# Herbicide Tolerance and Weed Control in Understory Species of Longleaf Pine (*Pinus palustris*) Ecosystems

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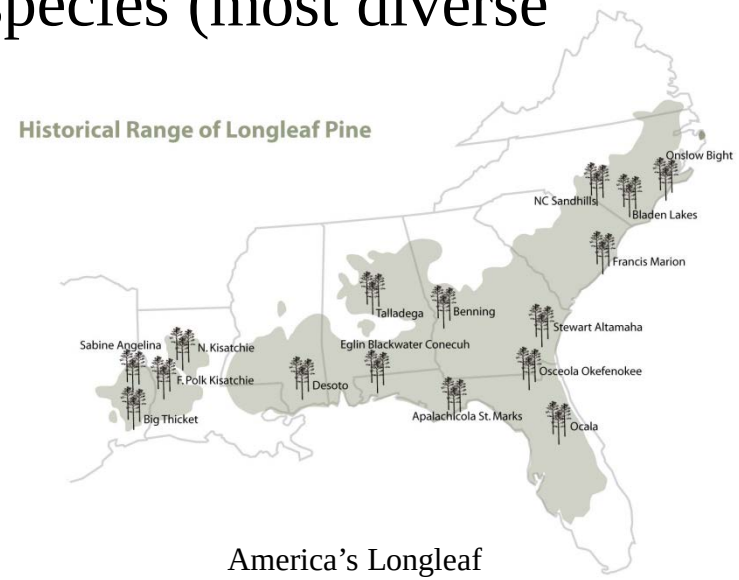
# Outline

- History of Longleaf Pine
- Seedling Evaluation
- Seed Production Evaluation
- Imazapyr Bioassay

# Longleaf Ecosystems

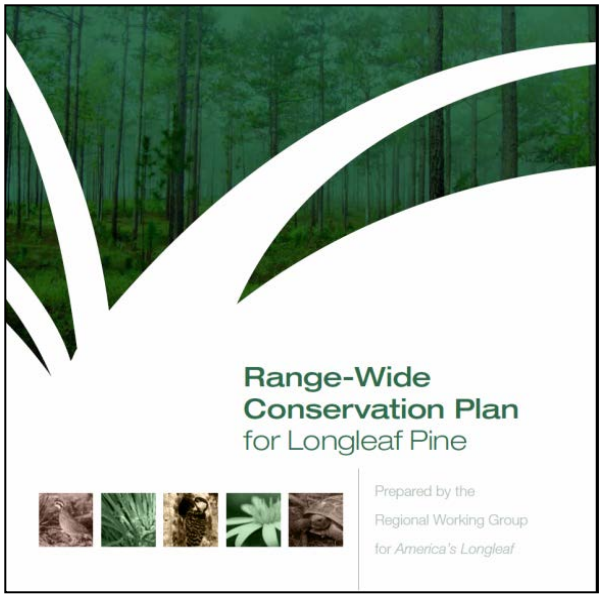
- Longleaf  pine were once part of a dominant ecosystem throughout the southeastern U.S. But it has been diminished to about 3% of its original acreage.
- Longleaf pine ecosystems are some of the most diverse in North America.
  - Numerous vegetative and wildlife species (most diverse ecosystems other than the tropics)




America's Longleaf

# Longleaf Restoration Plan

- Launched in 2009 - Regional Working Group for America's Longleaf
- The 15-year goal for this Conservation Plan is an increase in longleaf acreage from 3.4 to 8.0 million acres.
- The plan calls to:
  - 1) Maintain existing longleaf stands in good condition
  - 2) Improve areas that are classified as "longleaf forest types" but that lack key components such as understory species and communities
  - 3) Restore longleaf pine forests to suitable sites currently in other forest types or land classifications



# Identified Research Needs

- Develop the seed and plant production technologies and standards
- Guidance needed to produce understory plant materials
- Identify species important in the ground layer of the longleaf pine communities
- **Goal: to help guide development efforts for commercial production**.

