Comparison of POST-emergence Herbicide Programs without Dicamba in XtendFlex Soybean Systems: Waterhemp Control and Crop Response

Arthur Franco Teodoro Duarte[1], Ryan P. DeWerff[1], Nicholas J. Arneson[1], Jose Junior Nunes[1], Rodrigo Werle[1].
[1]Department of Agronomy, UW-Madison – Corresponding author's email: francoteodor@wisc.edu

INTRODUCTION

- The release of dicamba-resistant (Xtend) soybean (*Glycine max* Merr.) recently allowed for over-the-top (OTT) applications of dicamba throughout the United States, providing soybean growers with an additional option for POST control of glyphosate-resistant weeds, such as waterhemp (*Amaranthus tuberculatus*).[1]
- Farmers in parts of Wisconsin (Figure 1) are subjected to the Endangered Species Act (ESA) restrictions not allowing OTT dicamba applications.[2]
- These requirements in addition to irregular field sizes and heavy reliance on retail spray operations for herbicide applications have led Wisconsin growers to adopt the XtendFlex soybean trait, which also allows glufosinate OTT, without spraying dicamba POST.

OBJECTIVE

- Evaluate waterhemp control (Experiment #1), crop phytotoxicity (Experiments #1 & #2), and yield (Experiment #2) in XtendFlex soybeans when dicamba is used in combination with an effective PRE and glufosinate used in combination with other foliar and layered soil residual products POST.
- **Hypothesis**: dicamba PRE and layered glufosinate-based POST herbicide programs can provide effective waterhemp control without yield impact.

MATERIALS AND METHODS

- Experiments were conducted in a RCBD with 4 replications in Brooklyn (#1 & #2) & Arlington (#2), WI, in 2021 & 2022
- Planting dates: 05/25/2021 & 05/23/2022 in Brooklyn; 05/12/2021 & 05/09/22 in Arlington
- Soybean Variety used: AG20XF1
- Treatments sprayed with CO_2 backpack sprayer (140 L ha^{-1} carrier volume)
- Visual soybean injury (0-100%) evaluated at 21 days after PRE and 14 days after POST application in both locations
- Visual waterhemp control (0-100%) evaluated at the two center soybean rows during harvest in Brooklyn
- Soybean yield (kg ha^{-1}) in both locations
- Data subjected to ANOVA and means compared with LSD test (α: 0.05) in R

Figure 1. Map of the Endangered Species Act counties (in red) in Wisconsin. 26 counties are subjected to the ESA restrictions.

Figure 2. Soybean plant showing ~ 25% injury at 14 DAT POST.

RESULTS

Table 1. Treatments evaluated at PRE and POST herbicide application. FLMXZ (flumioxazin); PXSF (pyroxasulfone); DCMB (dicamba); GLFS (glufosinate); ACTLH (acetochlor); GLPH (glyphosate); FMSF (fomesafen). [1]Added AMS at 2.5% v/v. [2]Added VaporGrip Xtra.

#	PRE	Rate (g a.i. ha^{-1})	POST[1]	Rate (g a.i. ha^{-1} or a.e. ha^{-1})
1	Check	-	Check	-
2	FLMXZ + PXSF	35 + 44	GLFS + ACTLH	655 + 1,209
3	FLMXZ + PXSF + DCMB[2]	35 + 44 + 620	GLFS + ACTLH	655 + 1,209
4	FLMXZ + PXSF	35 + 44	GLFS + ACTLH + GLPH	655 + 1,209 + 1,260
5	FLMXZ + PXSF + DCMB[2]	35 + 44 + 620	GLFS + ACTLH + GLPH	655 + 1,209 + 1,260
6	FLMXZ + PXSF	35 + 44	GLFS + ACTLH + FMSF	655 + 1,209 + 264
7	FLMXZ + PXSF + DCMB[2]	35 + 44 + 620	GLFS + ACTLH + FMSF	655 + 1,184 + 264
8	FLMXZ + PXSF	35 + 44	GLFS + ACTLH + FMSF + GLPH	655 + 1,184 + 264 + 1,260
9	FLMXZ + PXSF + DCMB[2]	35 + 44 + 620	GLFS + ACTLH + FMSF + GLPH	655 + 1,184 +264 + 1,260

