Influence Of Tillage Methods On Management Of *Amaranthus* Species In Soybean

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Introduction

- The challenge of managing herbicide-resistant weeds has led to a renewed interest in cultural control methods like tillage for weed control

- Herbicide-resistant *Amaranthus* species are some of the most troublesome weed species in U.S. soybean production

- Further research is needed to understand the effects of different tillage types on weed seed distribution in the soil seedbank

Objectives

1. Determine the effects of four tillage treatments, with and without residual herbicide programs, on season-long emergence of *Amaranthus* species in glufosinate-resistant soybean.

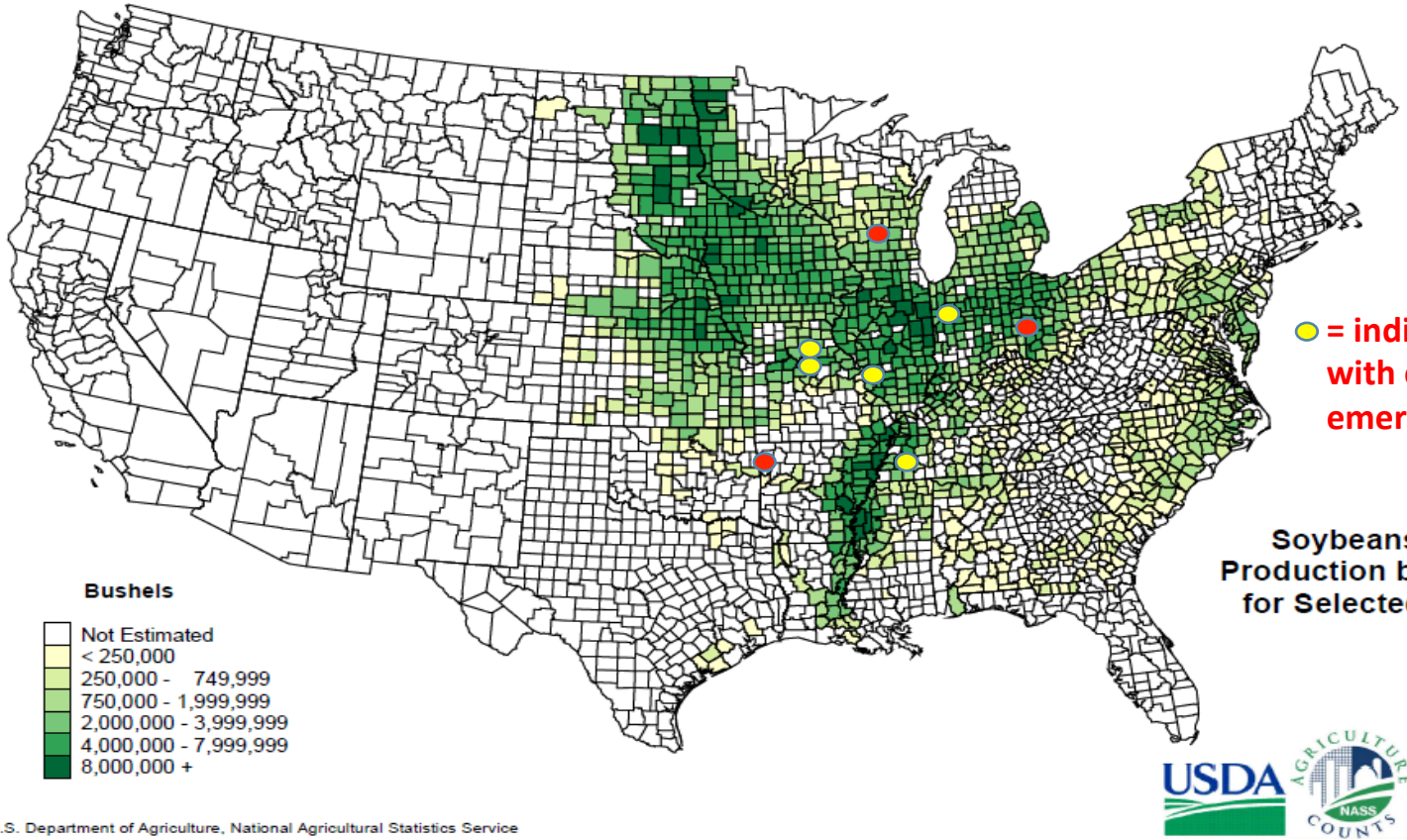
2. Determine the effects of four tillage treatments on the vertical distribution of weed seed in the soil profile.

