



Genetics and Herbicide: the Diverging Tale of Cogongrass in the Southeast

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Welcome North Carolina!



Got this?

Do this?





Ervin 2005

- Prolific Seed Producer
- Rhizomatous
- Obligate Outcrosser
- Wind Pollinated and Dispersed



Burned young pine trees



Disturbance & Roadsides

Pyrogenic & Intense Fire Events



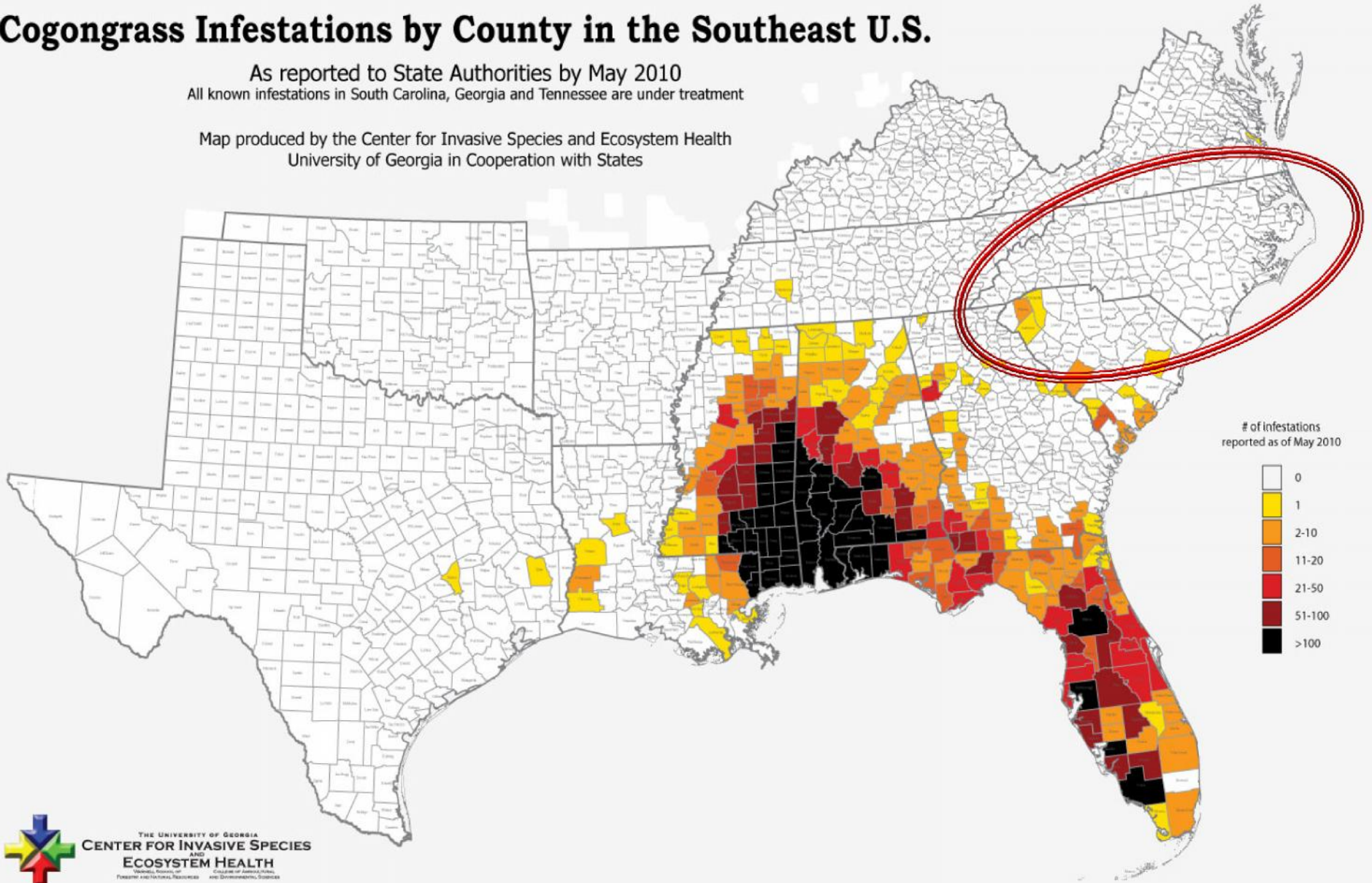
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Cogongrass Infestations by County in the Southeast U.S.

As reported to State Authorities by May 2010

All known infestations in South Carolina, Georgia and Tennessee are under treatment

Map produced by the Center for Invasive Species and Ecosystem Health
University of Georgia in Cooperation with States

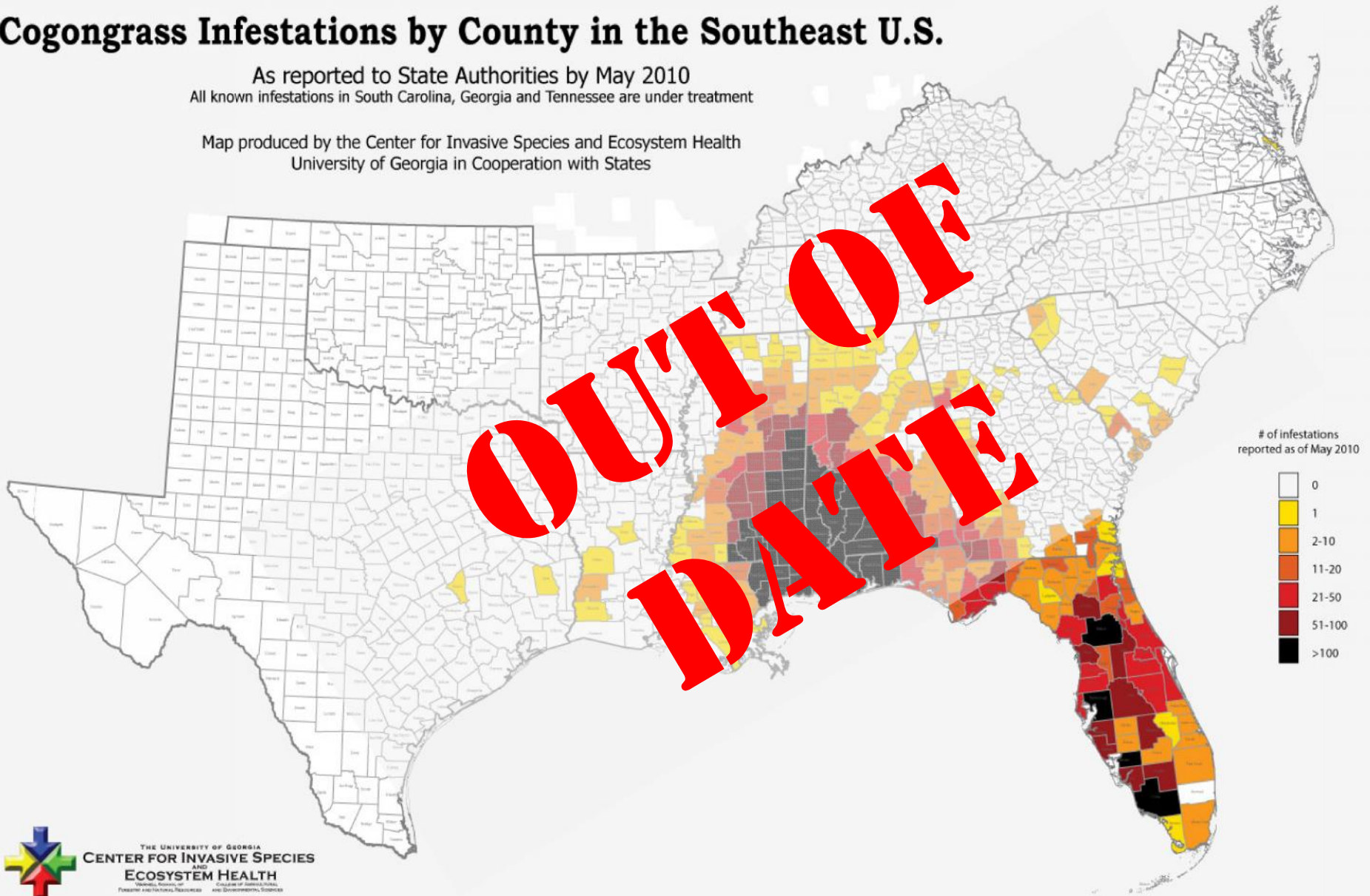


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killed it all”

