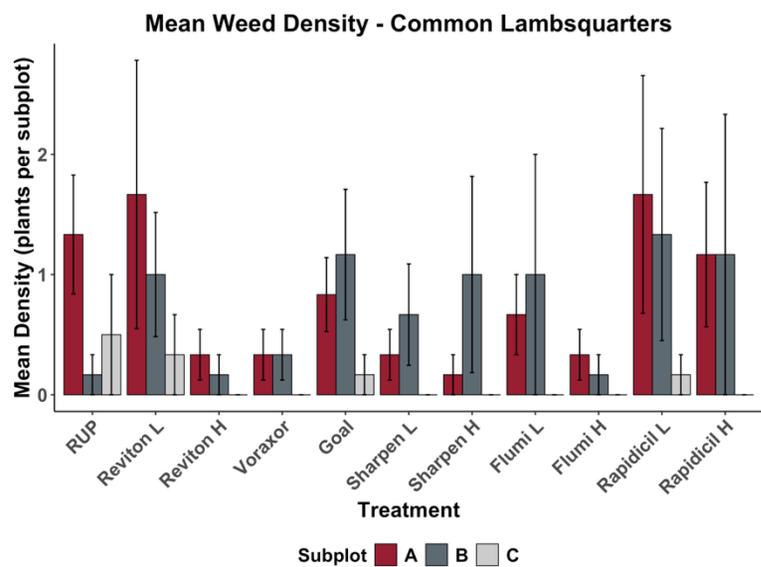


Figure 2. Mean weed biomass per subplot.

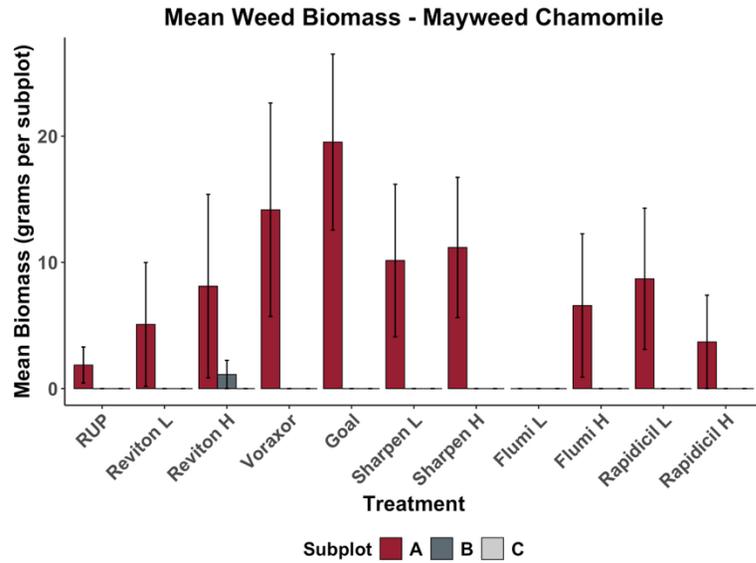
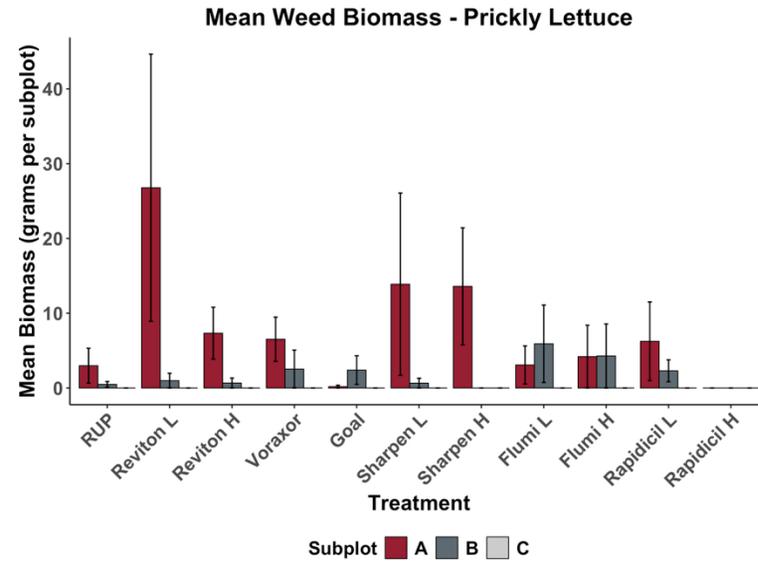
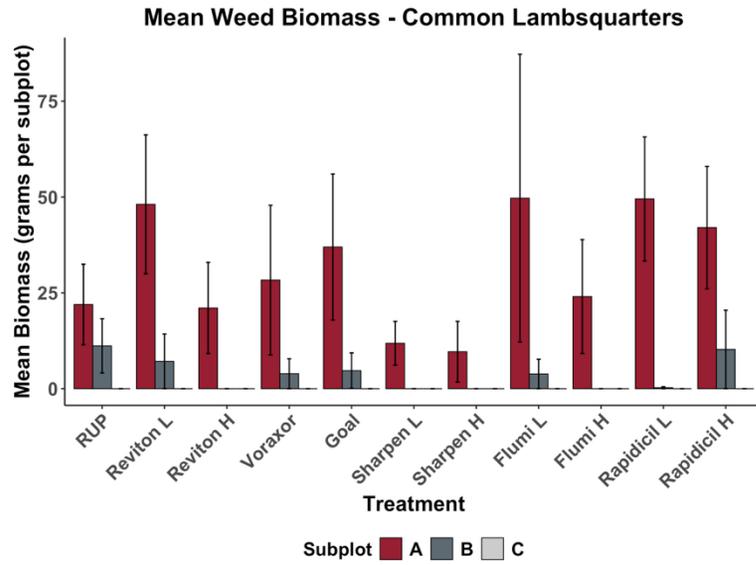


Table 2. Total rainfall for Pullman, WA for spring 2025.

Date	Total Rainfall (mm)
1/3/25	0.017
1/10/25	0.034
1/31/25	0.136
2/1/25	0.017
2/19/25	0.051
2/22/25	0.017
2/23/25	0.051
2/24/25	0.85
3/13/25	0.068
3/15/25	0.34
3/20/25	0.085
3/21/25	0.068
3/22/25	0.034
3/28/25	0.017
3/31/25	0.119
4/7/25	0.255
4/29/25*	0.034
5/11/25	0.017

*Main herbicide application occurred after this date (5/9/2025).