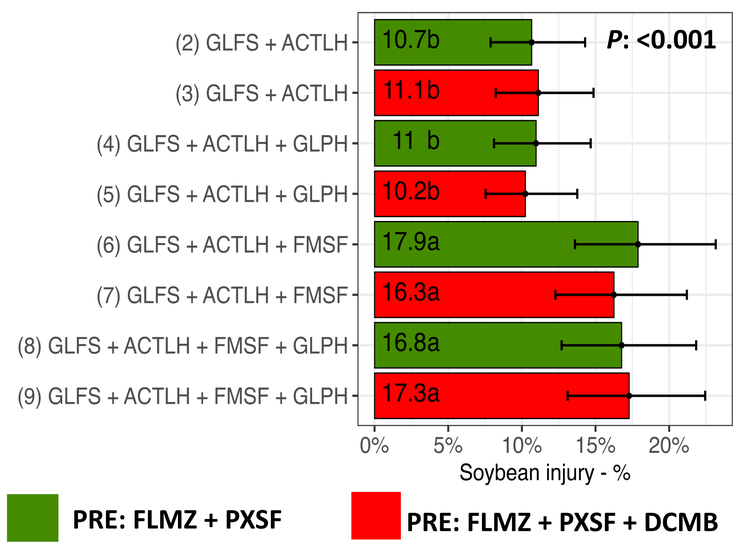

Figure 3. Visual soybean injury (%) 14 days after POST application. Average of 2021 and 2022 in Brooklyn and Arlington, WI (4 site-years). Means followed by the same letter do not differ (α: 0.05). Error bars indicate 95% confidence interval (CI).

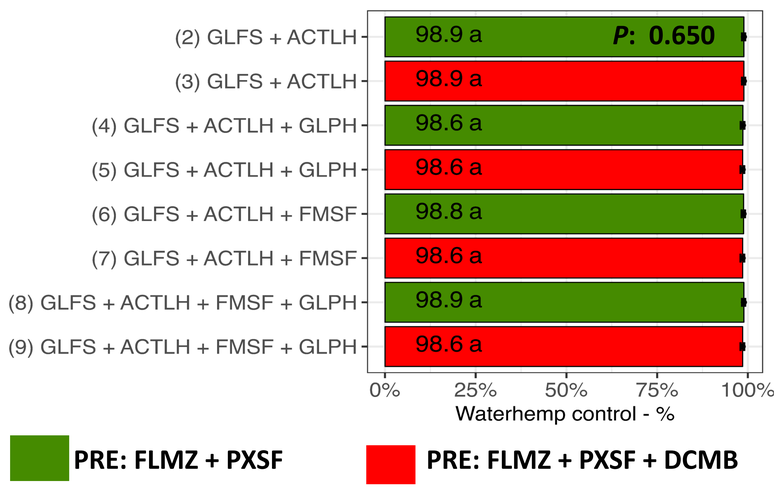

Figure 4. Visual waterhemp control (%) at soybean harvest. Average of 2021 and 2022 in Brooklyn (*p*-value: 0.650), WI (2 site-years). Means followed by the same letter do not differ (α: 0.05). Error bars indicate 95% CI.

