Dose Response of Selected Glyphosate-Resistant Weeds to Prepackaged Mixture of Fluthiacet-methyl and Mesotrione Applied at Two Growth Stages

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Introduction

- Glyphosate-resistance has been confirmed in 29 weed species worldwide, including 15 species in the United States (Heap 2014).
- Several approaches proposed for managing herbicide-resistant weeds, include diversifying weed management practices and using multiple herbicide modes of action (MOA) (Norsworthy et al. 2012).
- No herbicide with new mode of action has been commercialized in last 22 yrs, therefore synergistic mixtures of existing herbicide chemistries offer suitable option for controlling weeds, including glyphosate-resistant weeds.
- A new prepackaged mixture of fluthiacet-methyl and mesotrione (1:17.5 ratio) has been registered for POST broadleaf weed control in field corn, seed corn, yellow popcorn and sweet corn.
- This mixture of protoporphyrinogen oxidase (PPO) and 4-hydroxyphenylpyruvate dioxygenase (HPPD) inhibitors has both contact and systemic activity.

Objective

- To determine the response of glyphosate-resistant common waterhemp, giant ragweed, and kochia to prepackaged mixture of fluthiacet-methyl plus mesotrione when applied to 10- and 20-cm tall plants under greenhouse conditions.

Materials and Methods

- Green house experiment
- Year and Location: 2014, University of Nebraska-Lincoln, Lincoln
- Three glyphosate-resistant weed species: common waterhemp, giant ragweed, and kochia
- Two growth stages: 10- and 20-cm tall
- Herbicide treatments: 8 rates (0, 0.25×, 0.50×, 0.75×, 1.0×, 1.5×, 2.0×, and 2.5×), prepackaged mixture of fluthiacet-methyl and mesotrione
  - where, 1× = recommended field rate of fluthiacet-methyl plus mesotrione (87.4 g ai ha⁻¹).
- Experimental design
  - A factorial of eight rates of fluthiacet-methyl plus mesotrione, three weed species, and two growth stages
  - Pots were arranged in a completely randomized design with four replications.
  - A single plant per pot was considered as an experimental unit.
- Visual weed control assessment: At 7, 14, and 21 d after treatment (DAT) using a scale ranging from 0% (no control) to 100% (complete control).
- Aboveground biomass of each weed species was harvested at 21 DAT, oven-dried for 7 d at 65°C, and dry weight was determined.
- Statistical analysis
  - Visual control ratings and dry weight reduction (as a percentage compared to nontreated control) data were regressed over herbicide treatments using the four-parameter log-logistic model (Seefeldt et al. 1995). Y = C + [D – C/1 + exp (B log X – log E)]
  - Where, Y is the response variables (percent weed control or percent reduction in dry weight), C is the lower limit, D is the upper limit, B is the slope of the line, E is the dose resulting in a 50% control (known as ED50), and X is the herbicide dose.
  - Analyses of dose–response curves were performed separately for each weed species and ED50 and ED90 values (effective dose that provided 50 and 90% weed control) were determined using the drc package in R software (Ritz and Streibig 2005).

Results and Discussion

- The response and the effective rate required to achieve acceptable control varied depending on the weed species and their growth stage.
- The rates of fluthiacet-methyl plus mesotrione required for 90% control (ED90) of 10-cm tall common waterhemp, giant ragweed, and kochia were 78, 251, and 17 g ai ha⁻¹, respectively.
- Kochia at 10 cm height, was the most sensitive to this prepackaged herbicide mixture followed by common waterhemp, while giant ragweed was the least sensitive.

Conclusion

- Prepackaged mixture of fluthiacet-methyl plus mesotrione applied POST at the labeled rate (87 g ai ha⁻¹) has the potential to control glyphosate-resistant common waterhemp and kochia in corn, but a higher rate would be required to achieve 90% control of glyphosate-resistant giant ragweed.
- However, appropriate recommendations can be made on the basis of dose response studies conducted with corn under the field conditions.

References