Planting Date, Row Spacing, and Herbicide Program Influence on Weed Management in Soybean

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Introduction

- Weeds are one of the main problems in soybean (*Glycine max* (L.) Merr.) production (Datta et. al., 2017).
- Palmer amaranth (*Amaranthus palmeri*), waterhemp (*Amaranthus tuberculatus*), common cocklebur (*Xanthium strumarium*), and foxtail species (*Setaria spp.*) are common and troublesome weeds in this soybean' (Van Wychen 2019).
- There is a trend of planting soybean earlier (Ciampitti et. al., 2017), so there is a potential need to modify weed management practices.

Objective

- To evaluate the effect of planting date and row spacing on residual herbicide use in soybean

Methods

- Four locations in 2023 (Table 1).
- soybean were planted using John Deere split-row vacuum planter, with 38-cm and 76-cm row spacing.
- Treatments were arranged in split-block design with planting date as main plot.
- Row spacing and herbicide treatments randomized with planting date (Table 2).
- Weed-free and non-treated controls.
- Plots were 9-m by 3-m, replicated four times.
- Herbicides were applied using a CO_2-pressurized backpack sprayer equipped with a AIXR 11002 nozzle, calibrated to deliver 187 L ha^{-1}.

Table 1. Trial locations, soybean varieties, planting dates, and row spacing.

Location	Variety	Early Planting Date	Late Planting Date
Manhattan	GH4093 E3	4/14	5/22
Ottawa	GH4433 E3	4/24	5/24
Parsons	GH4433 E3	4/12	5/26
Scandia	GH 3774 E3	4/26	6/1

Table 2. Herbicide rates and application timings evaluated.

Application Timing	Herbicide	Rates (g a.i. ha^{-1})
At planting (pre-emergent herbicide)	Sulfentrazone + Metribuzin (Authority MTZ)	126+189
	Flumioxazin + Metribuzin (Dimetric Charged)	394+88
Four weeks after planting (post-emergent herbicide)	2,4-D choline (Enlist One) + Glyphosate (RoundUp PowerMax 3)	1066+841
	2,4-D choline (Enlist One) + Glyphosate (RoundUp PowerMax 3) + S-metolachlor (Dual II Magnum)	1066+841+1598

Data collection and analysis

- Percent weed control was estimated visually every 4 weeks after herbicide application.
- Weed biomass was collected at R7 soybean in 0.5 m^2 area.
- Grain moisture, test weight, and yield per plot were determined at soybean harvest.
- Data were subjected to analysis of variance appropriate for treatment structure with replication as a random variable.
- Data were presented according to interactions as appropriate, and means were separated using Tukey's Honestly Significant Difference (α=0.05).

Literature Cited

- Datta et al., 2017. Crop protection, 95, 60-68.
- Van Wychen 2019. Weed Science Society of America
- Ciampitti et. al., 2017. Extension Agronomy, eUpdate, Kansas State University Issue 626.

