



# **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.

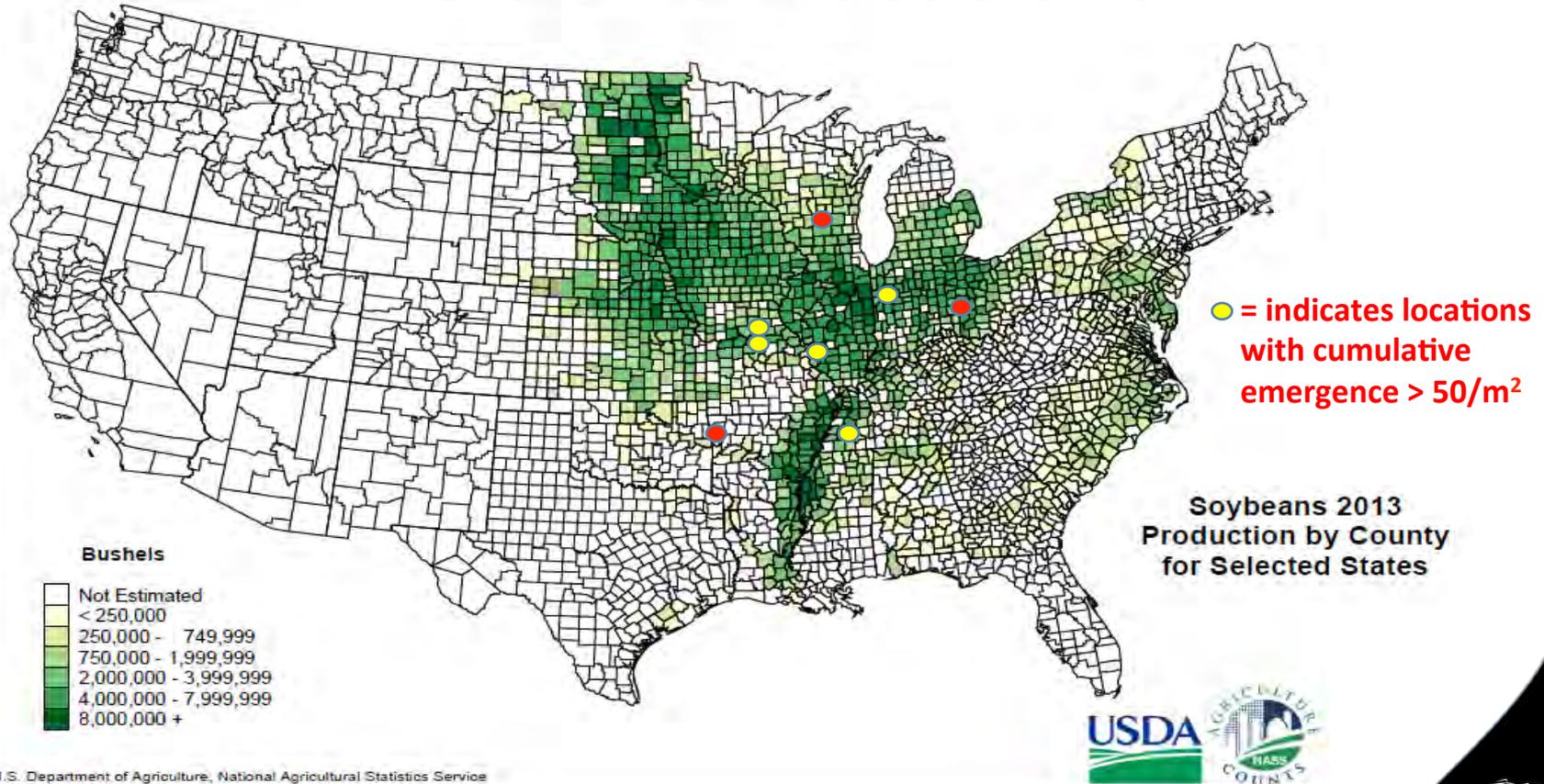


# Materials and Methods

- 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<sup>2</sup> 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

