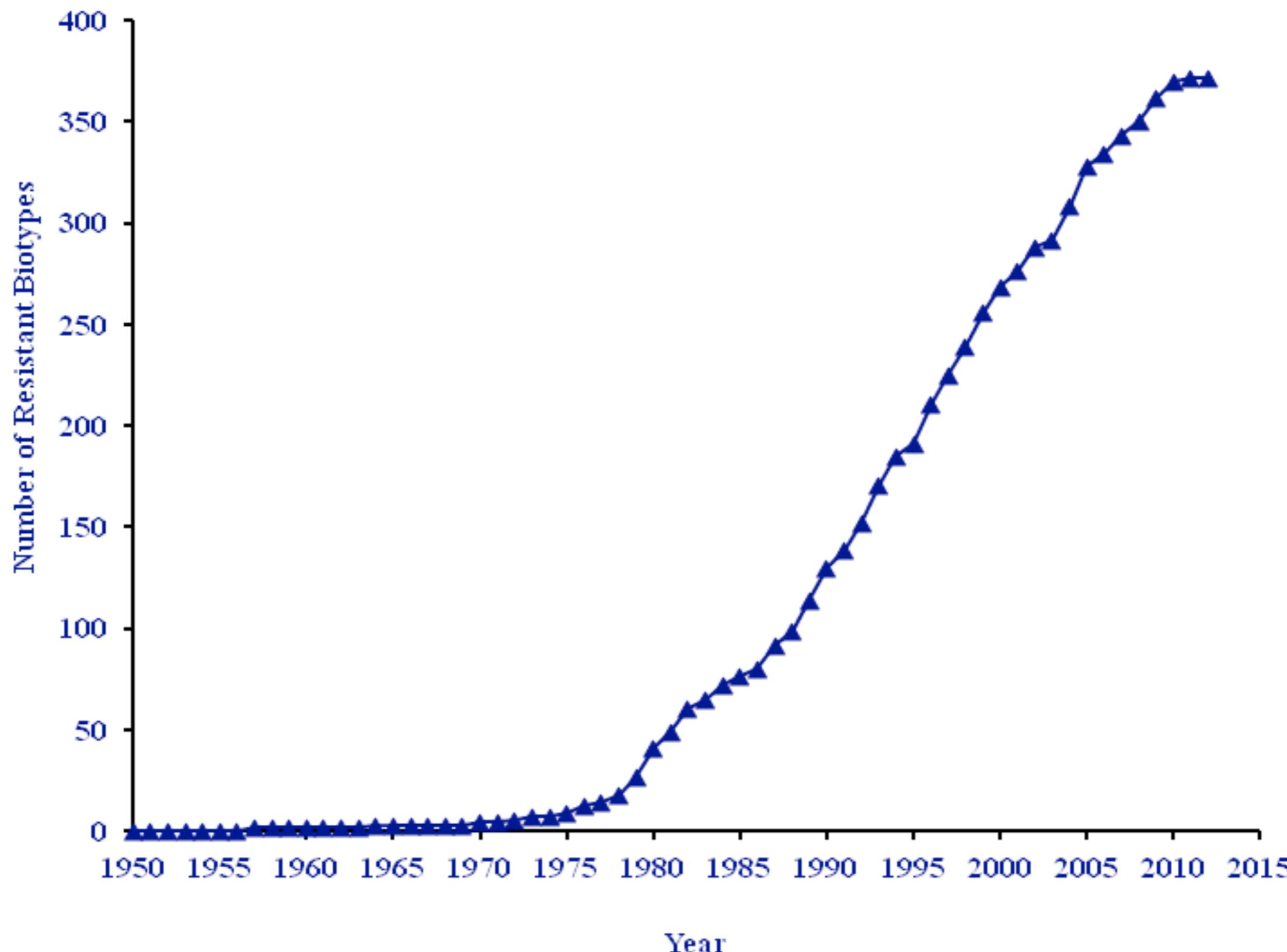


Herbicide Resistance in the Southeast: An Emerging Problem for Turf Managers

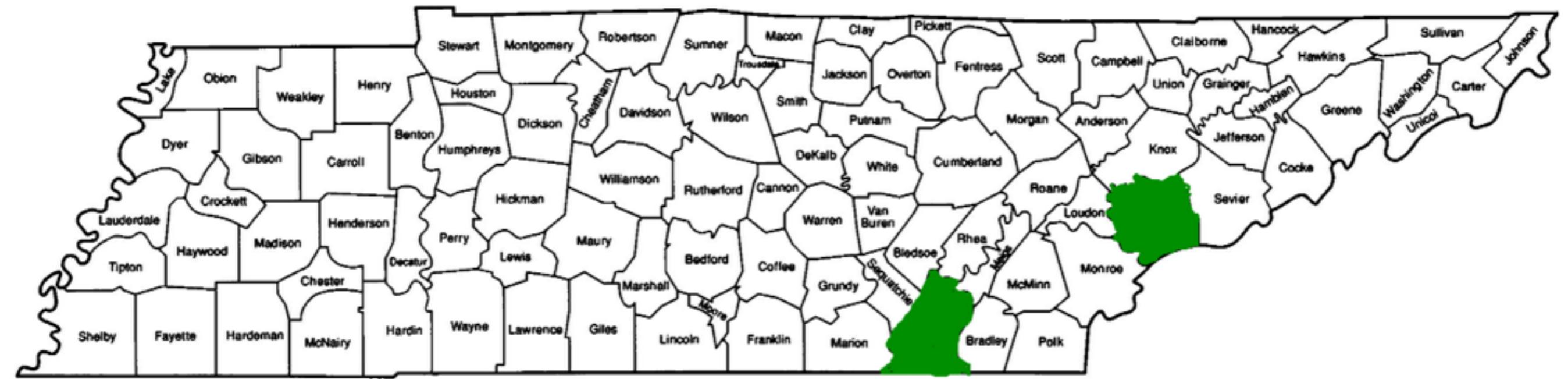
J.T. Brosnan, Ph.D.
University of Tennessee

Twitter: @UTturfweeds





Source: Ian Heap
<http://www.weedscience.com>



DNA Resistance



ALS and PSII Resistance

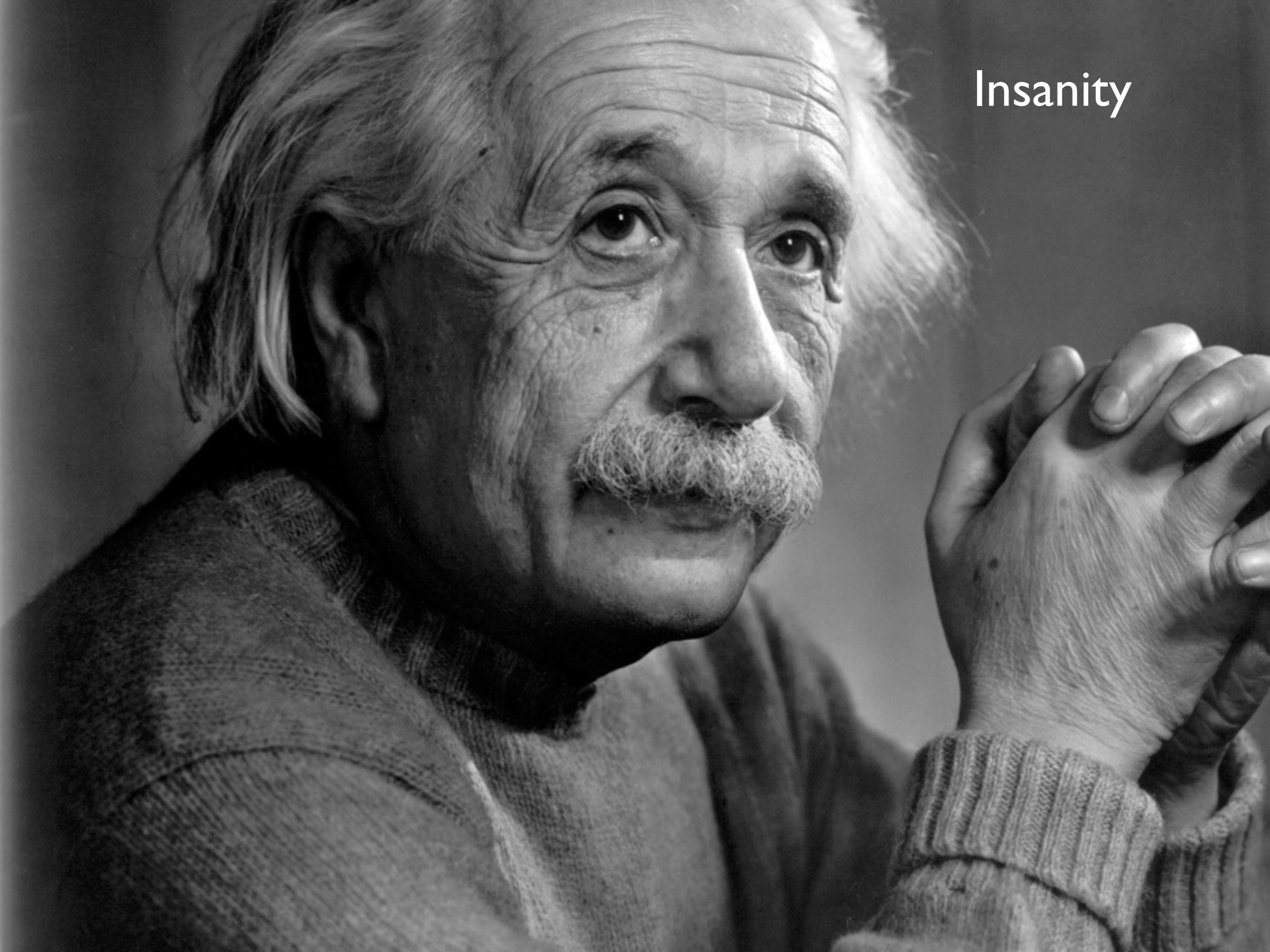


Glyphosate Resistance



Counties with Known Biotypes of Herbicide Resistant Annual Bluegrass - Spring 2014





Insanity



Doug Duffer













Roundup + Barricade in Early Spring



What happened?





The image shows a wide expanse of dry, brown grass. There are several small, irregular patches of green grass scattered across the field, most notably one in the lower-left quadrant and another in the upper-right quadrant. A single, small, light-colored object, possibly a cigarette butt, is visible on the right side of the frame.

The following spring



Glyphosate 21 DAT



The following summer



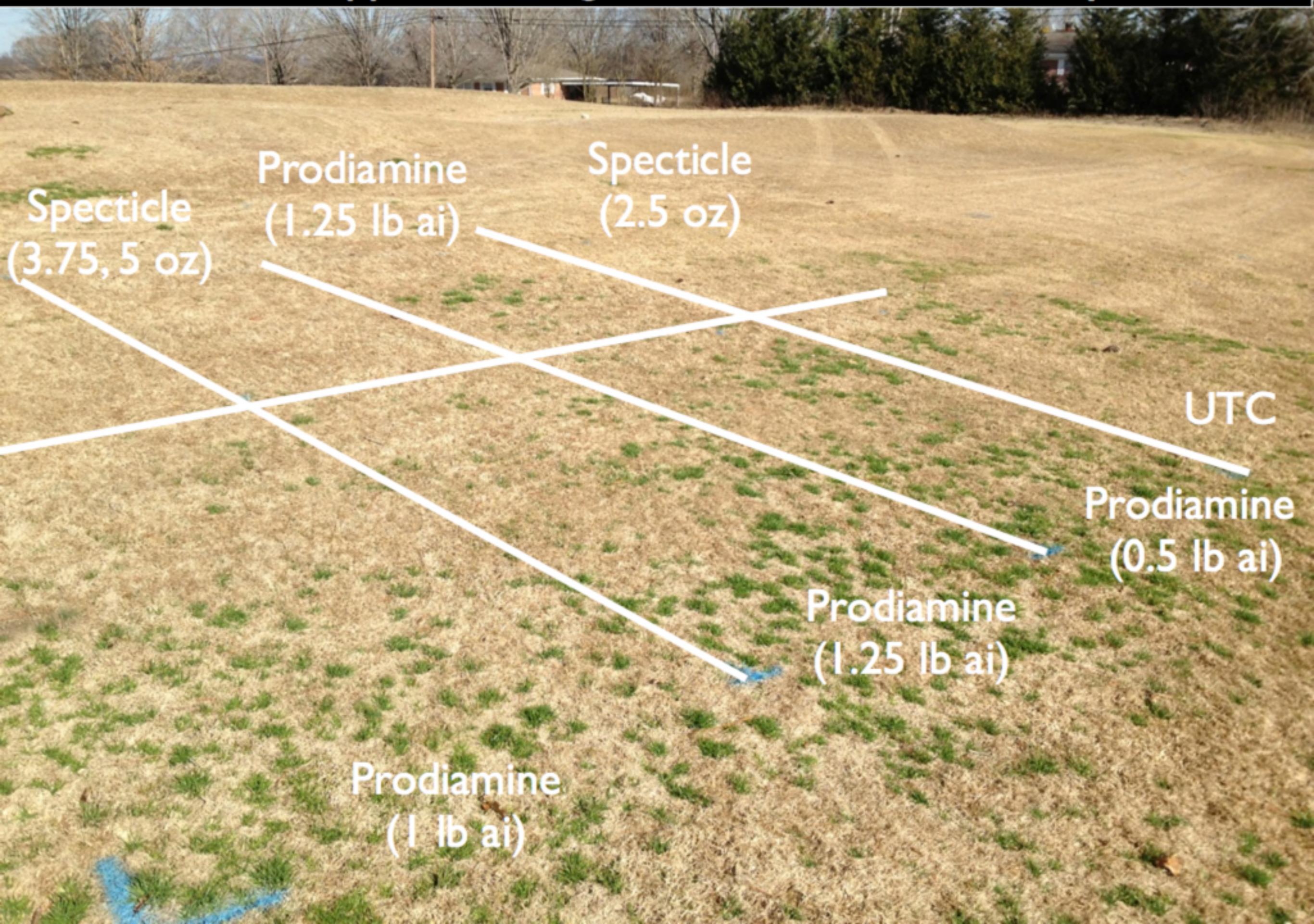
Doug Duffer

“As long as I
can remember”

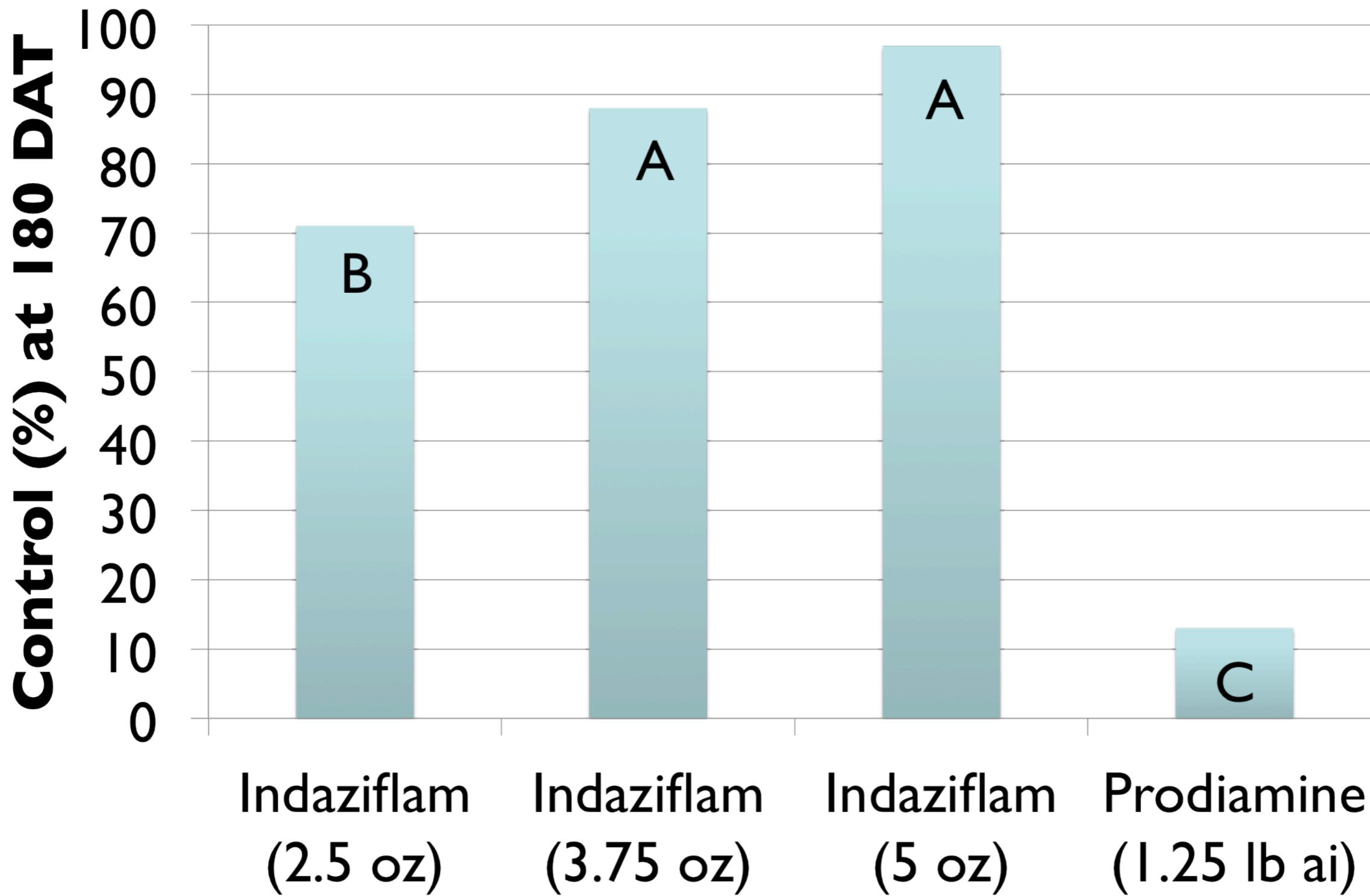
Same
Herbicide + 10 years =
Program

HERBICIDE RESISTANCE

Treatments Applied 22 August 2012; Photo 1 February 2013



PRE Control of Prodiame Resistant Annual Bluegrass. Alcoa, TN. 2012-2013.

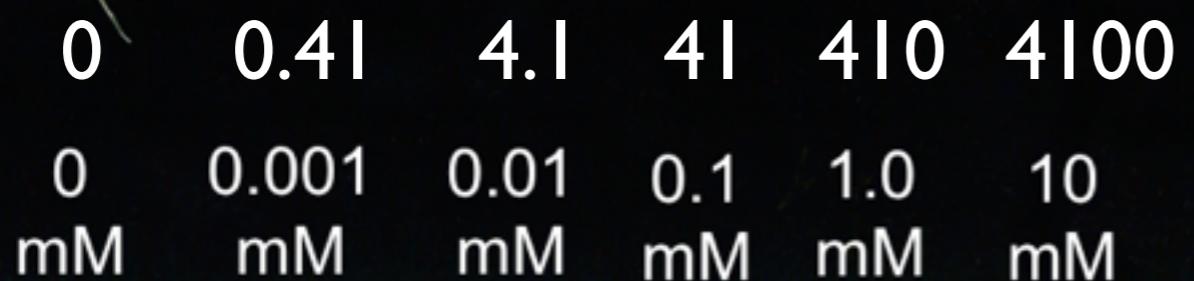




CE
SAFETY CHOICE
Nitrile Exam Gloves
Powder-Free

LONK

**Root growth of
prodiamine
resistant (PR) and
susceptible (SS)
annual bluegrass in
Alcoa, TN**



A scanning electron micrograph (SEM) showing two wheat roots. The root on the left is labeled 'Resistant' and shows normal, dense root hairs at its tip. The root on the right is labeled 'Susceptible' and shows significant growth inhibition, with a sparse, irregular cluster of root hairs at its tip.

Resistant

Susceptible

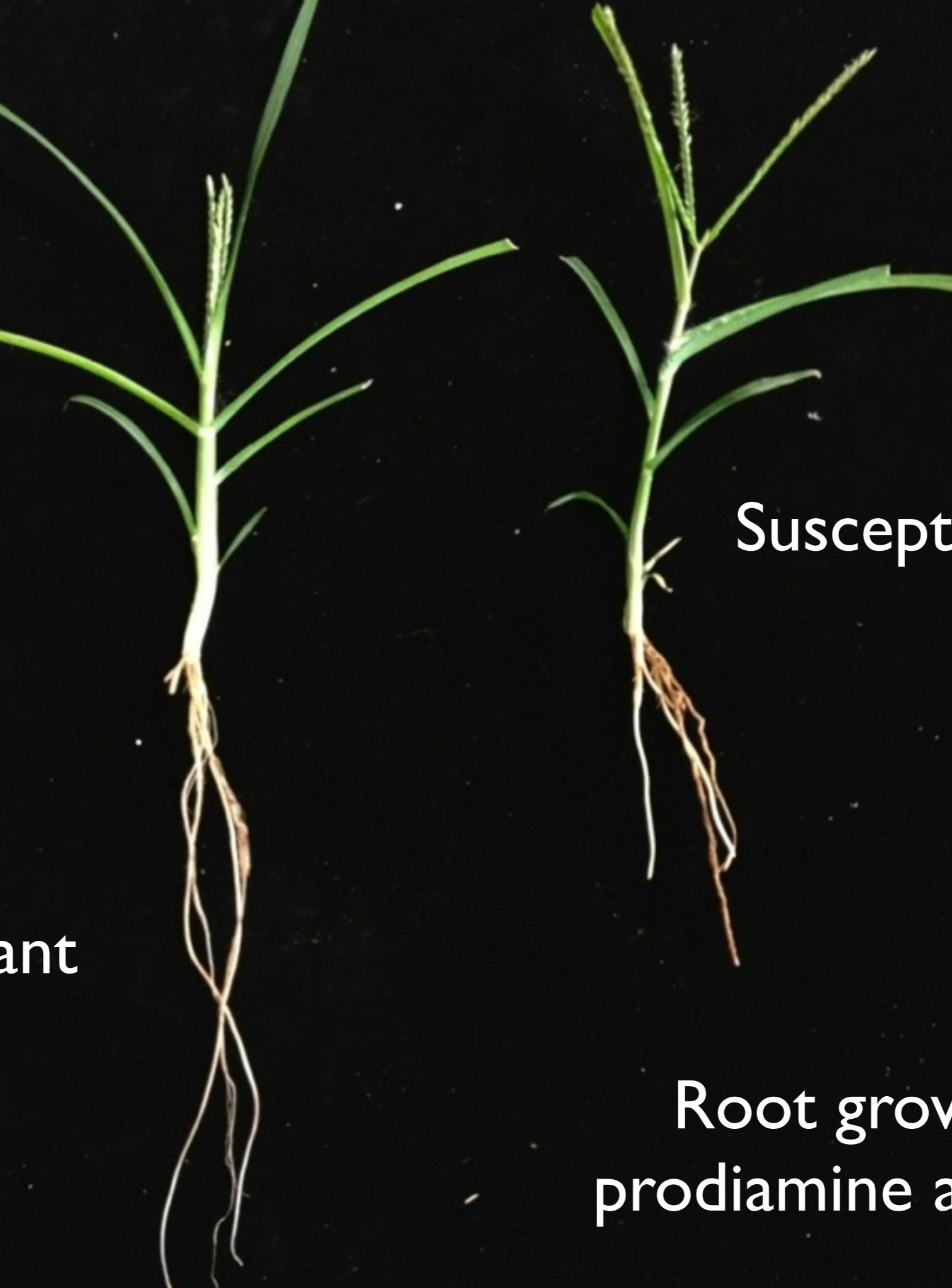
Root growth after
prodiameine at 10 mM



Biotype is Cross-Resistant to Glyphosate

A photograph showing a field of green grass. In the center, there is a distinct, irregularly shaped patch of brown, dead grass. The surrounding grass is a vibrant green. The lighting suggests it might be late afternoon or early morning.

Prodiamine Resistant Goosegrass



Resistant

Susceptible

Root growth after
prodiame at 0.001mM

Resistant
410



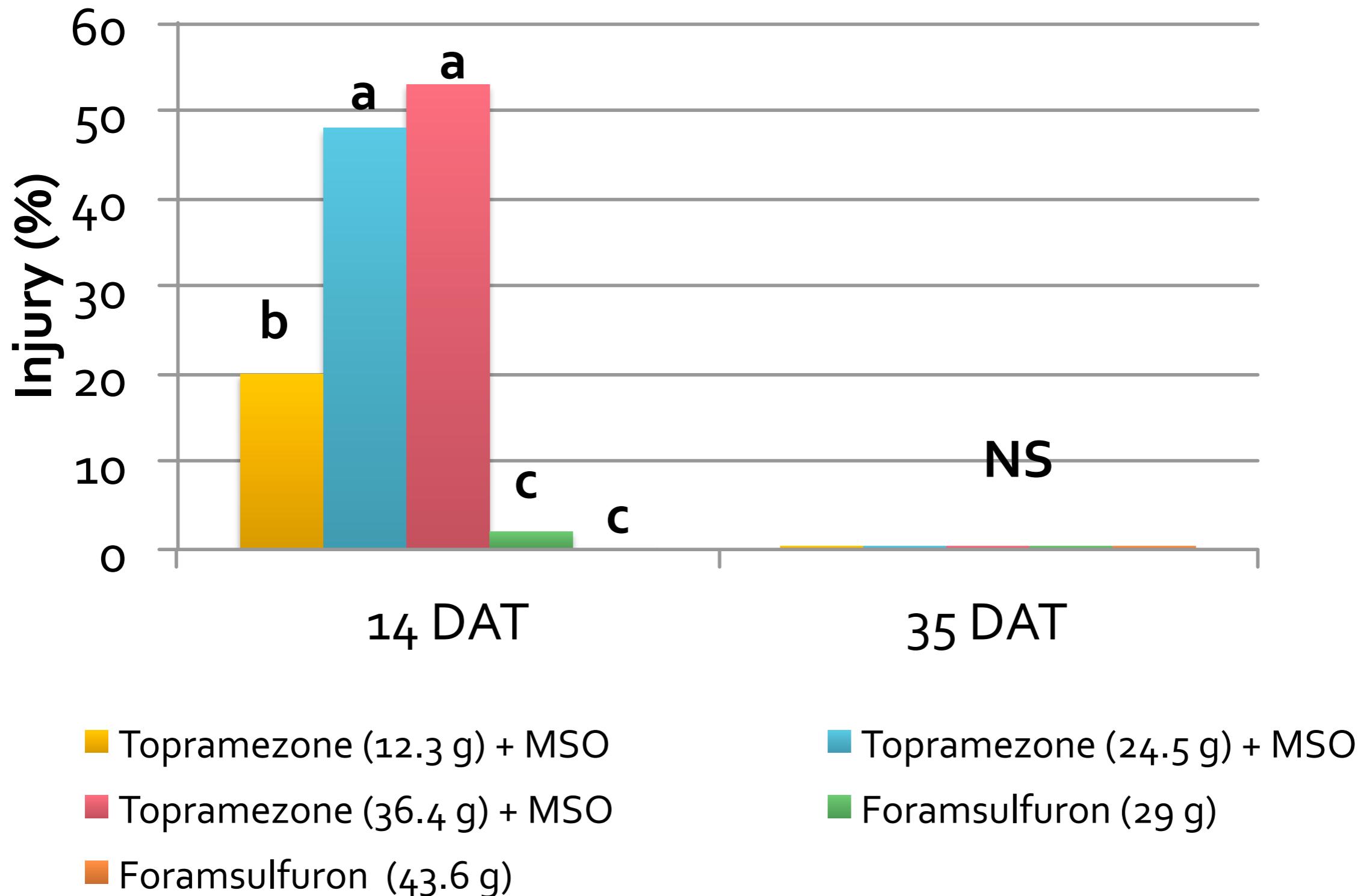
Root growth after
prodiamine at 1.0 mM

Susceptible
410

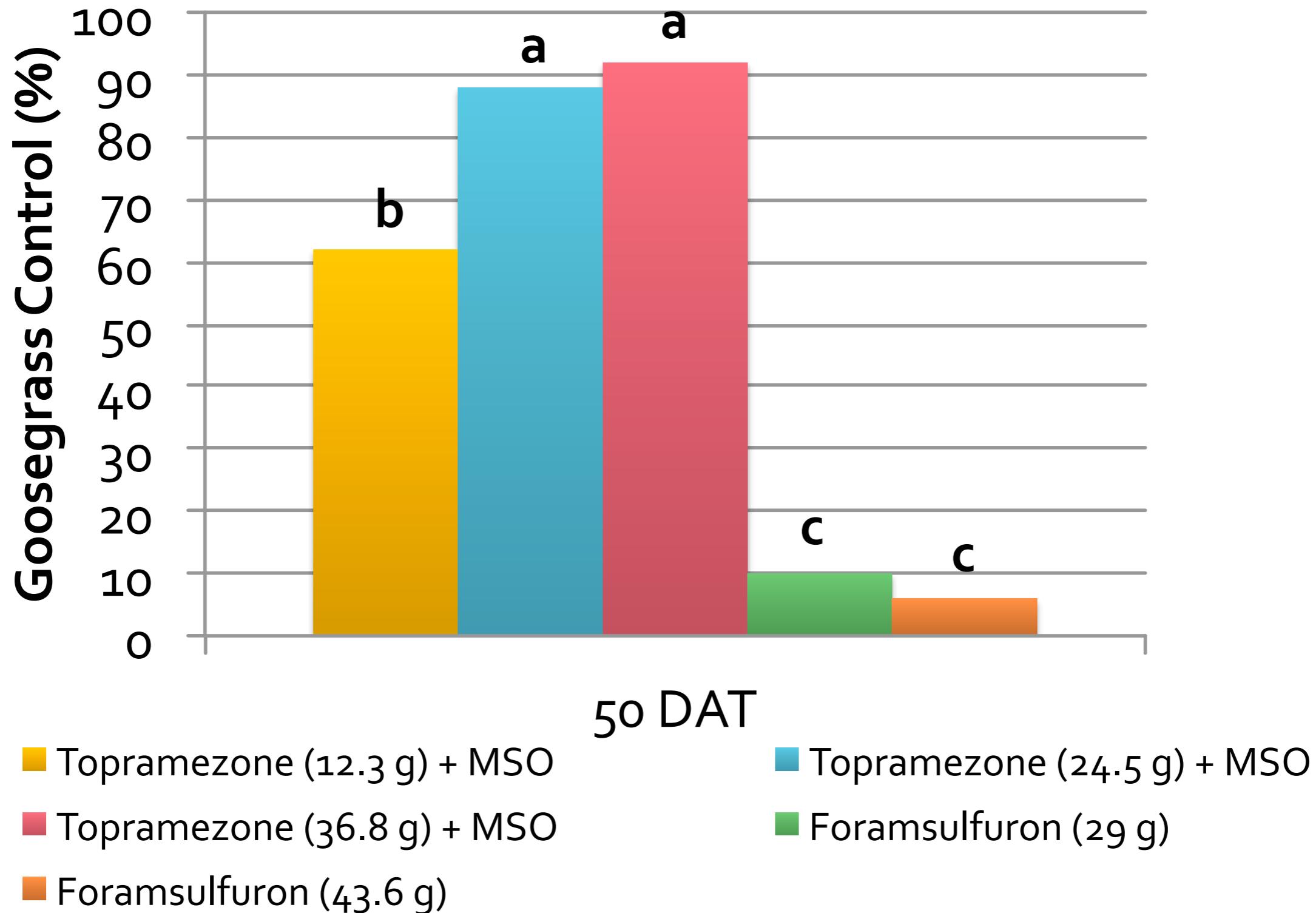


Root growth after
prodiamine at 1.0 mM

Tifway Injury



PR Goosegrass Control





No tolerant options left?



It's not just
a single
product

Can't Use Glyphosate





Options?

- Oxadiazon program
 - Increased \$\$
 - What do to rotate to from oxadiazon?
 - No post winter annual
 - Tank mix with glufosinate? (access, \$\$)
- Specticle program
 - Increased \$\$
 - Rotation with oxadiazon ?
 - CBG greens issues

Options?

- ALS or Simazine Programs
 - CBG greens complex issues
 - \$\$
 - No residual for summer annuals
 - Resistance is out there



Doug Duffer



Barry Budget

A Glyphosate-Resistant Biotype of Annual Bluegrass in Tennessee

James T. Brosnan, Gregory K. Breeden, and Thomas C. Mueller*

Glyphosate is regularly used to control annual bluegrass populations in dormant bermudagrass turf. A population of annual bluegrass not controlled by glyphosate at 840 g ha⁻¹ (glyphosate resistant, GR) was identified on a golf course in Humboldt, TN in 2010. Mature tillers of GR plants were established in a greenhouse and treated with glyphosate at 0, 210, 420, 840, 1,680, 3,360, and 6,720 g ha⁻¹. Mature tillers of a biotype known to be susceptible to glyphosate (SS) were also established in the greenhouse and subjected to the same treatments. At 14 d after treatment (DAT), glyphosate controlled the SS biotype > 95% at rates > 420 g ha⁻¹. Comparatively, the GR biotype was only controlled 76% with glyphosate at 6,720 g ha⁻¹. The rates required to provide 50% control (I_{50} values) for SS and GR biotypes were 236 and 2,812 g ha⁻¹ respectively, resulting in a resistance factor of 12. Photochemical efficiency (F_v/F_m) values on SS plants treated with glyphosate at > 210 g ha⁻¹ measured 0.000 at 14 DAT, whereas F_v/F_m values on GR plants were not significantly different from the untreated control with glyphosate rates \leq 840 g ha⁻¹ on the same date. In laboratory experiments, the SS biotype accumulated greater shikimate concentrations than the GR biotype 3 to 6 DAT. Future research should evaluate strategies for managing GR and SS annual bluegrass with alternative modes of action.

Nomenclature: Annual bluegrass, *Poa annua* L.; bermudagrass, *Cynodon dactylon* L. Pers.; glyphosate; photochemical efficiency.

Key words: bermudagrass, dormant, herbicide resistance, golf course, turf, weed control.

Annual bluegrass is a problematic winter annual weed on golf courses throughout the U.S. transition zone. In bermudagrass fairways and roughs, annual bluegrass infestations commonly occur during periods of dormancy (Toler et al. 2007). These infestations negatively affect bermudagrass quality because of the bunch-type growth habit, light green

been reported (Heap 2011; Hutto et al. 2004); however, only a single biotype of GR annual bluegrass has been confirmed (Binkholder et al. 2011). Selected from a zoysiagrass (*Zoysia* spp.) golf course in Missouri, glyphosate at 6.28 kg ha⁻¹ reduced the biomass of this biotype by only 60%, whereas applications at 0.78 kg ha⁻¹ and greater controlled a

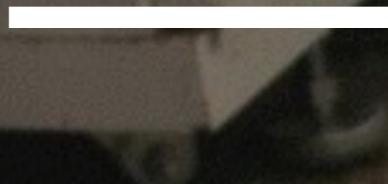


Humboldt CC

Roundup at 32 fl oz/A every year since 1990

No control reported in 2009 and 2010

0 fl oz



256 fl oz



Humboldt CC

- Only controlled 76% with 256 fl oz/A
- Susceptible biotype controlled >95% with 16 fl oz/A
- Resistance factor of 12
- Superintendent rotated to simazine (PSII) following season and observed control



Over 43% of golf courses in MS resistant to PSII inhibitor



Nozzle Nick

Nozzle Nick

- Zoysiagrass fairways, UD greens
- Simazine for 20 consecutive years
- Rotated to Kerb temporarily
- Rotated to ALS inhibitors
 - Lost control in 8 years





Red= Resistant



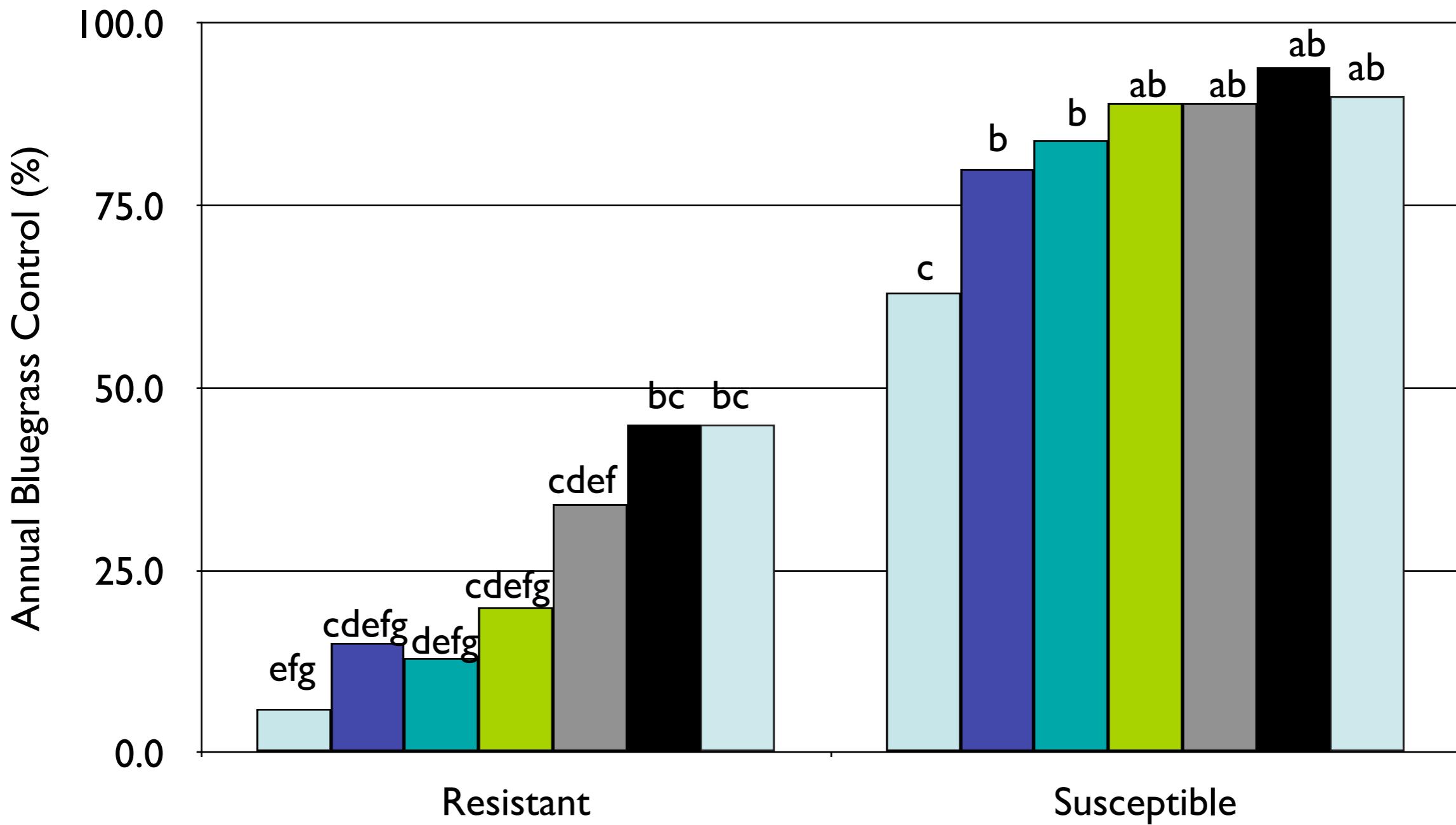
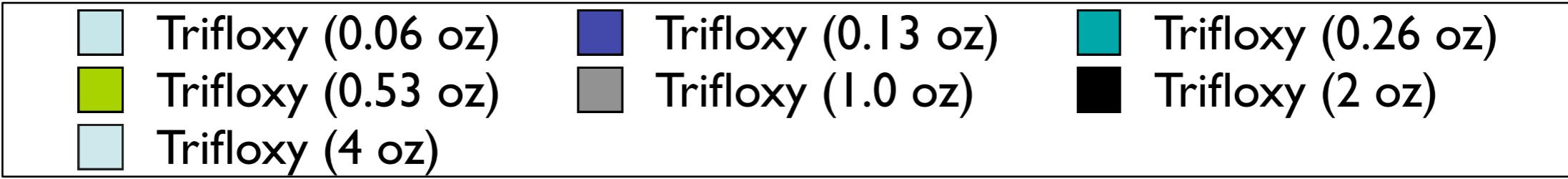
ALS Resistant POAAN 28 DAT with Trifloxsulfuron

Red= Resistant

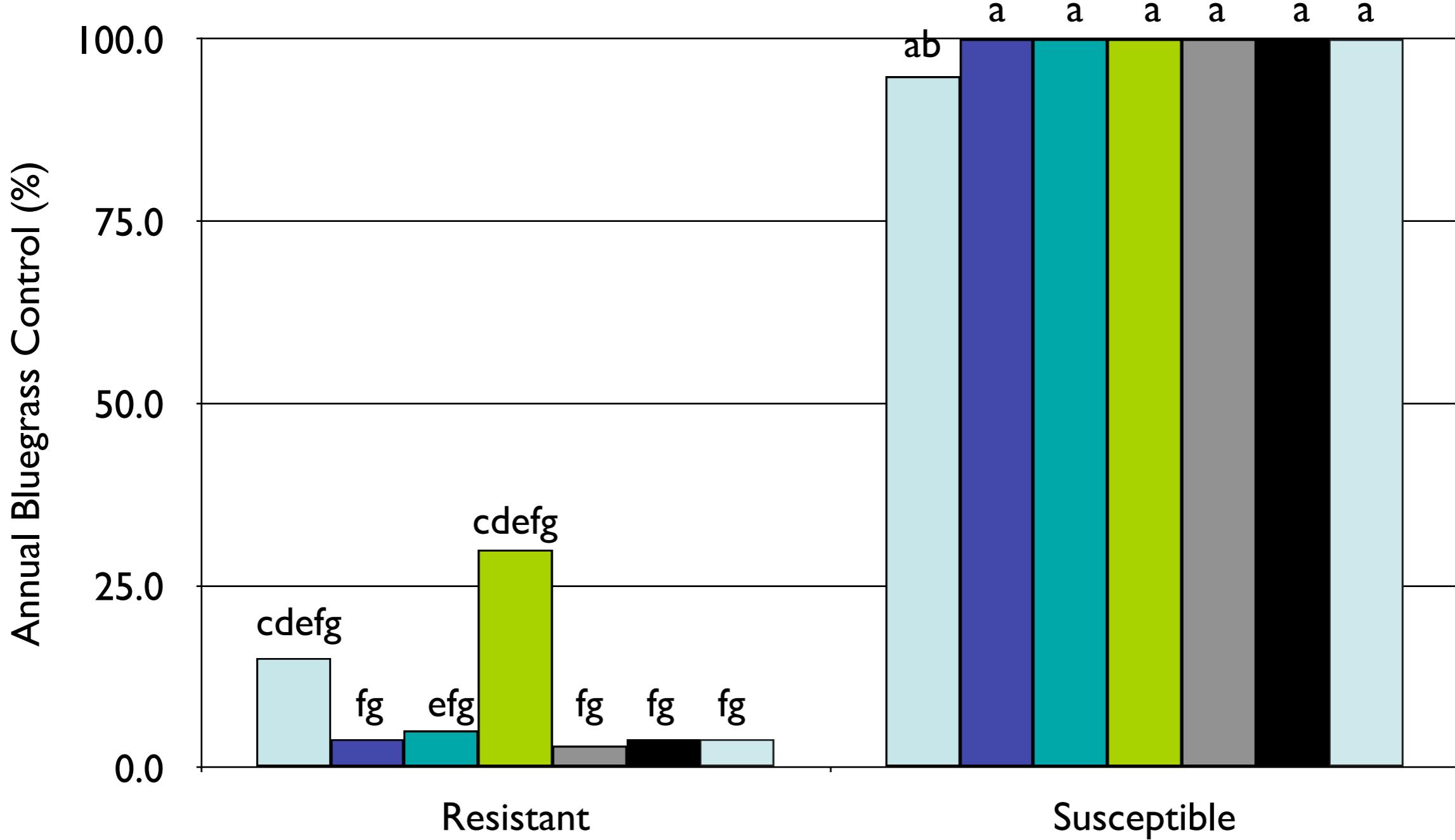
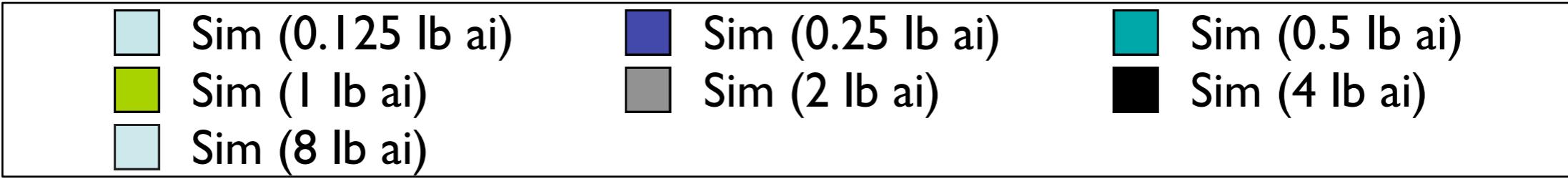


ALS Resistant POAAN 28 DAT with Foramsulfuron





Resistant POAN Control 21 DAT



Resistant POAN Control 21 DAT

Trifloxysulfuron at 4.24 oz/A + NIS at 21 DAT

Resistant

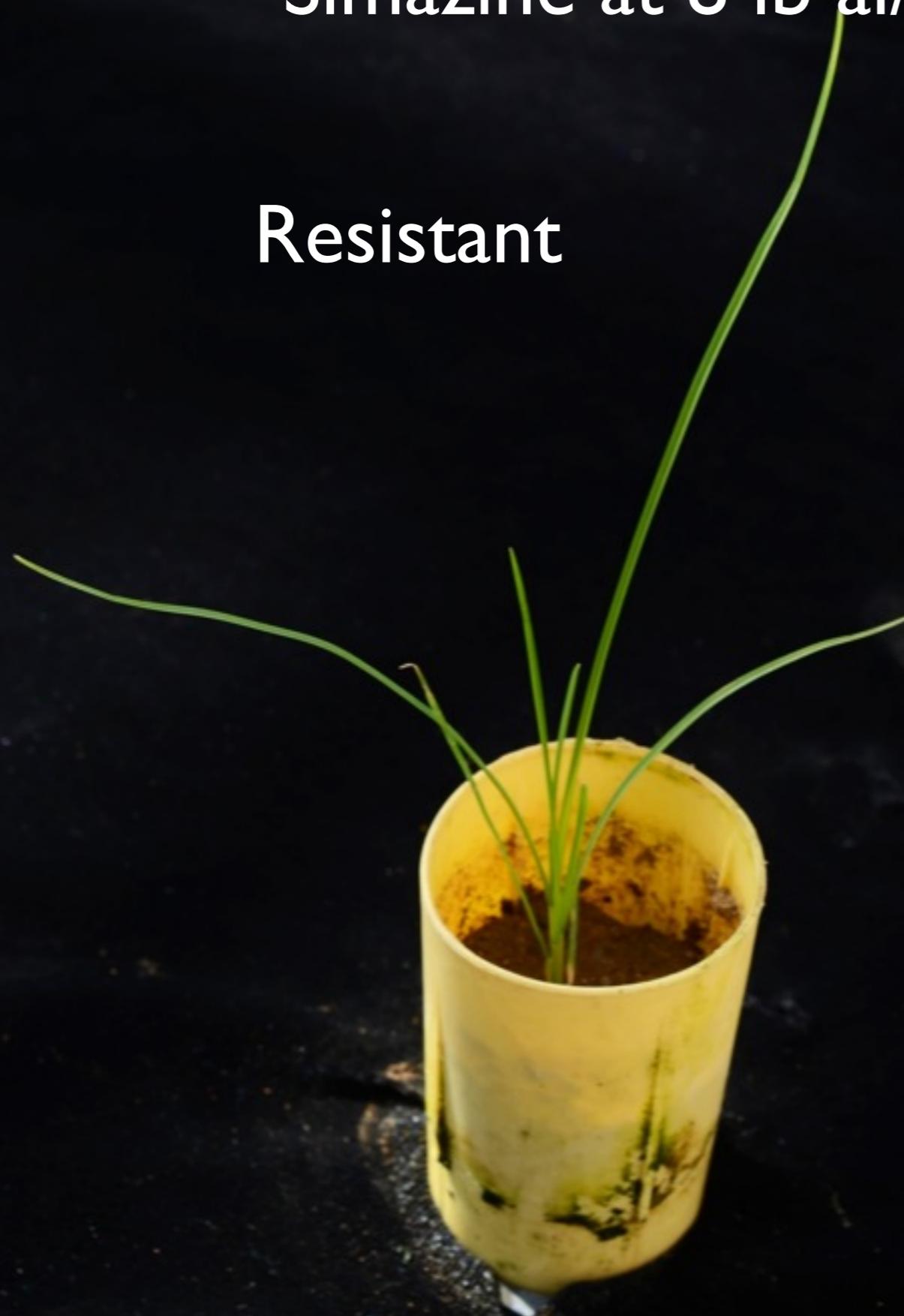


Susceptible



Simazine at 8 lb ai/A + NIS at 21 DAT

Resistant



Susceptible



What to do?