1-4 qt/A





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*“Glyphosate + 2,4-D killed
it”*

2%v/v + 1%v/v

“Glyphosate
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1-4 qt/A

“**Glyphosate +
Cogon-X killed
it**”

1 qt/A + 1 qt/A

“*Glyphosate + 2,4-D killed
it*”

2%v/v + 1%v/v

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1-4 qt/A

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Cogon-X killed
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1 qt/A + 1 qt/A

“**Glyphosate
never kills
it all**”

“*Glyphosate + 2,4-D killed
it*”

2%v/v + 1%v/v

What we know

- Highly Plastic Phenotype
- Worldwide Ecotypes
 - Bryson et al. 2010 (MS)
 - Cheng & Chou 1997 (Taiwan)
 - Al-Juboory & Hassawy 1980 (Iraq)
- Morphologically indistinguishable

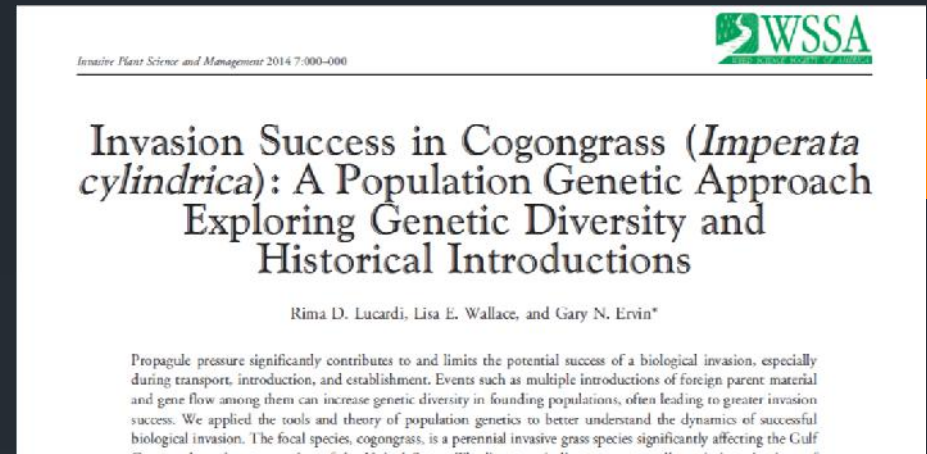
Ecotype Variability and Edaphic Characteristics for Cogongrass (*Imperata cylindrica*) Populations in Mississippi

Charles T. Bryson, I. Jason Krutz, Gary N. Ervin, Krishna N. Reddy, and John D. Byrd, Jr.*

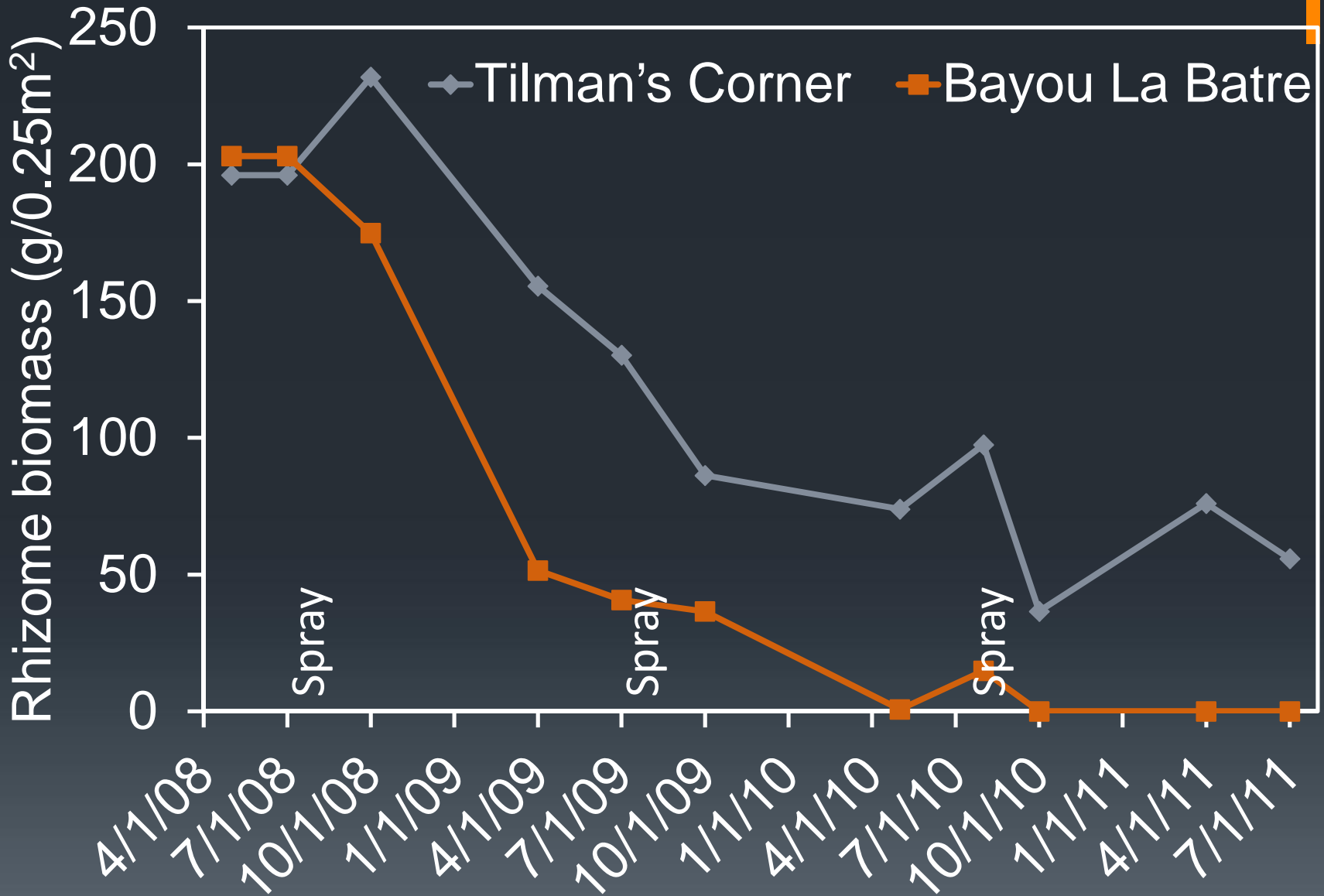
Cogongrass is a highly invasive, perennial grass that is found on all continents, except Antarctica. It continues to spread at an alarming rate in the southeastern United States. Cogongrass has been reported from a wide array of habitats; however, soils from areas where cogongrass grows have never been characterized. Live cogongrass plants, herbarium specimens, and soil samples were collected from 53 cogongrass populations from across the 10

What we know

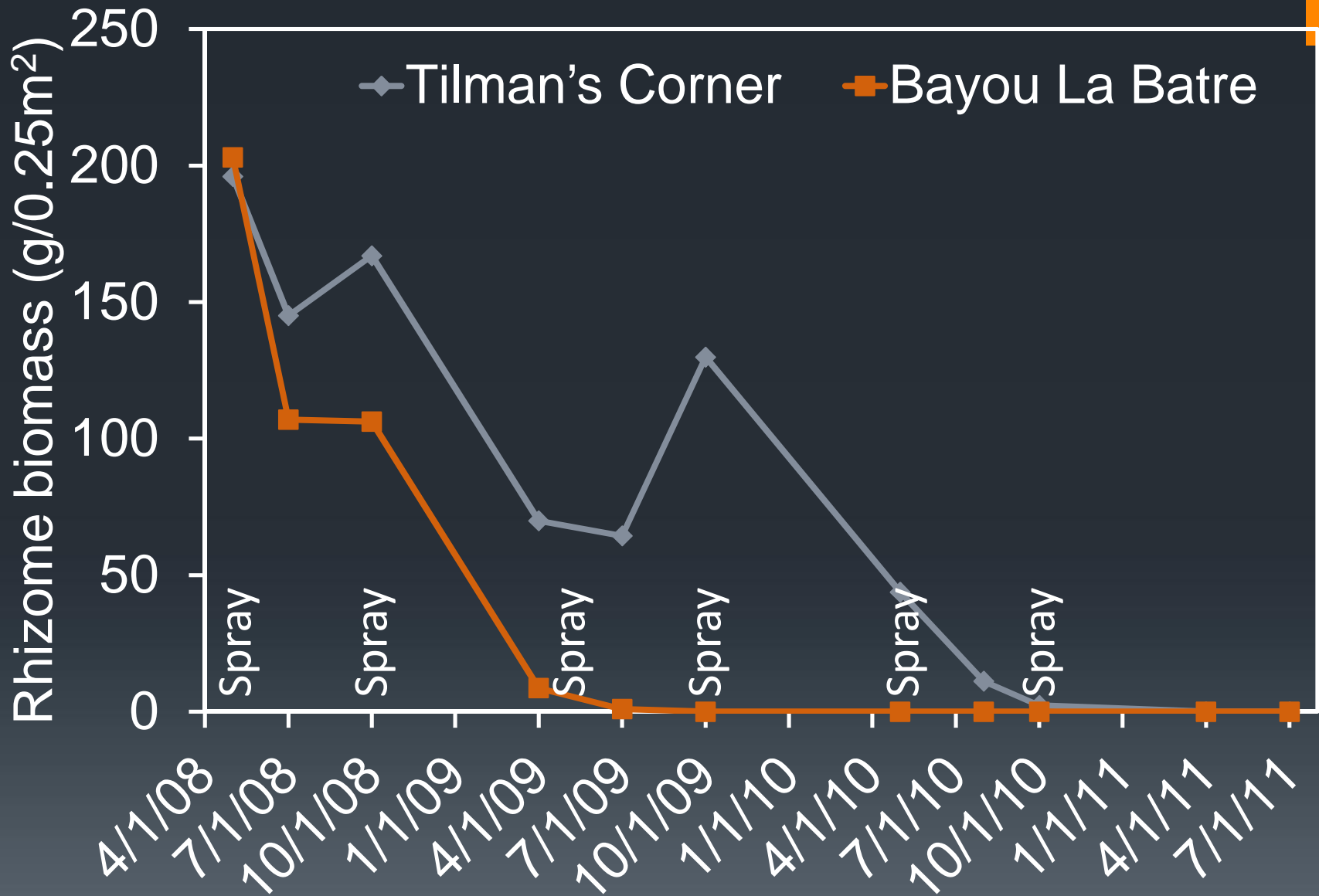
- Introduced twice from foreign soils (Tabor 1949, 1952)
- Hybrid swarms unlikely (Lucardi et al. 2014)
- Sexual reproduction and seed-borne propagule pressure supported



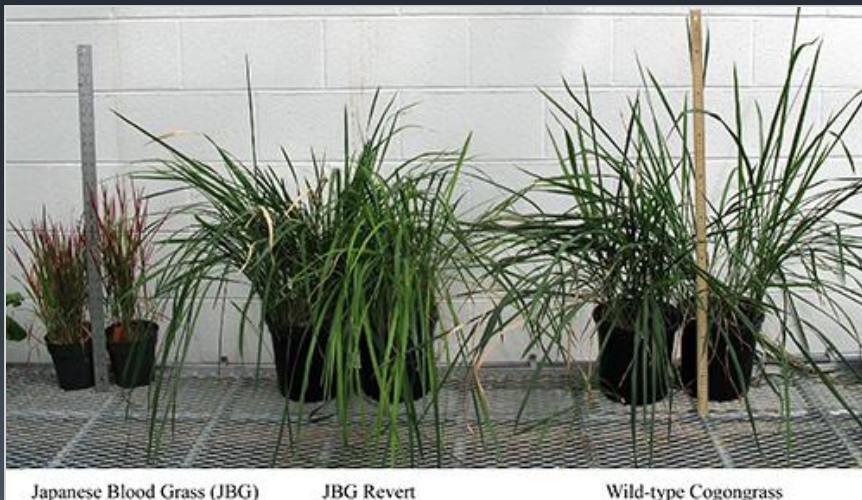
Glyphosate (1 app/yr in August)



Glyphosate applied in May and October each year



Do these live accessions respond differently to glyphosate?



Japanese Blood Grass (JBG)

JBG Revert

Wild-type Cogongrass

Cseke & Talley 2012

- What is the driver of the response?
 - Biotic vs Abiotic?
- What is the source of the variation?
 - Ploidy level?
 - Heredity vs Plasticity



36 pots/accession x 60 accessions = 2,160 pots



...divided into 2 greenhouses at CAIP

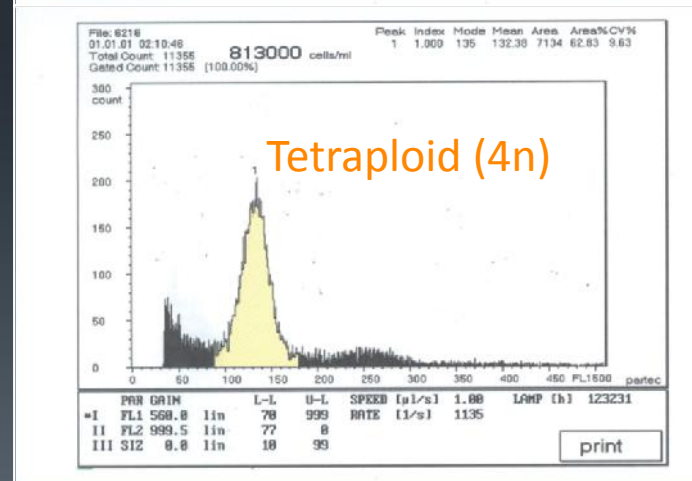
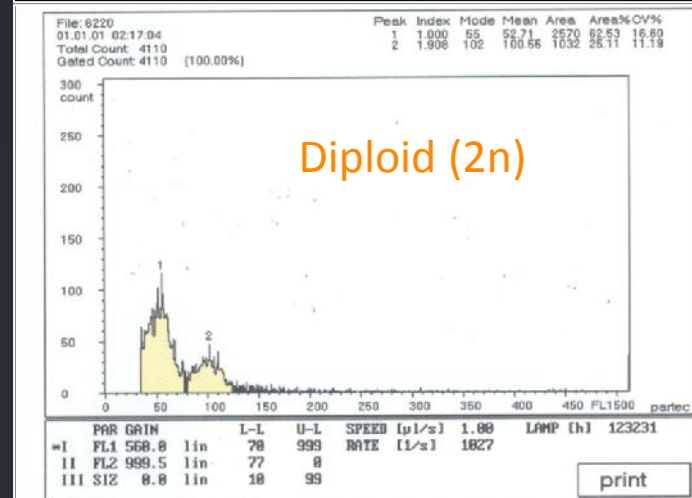
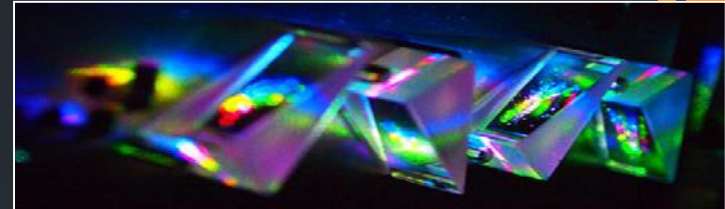


... and one at Auburn



Ploidy Analysis

- Flow cytometry
 - Polyploid present
- Chromosome squashes
 - 4n verification



Glyphosate Response

■ Pre-treatment

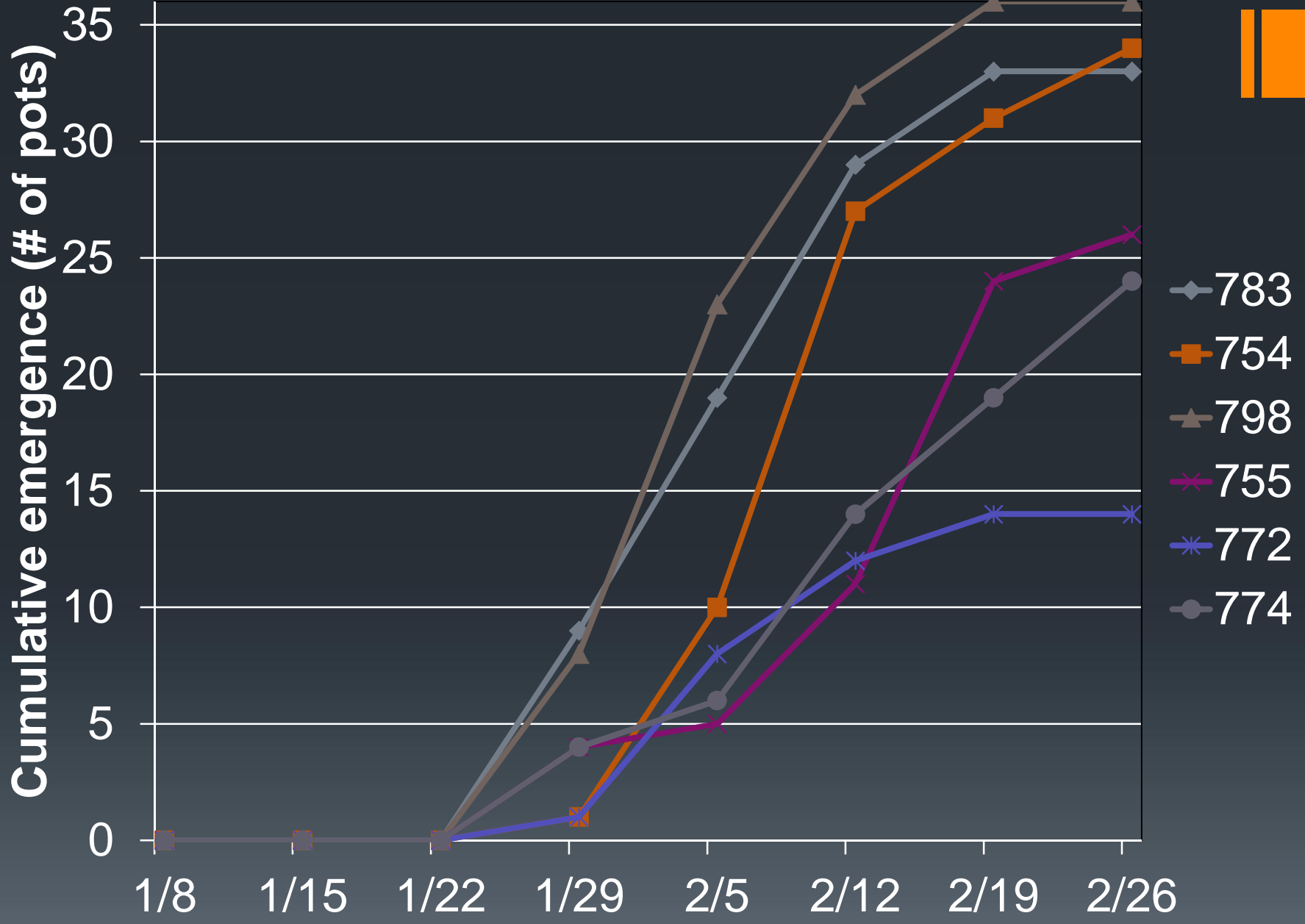
- Leaf area, length and width with Licor 3000-C
 - All leaves, or a subset of either the longest leaves or randomly selected leaves
- Leaf angle
- Shoot and rhizome biomass

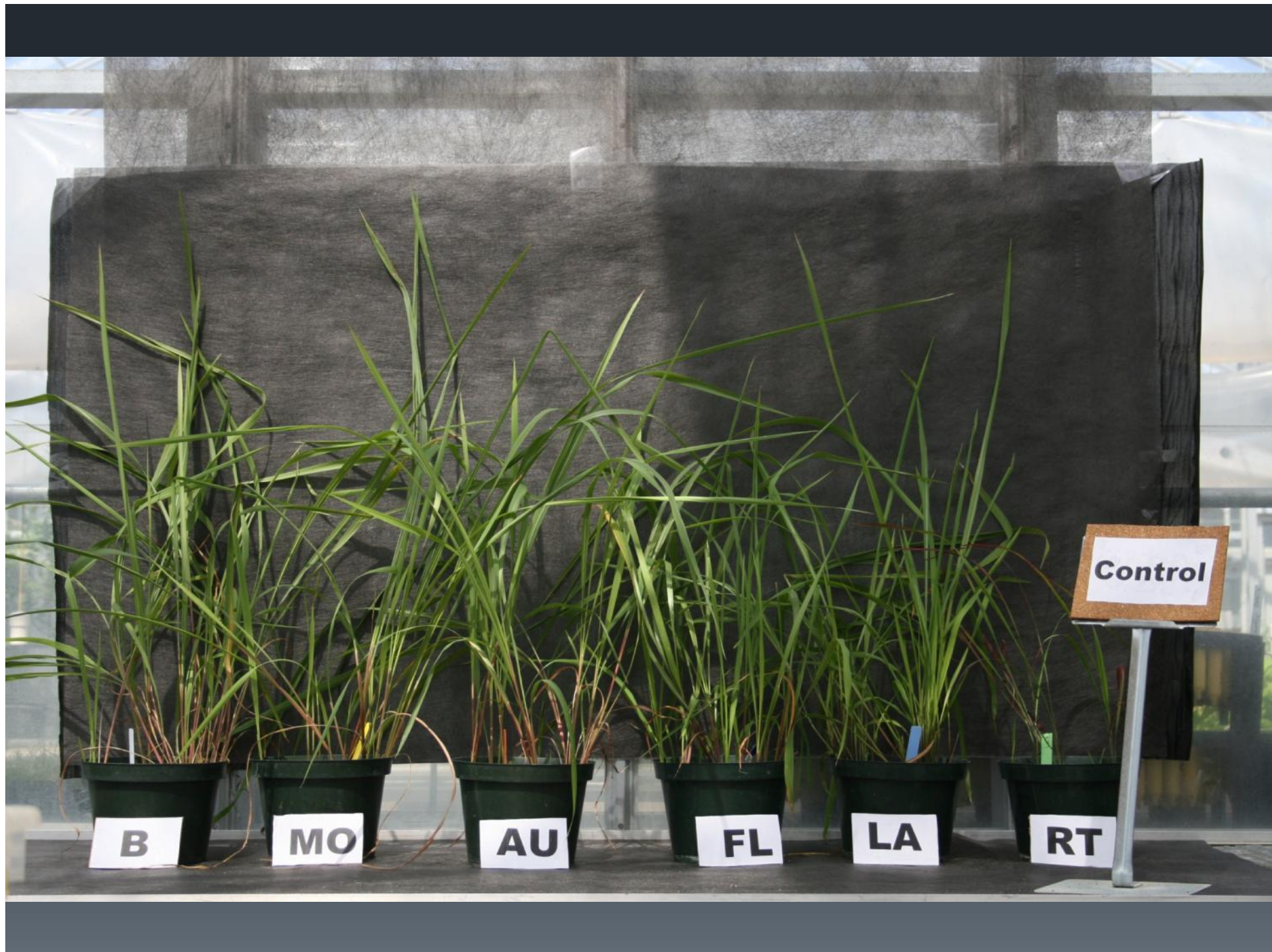
■ Post-treatment

- 30 DAT shoot biomass (living)
- 60 DAT shoot biomass (regrowth)
- 60 DAT rhizome/root biomass (living)

Relative 'Floppiness'







B

MO


AU

FL

LA


RT

Control



If we find any meaningful differences...

- Molecular genetics
 - Microsatellites
 - 18 polymorphic loci, 3 control monomorphic loci; Chiang et al.
 - 8 polymorphic loci; Maeda et al.
- ^{14}C studies
- Growth analysis
- Detailed rhizome analyses



“The opportunities for herbicide resistance are maximized in weeds that produce **prolific seed**, have relatively **short half-life** in the seedbank, and are **obligate outcrossers**; for herbicides that have a **single target site** that is not conserved or have multiple non-target resistance mechanisms; and in management, those management systems that do not use a diverse set of weed management tools and **rely only on herbicides** for weed control.”

Vencill et al. 2014. 6th German Conference on Weed Biology and Weed Control, March 11-13, 2014, Braunschweig, Germany



- Prolific Seed Producer
- Rhizomatous
- Glyphosate or Imazapyr
- Obligate Outcrosser
- Wind Pollinated and Dispersed



Sounds achingly familiar...





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FLORIDA



SCHOOL OF FORESTRY
AND WILDLIFE SCIENCES