Field pennycress (*Thlaspi arvense*) Response to Simulated Carryover of Group 15 Herbicides in the Greenhouse

Nathan L. Stufflebeam, Mason R. Blickenstaff, Claudia R. Bland, Brent S. Heaton and Mark L. Bernards

Western Illinois University, Macomb, IL

Introduction

- Field pennycress, also known as stinkweed, is a winter annual, and is being cultivated as an oilseed cover crop to be grown after corn and before soybean.
- Herbicides used in commercial agriculture for control of grass and broadleaf weeds pose a danger to field pennycress production, and there is a lack of data on herbicide carryover for pennycress stand establishment.
- Dose response studies may be used to simulate herbicide degradation in the soil, and identify herbicide levels that will not negatively impact a cover crop (Heaton & Bernards 2016).

Hypothesis and Objective

Hypothesis: Field pennycress stand will be reduced by Group 15 herbicide carryover.

Objective: To determine field pennycress sensitivity to Group 15 herbicide carryover using simulated half-life doses in the greenhouse.

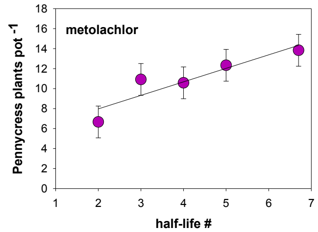
Methods

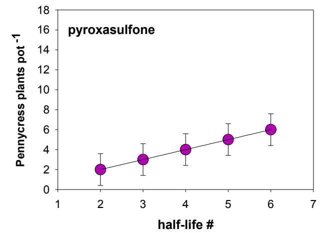
- Dose response experiments were conducted in the Spring and repeated in the Fall of 2020 in Western Illinois University's Agronomy Farm's Greenhouse.
- The greenhouse was set to a 15:9 h day:night with a temperature of 25±5 C.
- An Ipava silt loam soil was modified at 4 parts soil, 1-part perlite, and 1-part sand to improve drainage. Approximately 15 seeds of pennycress variety 'ARV1' were planted in 10x10 cm 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 was analyzed using proc glimmix in SAS 9.4. Data from the Spring and Fall applications were combined and a linear regression model was fit to the data.

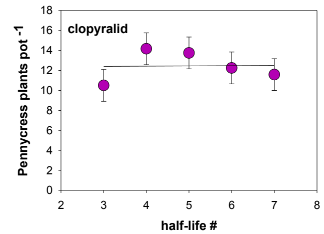
Table 1. Herbicide active ingredients, half-life, and the rates used in the dose-response study.

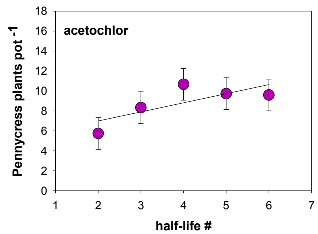
Treatment	Half-life (days)	Rate 1 (g ai/ha)	Rate 2 (g ai/ha)	Rate 3 (g ai/ha)	Rate 4 (g ai/ha)	Rate 5 (g ai/ha)
S-metholachlor	2.5 to 289	447	224	111	55.7	27.8
acetochlor	10 to 20	550	276	137	68.7	34.3
pyroxasulfone	16 to 26	29.7	14.8	7.4	3.7	1.85
dimethenamid	7 to 42	236	118	59	29.6	14.8
clopyralid	12 to 70	33.3	16.6	8.3	4.15	2.07
dicamba	<14	70	35	17.5	8.7	4.37
2,4-D	6.2	133	66.6	33.3	16.6	8.3

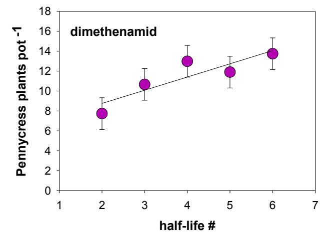
Results











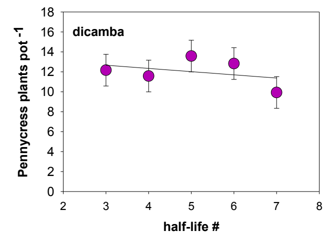


Figure 1 (above and right). Pennycress stand 3 weeks after planting as affected by seven herbicide active ingredients and five simulated half-life doses.

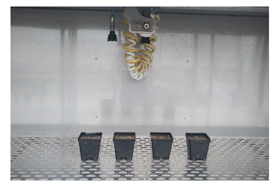


Figure 3. Pots in the spray chamber prior to application.

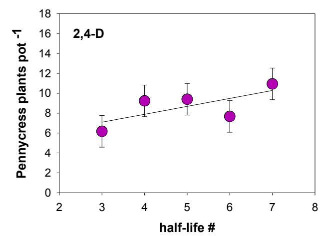


Figure 2. Field pennycress growing in the greenhouse on 10 Nov 2020.

Discussion

- We accept the hypothesis because field pennycress stand increased as Group 15 herbicide dose decreased.
- The average stand count in the untreated check was 11 plants pot^{-1}.
- Based on a typical application time of Group 15 herbicides (no later than early June in corn) and pennycress planting (after September 1), herbicide concentrations will likely be 1/8th to 1/32nd of the applied dose (3 to 5 half-life periods).
- Pyroxasulfone most negatively affected pennycress stand among the Group 15 herbicides, and 2,4-D among the Group 4 herbicides. Clopyralid and dicamba had no effect on pennycress stand at doses equal to what would be expected after 3 half-life periods.
- Future research should include dose-response studies with multiple active ingredient corn herbicides.

Works cited

Heaton BS, Bernards ML (2016) Cover crop species response to herbicide dose. Weed Science Society of America Proceedings 56:247.

Acknowledgements

This research was funded by AFRI competitive grant 2019-69012-2985 from USDA-NIFA.
We thank Daniela McConville for her assistance.