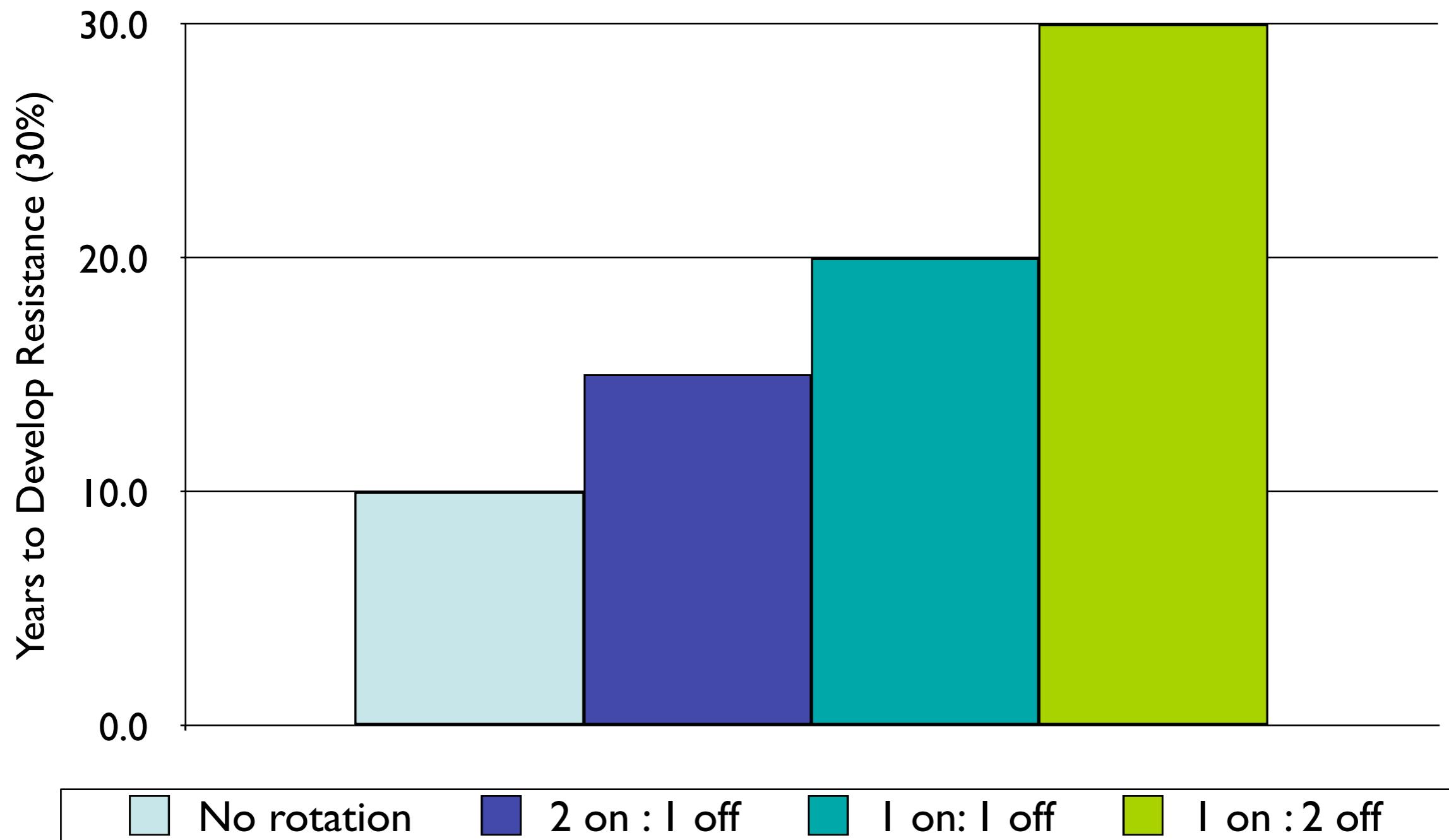
Knowledge About Products



HERBICIDE RESISTANCE GUIDE

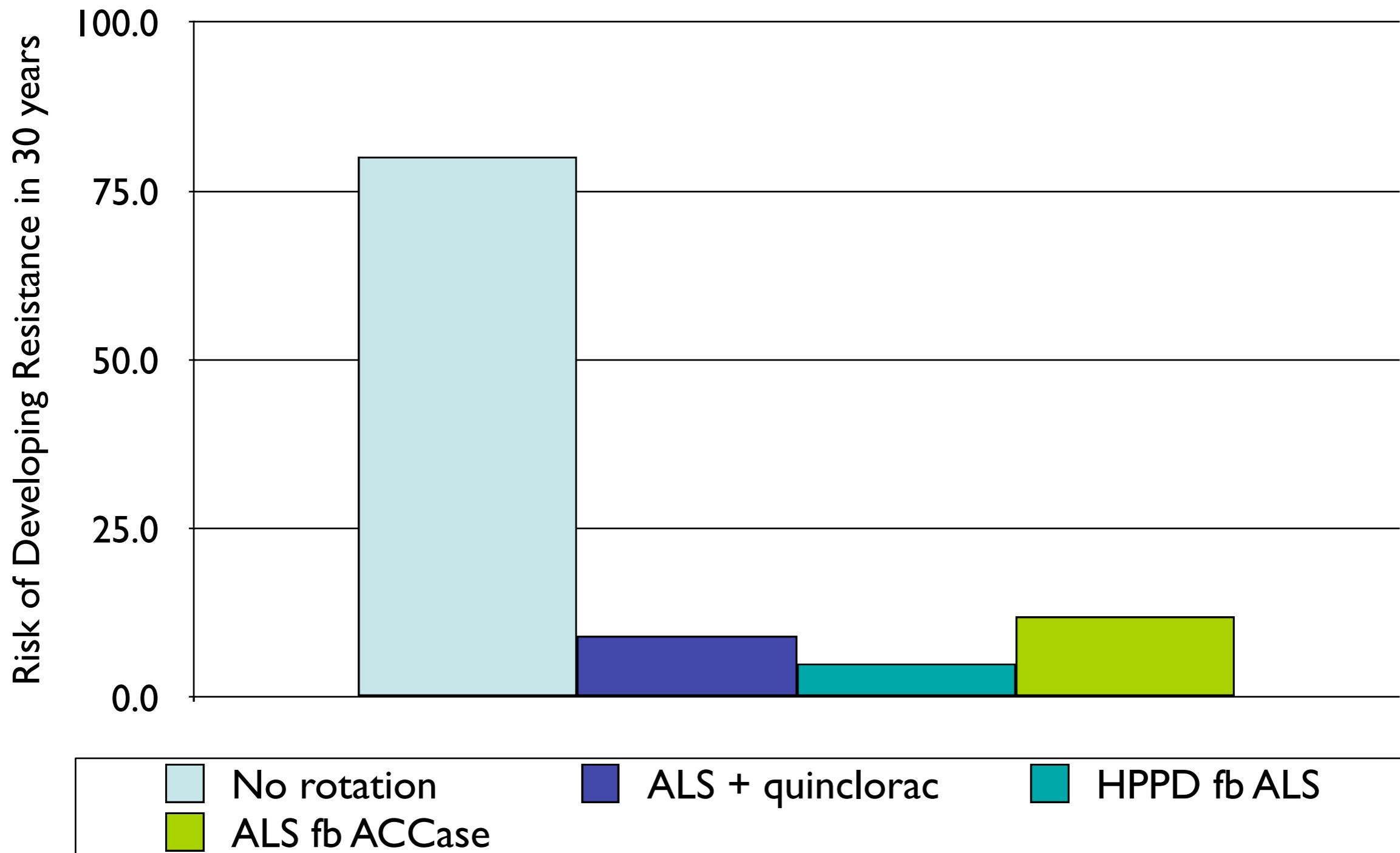
HERBICIDES FOR ANNUAL BLUEGRASS CONTROL GROUPED BY MECHANISM OF ACTION

Modeled Effects of Rotation on Triazine Resistance



*Assumes rate for 95% control, 2 yr seed life, fitness = 1

Modeled Effects of Rotation/Mixtures on ALS Resistance



Resistance (20%) observed within 4 years with ALS only program

Incorporate soil active
herbicides





Manage Seed Production



Control Escapes

**Challenge To Do Things
Differently**





Peer Pressure

of attorney, banker, or trustee

5

E13570303A

5

5

7466A
3



SERIES
1986

July 7, 1986
Secretary of the Treasury

3

C

SERIES
1986



195211C
2



SERIES
1986

July 7, 1986
Secretary of the Treasury

2

100

H 19

Potential Case

- Contact University Extension asap
 - Testing for confirmation
 - Track spread across state
- Control/Remove any surviving plants
- Rotate chemistry the following year



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35 people like this.
Be the first of your friends.



Corn Speedwell (*Veronica arvensis*)

Weed in Focus



Annual Bluegrass

Poa annua

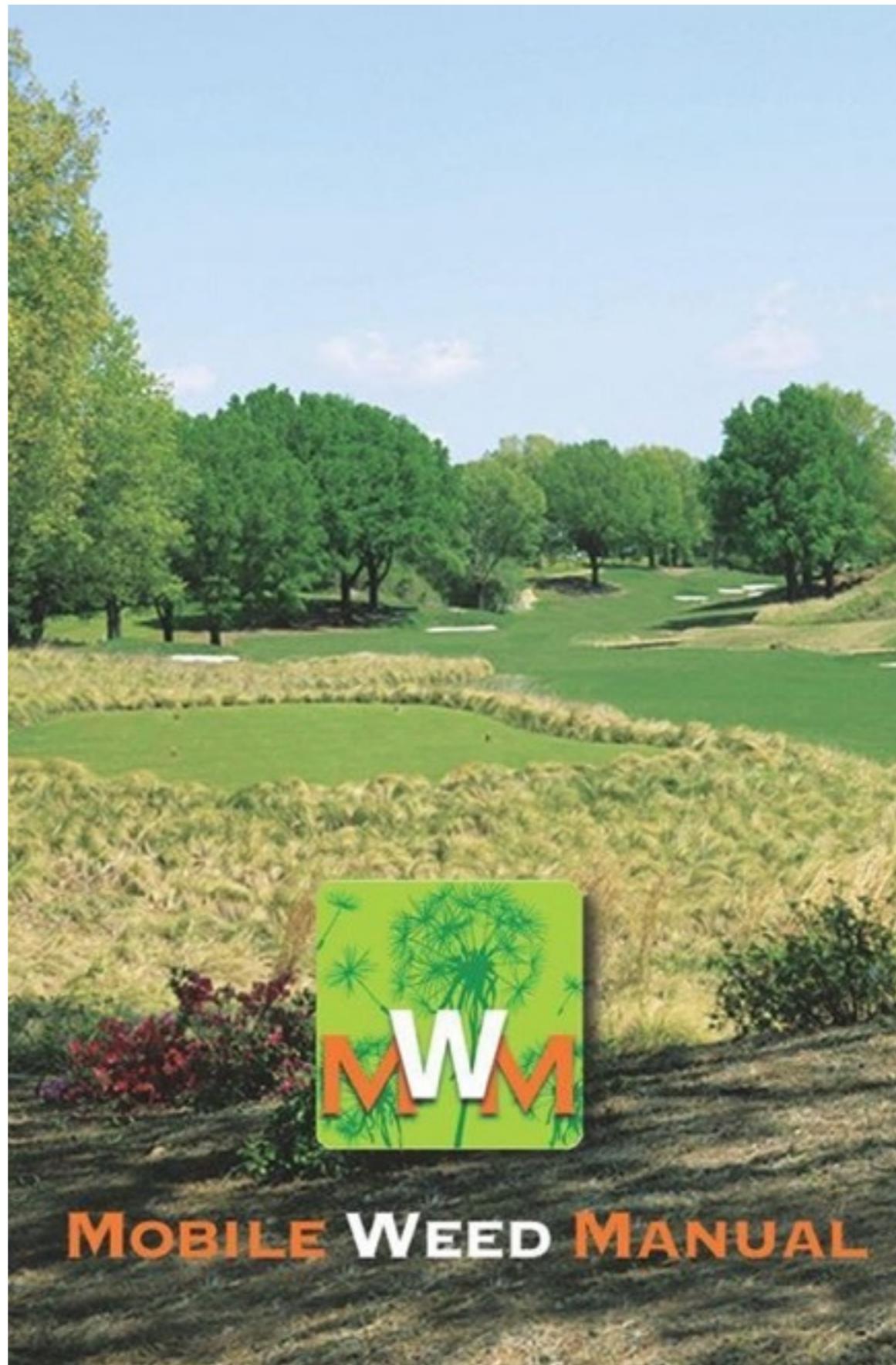
Upcoming Events

- **October 22**, ETGCSA Scholarship and Research Golf Tournament
The Virginian, Bristol, VA
- **October 29**, MTGCSA Scholarship Fundraiser Golf Outing
The Vanderbilt Legends Club, Franklin, TN
- **November 12**, MTGCSA Educational Meeting
Brentwood Country Club, Brentwood, TN

Winter Annual Weeds Are On The Way

Saturday, August 25, 2012

Temperatures have begun to cool across much of Tennessee over the past few weeks with overnight lows falling below 60 degrees in certain locations. This cooler weather, combined with the elevated levels of soil moisture experienced across the eastern region of the state, will create a hospitable environment for the germination of winter annual weeds such



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Jim Brosnan, Ph.D.
@UTTurfWeeds
Associate Professor-Turf Weed Science, Co-Director- Center for
Athletic Field Safety
University of Tennessee · tennesseeeturfgrassweeds.org

155 TWEETS 222 FOLLOWING 213 FOLLOWERS 

Tweets

 **Theo Lankford** @theo3342 9h
A big thanks to everyone who attended #TTA14 this week. Looking forward to the next 4 years! @TnTurfAssoc
 Retweeted by Jim Brosnan, Ph.D.
     

 **Scott Senseman** @UTPSDeptHead 16h
Congratulations to Mr. Matt Elmore for winning the Graduate Student Contest at the Northeast Weed Science Society Meetings yesterday.
 Retweeted by Jim Brosnan, Ph.D.
     

 **Michael Crawford** @JMichael7502 8 Jan
@TurfRepublic Thank you for the wonderful insight on all the cutting edge tools in our industry! #TTA14
 Retweeted by Jim Brosnan, Ph.D.

@UTturfweeds



Turf & Ornamental Field Day
September 11, 2014