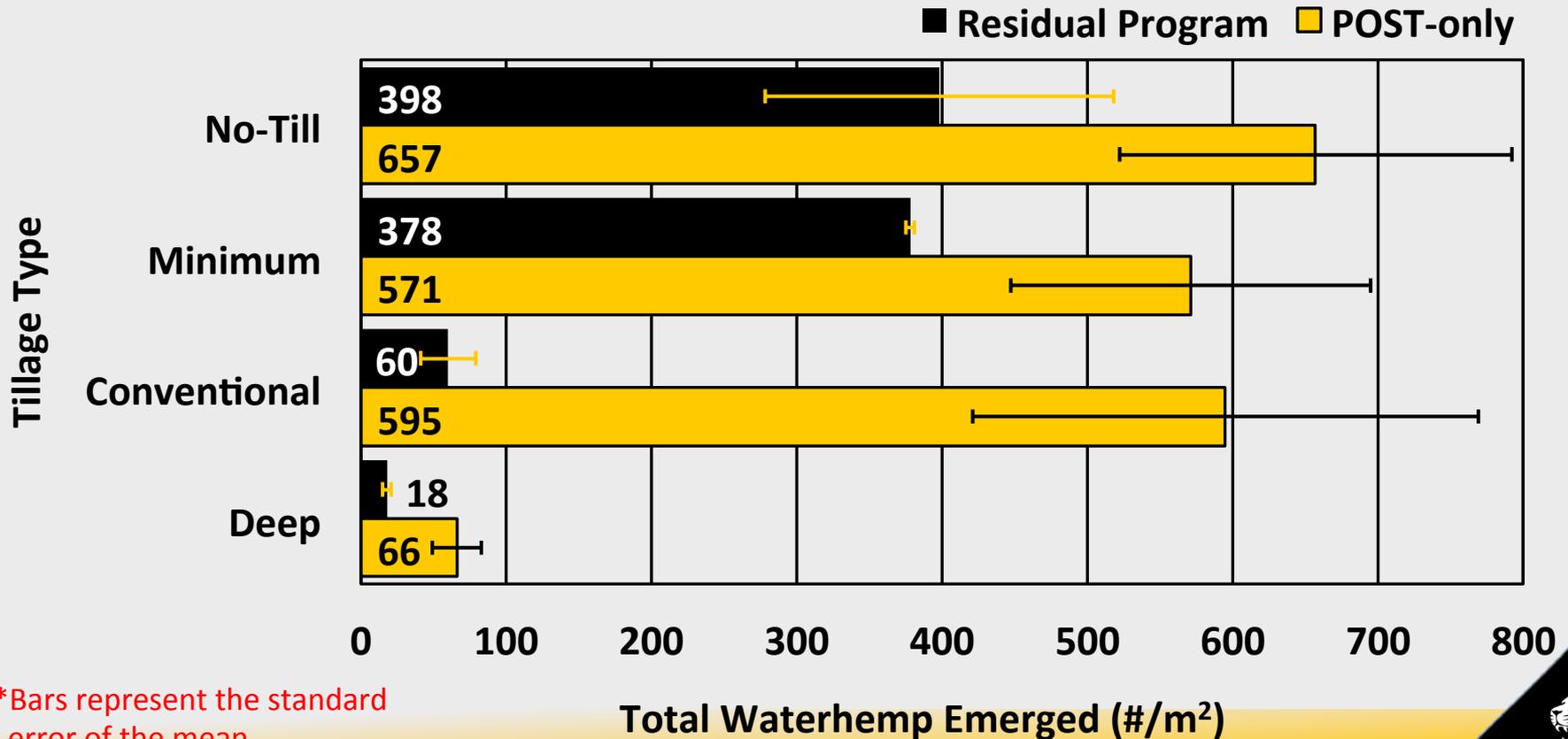


# Materials And Methods

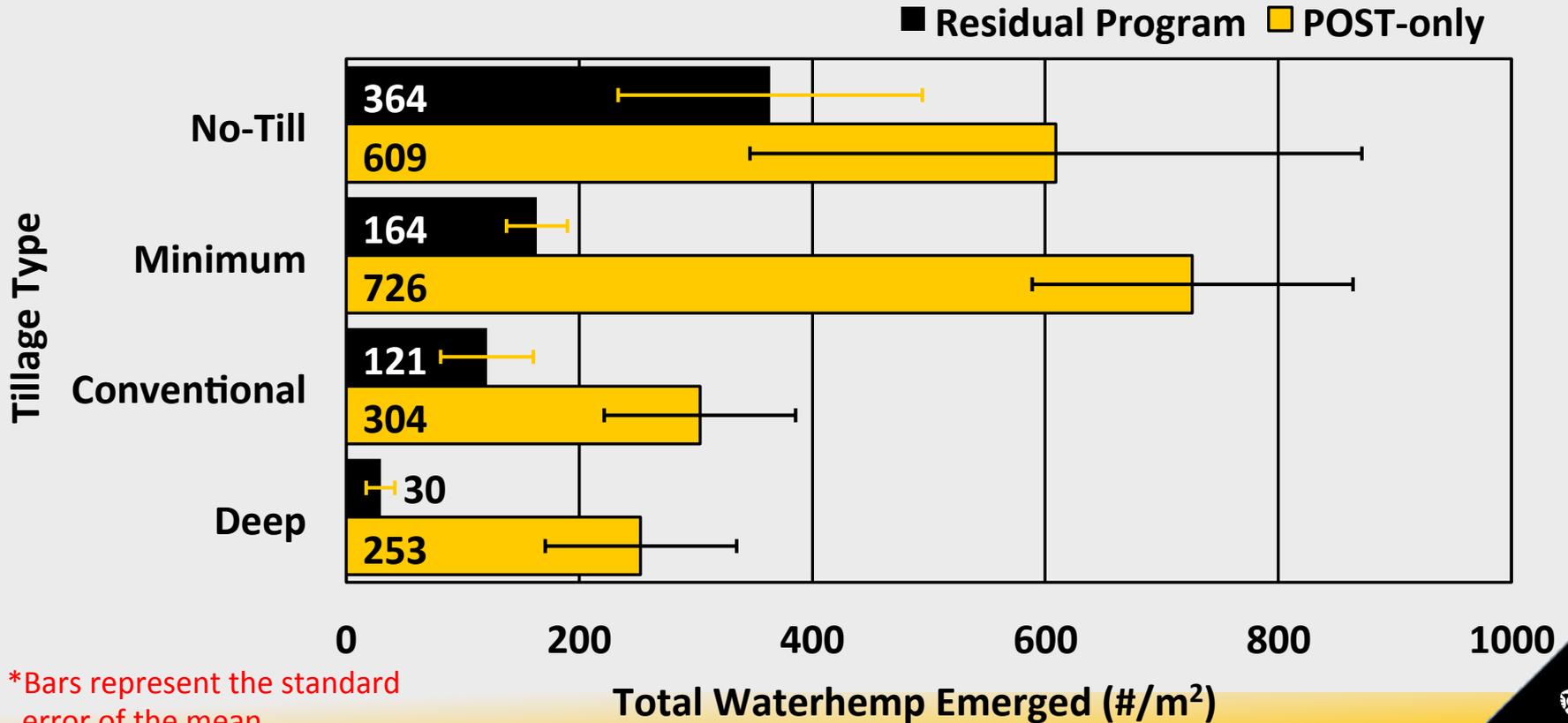
- 6 soil cores taken to a depth of 25-cm from each plot in the spring after tillage and prior to planting and herbicide application
- Soil cores cut into six sections corresponding to depths of 0-1, 1-5, 5-10, 10-15, 15-20 and 20-25 cm
- Soil segments were pulverized and spread as a thin layer of topsoil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



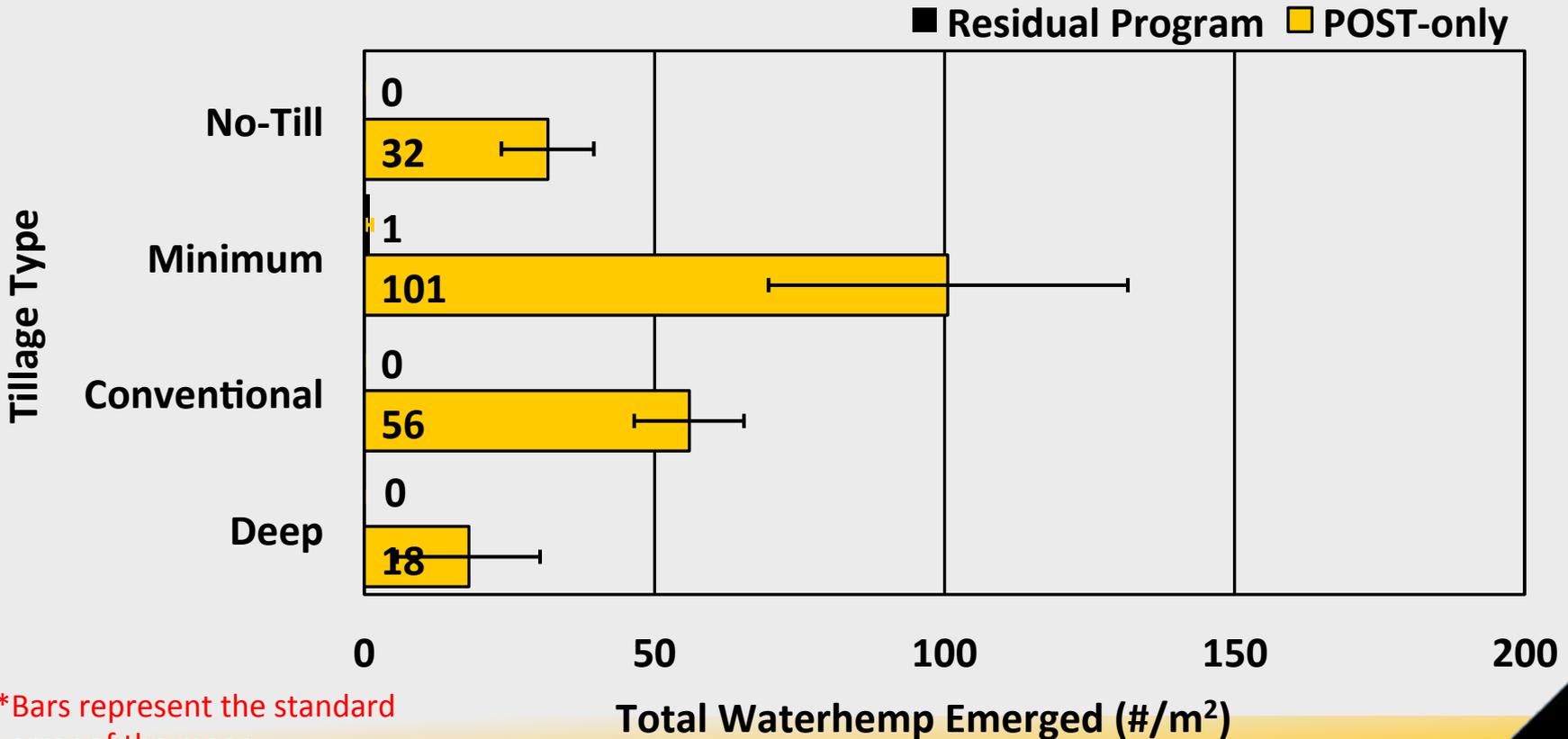
# Influence of Tillage Type and Herbicide Program on Cumulative Waterhemp Emergence (Columbia, Missouri 2014)