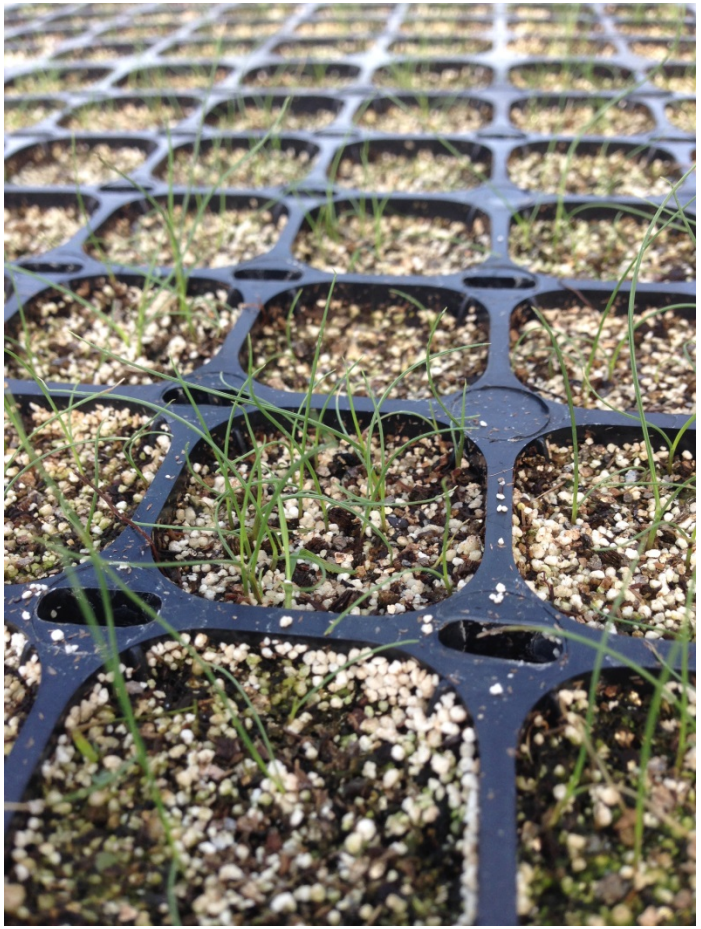
# Project Grant

- In 2012, Drs. Scott Enebak, and Paul Jackson received a grant from the USFS to evaluate herbicides on the growth and development stages of native longleaf pine understory species.

- The purpose and goals of the grant parallel many of the goals outlined in the restoration plan.

“Seedlings” = Grass Seedlings

# Grass Seedling Evaluation



# Grass Seedling Evaluation

2013

- NC State Forest Nursery – Goldsboro, NC
- 3 Study Species
  - Wiregrass
  - Indian grass
  - Muhly grass
- 4 Herbicides
  - Goal (8 and 16 oz/ac)
  - GoalTender (12 and 24 oz/ac)
  - Pendulum Aquacap (17 and 34 oz/ac)
  - Sedgehammer (0.5 and 1 gram/ac)

