

The Effect of Trifludimoxazin on the Frequency of the $\Delta G210$ Target Site Mutation in Field Populations of Waterhemp

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Introduction

- Protoporphyrinogen IX oxidase (PPO) inhibitors are an important group of soil and foliar herbicides frequently used in soybean for the control of glyphosate-resistant species such as waterhemp.
- PPO inhibitor resistance in waterhemp threatens the long term utility of PPO inhibiting herbicides (Heap 2020).
- The majority of PPO inhibitor resistance in waterhemp is conferred by the $\Delta G210$ mutation (Nie et al. 2019).
- Soil applied PPO inhibitors provide control of PPO inhibitor resistant waterhemp at the cost of diminished length of residual control and greater frequency of resistance in the surviving waterhemp (Wuerffel 2015).
- Trifludimoxazin is a new PPO inhibiting herbicide under development that controls PPO inhibitor resistant waterhemp ($\Delta G210$ and R128G) in a greenhouse setting and can provide excellent control in a field setting with known presence of PPO resistance (Steppig et al. 2018).

Hypothesis and Objective

- Trifludimoxazin will not exert selection for PPO inhibitor resistant waterhemp when applied PRE.
 - Combinations of trifludimoxazin with other PPO inhibitors will still exert selection for resistance.
- Objective:** Determine if trifludimoxazin alone and in combination with other PPO inhibitors exerts selection pressure for the waterhemp $\Delta G210$ resistance mutation in field settings.

Materials and Methods

- Field trials were conducted at two Indiana locations in 2020.
- Trifludimoxazin, saflufenacil, and fomesafen were applied alone and in all combinations at 12.5, 25, and 263 g ai ha⁻¹, respectively (8 treatments).
- Leaf tissue from the first 25 waterhemp plants to emerge in each plot was collected and assayed for the $\Delta G210$ mutation using the Taqman™ qPCR assay.
- Control was evaluated weekly through the duration of the trials.
- Trials utilized a randomized complete block design with four replications.
- Analysis of variance was run using PROC GLIMMIX in SAS.
- Means were separated using Tukeys HSD for control data and Fishers Protected LSD for resistance frequency data.

Results

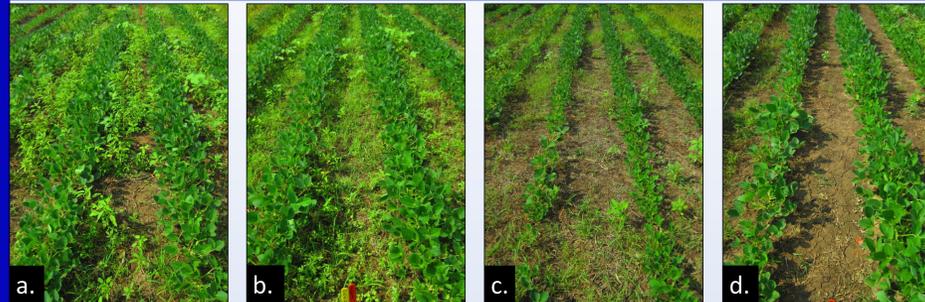


Figure 1. Photos 42 DAT of plots that received no herbicide (a), trifludimoxazin (b), saflufenacil (c), and the 3 herbicide combination (d).

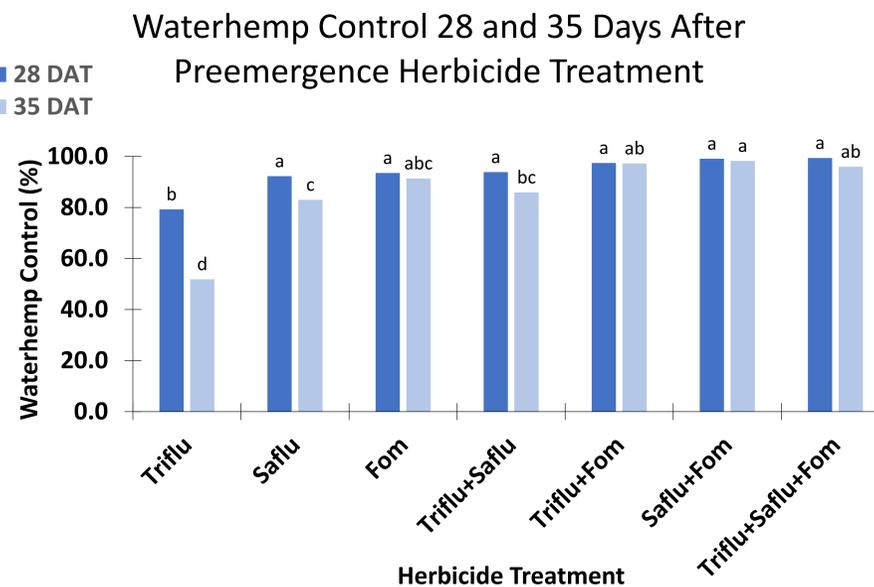


Figure 2. Waterhemp control 28 and 35 days after herbicide applications pooled across sites. Letters of significance above bars denote differences between treatments within an evaluation timing. Abbreviations: Triflu – Trifludimoxazin; Saflu – Saflufenacil; Fom – Fomesafen.

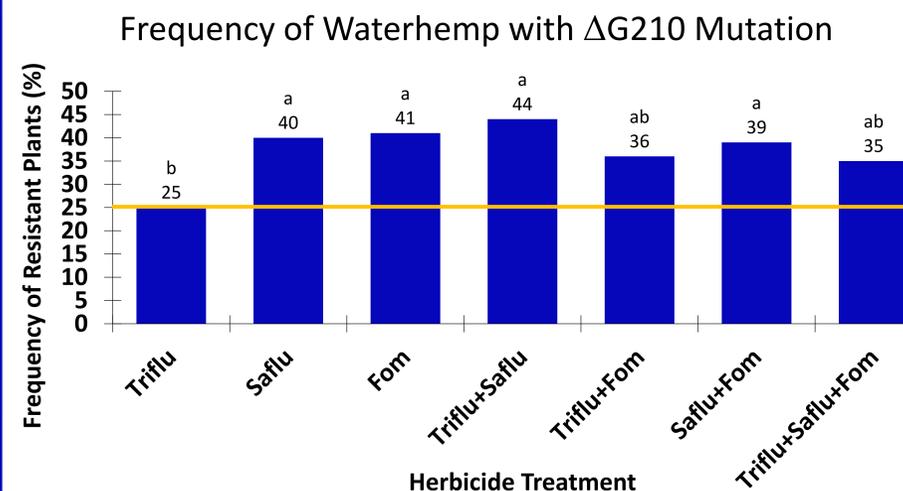


Figure 3. Frequency of waterhemp with the $\Delta G210$ mutation that emerged after a soil applied PPO inhibitor application pooled across sites. Yellow line indicates frequency of resistance in plots receiving no herbicide. Bars with different letters indicates significant difference between treatments. Abbreviations: Triflu – Trifludimoxazin; Saflu – Saflufenacil; Fom – Fomesafen.

Discussion

- Waterhemp emergence was limited due to below average rainfall (<12 mm) during the first 28 days following herbicide activation in the soil (Figure 1, Figure 2).
- Control at 35 DAT from trifludimoxazin and saflufenacil was increased with the addition of fomesafen but not better than fomesafen alone.
- Trifludimoxazin application did not increase the frequency of $\Delta G210$ waterhemp compared with no herbicide (Figure 3).
- Fomesafen and saflufenacil increased the frequency of $\Delta G210$ waterhemp by 15 and 16%, respectively compared to trifludimoxazin and the no herbicide control.
- None of the herbicide combinations reduced selection pressure for the $\Delta G210$ mutation.

Conclusions

- Trifludimoxazin does not exert selection pressure for the $\Delta G210$ mutation.
- Combinations of Trifludimoxazin and other PPO inhibitors did not lessen selection for the $\Delta G210$ mutation

Future Research

- Determine if trifludimoxazin selects for other mutations or mechanisms of PPO inhibitor resistance
- Explore factors contributing to the efficacy of soil applied PPO inhibitors against resistant biotypes

References

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