Materials and Methods

- Identical field trial conducted in 2014 in Arkansas, Illinois, Indiana, Ohio, Tennessee, Wisconsin, and Missouri (2 sites)

- Tillage Treatments Evaluated:
  1. **Deep Tillage**: fall moldboard plow fb spring pass w/field cultivator
  2. **Conventional Tillage:** fall chisel plow fb spring pass w/field cultivator
  3. **Minimum Tillage:** one pass of a vertical tillage tool in the spring
  4. **No-Tillage:** burndown herbicide at about same time as spring tillage

Field Trial Locations



Materials And Methods

Each tillage treatment also received two herbicide treatments:

1. **Residual Program:** Preemergence (PRE) application of flumioxazin followed by postemergence (POST) application of glufosinate + *S*-metolachlor
2. **POST-only:** POST applications of glufosinate during the season

Split-plot arrangement of treatments with four replications:

- Whole Plots → tillage types
- Sub-plots → herbicide treatments

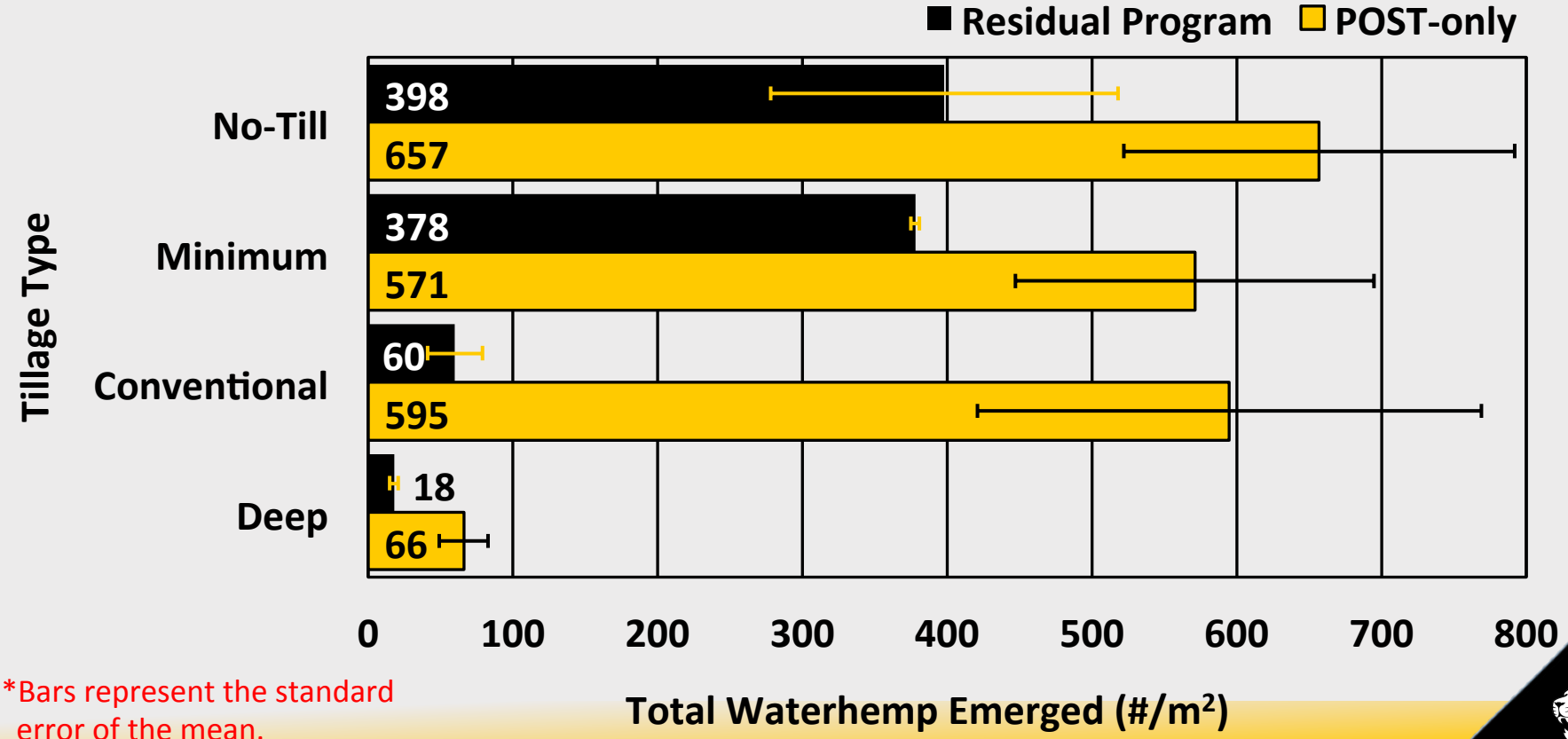
Materials And Methods

- Weed counts taken in two, 1-m^2 quadrats within the middle two rows of each plot every 2 weeks following planting up to R6 stage or soybean senescence
- After each count, the entire trial was sprayed with glufosinate and emerged seedlings were removed to ensure no weed escapes

Materials And Methods

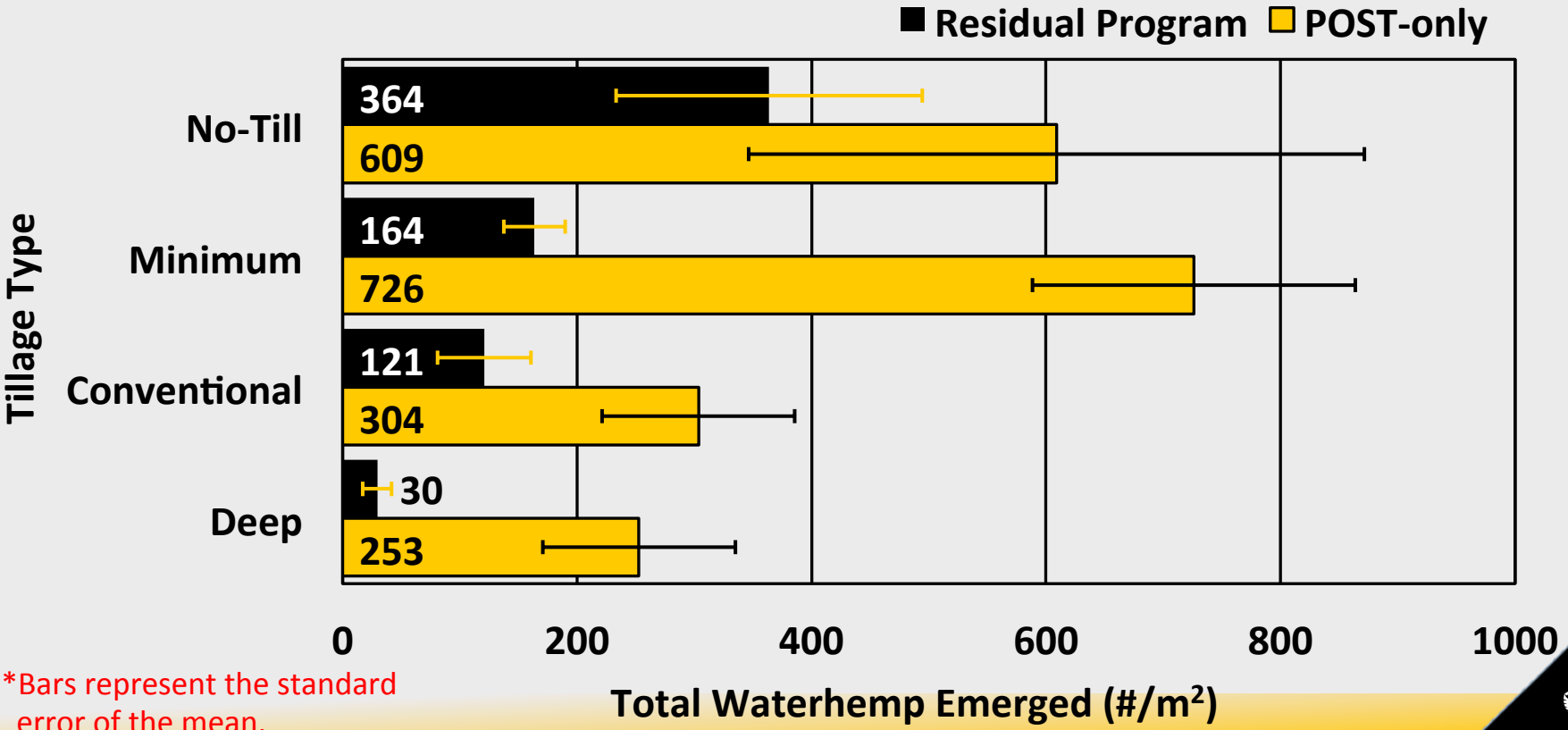
- 6 soil cores taken to a depth of 25-cm from each plot in the spring after tillage and prior to planting and herbicide application
- Soil cores cut into six sections corresponding to depths of 0-1, 1-5, 5-10, 10-15, 15-20 and 20-25 cm
- Soil segments were pulverized and spread as a thin layer of topsoil over commercial potting medium
- Emerged weed seedlings counted, identified to species, then removed every two weeks
- Seedling emergence monitored over 3 months

Influence of Tillage Type and Herbicide Program on Cumulative Waterhemp Emergence (Columbia, Missouri 2014)



*Bars represent the standard error of the mean.

Influence of Tillage Type and Herbicide Program on Cumulative Waterhemp Emergence (Moberly, Missouri 2014)



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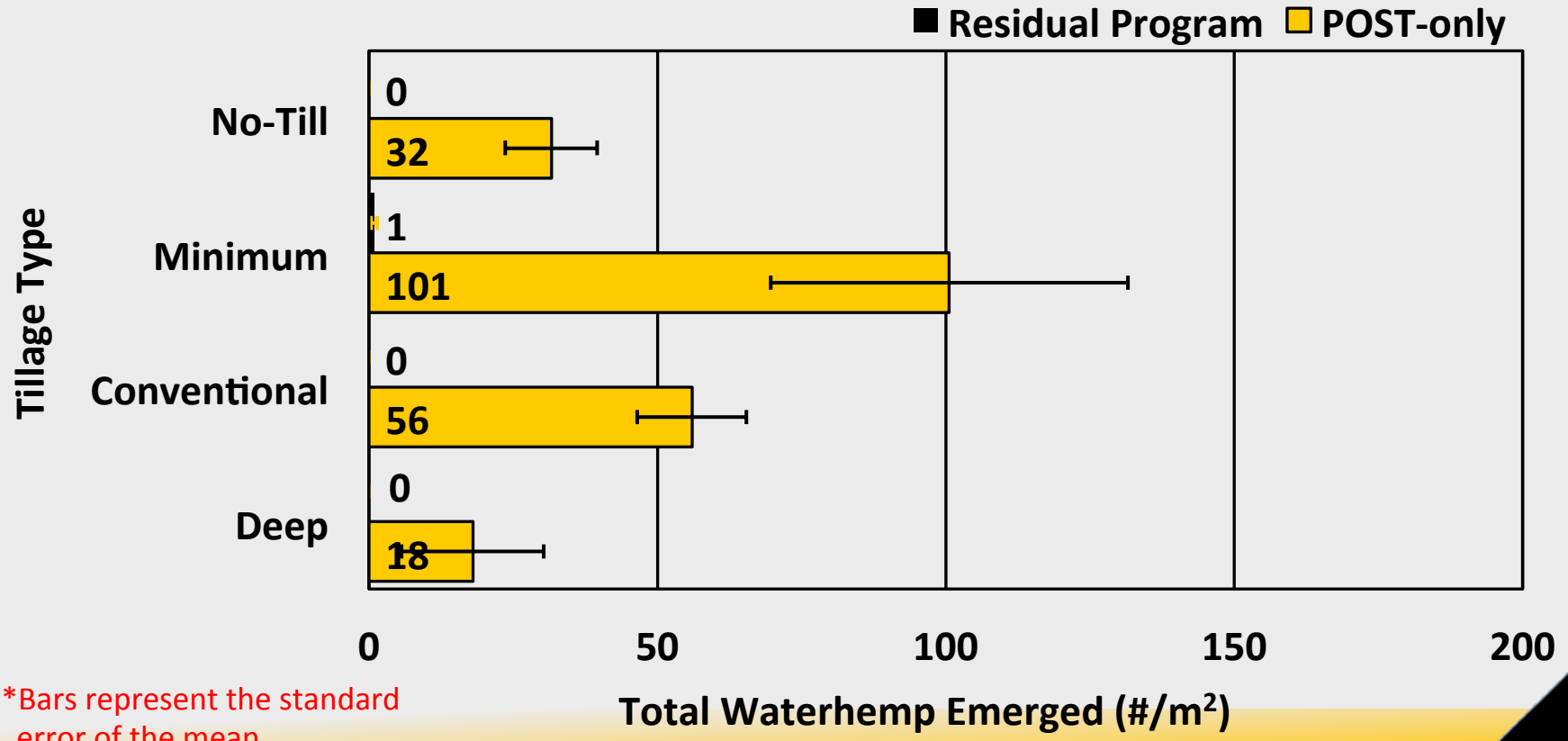
Influence of Tillage Type and Herbicide Program on Cumulative Waterhemp Emergence (Belleville, Illinois 2014)



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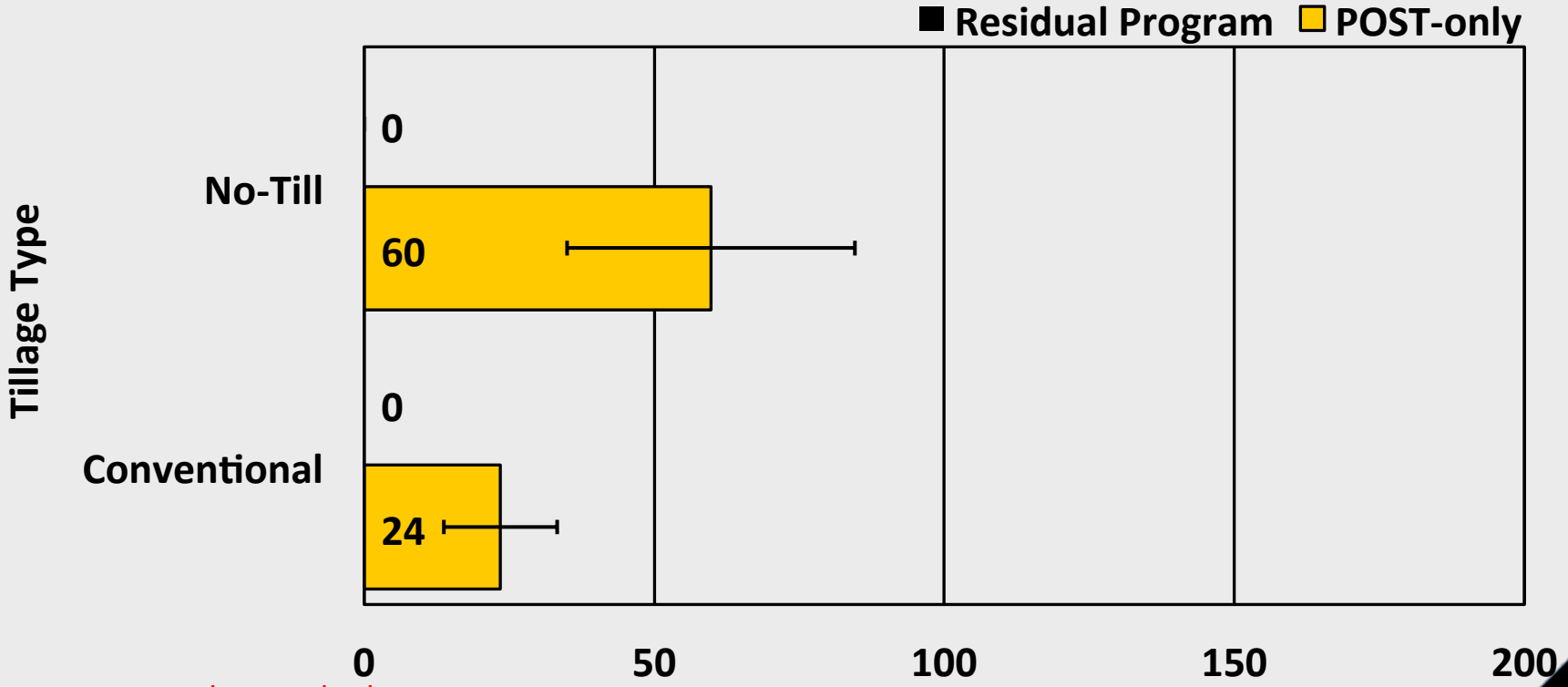
Influence of Tillage Type and Herbicide Program on Cumulative *Amaranthus* Species Emergence (Lafayette, Indiana 2014)



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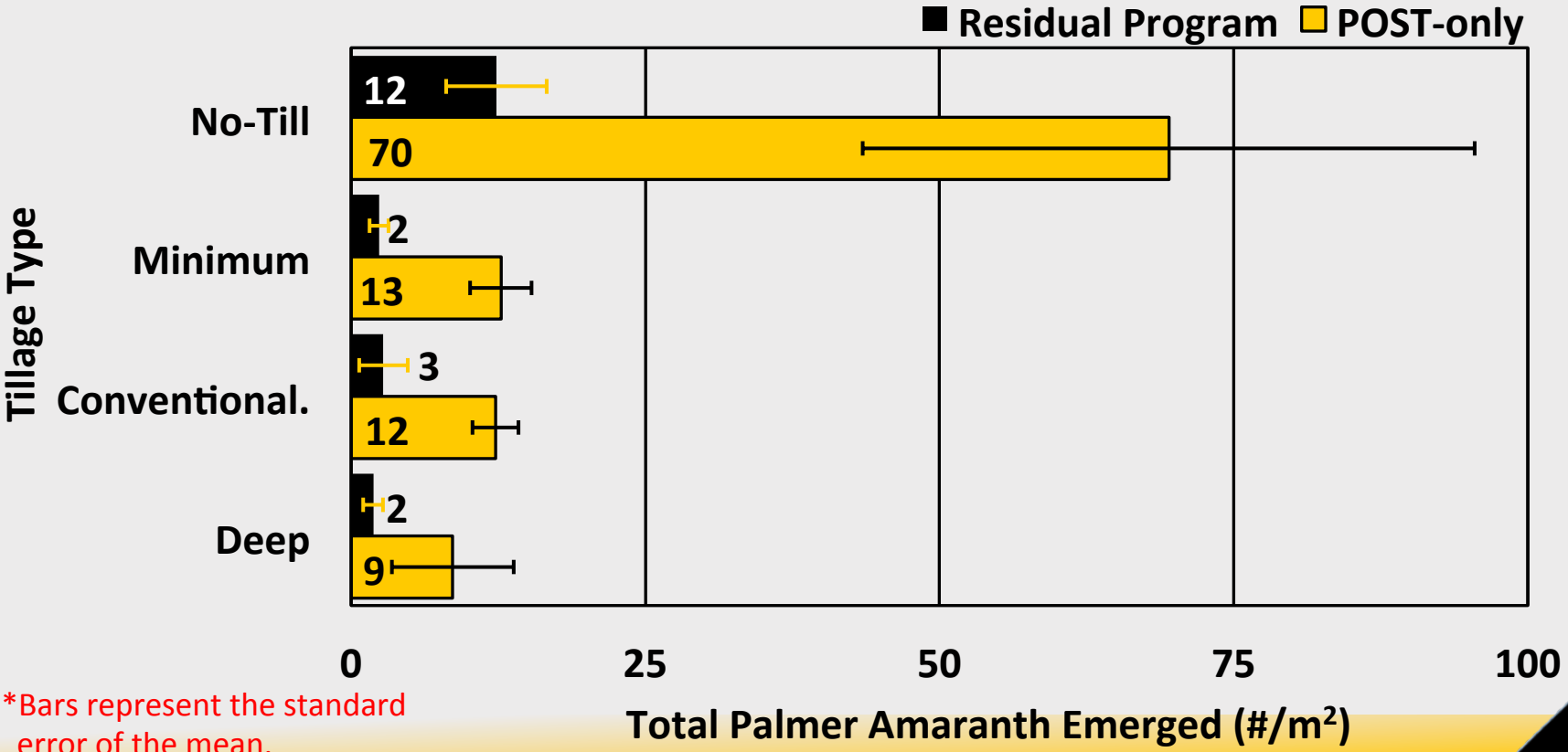
Influence of Tillage Type and Herbicide Program on Cumulative Palmer Amaranth Emergence (Jackson, Tennessee 2014)



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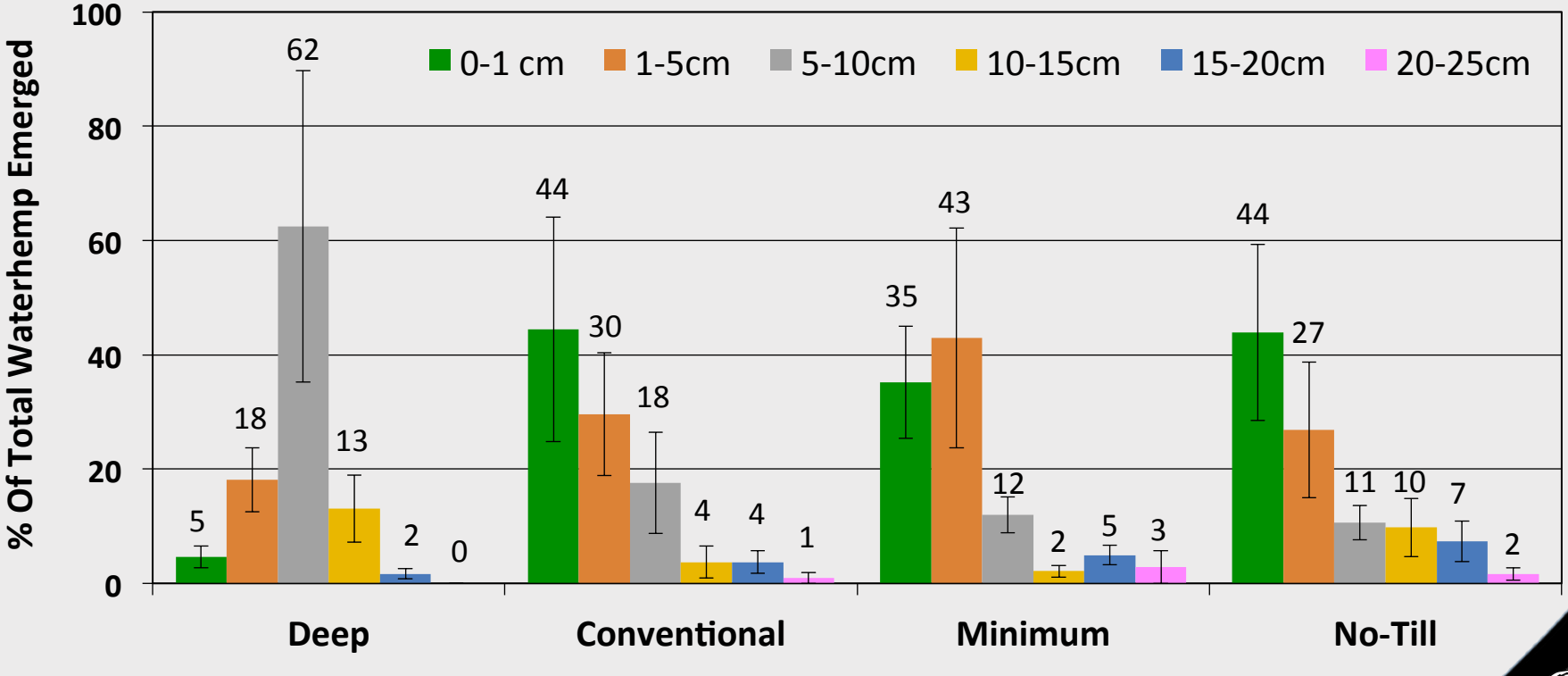
Summary of the Effects of Different Tillage Systems on *Amaranthus* Species Emergence

Location	Minimum Tillage	Conventional Tillage	Deep Tillage
	----- % Increase/Decrease Compared to No-till -----		
Missouri (Columbia)	26% ↑	38% ↓	92% ↓
Missouri (Moberly)	8% ↓	66% ↓	71% ↓
Illinois	313% ↑	175% ↑	44% ↓
Indiana	N/A	60% ↓	N/A
Tennessee	80% ↓	80% ↓	85% ↓