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Results

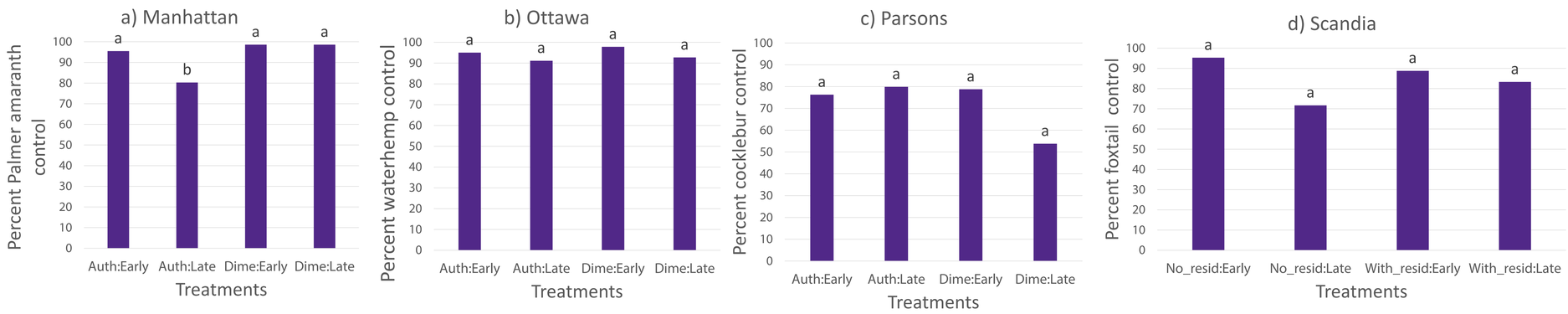

Figure: 1 Percent weed control of a) Palmer amaranth at Manhattan, b) Waterhemp at Ottawa, c) Cocklebur at Parsons, and d) Foxtail at Scandia. Auth, Authority MTZ; Dime, Dimetric Charged; Early, early-planted soybean; Late, late-planted beans; No_resid, Enlist One + Roundup Powermax 3; With_resid, Enlist One + Roundup Powermax 3 + Dual II Magnum. Letters represent differences according to Tukey HSD test (α=0.05).

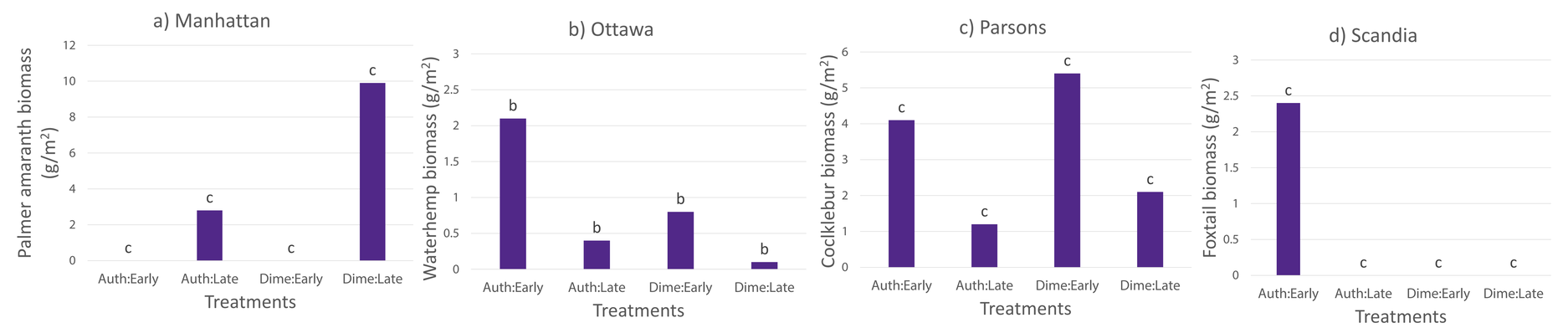

Figure 2. Weed biomass at R7 growth stage of soybean at a) Manhattan, b) Ottawa, c) Parsons, and d) Scandia. Auth, Authority MTZ; Dime, Dimetric Charged; Early, early-planted beans; Late, late-planted soybean. Letters represent differences according to the Tukey HSD test (α=0.05).

