Influence of Herbicide Programs on Glyphosate-Resistant Common Waterhemp Control in Glyphosate-Tolerant Soybean

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Introduction

- Glyphosate-resistant common waterhemp (*Amaranthus rudis* Sauer) is one of the most encountered and troublesome weeds in agricultural fields in midwestern United States
- Common waterhemp is a C_4 weed with rapid growth habit, extended seedling emergence, and potential for prolific seed production

7th June | 15th July | 20th Aug | 24th Sept

Fig. 1: Extended germination period of common waterhemp

- Common waterhemp biotypes resistant to triazines, HPPD-inhibitors, ALS-inhibitors, growth regulators and recently to glyphosate have been confirmed in Nebraska
- Control of glyphosate-resistant common waterhemp is a major challenge for soybean growers, because of limited effective post-emergence soybean herbicide options

Objective

To evaluate the efficacy of several herbicide programs for control of glyphosate-resistant common waterhemp in glyphosate-tolerant soybean and their impact on soybean yield

Materials and Methods

- Field experiments were conducted in Dodge County, NE in 2013 and 2014 in a field where glyphosate-resistant common waterhemp was confirmed recently
- Experiments were laid out in randomized complete block design with four replications
- PRE herbicides were applied at soybean planting, whereas early-POST and mid-POST herbicides were applied at 15 days- and 30 days after planting (DAP) of soybean, respectively
- Observations of visual common waterhemp control and density, biomass reduction, and soybean yield were recorded
- Two-years data were combined as year-by-treatment interaction was not significant, except for soybean yield and subjected to ANOVA using the PROC GLIMMIX procedure in SAS

Table 1. Herbicide treatments, application timing, and rates for common waterhemp control

Herbicide treatments	Trade name	Timing	Rate (kg ai or ae ha^{-1})	Code
Nontreated control	--------	-------	--------	NT
Glyphosate *fb* Glyphosate	Roundup PowerMax	E-PO *fb* M-PO	1.70 *fb* 0.87	T1
Imazethapyr + Glyphosate *fb* Glyphosate	Extreme *fb* Roundup PowerMax	E-PO *fb* M-PO	0.91 *fb* 0.87	T2
Imazethapyr + Glyphosate + Acetochlor *fb* Glyphosate	Extreme + Warrant *fb* Roundup	E-PO *fb* M-PO	0.91 + 1.68 *fb* 0.87	T3
Imazethapyr + Fomesafen + Glyphosate + Acetochlor *fb* Glyphosate	Extreme + Flexstar GT+ Warrant *fb* Roundup PowerMax	E-PO *fb* M-PO	0.91 + 1.38 + 1.68 *fb* 0.87	T4
Imazethapyr + Fomesafen + Glyphosate + Acetochlor *fb* Lactofen + Glyphosate	Extreme + Flexstar GT+ Warrant *fb* Cobra + Roundup PowerMax	E-PO *fb* M-PO	0.91 + 1.38 + 1.68 *fb* 0.22 + 0.87	T5
Flumioxazin + Chlorimuron *fb* Fomesafen + Glyphosate	Valor XLT *fb* Flexstar GT	PRE *fb* M-PO	0.11 *fb* 1.38	T6
Saflufenacil + Imazethapyr *fb* Fomesafen + Glyphosate	Optill *fb* Flexstar GT	PRE *fb* M-PO	0.09 *fb* 1.38	T7
Saflufenacil + Imazethapyr + Dimethenamid-P *fb* Fomesafen + Glyphosate	Optill + Outlook *fb* Flexstar GT	PRE *fb* M-PO	0.09 + 0.53 *fb* 1.38	T8
Sulfentrazone + Imazethapyr *fb* Fomesafen + Glyphosate	Authority Assist *fb* Flexstar GT	PRE *fb* M-PO	0.42 *fb* 1.38	T9
Sulfentrazone + Chlorimuron *fb* Fomesafen + Glyphosate	Authority XL *fb* Flexstar GT	PRE *fb* M-PO	0.39 *fb* 1.38	T10
Sulfentrazone + Chloransulam *fb* Fomesafen + Glyphosate	Sonic *fb* Flexstar GT	PRE *fb* M-PO	0.39 *fb* 1.38	T11
Chlorimuron + Thifensulfuron + Flumioxazin *fb* Fomesafen + Glyphosate	Enlite *fb* Flexstar GT	PRE *fb* M-PO	0.09 *fb* 1.38	T12
S-metolachlor *fb* Fomesafen + Glyphosate	Dual II Magnum *fb* Flexstar GT	PRE *fb* M-PO	1.42 *fb* 1.38	T13
S-metolachlor + Fomesafen *fb* Acifluorfen + Glyphosate	Prefix *fb* Ultra Blazer + Roundup	PRE *fb* M-PO	1.48 *fb* 0.56 + 0.87	T14
Flumioxazin + Pyroxasulfone *fb* Fomesafen + Glyphosate	Fierce *fb* Flexstar GT	PRE *fb* M-PO	0.20 *fb* 1.38	T15
Pyroxasulfone *fb* Fomesafen + Glyphosate	Zidua *fb* Flexstar GT	PRE *fb* M-PO	0.21 *fb* 1.38	T16
S-metolachlor + Metribuzin *fb* Fomesafen + Glyphosate	Boundary *fb* Flexstar GT	PRE *fb* M-PO	2.05 *fb* 1.38	T17
Pendimethalin + Metribuzin *fb* Fomesafen + Glyphosate	Prowl H_2O + Sencor *fb* Flexstar GT	PRE *fb* M-PO	1.92 + 0.42 *fb* 1.38	T18

*Abbreviations: E-PO, early post-emergence; M-PO, mid post-emergence; PRE, pre-emergence; *fb*, followed by

Results

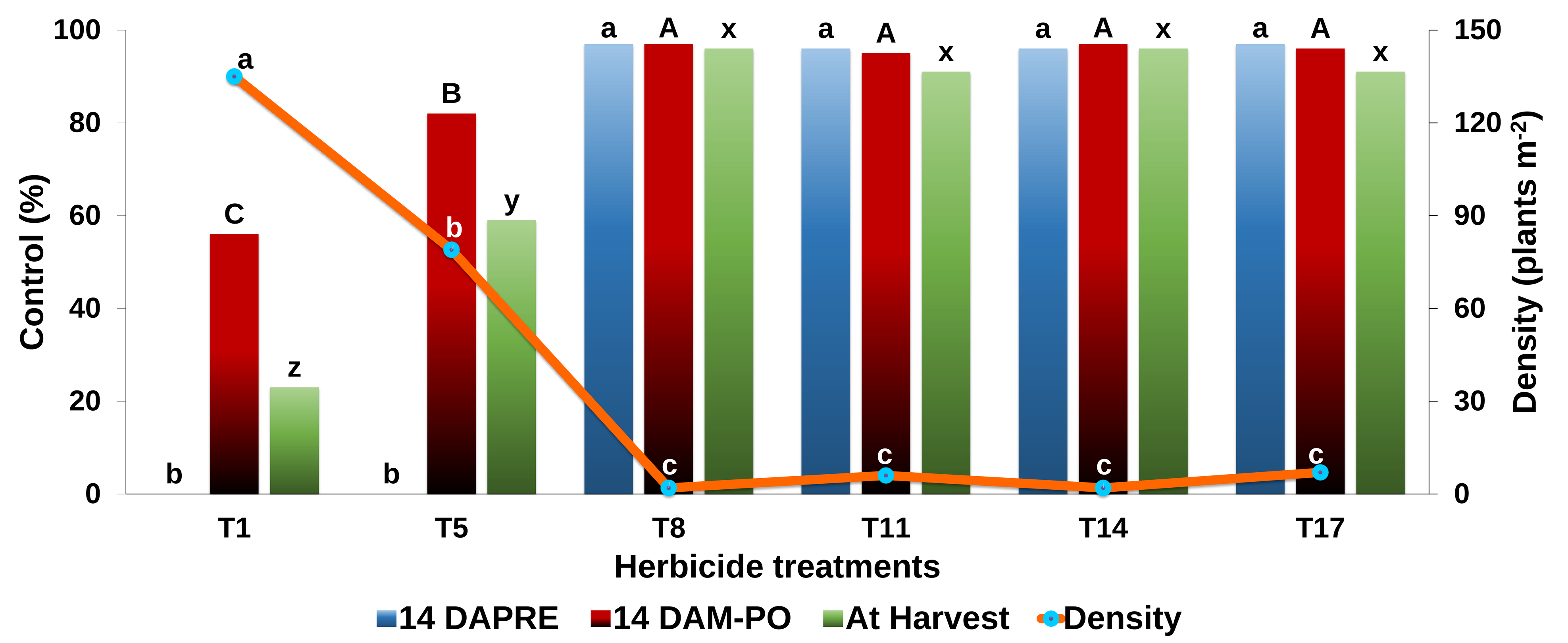

Fig. 2: Effect of herbicide treatments on glyphosate-resistant common waterhemp control and density

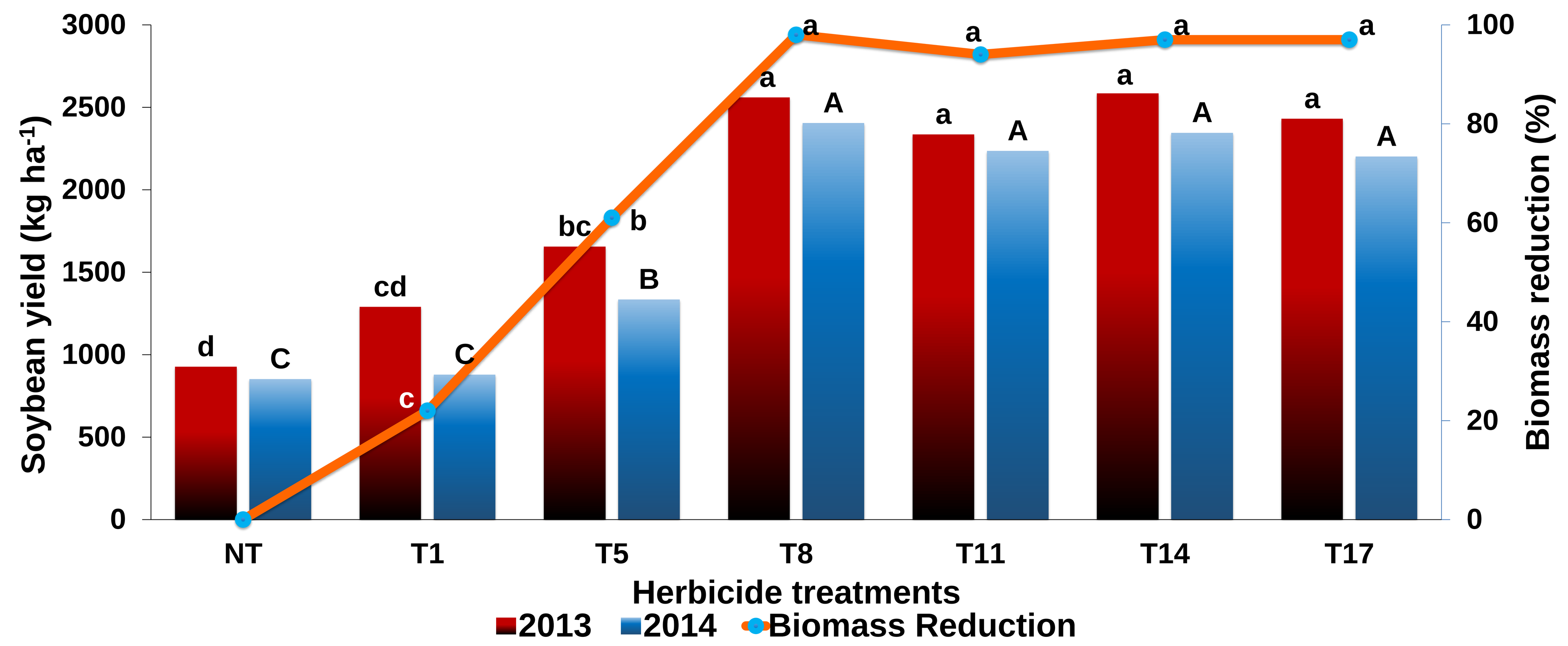

Fig. 3: Effect of herbicide treatments on common waterhemp biomass reduction and soybean yield

Nontreated control

Imazethapyr + Fomesafen + Glyphosate + Acetochlor *fb* Lactofen + Glyphosate

Saflufenacil + Imazethapyr + Dimethenamid-P *fb* Fomesafen + Glyphosate

S-metolachlor + Metribuzin *fb* Fomesafen + Glyphosate

Lactofen injury to soybean plants at 14 DAT

Shoot-regrowth 30 days after PPO-inhibitor applications

Conclusions

- Most of the herbicide programs containing PRE followed by POST treatments of PPO-inhibiting herbicides provided ≥ 83% control of glyphosate-resistant common waterhemp and resulted in higher soybean yield (≥ 1,796 kg ha^{-1}) than POST-only treatments that provided ≤ 59% control of common waterhemp along with ≤ 1,334 kg ha^{-1} soybean yield
- In early season, 20-50% soybean-injury was observed with POST-applications of lactofen that delayed the canopy-closure, whereas fomesafen did not result in any significant soybean-injury