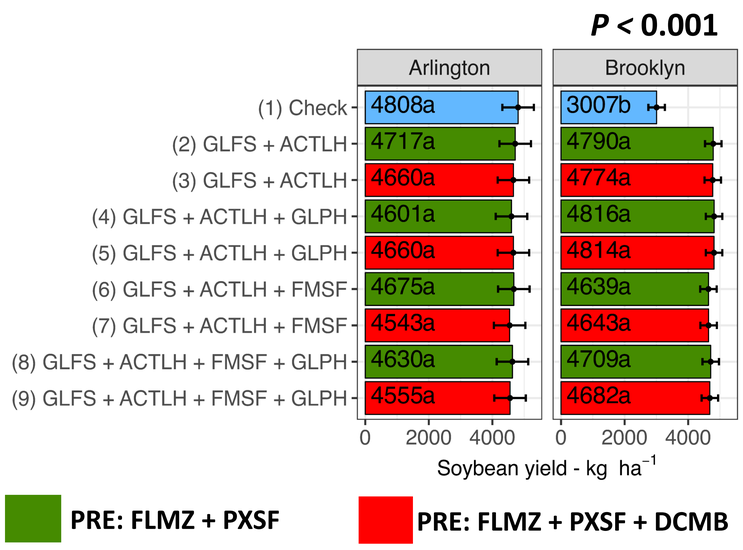

Figure 5. Soybean yield (kg ha^{-1}). Averages of 2021 and 2022 in Brooklyn (*p*-value: <0.001) and Arlington (*p*-value: 0.697), WI (4 site-years). Means followed by the same letter do not differ (α: 0.05). Error bars indicate 95% CI.

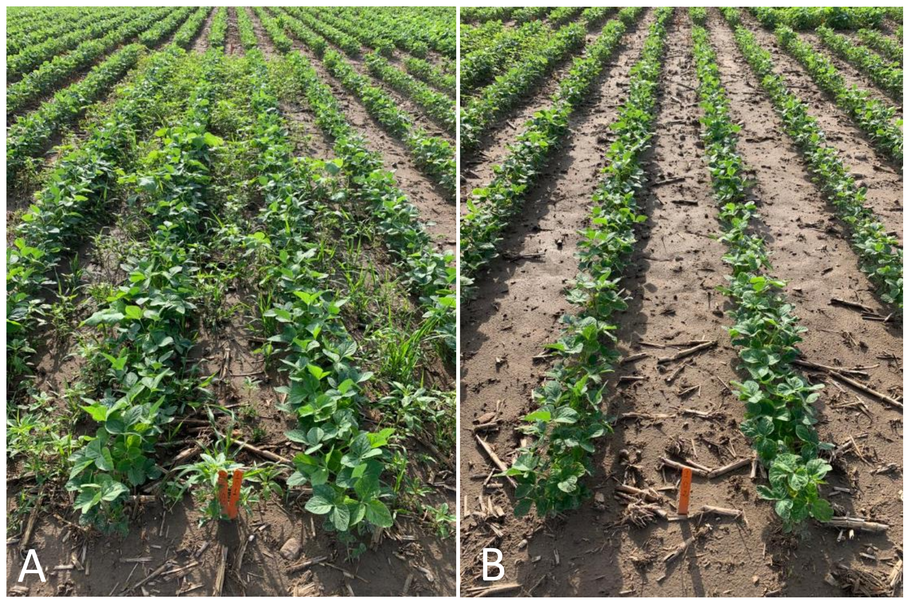

Figure 6. Weed pressure in nontreated control (A) and treatment 2, consisting of FLMZ + PXSF as PRE and GLFS + ACTLH as POST (B) at Brooklyn, WI, 2022.

DISCUSSION

- Dicamba in combination with flumioxazin + pyroxasulfone slightly enhanced residual waterhemp control (by ~5%) in 2021 and did not increase soybean injury 21 days after PRE application (data not shown).
- Treatments containing fomesafen resulted in the highest level of soybean injury 14 days after POST application (>15%; Figure 3) but did not impact yield (Figure 5).
- All treatments provided excellent control (>98%) of waterhemp across both years (Figure 4) improving soybean yield compared to the nontreated control at Brooklyn (Figure 5).

CONCLUSION

- These results suggest that Wisconsin growers can adopt XtendFlex soybean relying on effective PRE and layered glufosinate-based POST programs for waterhemp control.

FUTURE DIRECTIONS

- Additional herbicide efficacy research evaluating other troublesome soybean weeds (i.e., *Ambrosia trifida* L.)
- Evaluate synergistic herbicide mixtures to postpone glufosinate resistance evolution.

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REFERENCES

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- **2 - Anonymous** (2020) Counties in which additional endangered species protection measures apply. https://www.roundupreadyxtend.com/Documents/esa-one-sheet-FINAL-1.5.pdf. Accessed: October 10, 2022.