Need for New Control Methods to Address Resistant Weeds

University of Tennessee

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Glyphosate-Resistant Weeds

Tennessee

- ***Conyza canadensis*** **(horseweed)**
- ***Amaranthus palmeri*** **(Palmer amaranth)**
- ***Ambrosia trifida*** **(giant ragweed)**
- ***Amaranthus tuberculatus*** **(common waterhemp)**
- ***Lolium multiflorum*** **(Italian ryegrass)**
- ***Sorghum halepense*** **(Johnsongrass)**
- ***Poa annua*** **(annual bluegrass)**
- ***Eleusine indica*** **(Goosegrass)**
- **Echnichloa (barnyardgrass or junglerice)**

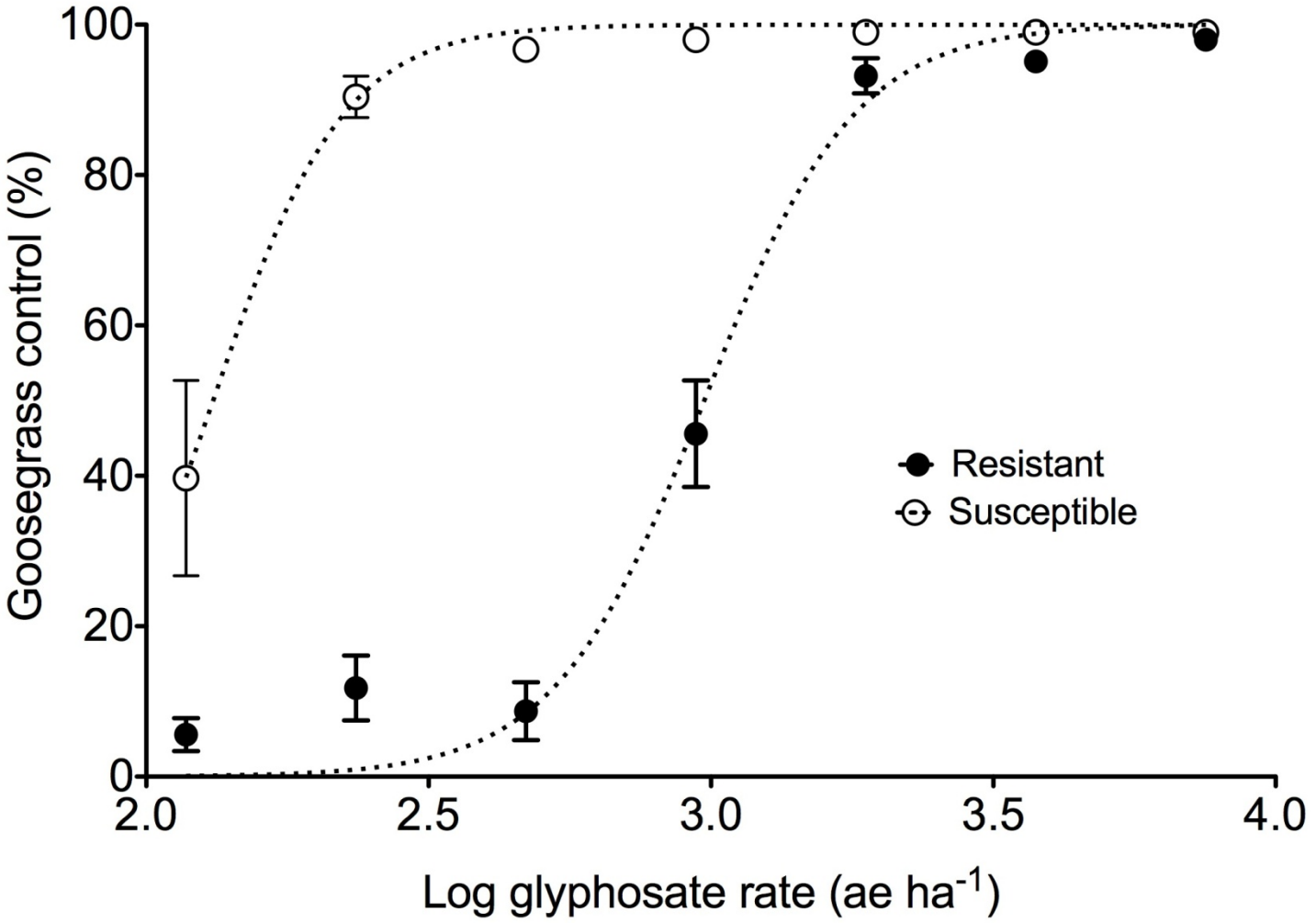
Herbicide Resistance in Weedy Grass Species in Tennessee has quietly become an serious issue for corn, cotton and soybean growers

- Glyphosate-resistant goosegrass and Johnsongrass have started changing weed management
- Barnyardgrass in 2 counties has become a problem
- Glyphosate and ALS-resistant Italian ryegrass are also causing significant issues in no-till

Glyphosate-Resistant Goosegrass

Glufosinate Early Post fb 2 Glyphosate Apps

Confirmation of GR Goosegrass



Mueller et al. 2011

GR Goosegrass Control 21 DAA

GR Johnsongrass

44oz/A Roundup PowerMax

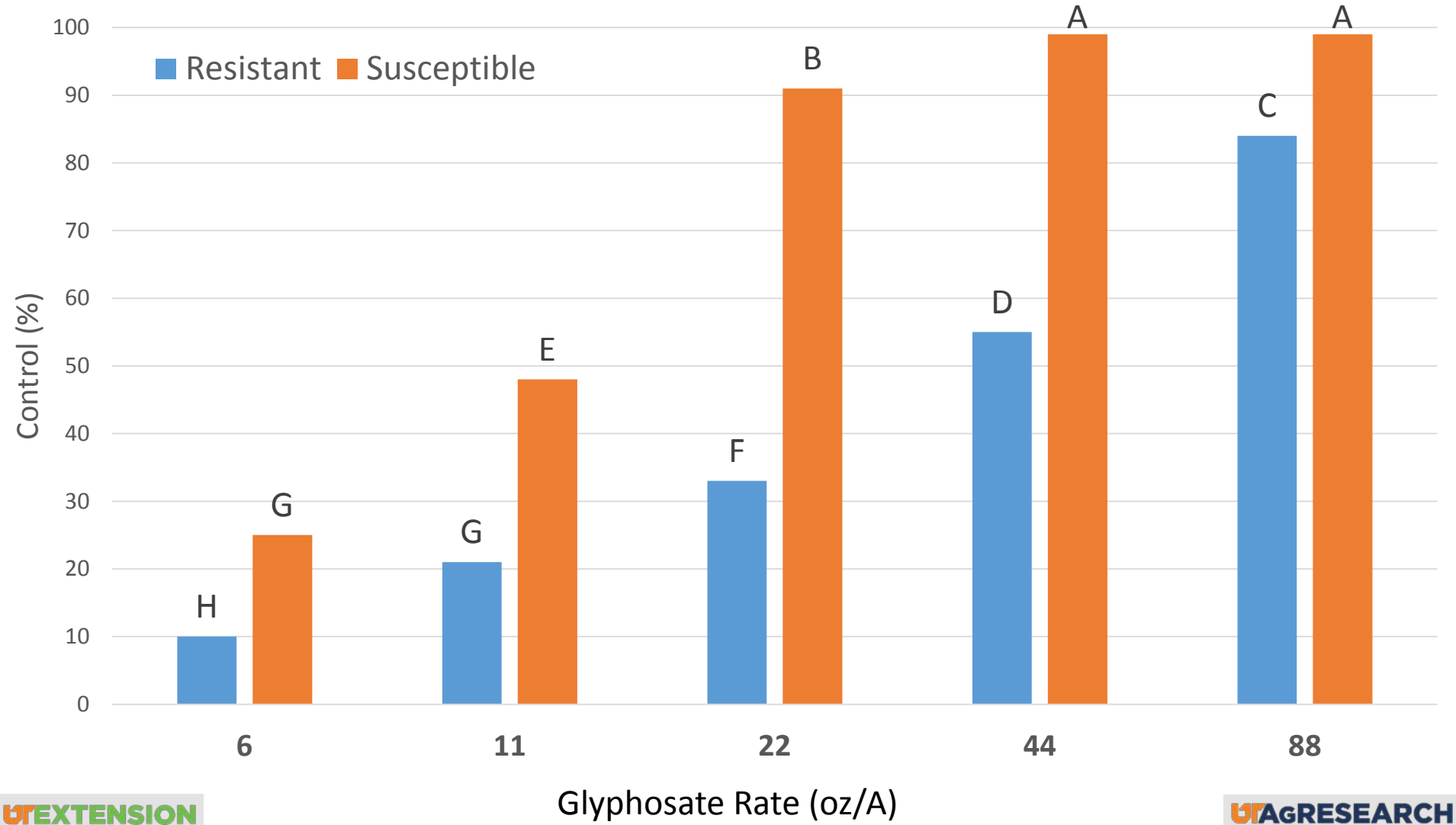
32oz/A Roundup PowerMax + 16 oz/A Select Max Burndown

Steckel 2016

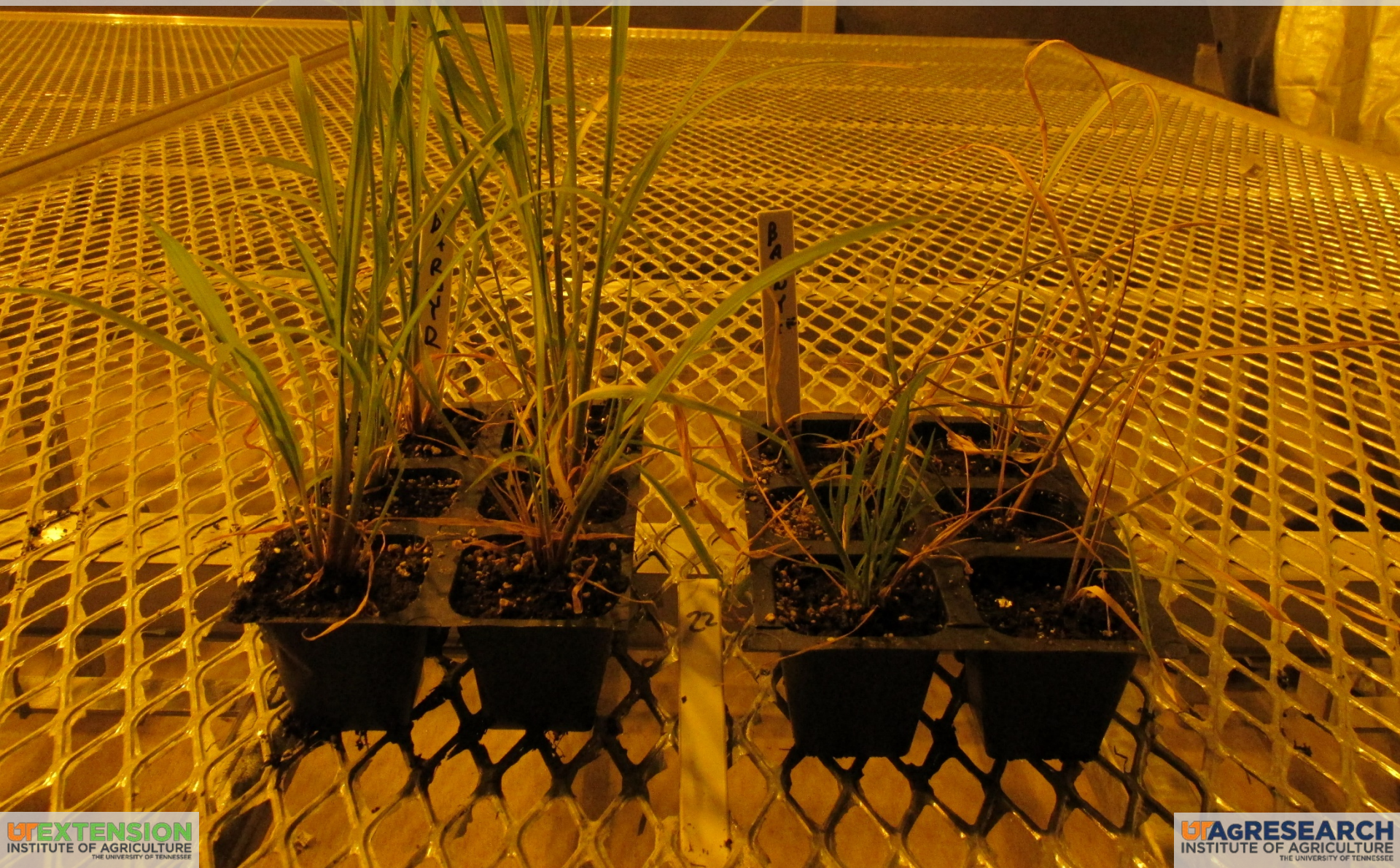
Barnyardgrass Burndown with 32 oz/A Roundup PowerMax + 10 oz/A Clarity

2015

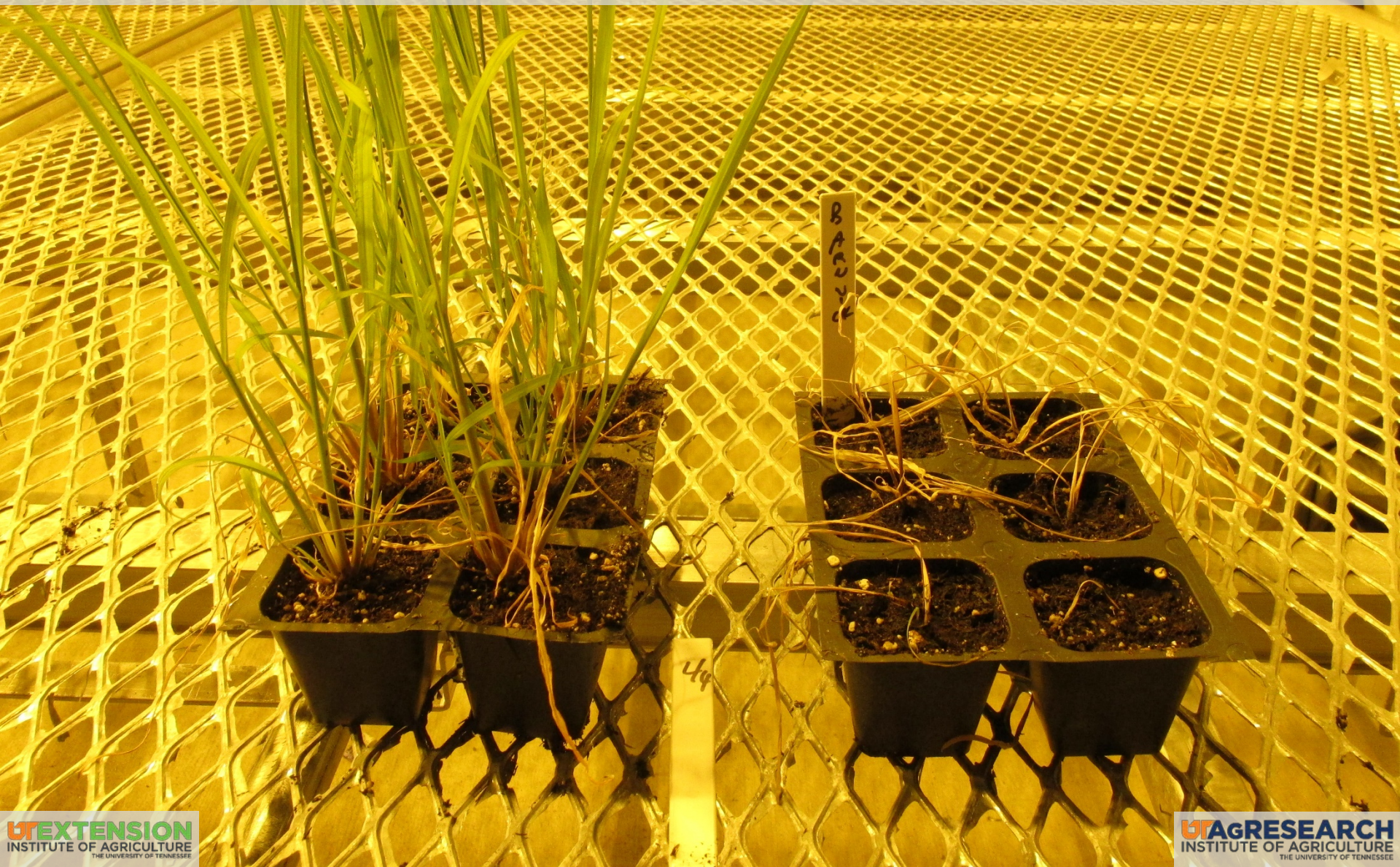
Barnyardgrass Initial Assessment



Barnyardgrass Treated with Equivalent 22 oz/A Roundup PowerMax



Barnyardgrass Treated with Equivalent 44 oz/A Roundup PowerMax



Echinochloa Species (Barnyard Grass or Jungle Rice) Just Confirmed Glyphosate-Resistant

- **TN: mechanism of resistance is here to for unknown (reduced translocation) about - 4x glyphosate**

- **MS: mechanism of resistance is site mutation about - 2x glyphosate**

Clethodim and Glyphosate – Resistant Ryegrass In Mississippi

Glyphosate – Resistant Ryegrass

Steckel 2012

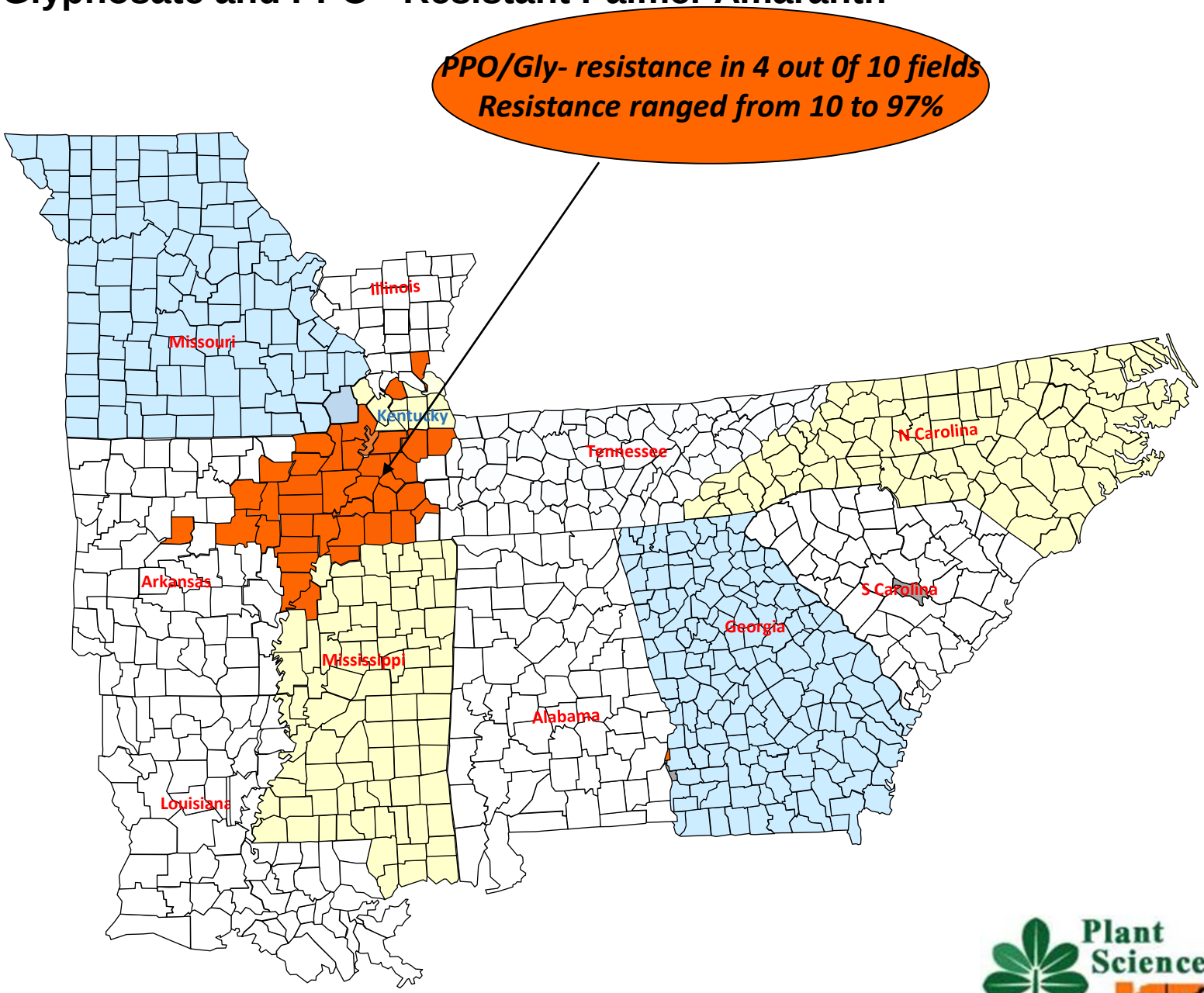
UTEXTENSION
INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

Glyphosate-Resistant Weed Species

- New auxin technologies will not help manage glyphosate-resistant grass species
- Rather: new auxin technologies will likely speed up development of glyphosate-resistant grass species
- Over reliance on clethodim is a major concern!!!

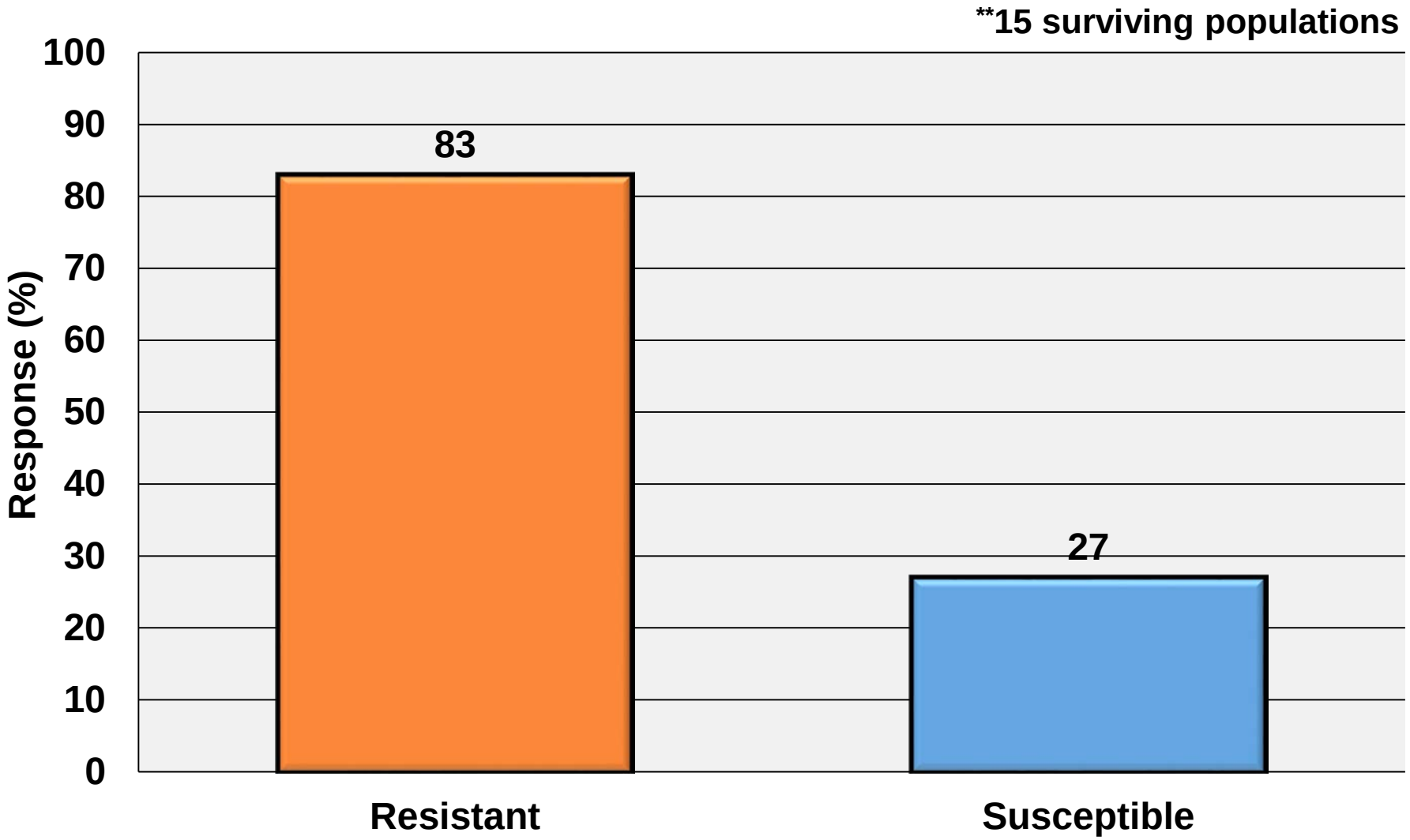

Valor 2 oz PRE fb/1.5 pt FlexStar + 32 ozs Glyphosate on 2” Palmer
Roundup Ready System
UTEXTENSION
INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

Glyphosate and PPO - Resistant Palmer Amaranth

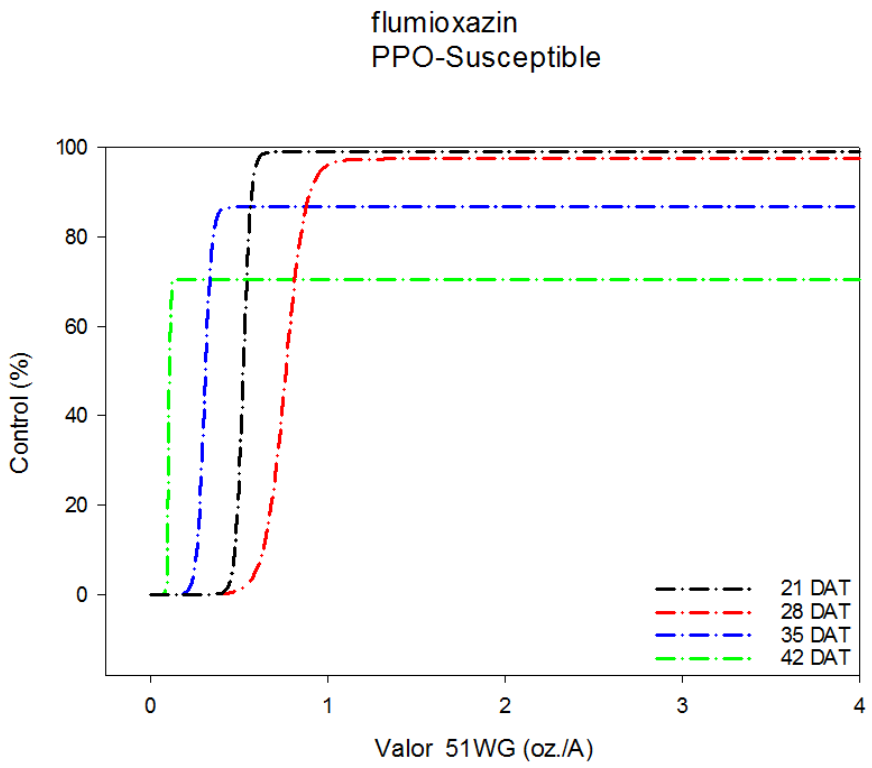


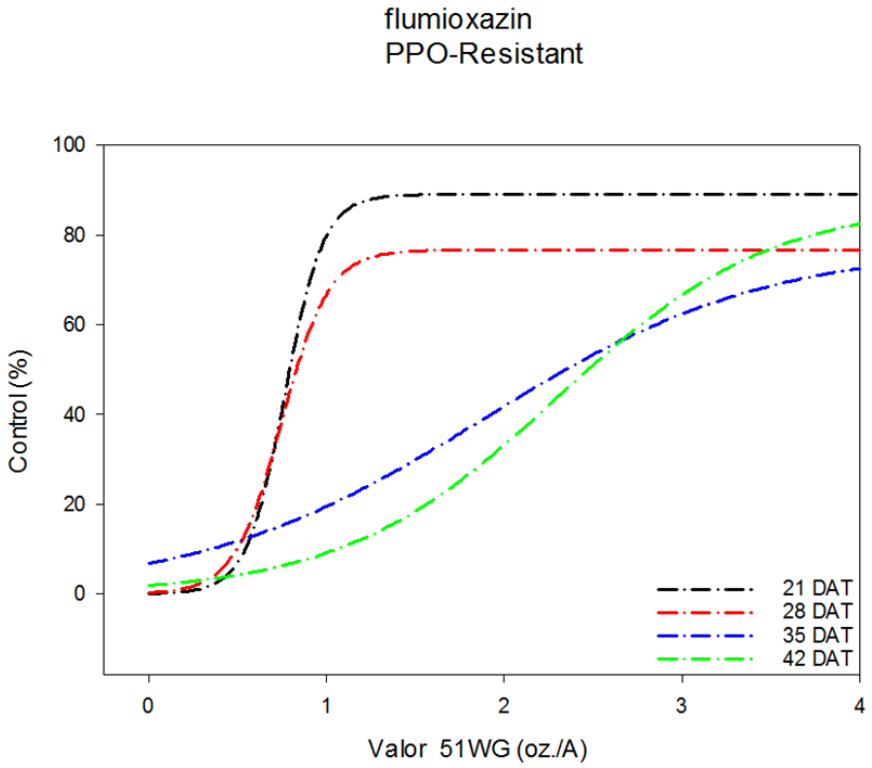
Plant Sciences

Response of Palmer amaranth from Total Screen – 2017



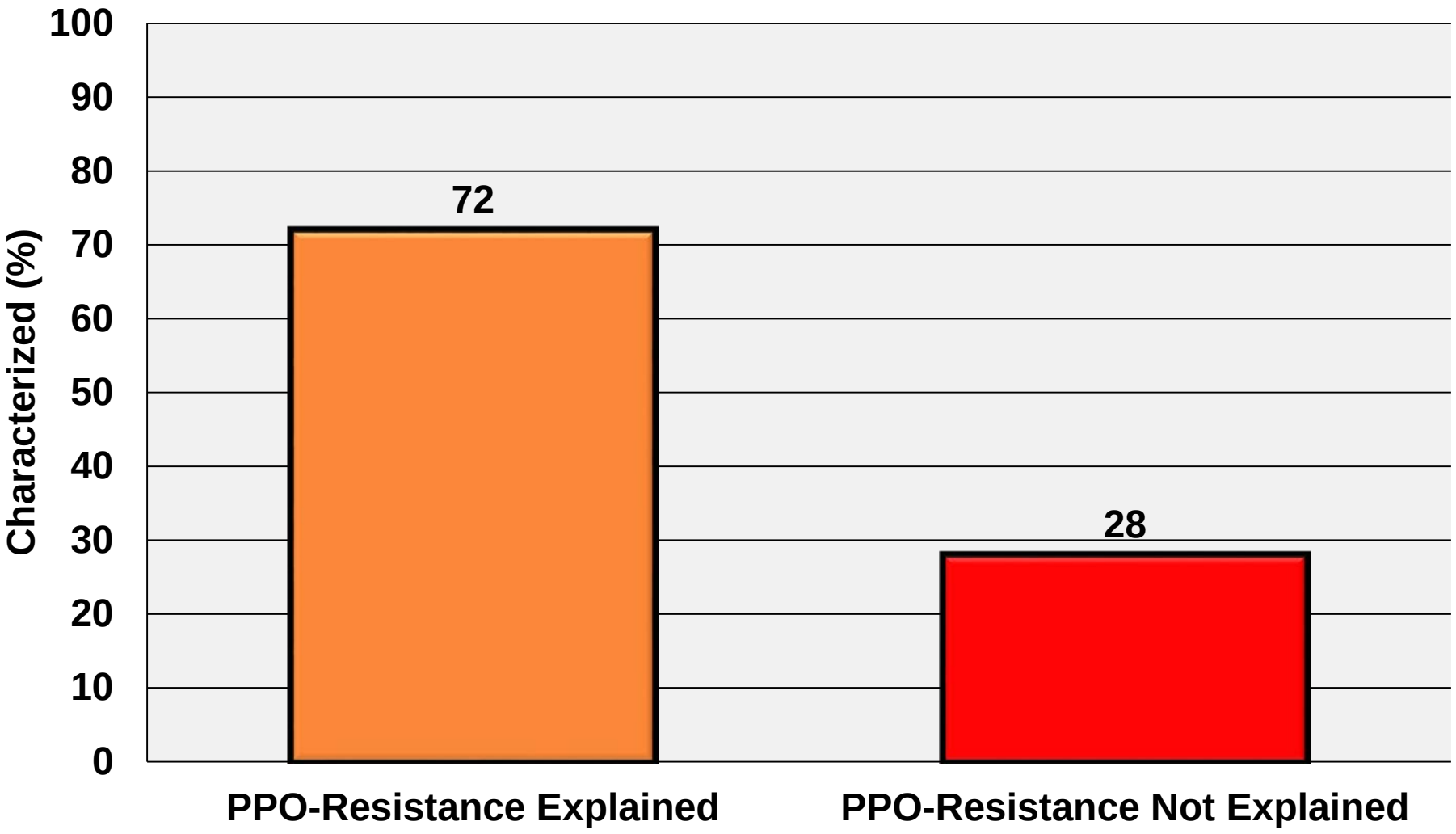
Valor Residual Palmer amaranth Control at a PPO-Susceptible Site vs PPO-Resistant Site



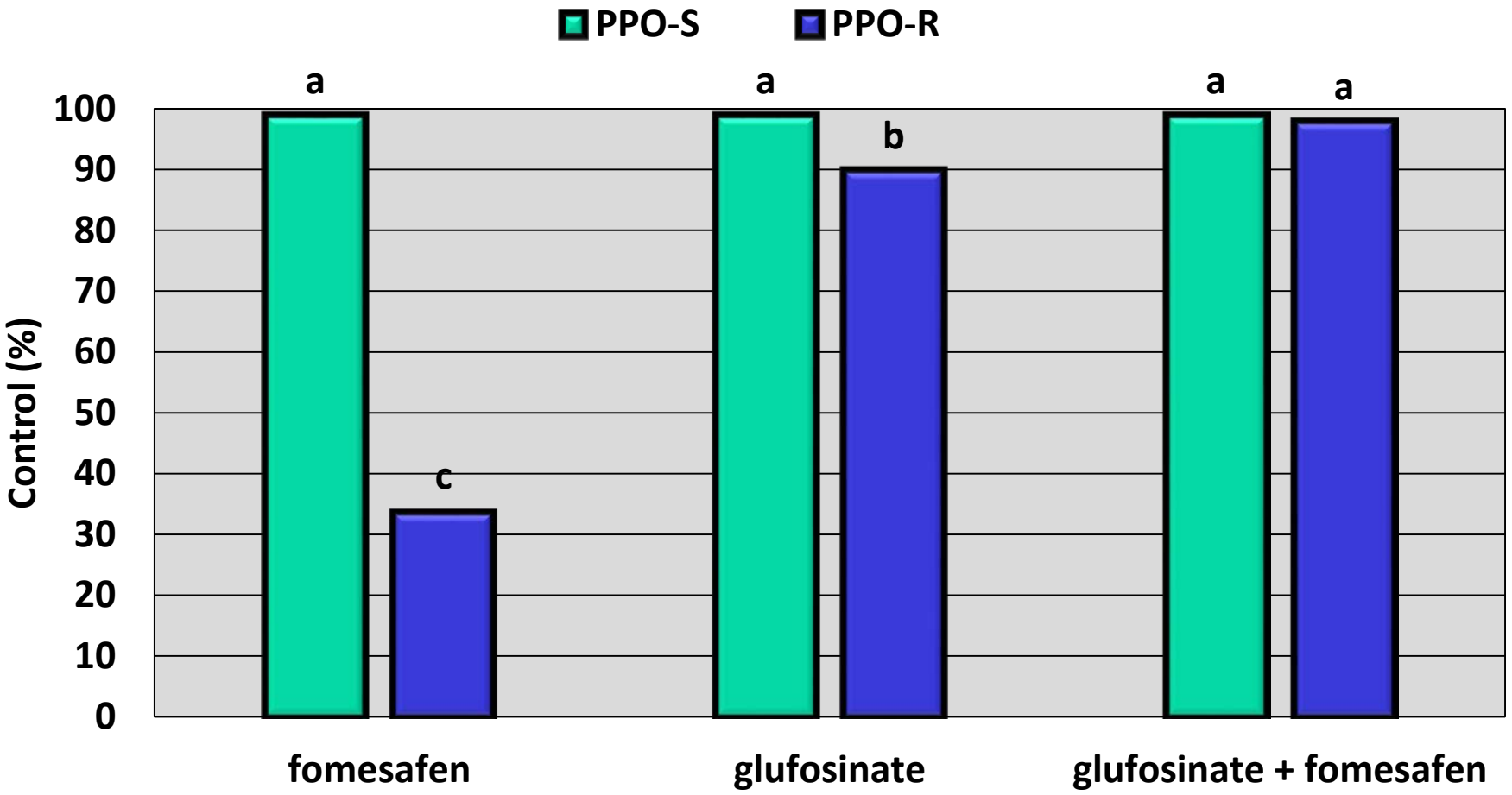


Copeland and Steckel 2017

Resistance Explained in Tennessee

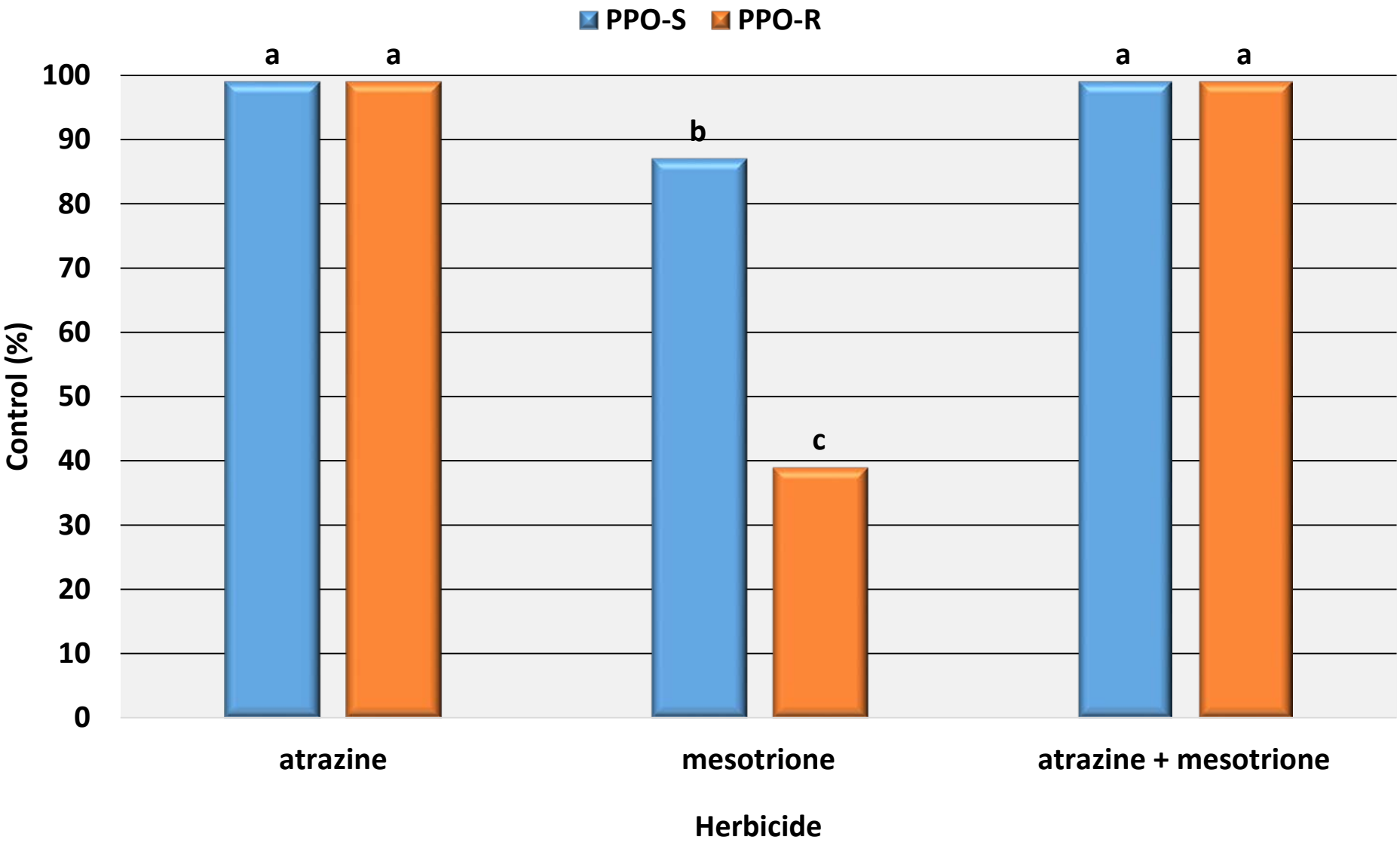


PPO-Resistant Palmer amaranth: LibertyLink System

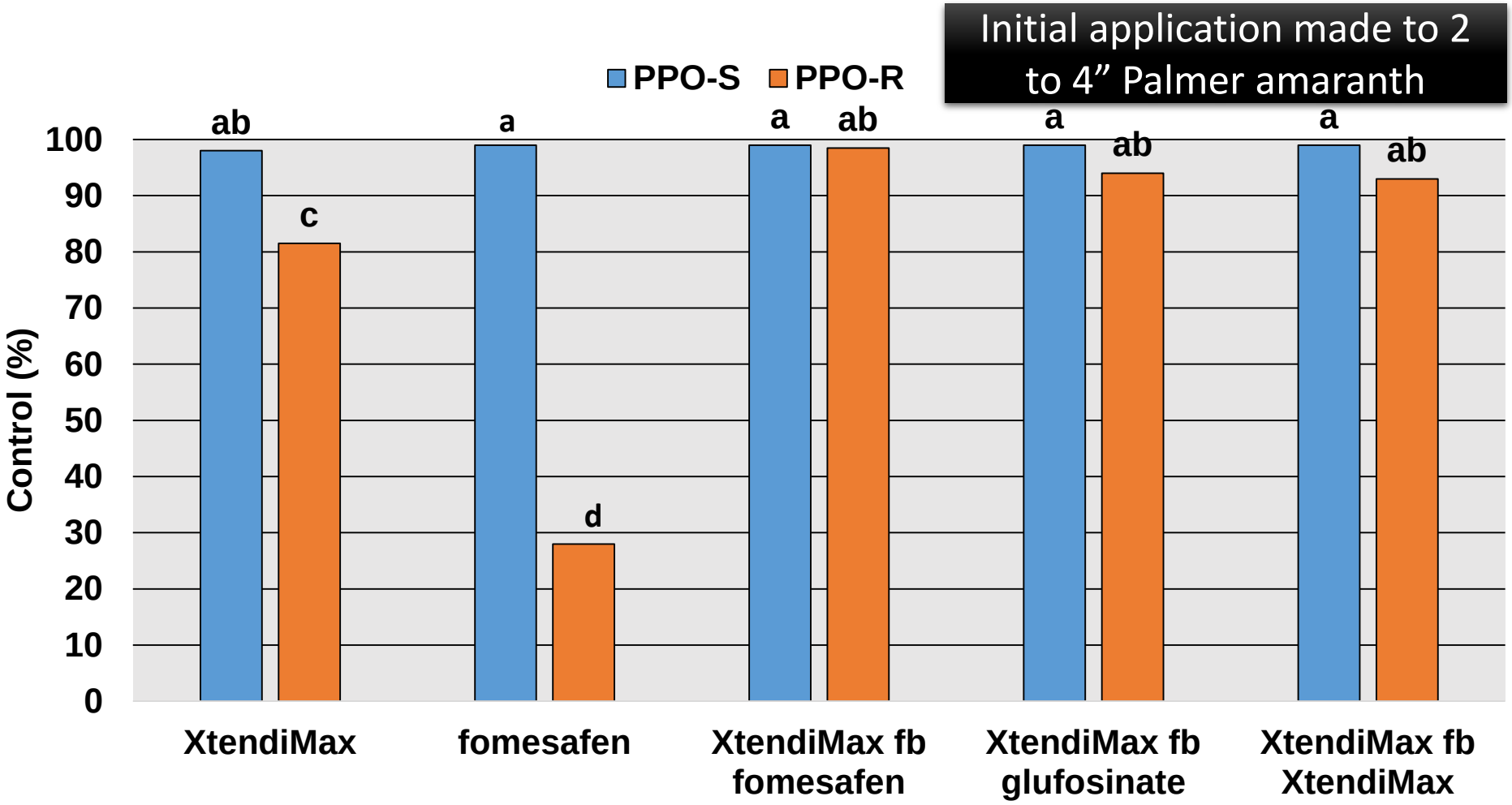


Copeland and Steckel 2017

PPO-Resistant Palmer amaranth: Corn System 21 DAT



PPO-Resistant Palmer amaranth: Xtend System 21 DAT



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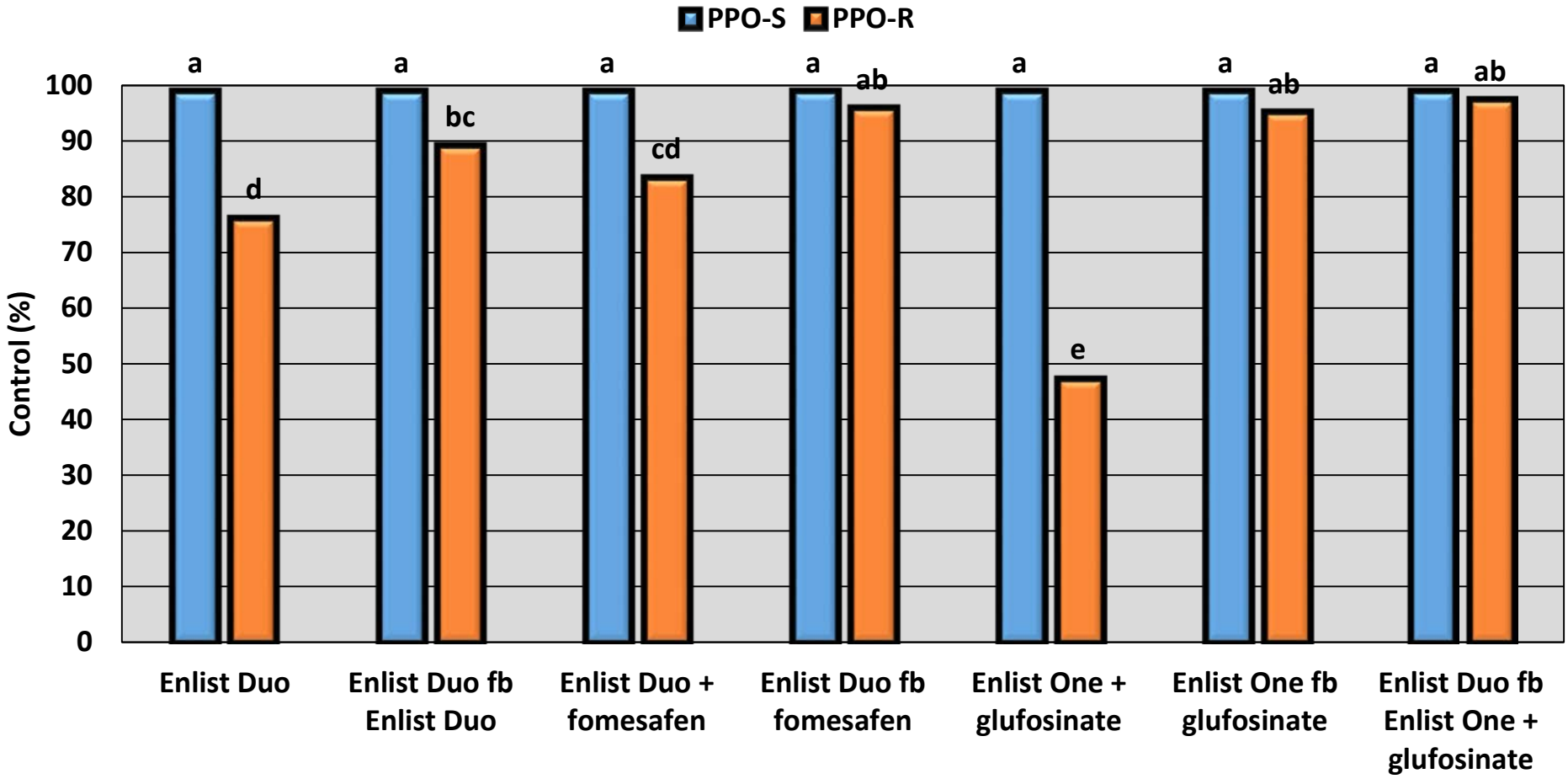
Picture taken 6/14

Sprayed 6/7

Palmer amaranth growth after 22 oz/A of Xtendimax

Grew 0.6”/day

PPO-Resistant Palmer amaranth: Enlist System



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Dual Magnum Residual Palmer amaranth Control at a PPO-Susceptible Site vs PPO-Resistant Site

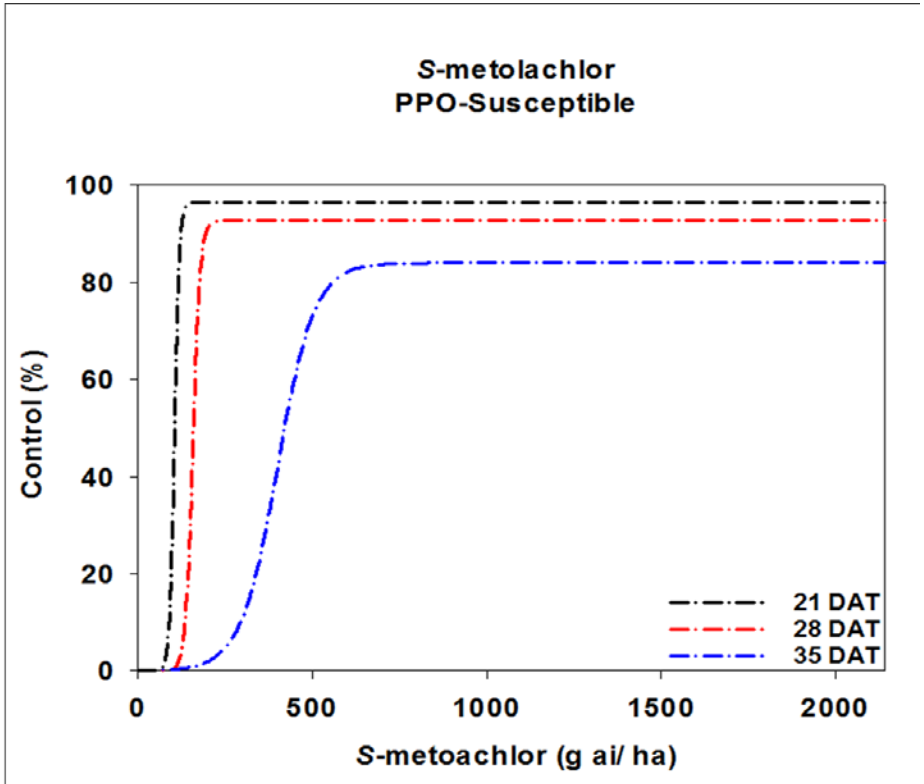


Figure 8. Percent control of PPO-S as affected by rate of *S*-metolachlor.

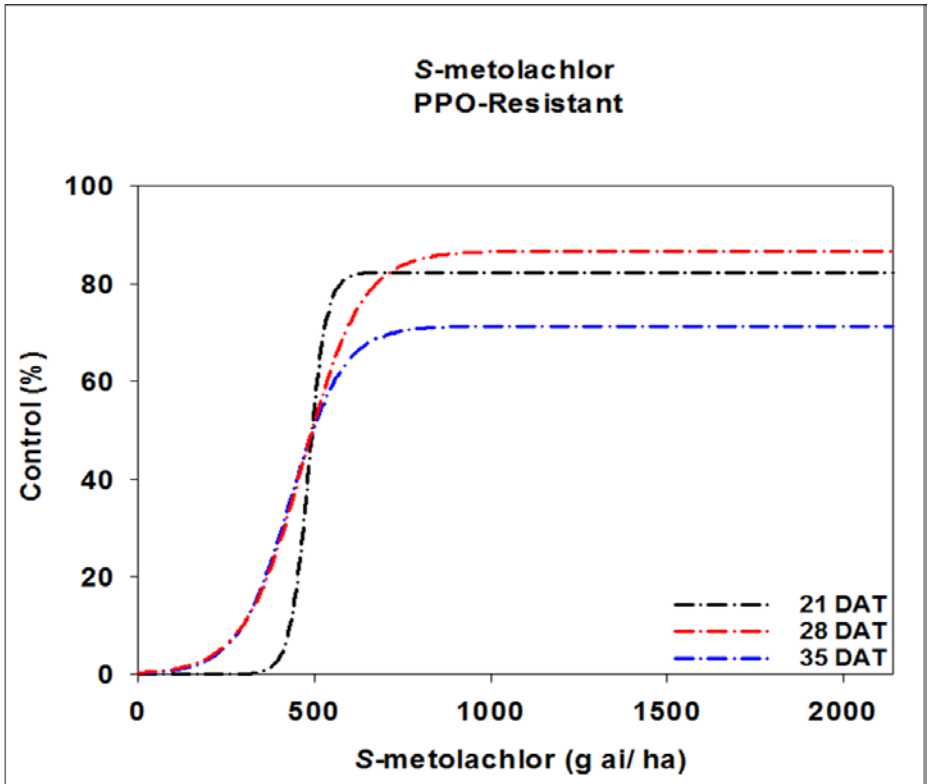


Figure 7. Percent control of PPO-S as affected by rate of *S*-metolachlor.

Copeland and Steckel 2017

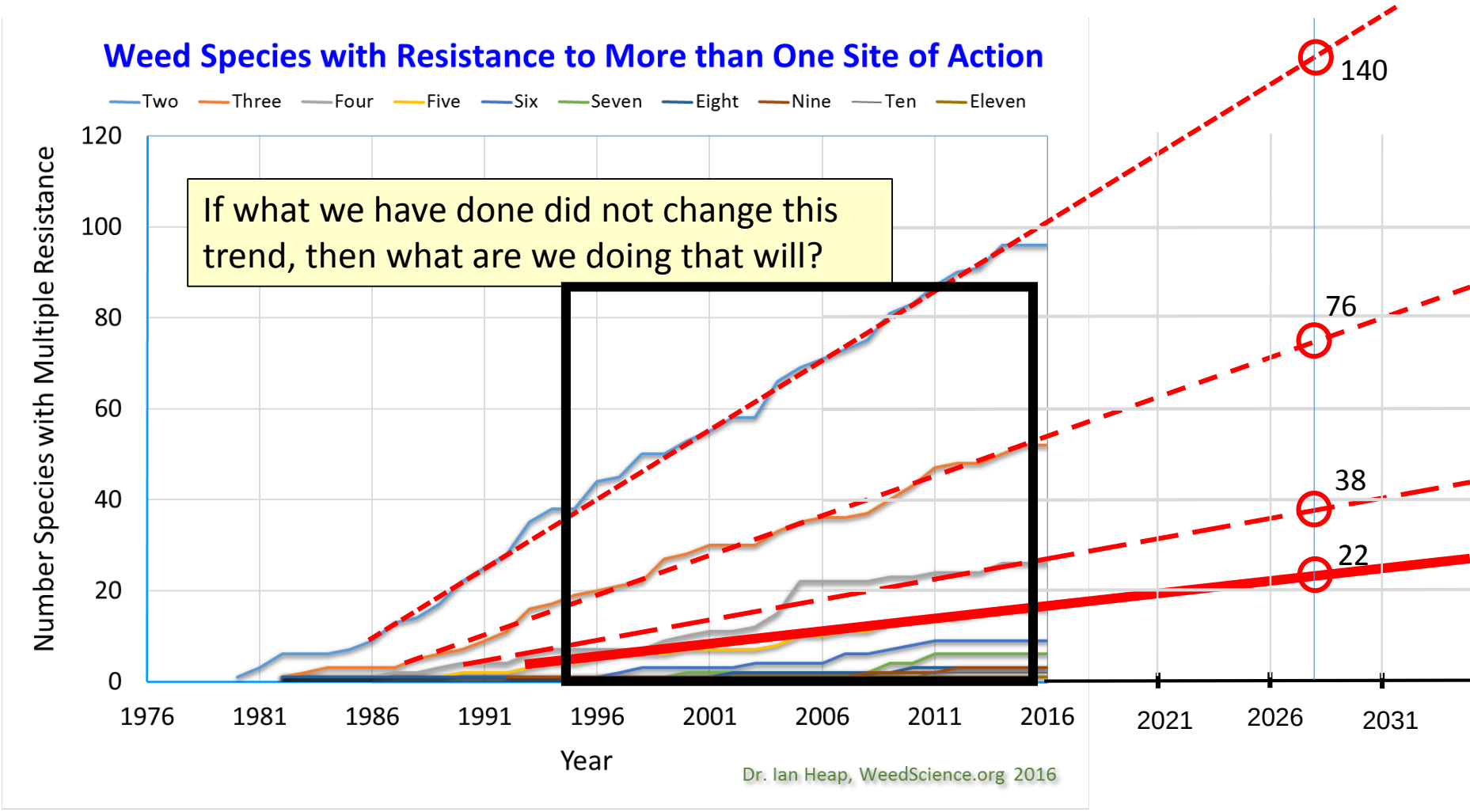
Palmer Amaranth Resistance Status in TN

- Most populations are glyphosate and PPO and ALS-Resistant
- Some are also resistant to DNA herbicides
- At least at one location that has Palmer resistant to all the above herbicides - recent research would suggest added tolerance to:
  - HPPD, acidanilide, glufosinate and auxin herbicides
  - Definitely smoke… is it metabolic resistant?

Multiple or Stacked Herbicide-Resistant Weeds

Tennessee

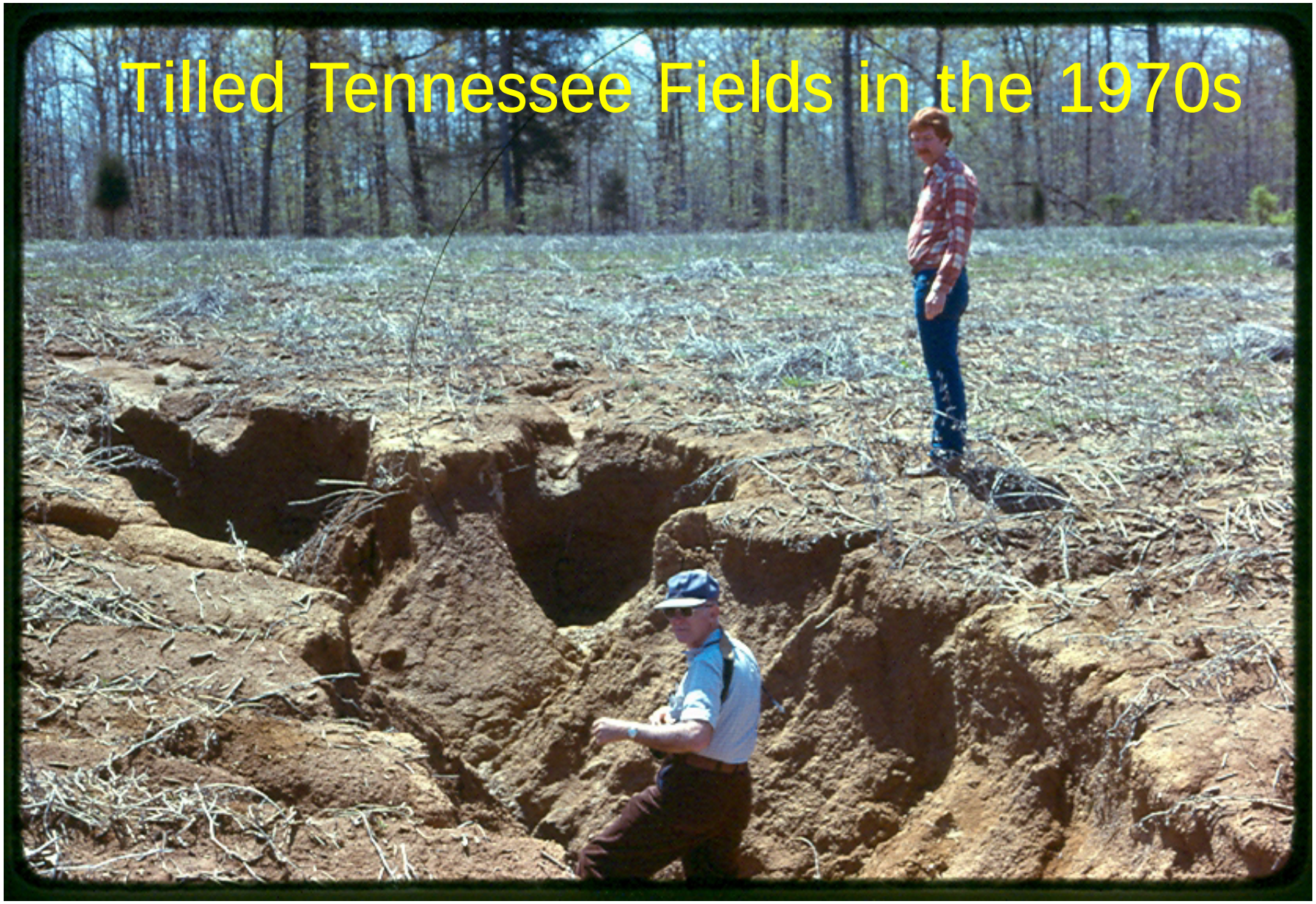
- ***Conyza canadensis*** **(Group 2, 9)**
- ***Amaranthus palmeri*** **(Group 2, 9, 14 and some 3)**
- ***Amaranthus tuberculatus*** **(Group 2, 9, 14)**
- ***Lolium multiflorum*** **(Group 2, 9 and 1 reported in MS)**
- ***Poa annua*** **(Group 2, 3, 5, 9)**
- ***Eleusine indica*** **(3, 9)**


Weed Species with Resistance to More than One Site of Action
Two
Three
Four
Five
Six
Seven
Eight
Nine
Ten
Eleven
Number Species with Multiple Resistance
120
100
80
60
40
20
0
If what we have done did not change this trend, then what are we doing that will?
140
76
38
22
1976
1981
1986
1991
1996
2001
2006
2011
2016
2021
2026
2031
Year
Dr. Ian Heap, WeedScience.org 2016

What Can Be Done Different???

- Use multiple effective herbicide modes of action…
- Integrate weed management tactics that do not come out of a jug!!!
  - Tillage, narrow row width, crop rotation, cover crops
- Hope for a new weed management TOOL!!!

Cover Crops


Tilled Tennessee Fields in the 1970s

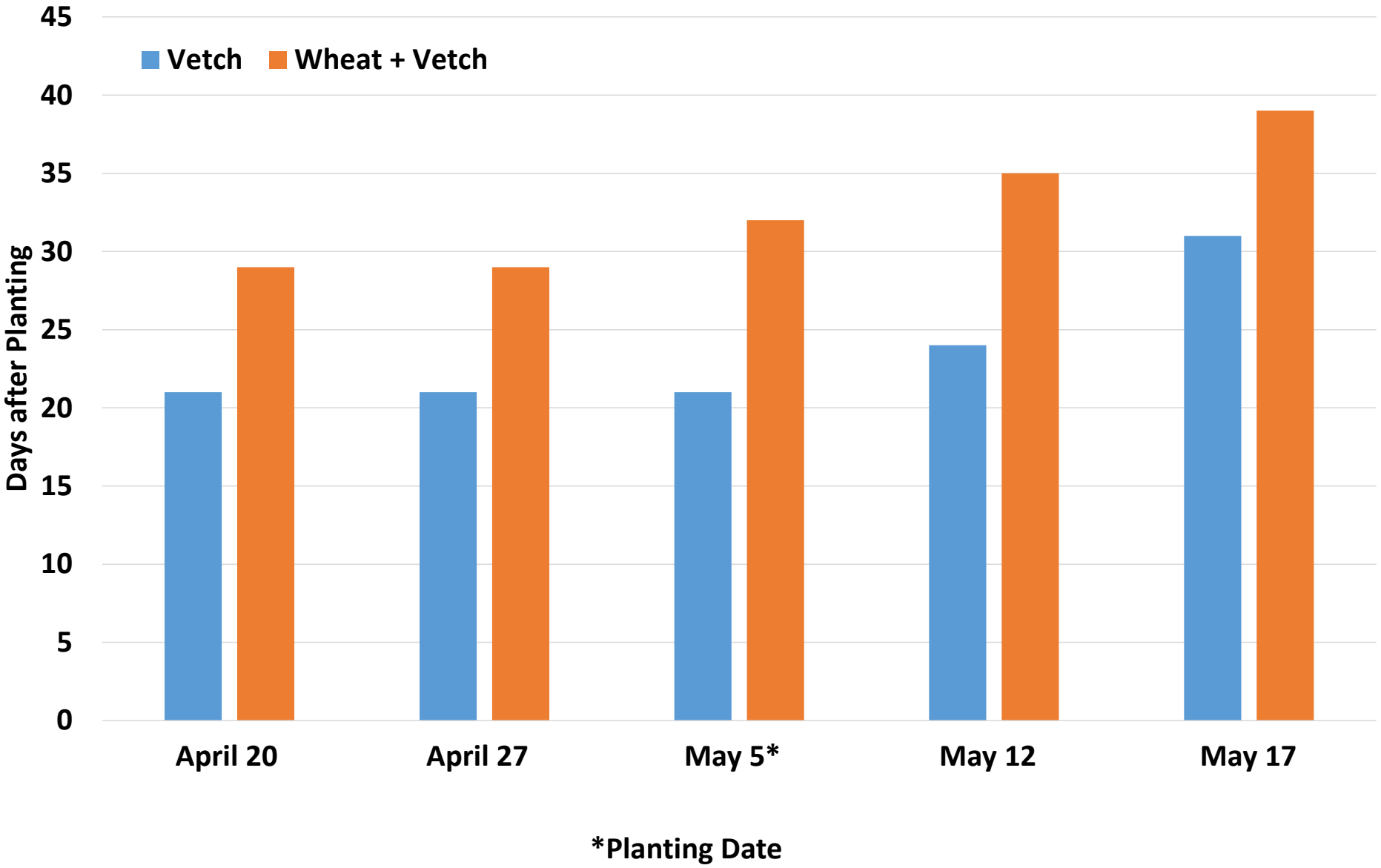

Tillage in Tennessee is not an Option!!!

Robust Cover Crop Needed for Pigweeds

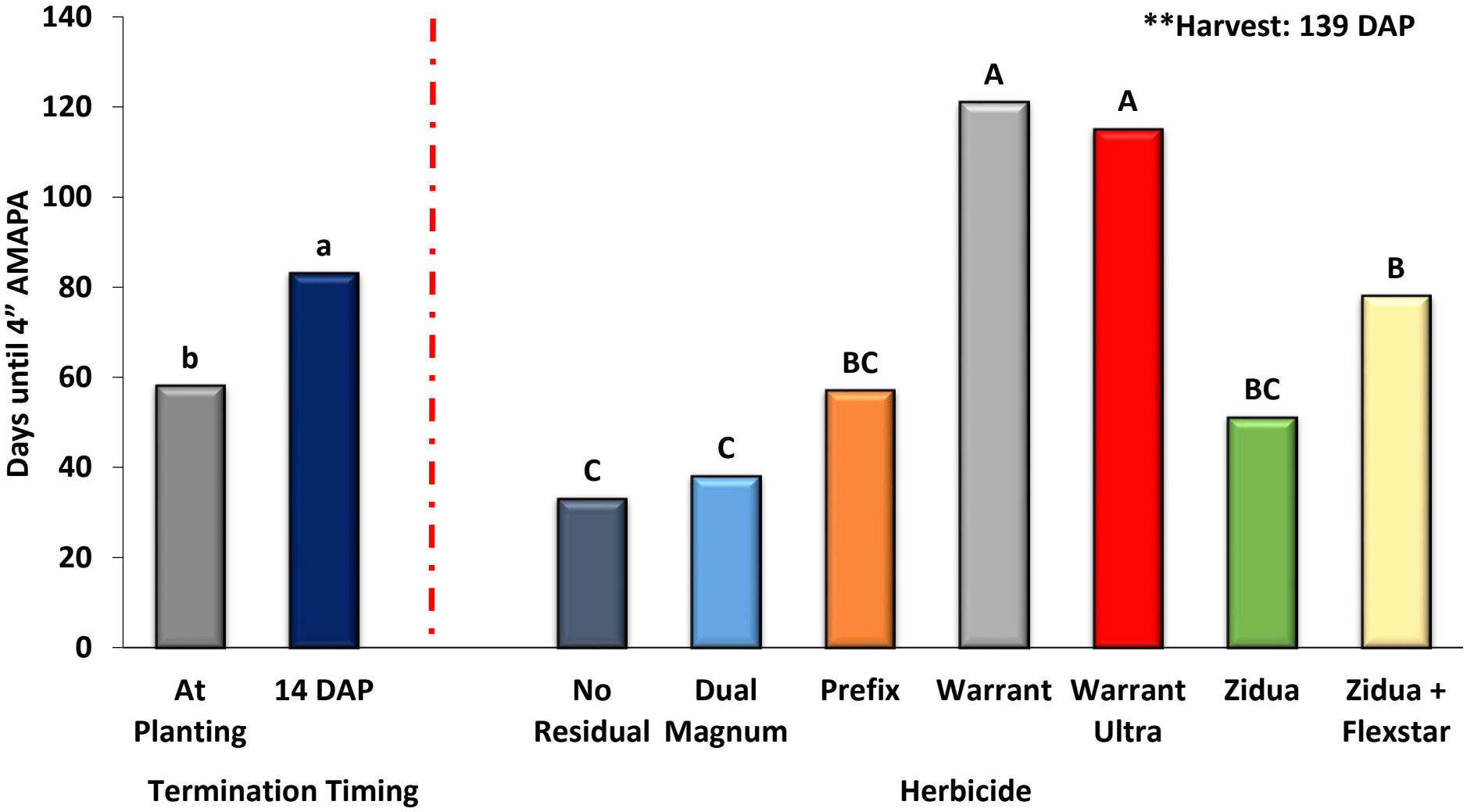
“Planting Green”


Cover Terminated 14 DAP
Roundup Xtend Soybeans
Steckel 2015

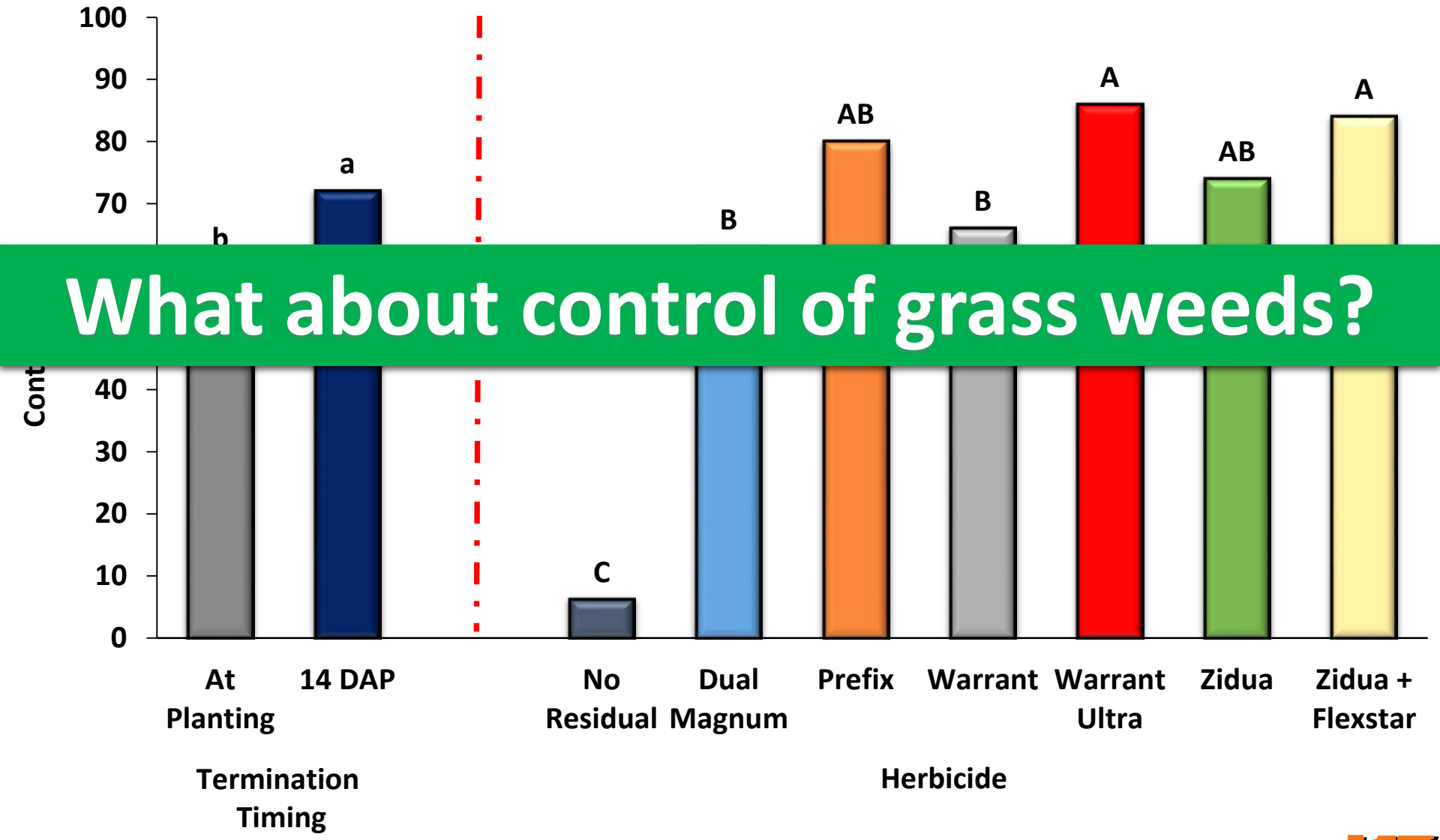
Days Until 4” Palmer amaranth



Main effects of Termination Timing and Herbicide on Days until 4” AMAPA

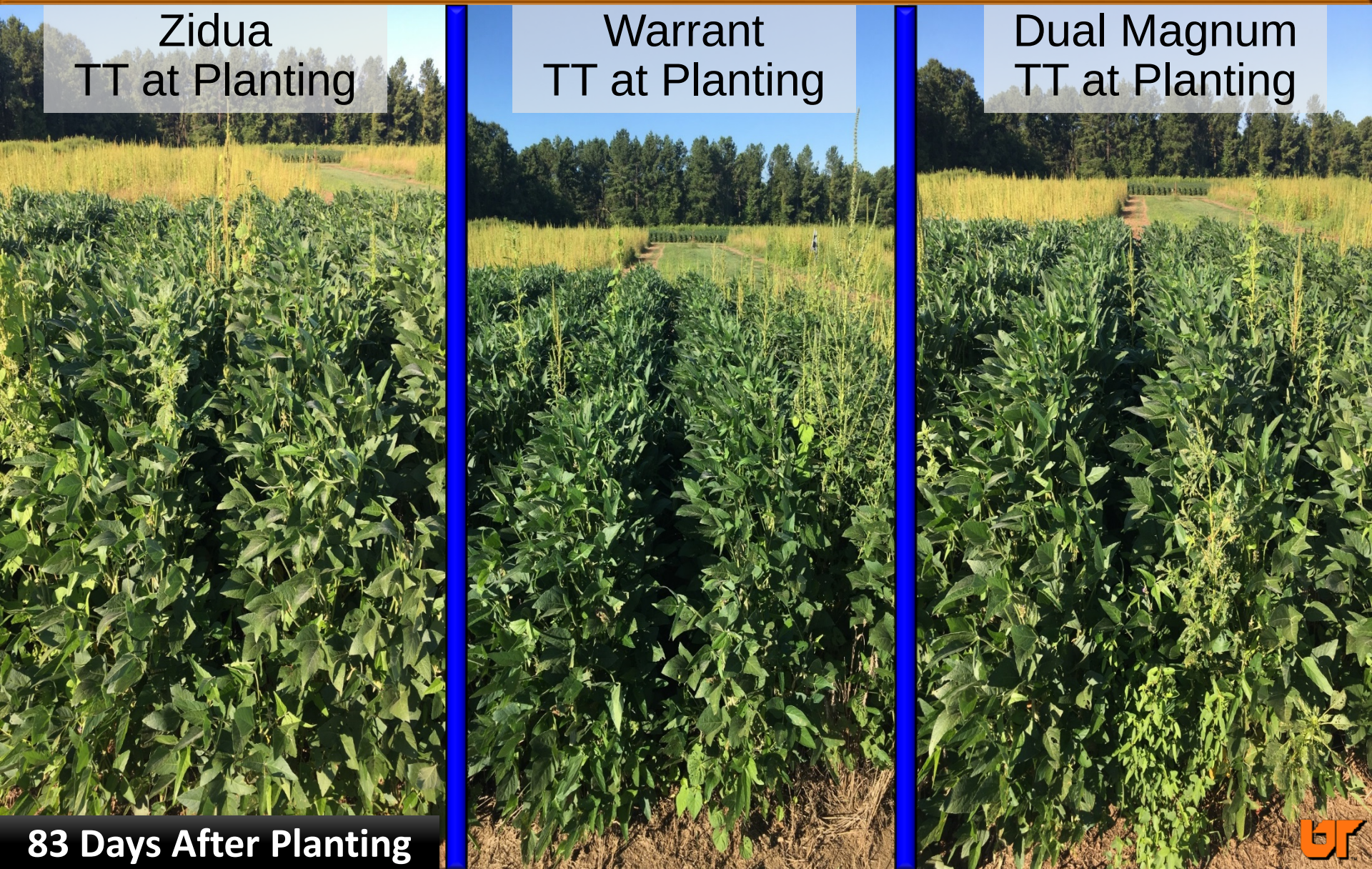


Main effects of Termination Timing and Herbicide on ELEIN Control At R1

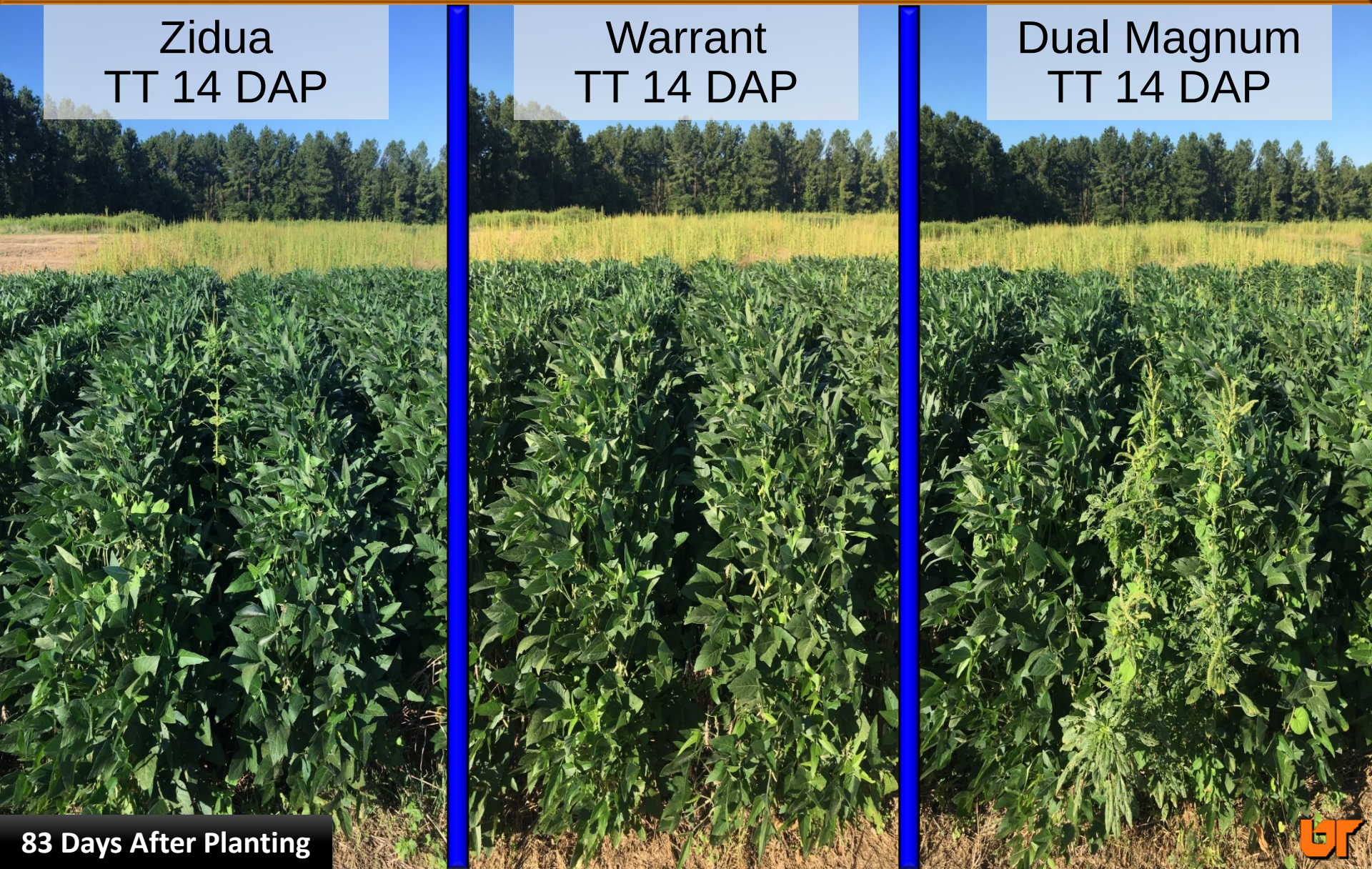


What about control of grass weeds?

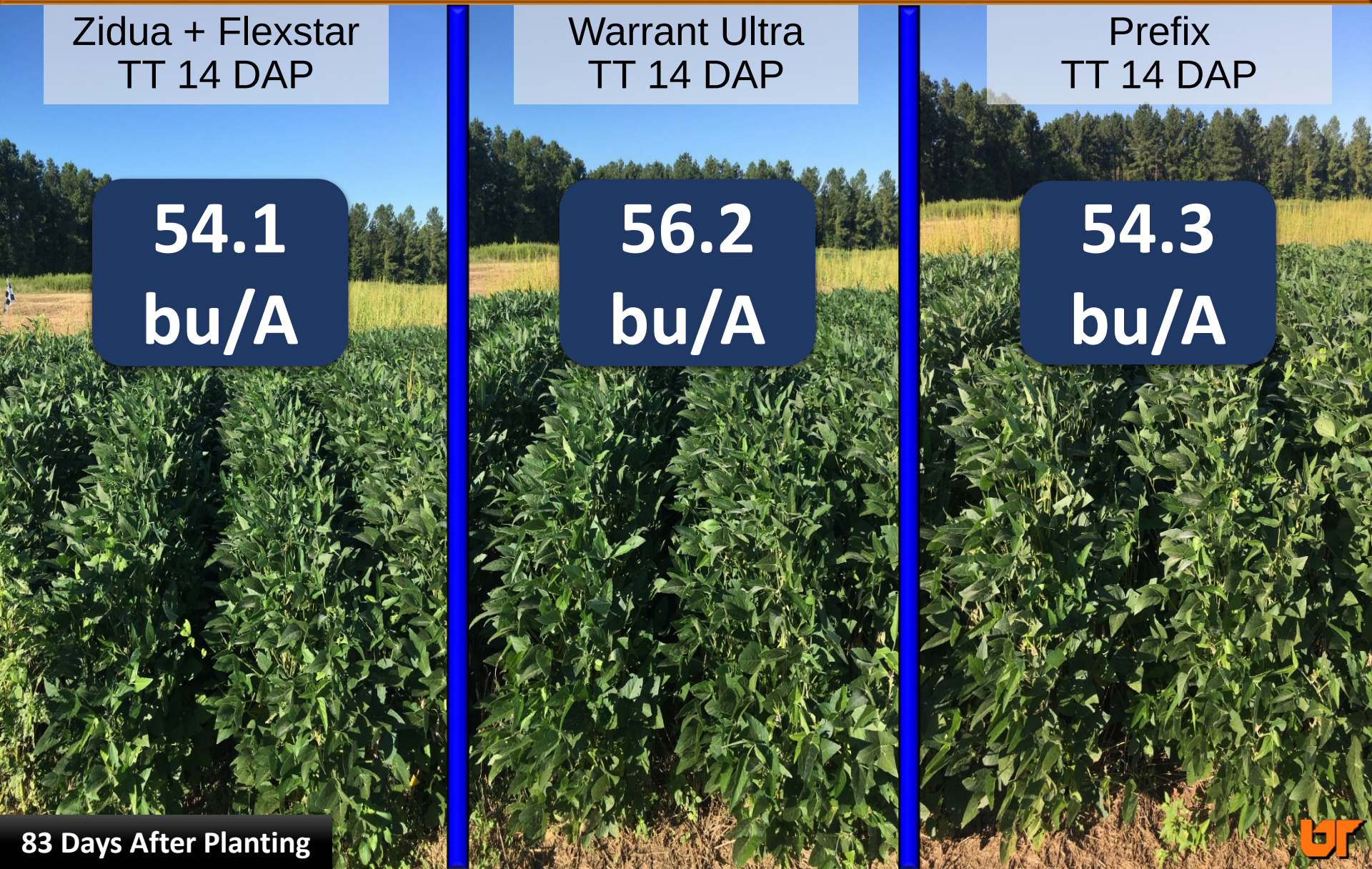
XtendiMax + Roundup PM +…



XtendiMax + Roundup PM +…



XtendiMax + Roundup PM +…



Conventional vs. Planting Green Costs

Timing	Conventional	Cover Crop "Planting Green"			
	----	Cereal Rye	Cereal Rye + Vetch	Wheat	Wheat + Clover***
Cover Crop Planting	----	$26.40	$74.40	$8.00	$15.75
Prior to Planting	$17.00 (RPM + Sterling Blue + Verdict + MSO)	----	----	----	----
At Planting	$28.00 (Gramoxone + Boundary + NIS)	----	----	----	----
EPOST	$32.00 (RPM + XtendiMax + Warrant Ultra)	$32.00 (RPM + XtendiMax + Warrant Ultra)	$32.00 (RPM + XtendiMax + Warrant Ultra)	$32.00 (RPM + XtendiMax + Warrant Ultra)	$32.00 (RPM + XtendiMax + Warrant Ultra)
MPOST	$20.00 (Select+ COC + FirstRate)	$20.00 (Select + COC + FirstRate)	$20.00 (Select + COC + FirstRate)	$20.00 (Select + COC + FirstRate)	$20.00 (Select + COC + FirstRate)
LPOST	$16.00 (RPM + XtendiMax)	----	----	----	----
Total Costs	**$113.00**	**$78.40**	**$126.40**	**$60.00**	**$67.75**

****Based on 30 inch Row Spacing**

Weed Control using Cover Crops

Goal

- Uniformity
- Biomass
- Easy to terminate
- Specific for the following cash crop

Species

- Cereal Rye – 60 lbs/A
- Wheat – 60 lbs/A
- Crimson Clover – 15 lbs/A
- Hairy Vetch – 20 lbs/A

Things to Keep in Mind

Removes cost of early burndown(s)

- Italian ryegrass and horseweed suppression

Likely will remove 1 in-season herbicide application

- Burndown(s) & Late POST application(s)

Extremely effective in newer technologies

- Enlist, Xtend & LibertyLink

NOT a silver bullet

- Other weeds (besides AMAPA) are less sensitive to cover crop management tactics


Questions?