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Reducing herbicide reliance through cropping system diversification: A case study in the central Corn Belt

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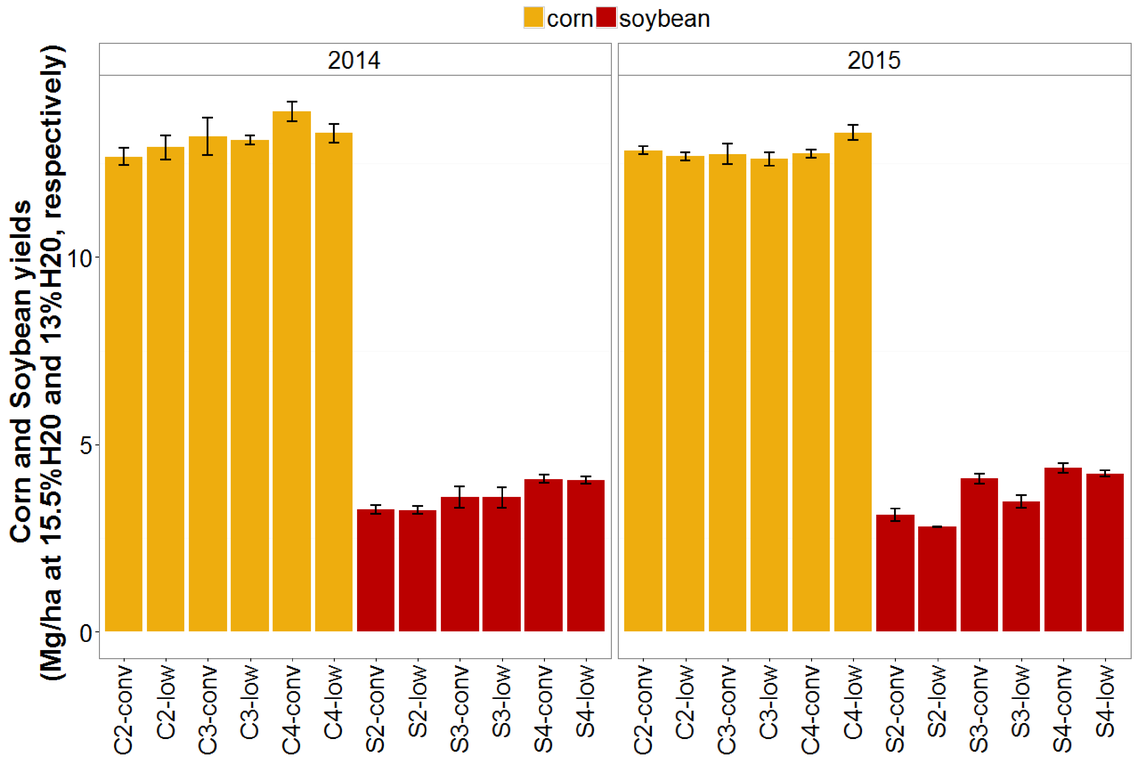
Introduction

- Increasing problems from weed resistance to herbicides and increasing concerns over environmental damage from herbicides have led to a search for sustainable and profitable weed management strategies for the central Corn Belt crop production systems.
- Approaches that exploit diverse cropping systems to subject weeds to multiple stress and mortality factors may provide reliable weed management with reduced dependence on chemicals.
- Three crop rotation systems were compared (2-year: corn-soybean; 3-year: corn-soybean-oat/red clover; 4-year: corn-soybean-oat/alfalfa-alfalfa) managed with conventional and low-input herbicide regimes with regard to their effects on weed and crop performance.

Results

- For a given rotation system, the low herbicide regime, i.e. reduced herbicide inputs and increased mechanical weed control, used 62% and 94% less herbicide active ingredient (kg a.i. ha^{-1}) on corn and soybean, respectively, compared to the conventional regime.
- Reduced herbicide use significantly increased weed biomass and viable seedbank density but those increases did not affect corn or soybean yield.

