PURDUE WEED SCIENCE

Growth and Seed Production of Multiple Glyphosate- and Acetolactate Synthesis-Resistant Horseweed (*Conyza canadensis*) Biotypes

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Introduction

Populations with both glyphosate- and acetolactate synthesis (ALS)-resistant horseweed (*Conyza canadensis*) biotypes are common soybean weeds in no-till cropping systems in the Eastern cornbelt. Biotypes exist with multiple resistance to these two herbicide mode-of-actions. These biotypes are particularly problematic because when additional herbicides are tank-mixed with postemergence glyphosate, ALS inhibiting herbicides are commonly used in soybean to increase postemergence horseweed control.

Objective

The objective of this experiment was to compare the growth and seed production capability of glyphosate-resistant, ALS-resistant, and multiple glyphosate+ALS-resistant horseweed populations.


Mature horseweed plants

Methods

A four by four factorial field experiment was conducted in 2007 and 2008 in southeastern Indiana. Factors were four herbicide treatments by four horseweed populations replicated four times.

	Herbicide Treatments		Horseweed Populations
1	Glyphosate 840 g ae/ha	1	Glyphosate-resistant **(GLYR)**
2	Cloransulam 35 g ai/ha	2	ALS-resistant **(ALSR)**
3	Glyphosate+Cloransulam	3	Glyphosate+ALS-resistant **(G+AR)**
4	Untreated	4	Susceptible **(SUS)**

Horseweed was propagated in the greenhouse, transplanted to the field in mid-May, and sprayed when 12-cm tall. Leaf area, seed production, and biomass accumulation was collected in mid-October (12 WAT or approximately 5 months after transplanting). Data were log transformed and subjected to mixed-model analysis of variance. Means were separated by corresponding P-values, and untransformed data are presented for clarity.

Results

Tables 1 and 2. P-values for biomass accumulation and seed production of untreated herbicide-resistant horseweed populations 5 months after transplanting in a field experiment located at Butlerville, IN in 2007 and 2008.

1.

Dry weight (g plant^{-1})	Fresh weight (g plant^{-1}) SUS*	GLYR	ALSR	G+AR
SUS	—	0.971	0.999	1.0
GLYR	0.639	—	1.0	0.653
ALSR	0.999	1.0	—	0.960
G+AR	1.0	0.151	0.948	—

2.

Seeds plant^{-1}	Leaf area (cm^2 plant^{-1}) SUS	GLYR	ALSR	G+AR
SUS	—	0.023	0.007	0.143
GLYR	0.962	—	1.0	1.0
ALSR	1.0	1.0	—	0.985
G+AR	1.0	0.396	0.978	—

*Abbreviations: SUS, susceptible; GLYR, glyphosate-resistant; ALSR, acetolactate synthesis-resistant; G+AR, glyphosate+acetolactate synthesis-resistant.

Table 3. Influence of herbicide applications on seed production of herbicide-resistant horseweed populations in a field experiment located at Butlerville, IN in 2007 and 2008.

Herbicide treatments	Horseweed populations: Susceptible Mean	P > *F*	Glyphosate-resistant Mean	P > *F*	ALS-resistant Mean	P > *F*	Gly+ALS-resistant Mean	P > *F*
	seeds plant^{-1}		seeds plant^{-1}		seeds plant^{-1}		seeds plant^{-1}	
Glyphosate								
Treated (840 g ae ha^{-1}) vs.	1,000	<0.0001	**17,000**	**0.7936**	0	<0.0001	**192,000**	**1.0**
Untreated (0 g ae ha^{-1})	93,000		**23,000**		37,000		**176,000**	
Cloransulam								
Treated (35 g ai ha^{-1}) vs.	4,000	<0.0001	0	0.0003	**31,000**	**0.2790**	**144,000**	**0.8092**
Untreated (0 g ae ha^{-1})	93,000		23,000		**37,000**		**176,000**	
Glyphosate+Cloransulam								
Treated (840 g ae + 35 g ai ha^{-1}) vs.	0	<0.0001	1,000	<0.0001	0	<0.0001	**176,000**	**1.0**
Untreated (0 g ae ha^{-1})	93,000		23,000		37,000		**176,000**	

Discussion

Comparison Absent Herbicide Exposure

The susceptible, glyphosate-resistant, ALS-resistant, and multiple glyphosate+ALS-resistant horseweed populations did not differ in there total biomass accumulation (Table 1) or seed production capability (Table 2) absent herbicide exposure. The susceptible population produced more leaf area (data not shown) than the glyphosate-resistant and ALS-resistant populations (Table 2).

Comparison Following Herbicide Exposure

Glyphosate (840 g ae ha^{-1}) did not reduce seed production of the glyphosate- or the glyphosate+ALS-resistant populations compared to untreated plants.

Cloransulam (35 g ai ha^{-1}) did not reduce seed production of the ALS- or the glyphosate+ALS-resistant populations compared to untreated plants.

Furthermore, a tank-mix of glyphosate+cloransulam (840 g ae + 35 g ai ha^{-1}) did not reduce seed production of the glyphosate+ALS-resistant populations compared to untreated plants.

We concluded horseweed populations with glyphosate-, ALS-, and glyphosate+ALS-resistant biotypes have the potential to be as competitive and prolific as susceptible populations.