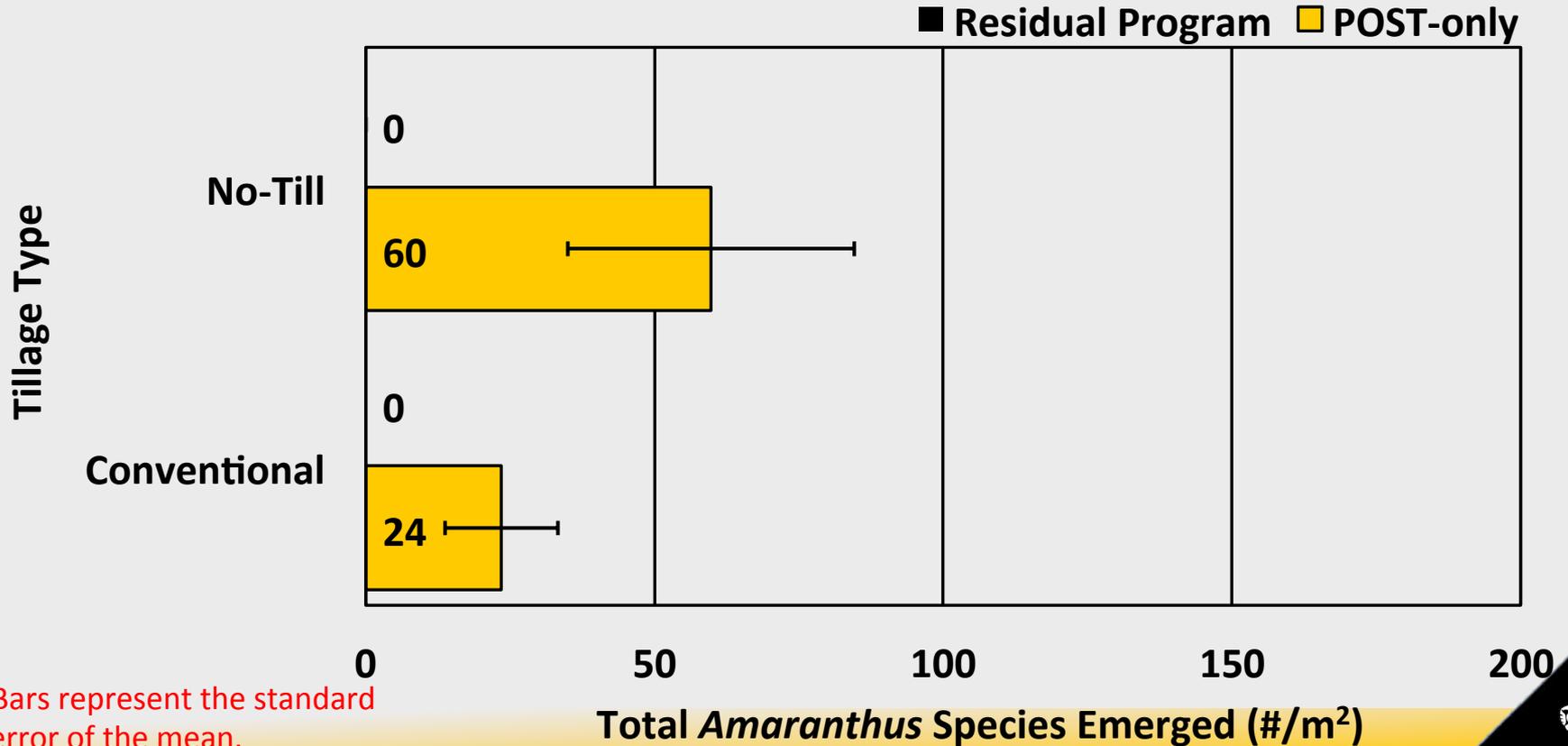
# Influence of Tillage Type and Herbicide Program on Cumulative Waterhemp Emergence (Moberly, Missouri 2014)



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



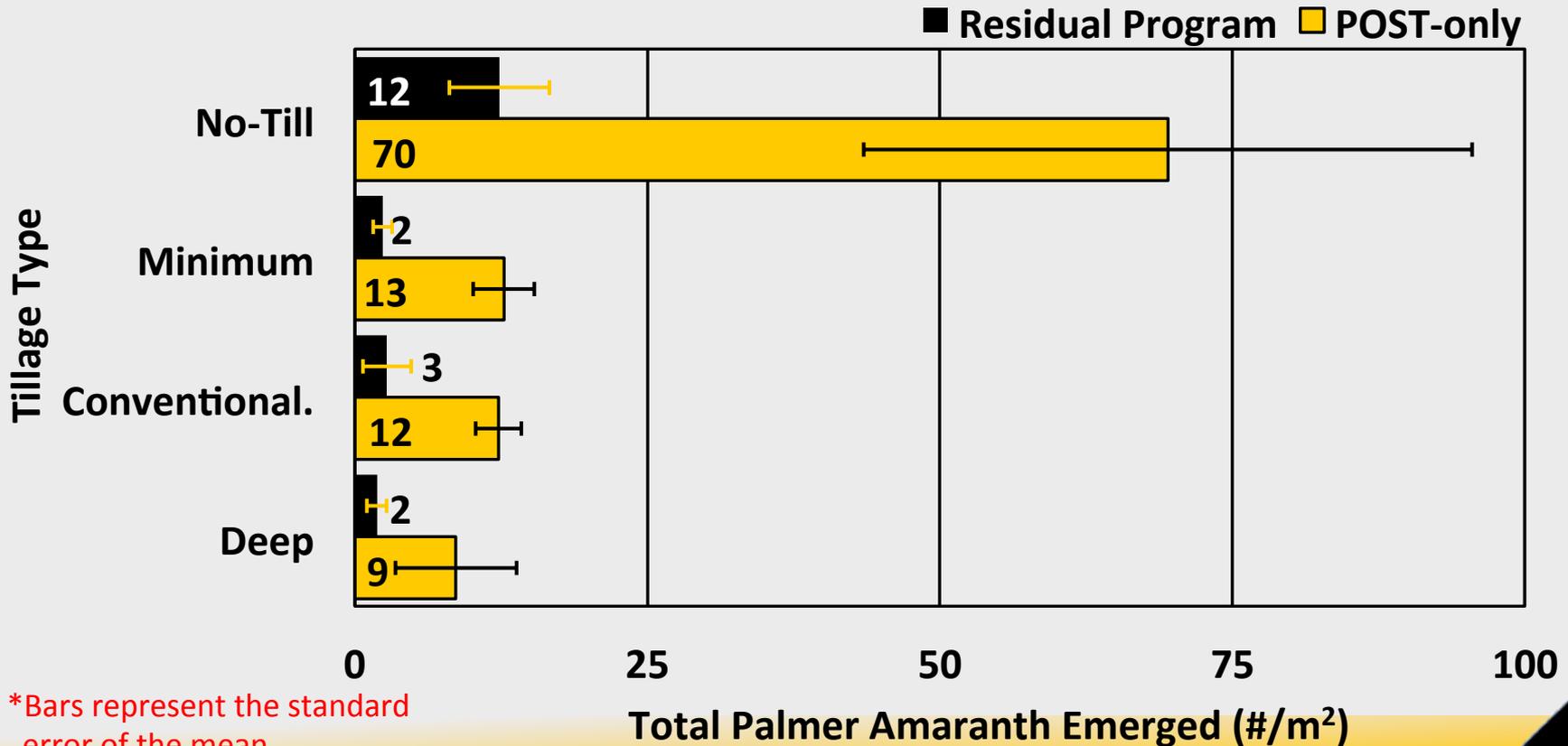
# Influence of Tillage Type and Herbicide Program on Cumulative *Amaranthus* Species Emergence (Lafayette, Indiana 2014)



\*Bars represent the standard error of the mean.



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

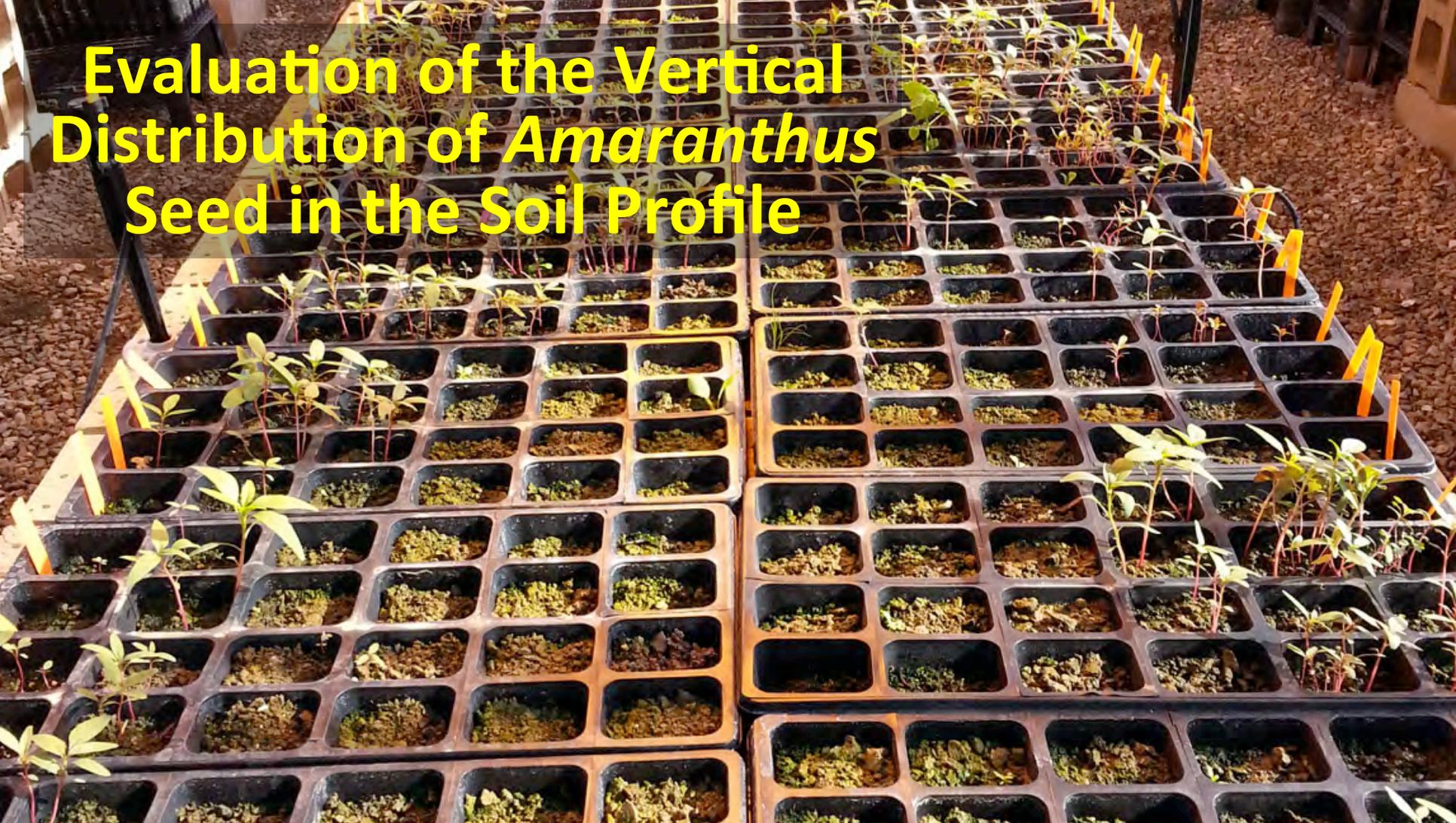


# Summary of the Effects of Different Tillage Systems on *Amaranthus* Species Emergence

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% ↓