Evaluation of the Vertical Distribution of *Amaranthus* Seed in the Soil Profile

Percentage Of Waterhemp Emerged By Depth

(Columbia, Missouri)



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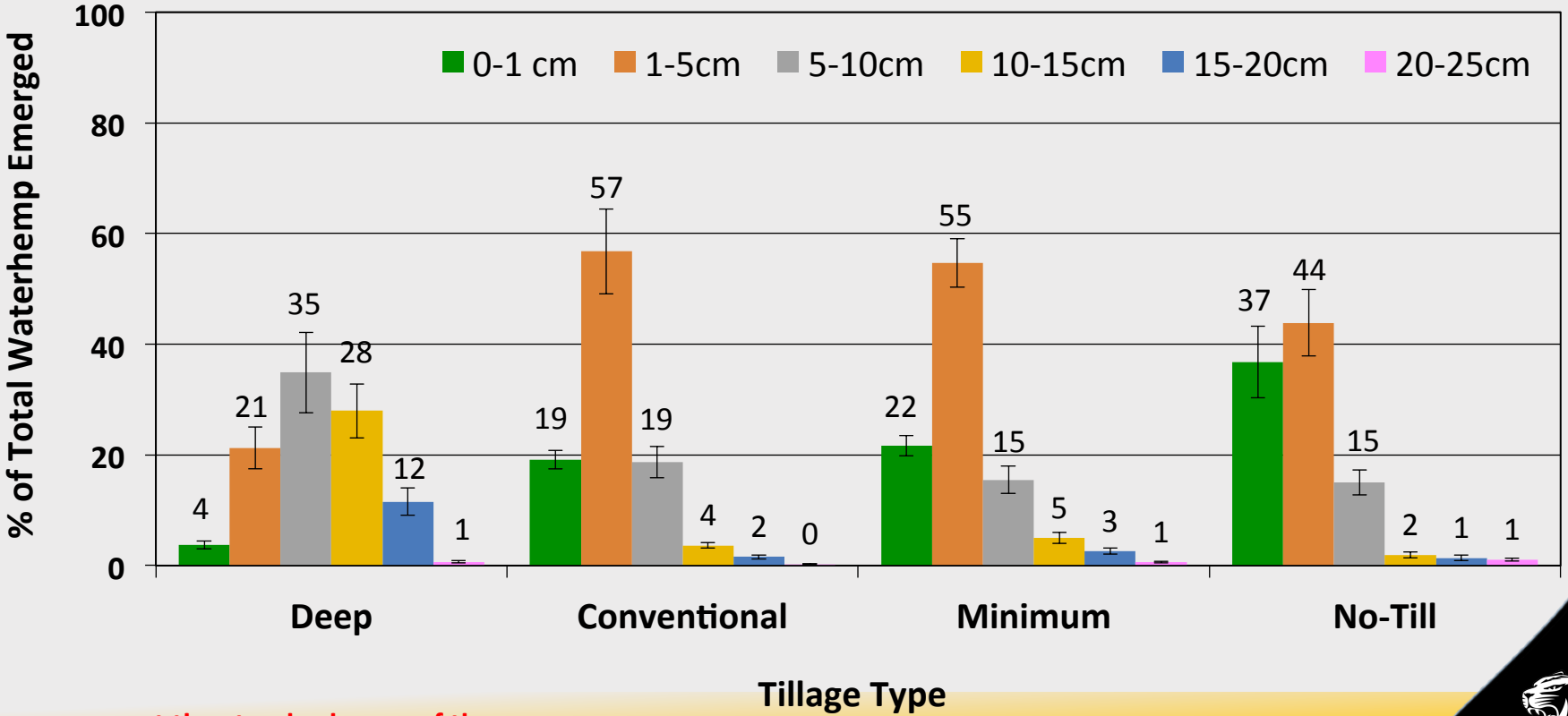
Percentage Of Waterhemp Emerged By Depth

(Moberly, Missouri)