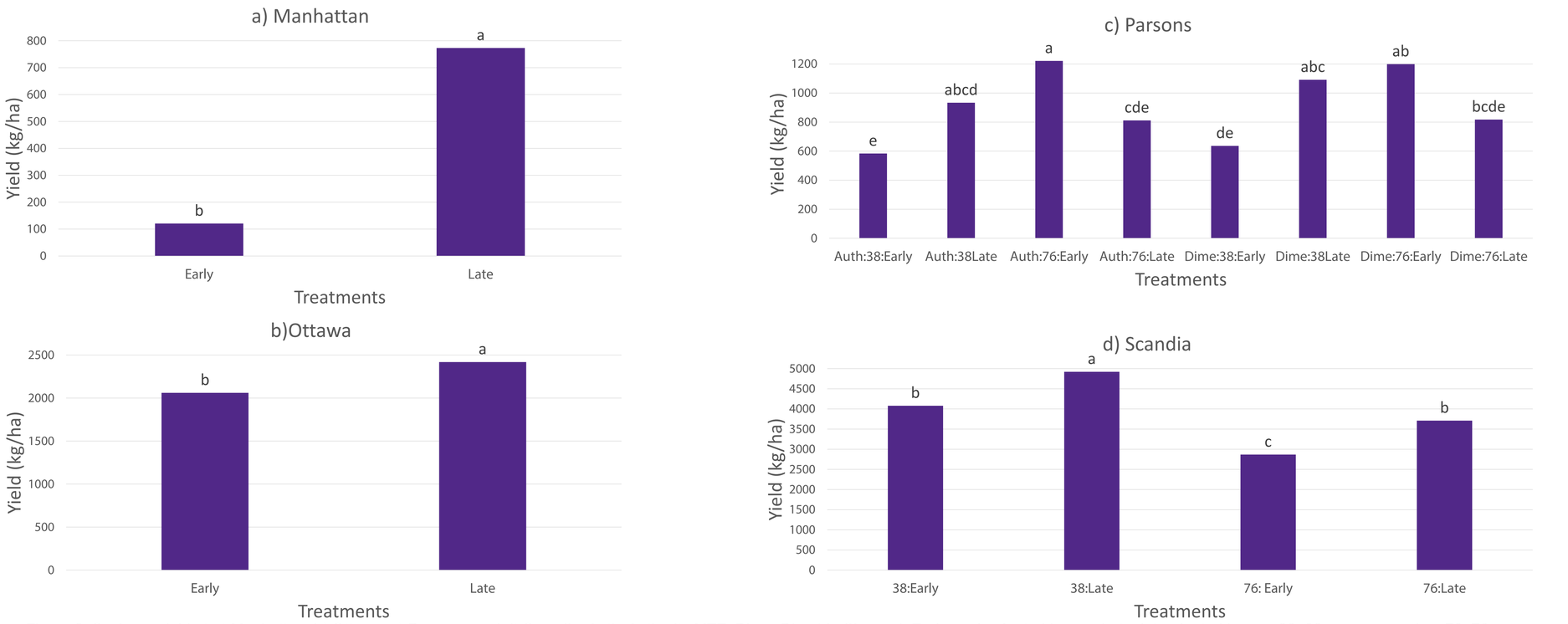

Figure 3. Soybean yield at a) Manhattan, b) Ottawa, c) Parsons, and d) Scandia. Auth, Authority MTZ; Dime, Dimetric Charged; Early, early-planted beans; Late, late-planted beans; 38, 38-cm row spacing; 76, 76-cm row spacing. Letters represent significant differences according to Tukey HSD test (α=0.05)

Discussion

Parameters	Manhattan (a)	Ottawa (b)	Parsons (c)	Scandia (d)
Percent Weed Control (Figure 1)	Authority MTZ had greater Palmer amaranth control in early-planted soybean.	Waterhemp control by Authority MTZ and Dimetric charged were similar for both planting dates.	Cocklebur control by both pre-emergent herbicides was similar for both early- and late-planted.	Foxtail control by both post-emergence herbicide programs was similar for both planting dates.
Biomass at R7 (Figure 2)	Both herbicides had similar biomass at both planting dates.	Both herbicides had similar biomass at both planting dates.	Cocklebur biomass was similar for both planting dates and both pre-emergent herbicides.	Foxtail biomass was similar for both pre-emergent herbicides at both planting dates.
Soybean Yield (Figure 3)	Late-planted soybean yield was greater than early-planted.	Late-planted soybean yield was greater than early-planted.	Trends are that late-planted soybean produced greater yield in 38-cm spacing and early-planted soybean yielded more in 72-cm spacing.	Yields were greatest in soybean planted late in 38-cm rows and were least in those planted early in 72-cm row spacing.

Conclusion

- There were few differences in weed control except for Authority early and Authority late in Manhattan.
- Weed control was not related to the effects of planting date and row spacing on soybean yield.

Future Work

- Estimate weed seed production of Palmer amaranth and waterhemp.
- Calculate canopy coverage.
- Partial budget analysis.