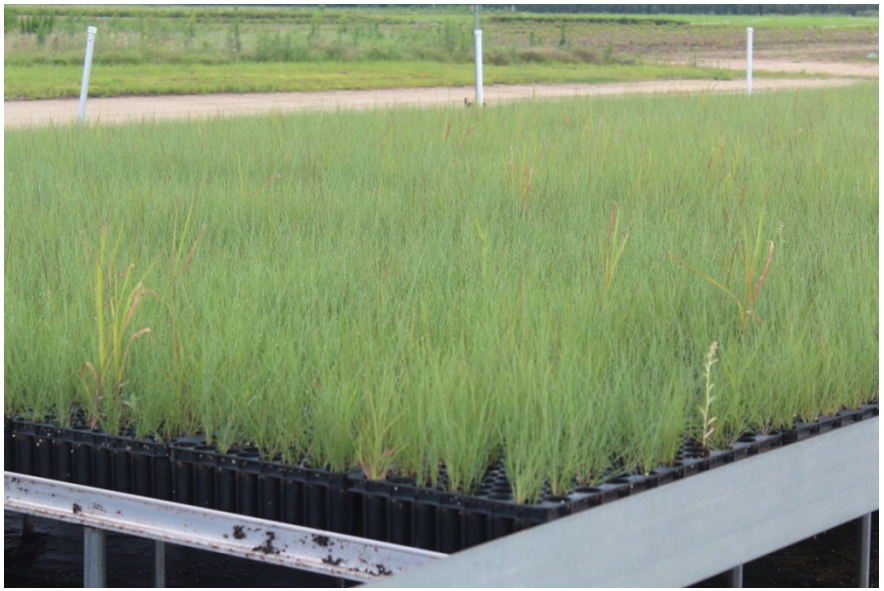
2014

- IFCo – Moultrie, GA
- 3 Study Species
  - Wiregrass
  - Indian grass
  - Little Bluestem
- 4 Herbicides
  - Cobra (12 oz/ac)
  - Goal (6 oz/ac)
  - Pendulum Aquacap (45 oz/ac)
  - Sedgehammer (3 oz/ac)

# Container Grass Seedlings

Indian grass

Muhly grass



Wiregrass

# Grass Seedling Evaluation

- Visually evaluated the injury of the grass seedlings and the presence of weeds
- Injury Rating: 1-9 (1=No Injury and 9=Mortality)

2013

- Goal and GoalTender caused damage to the grass seedlings - recovered

2014

- None of the herbicides caused any effects (only Little Bluestem and Indian grass have been evaluated at this time)

# Grass Seedling Evaluation
## Summary

- Used nursery herbicides because that is what you use and is readily available.
- It is possible to control weeds in these species using nursery herbicides
- Goal of this study is to determine which herbicides are tolerated by these grass species and which could also control weeds.
  - Finding which herbicides are detrimental to the grass species is equally important.