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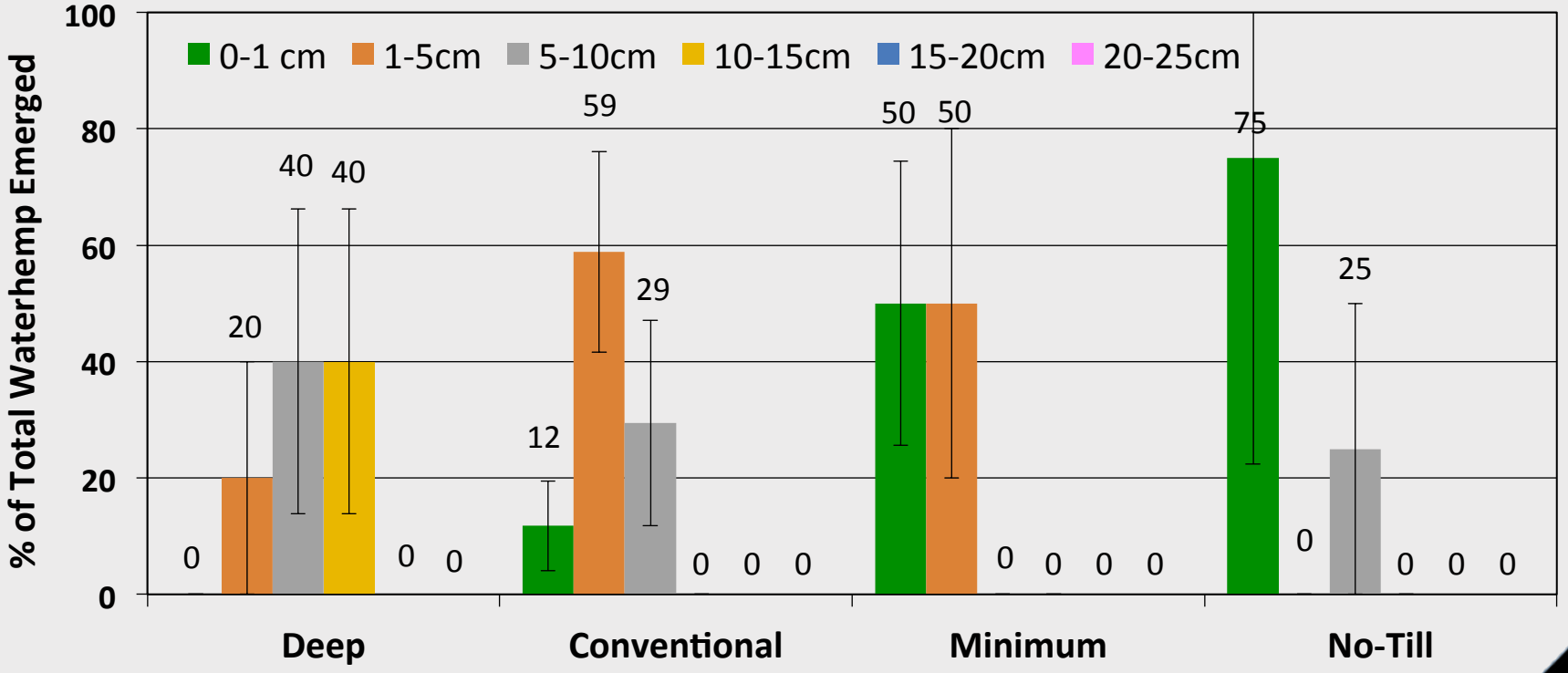
Percentage Of Waterhemp Emerged By Depth

(Belleville, Illinois)



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Summary of the Effects of Different Tillage Systems on the Vertical Distribution of *Amaranthus* Species in the Soil Profile

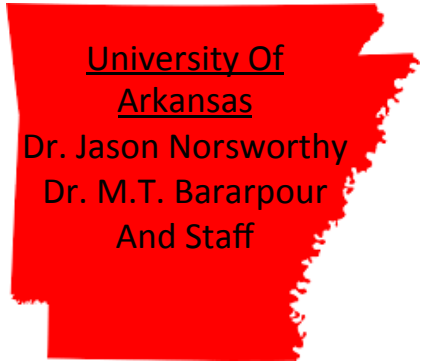
	Depth in the Soil Profile		
Tillage Type	**0-5 cm**	**5-15 cm**	**15-25 cm**
	---------- % of the Total Seed Emerged ----------		
No-till	71 to 81%	17 to 25%	0 to 9%
Minimum Tillage	77 to 100%	0 to 20%	0 to 8%
Conventional Tillage	71 to 77%	22 to 29%	0 to 5%
Deep Tillage	20 to 25%	63 to 80%	0 to 13%

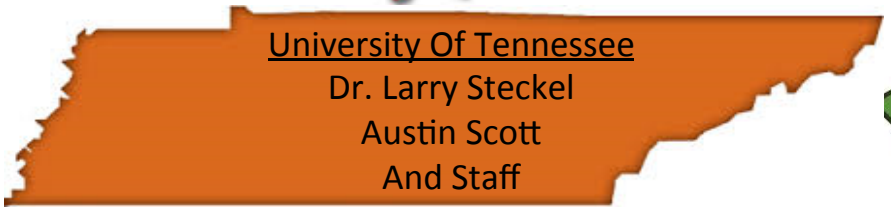
Conclusions

- Deep tillage treatments can be a useful tool for managing herbicide-resistant *Amaranthus* species by placing these seeds deep in the soil profile

- Minimum tillage implements such as vertical tillage tools are less effective than conventional and deep tillage at distributing weed seed below the top 5-cm of the soil profile

Thanks To The Many Individuals Who Have Worked Hard On This Study!





Special thanks for funding from the United Soybean Board!