Should Variable Soil Residual Herbicide Rates Be Determined By Soil Type, Weed Seedbank Densities or Both?

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Introduction

Agricultural fields will commonly contain spatial variability for organic matter content, soil texture, CEC, and pH; all factors that influence the labeled application rate of soil residual herbicides. However, soil residual herbicides are applied uniformly across a field. This practice allows for underapplication of herbicides in some locations in the field where reduced weed control may result. Conversely, applying a fixed application rate may also result in overapplication of the herbicide and risk potential crop injury. As application technology evolves the opportunity to perform variable rate applications of soil residual herbicides may be possible, but would these types of applications be justified?

Hypothesis

1. Underapplication of soil applied herbicides in fields with high soil variability will result in reduced weed control in high OM soils.
2. Overapplication of soil applied herbicides in fields with high soil variability will result in greater crop injury and yield loss in low OM soils.

Objectives

Determine the influence of variable application rates of corn and soybean residual herbicide in different soil management zones in two commercial fields in Indiana.

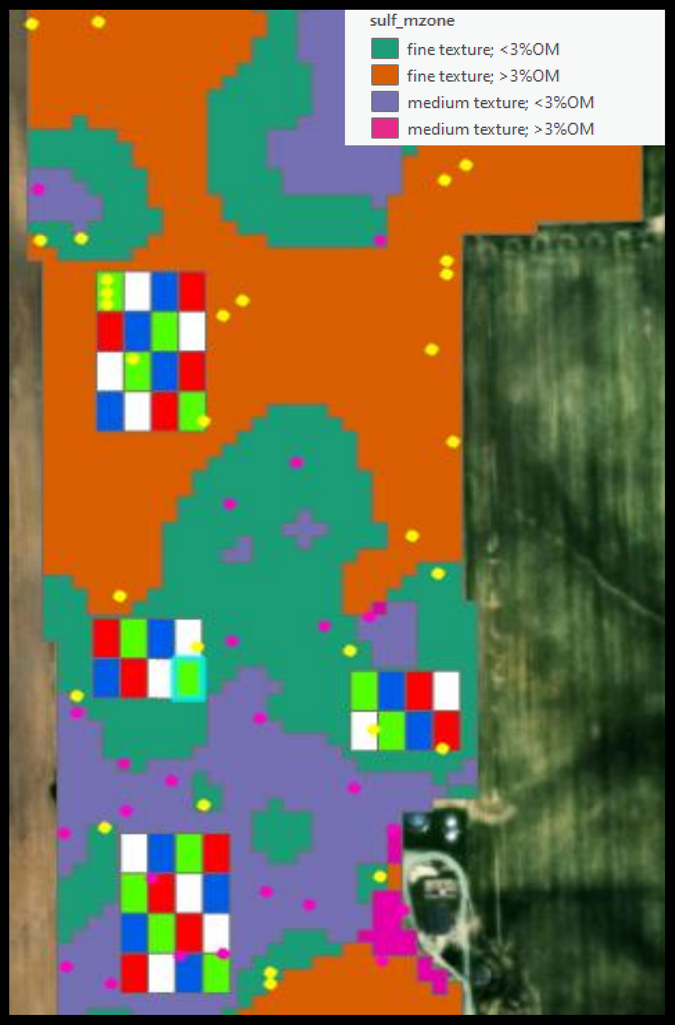

Figure 1. "Finney West" soybean field soil management zones with plot overlay.

Material and Methods

- The soil variability in two commercial fields was quantified, followed by generating management zones based on the specific herbicide label parameters for application rate (**Figure 1**).
- 60 x 100 ft plots were established in the major management zones within each field.
- A base rate of herbicide was applied by the grower with additional herbicide sprayed shortly after to match label guidelines for the three soils types present in each field.
- Soil cores were collected from each treatment area to document herbicide availability over time, to be accomplished using a greenhouse bioassay.
- Weed emergence counts, crop injury, and stand counts were taken 14 days after planting and prior to POST.
- Grain yield will be collected at harvest.
- Data were analyzed in R studio 4.3.1 using a 3-way ANOVA with soil type, herbicide rate, and seedbank abundance as factors.

Results

- No significant interactions on the corn field.
- No significant impact on crop injury from any herbicide rate
- Giant ragweed emergence was related more to soil seedbank abundance than soil residual herbicide rate or soil type at both sample timings.
- Ivyleaf morningglory emergence was significant by soil type with the fine >3% OM soil type having the greatest abundance.
- Both prickly sida and annual grass species had significant interactions between seedbank abundance, soil type, and herbicide rate (**Figure 3; A, B, C**)

Figure 2. Giant ragweed escapes in the "base" herbicide rate area next to a plot with a higher soil residual herbicide application rate.

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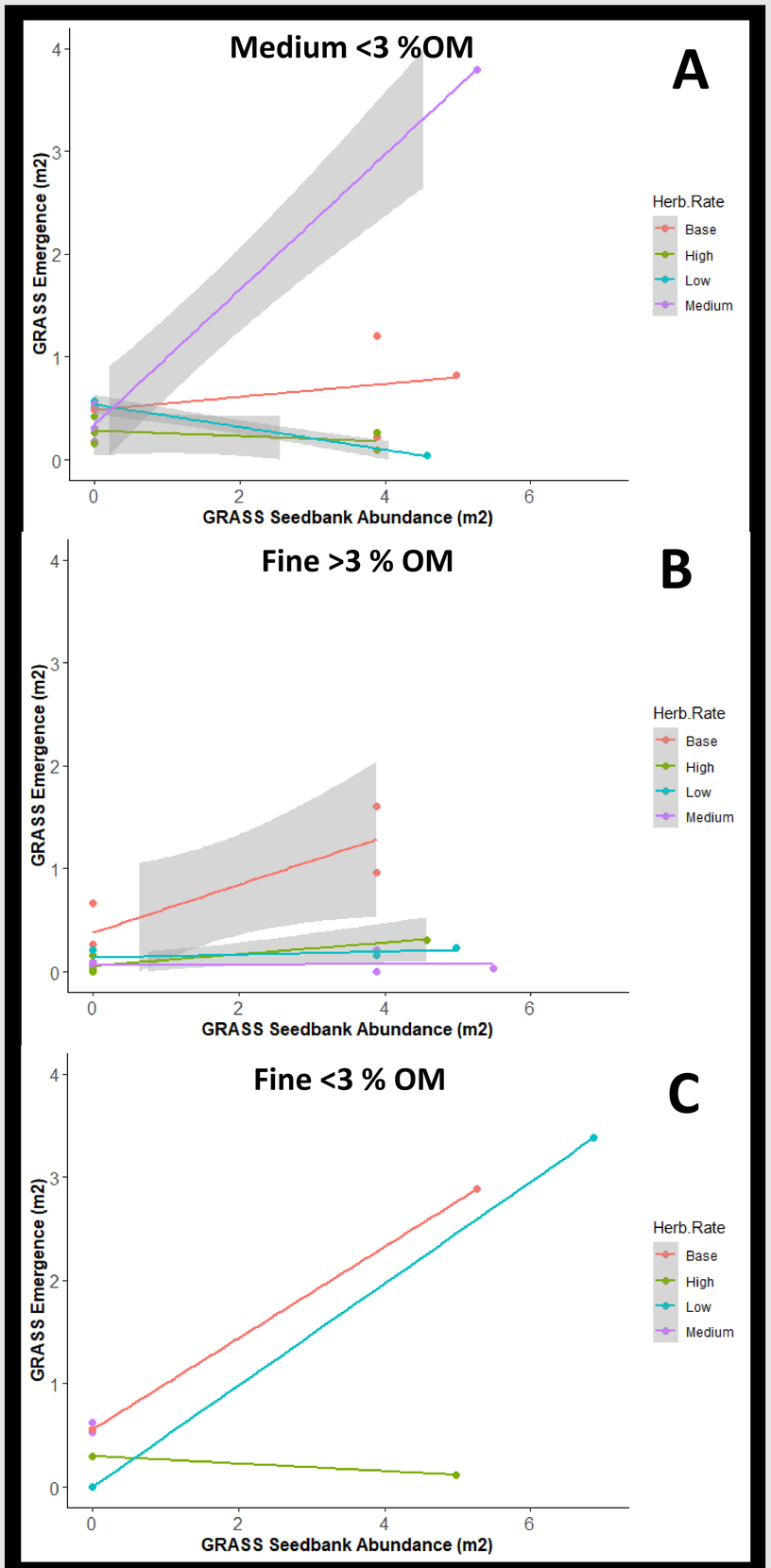

Figure 3. Annual grass emergence by seedbank abundance prior to POST

Conclusions

- This research indicates that variable rate applications of soil residual herbicides may need to consider both soil type boundaries and the spatial variability in the abundance of the soil weed seedbank to provide a valuable benefit for farmers.

Future Research

- Greenhouse bioassays on herbicide treated field soils to quantify herbicide in soil solution from variable rate application.
- Determine economic value of variable rate application.