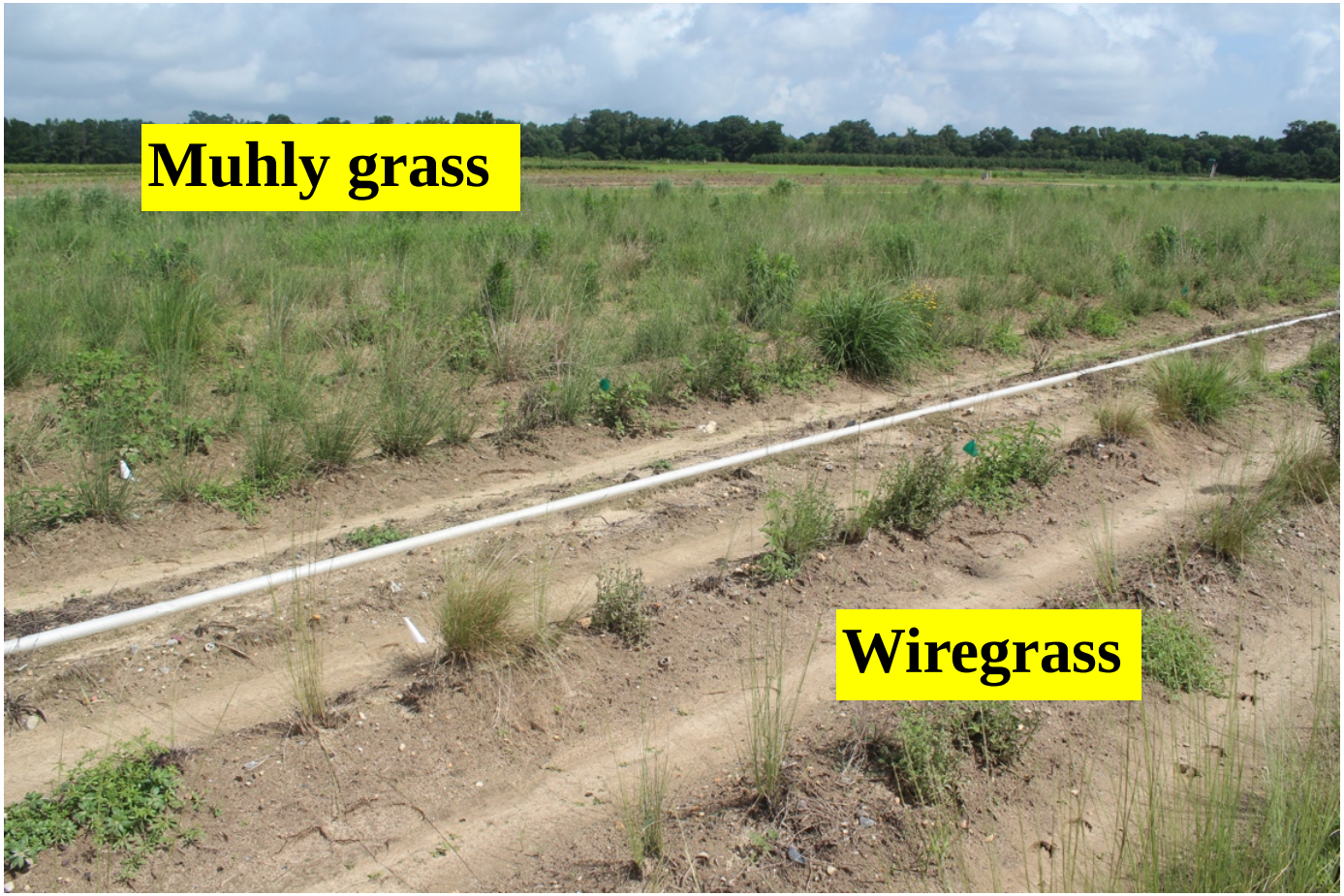
# Seed Production Area

# 2013

# Seed Production Area- 2013

- A wiregrass and muhly grass seed production area was sprayed with chemicals to determine tolerance and weed control.
- Visually evaluated the injury of the large production plants and the presence/absence of weeds
- Injury Rating: 1-9 (1=No Injury and 9=Mortality)

# Seed Production Area - 2013



# Seed Production Area - 2013:

## Evaluation and Weed Control Methods

- Low and High rate of each herbicide
- Evaluated using an injury rating (1-9) scale
  - 1= no injury
  - 9= plant mortality

<u>2 Study Species</u>

- Wiregrass
- Muhly grass

<u>5 Herbicides</u>

- Cobra
- Sedgehammer
- Goal
- GoalTender
- Pendulum Aquacap

# Seed Production Area – 2013
## Results

- None of the herbicides had significant effects on the plants in the seed production area.
- However, neither did any of the herbicides provide adequate weed control.
  - The area covered by weeds in the treatments steadily increased throughout the data collection.

# Seed Production Area

# 2014

# Seed Production Area- 2014

- Lolly Creek – Sumner, GA: land management company "committed to the growth and maintenance of the native landscape of the South — the Longleaf pine/wiregrass ecosystem"
- <u>Six Plant Species</u>
  - Narrow-leaf Sunflower } Sunflower
  - Florida Ticktrefoil } Forbs
  - Goat's Rue } Forbs
  - Wiregrass } Grasses
  - Yellow Indian Grass } Grasses
  - Little Bluestem } Grasses
- Each group received the same herbicides.

# Seed Production Area- 2014

- Plot Size: 6’ x 20’
- 15 Treatments
- 2 Herbicide Applications
  - March 27 and 31, 2014
  - May 5 and 6, 2014
- 8 Plots of each herbicide were sprayed in March
- 4 Plots of each herbicide received a second application in May to evaluate timing “A” vs. “A + B”

# