Field pennycress (*Thlaspi arvense*) Response to Simulated Carryover of Group 27 Herbicides in the Greenhouse

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Introduction

- Pennycress is being domesticated as an oil seed crop for use as a biofuel for the airline industry.
- Plant breeders developing pennycress lines have occasionally observed injury from Group 27 herbicide carryover.
- Half-life describes the degradation rate of a herbicide active ingredient in the soil. The half-life of the Group 27 herbicides used in corn is less than 15 days (Table 1, Shaner 2014).
- Greenhouse dose-response studies based on herbicide half-life can provide useful data on pennycress sensitivity to herbicides that may carryover from the previous crop, or that may be useful in managing weeds within a pennycress crop.

Hypothesis and Objective

Hypothesis: Pennycress stand will not be affected once herbicide application rate is less than would be expected after 4 half-life periods.

Objective: To evaluate the pennycress stand establishment to simulated herbicide carryover from important corn herbicide active ingredients.

Methods

- Dose response experiments were conducted in the Spring and Fall of 2020 at Western Illinois University's School of Agriculture Greenhouse in Macomb, IL. The greenhouse was set to a 15:9 h day:night with a temperature of 25±5 C.
- An Ipava silt loam soil was modified at 4 parts soil, 1-part perlite, and 1-part sand to improve drainage in 10 cm square pots. Approximately 15 seeds of pennycress variety 'ARV1' were planted in each pot and watered immediately prior to herbicide application.
- Herbicide treatments (Table 1) were sprayed using a single-tip chamber sprayer with nozzle 8002EVS at an application volume of 180 L ha^{-1}.
- The experiment was arranged as a randomized complete block design with six replications.
- Stand counts and visual estimations of chlorosis and necrosis were made 21 days (~3 weeks) after initial spray application was made.
- Data were analyzed using proc glimmix in SAS 9.4. ANOVA output indicated that the Fall and Spring runs were different, only data from the Spring run was graphed using Sigma Plot 14.0. A linear regression model was fit to the data.

Table 1. Herbicide active ingredient, half-life and rates used in dose-response study.

Treatment Name	Half-life (days)	Rate 1 (g ai/ha)	Rate 2 (g ai/ha)	Rate 3 (g ai/ha)	Rate 4 (g ai/ha)	Rate 5 (g ai/ha)
mesotrione	5 to 15	52.5	26.3	13.1	6.6	3.3
tembotrione	15	46	23	11.5	5.75	2.87
isoxaflutole	2.4	26.3	13.1	6.6	3.3	1.64
topramezone	14	12.3	6.1	3.06	1.53	0.77
tolpyralate	1.2	18.2	9.1	4.55	2.27	1.14
saflufenacil	9 to 32	37.4	18.7	9.4	4.7	2.34
atrazine	6 to 60	560	280	140	70	35
thiencarbazone	12	9.2	4.6	2.3	1.15	0.574
rimsulfuron	2 to 4	6.6	3.3	1.64	0.82	0.41

Results

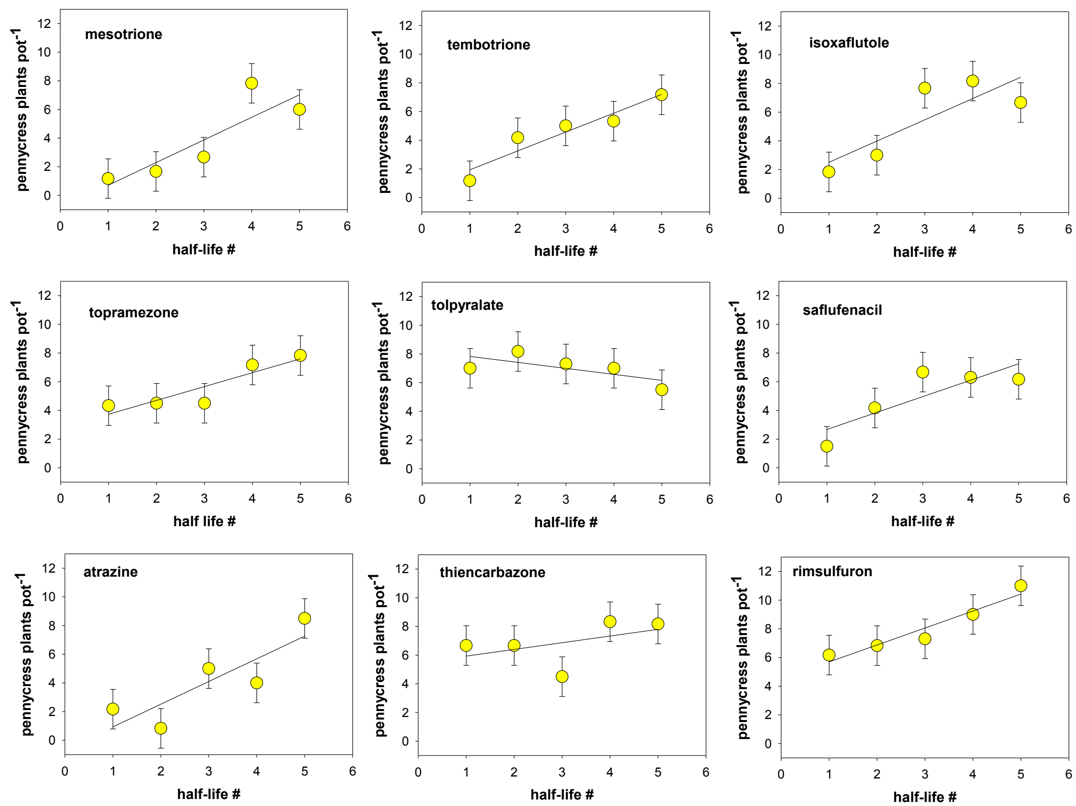

Figure 1. Pennycress stand 3 weeks after planting and herbicide application as affected by herbicide active ingredient and simulated half-life dose.

Figure 2. Pennycress growing in lowest dose of topramezone.

Discussion

- We accept the hypothesis. Pennycress stand equaled that of the untreated check (6.5 plants pot^{-1}, data not shown) when herbicide dose of Group 27 herbicides was less than or equal to the concentration expected after 4 half-life periods (0.06x labeled rate) (Figure 1).
- Mesotrione, tembotrione, isoxaflutole, topramezone, saflufenacil, and atrazine herbicides all reduced pennycress stand at application rates equal to 0.5x or 0.25x the labeled rate. Tolpyralate, rimusulfuron and thiencarbazone herbicides had little effect on pennycress stand.
- Based on half-life intervals and herbicide application time in corn, herbicide carryover injury in pennycress should be rare with these herbicides.
- This experiment will be repeated a third time, and followed with dose-response experiments using commercial corn herbicide mixtures.

Works Cited

Shaner DL (ed) 2014. Herbicide Handbook. Tenth ed. Weed Science Scoeity of America

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