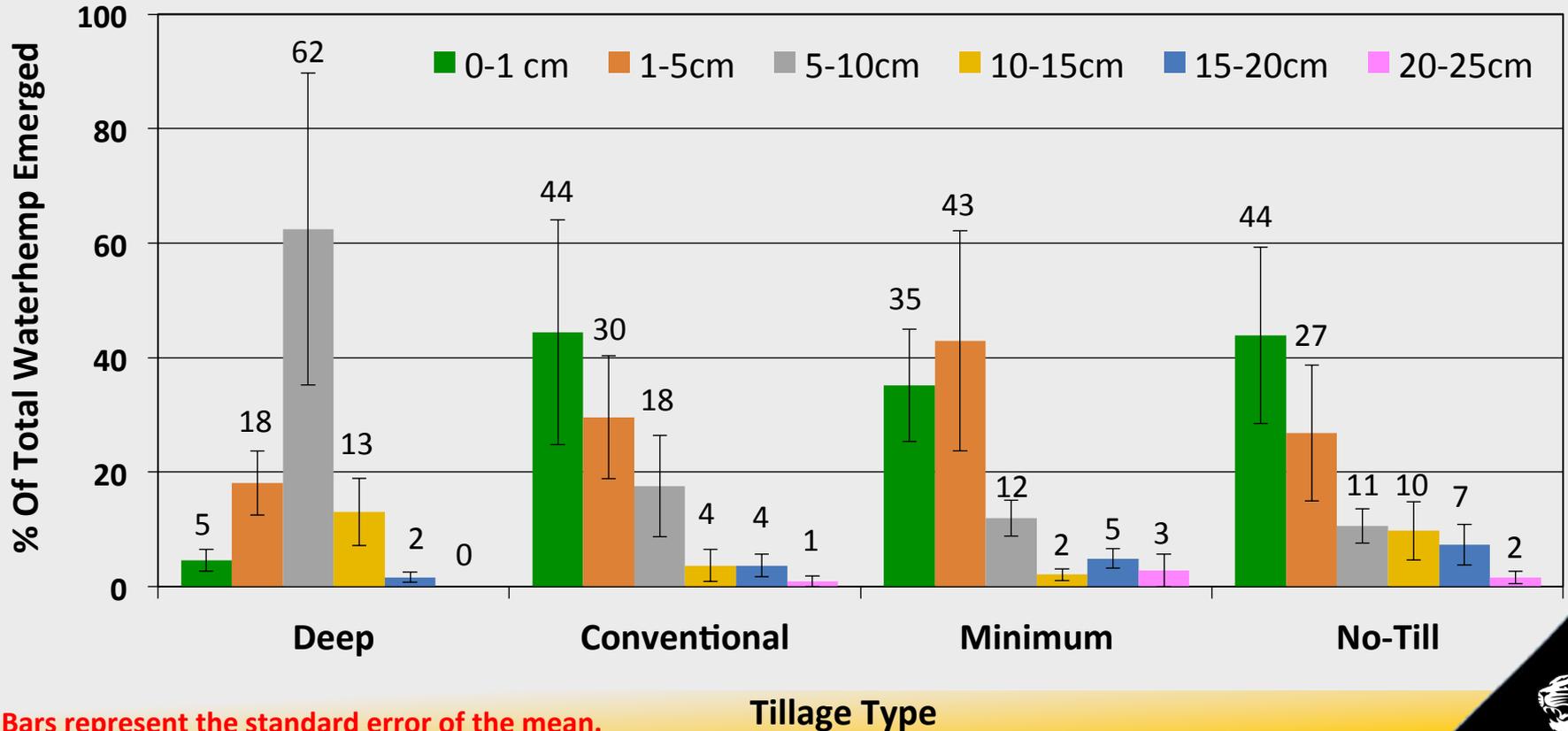


# Evaluation of the Vertical Distribution of *Amaranthus* Seed in the Soil Profile



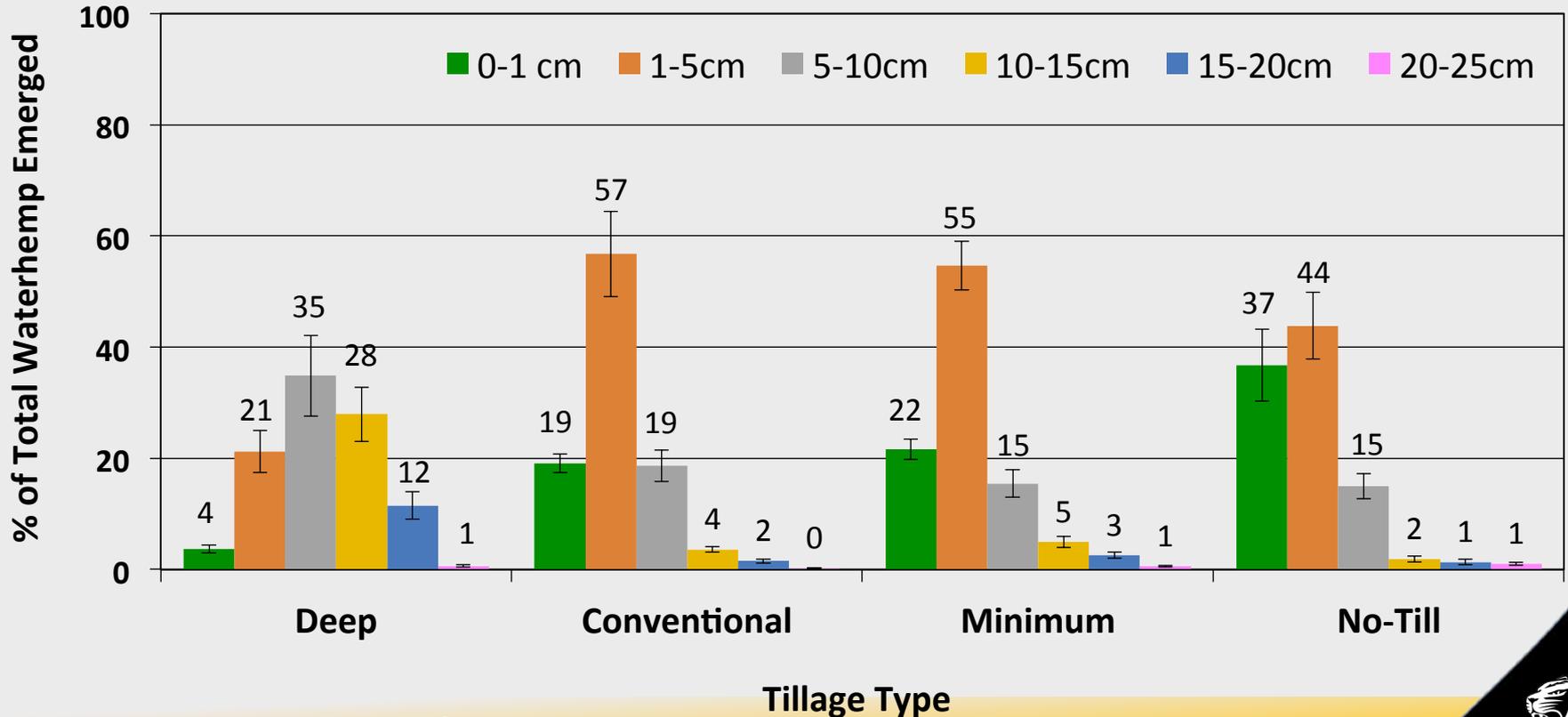
# Percentage Of Waterhemp Emerged By Depth

(Columbia, Missouri)



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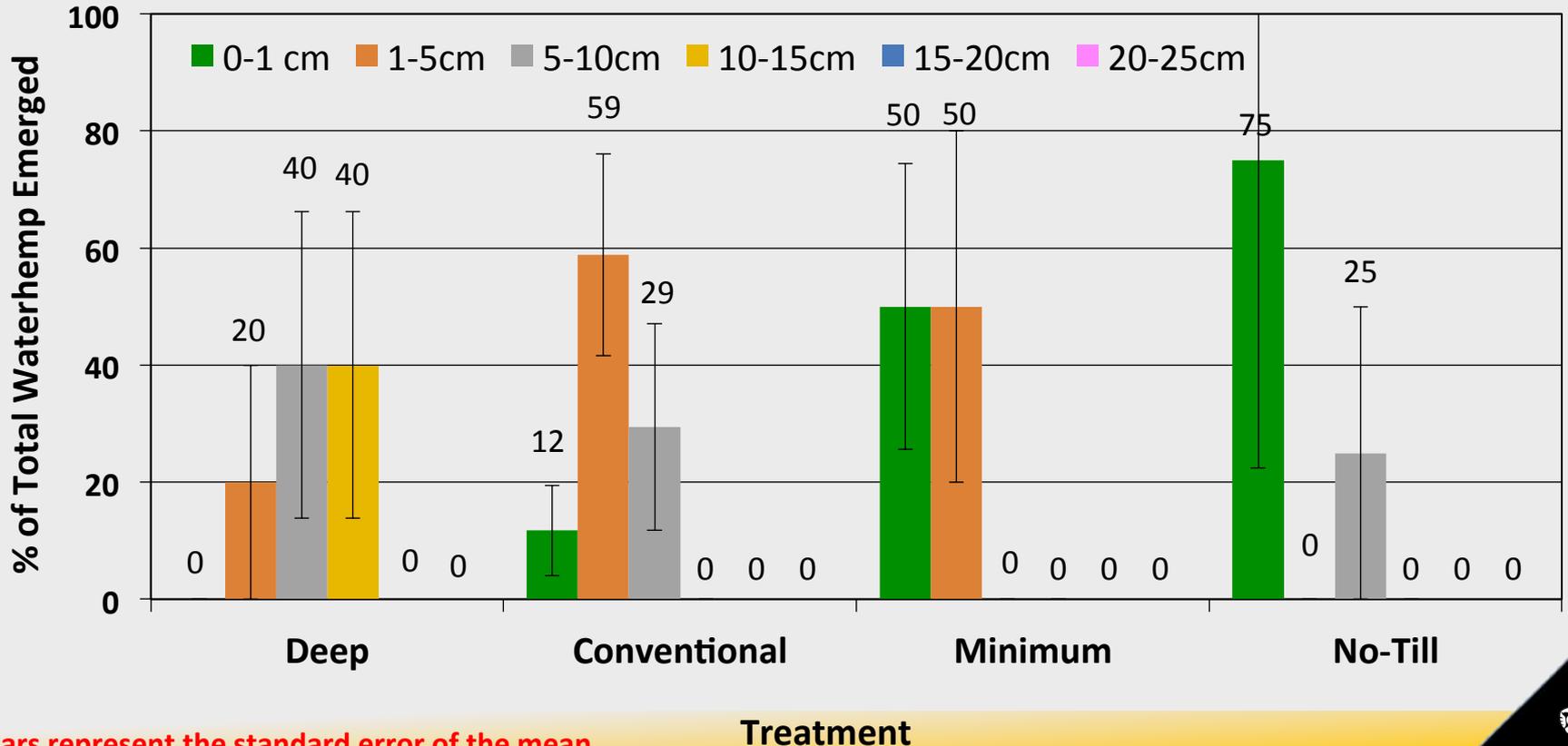
(Moberly, Missouri)



\*Bars represent the standard error of the mean.



# Percentage Of Waterhemp Emerged By Depth (Belleville, Illinois)



\*Bars represent the standard error of the mean.

Treatment



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

Tillage Type	Depth in the Soil Profile		
	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!

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