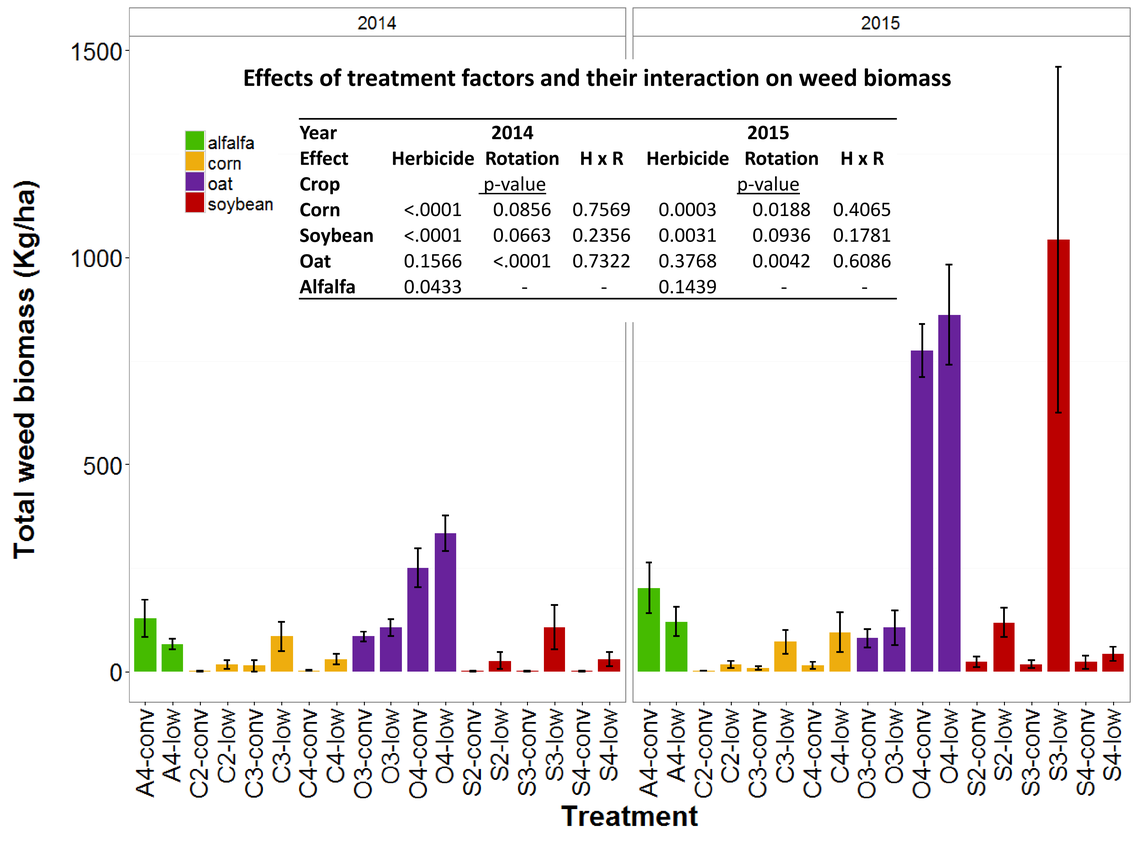


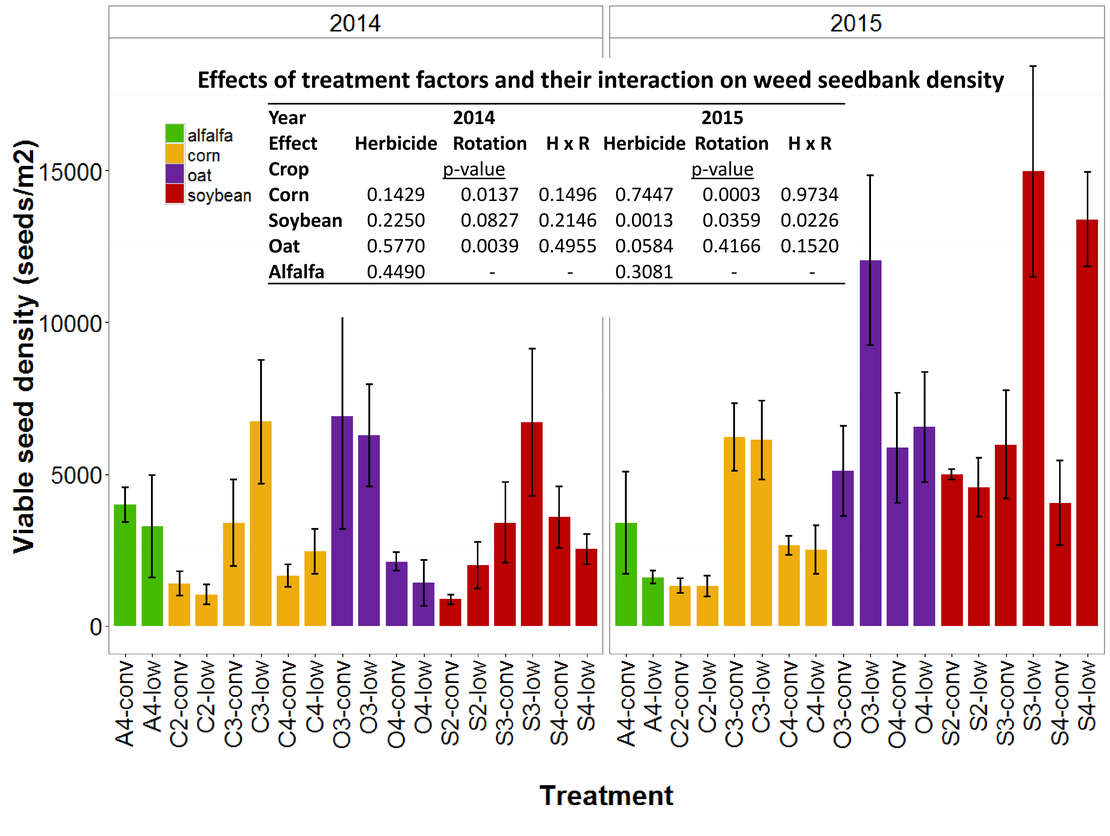
Effects of treatment factors and their interaction on corn and soybean yields

Year		2014			2015	
Effect	Herbicide	Rotation	H x R	Herbicide	Rotation	H x R
Crop		p-value			p-value	
Corn	0.5788	0.0571	0.4155	0.4985	0.1188	0.0836
Soybean	0.9092	0.0014	0.9995	0.1209	< 0.0001	0.9271

Materials and Methods

- Weed growth in three cropping systems (2-, 3- and 4-year rotation sequences) managed with two herbicide regimes (broadcast application versus banded application and mechanical weed removal) were compared. Oat and alfalfa phases were not treated with herbicide. The experiment was randomized complete block with 4 replications.
- Eight areas of 3.05mx0.76m per subplot of corn and soybean; eight quadrats of 0.25 m^2 per subplot of oat and alfalfa were sampled for weed biomass. Weed biomass samples were classified to species, oven dried to constant weight and tallied to kilogram per hectare.
- Soil samples from a total surface of 87 cm^2 at 20 cm depth were drawn from each subplot for seedbank density estimation. Seeds were mechanically separated from soil materials with elutriator and floatation, classified to species and tallied to counts per squared meter.





Conclusion

Multitactic weed management strategies within diversified cropping systems offer opportunities to reduce reliance on herbicides.

Acknowledgements

This poster was funded by the Vietnam Education Foundation (VEF), the Wallace Chair for Sustainable Agriculture, the Graduate Program of Sustainable Agriculture, the Graduate and Professional Student Senate, and ISU Department of Agronomy. The opinions, findings, and conclusions stated herein are those of the authors and do not necessarily reflect those of VEF. We thank Matt Woods, Edel Aron, Wendy Borjas, Tim Youngquist and Adam Millikin for field and laboratory technical assistance. We are also thankful for Ranae Dietzel, Lendie Follet, Philip Dixon and the R users community for help with coding and data analysis.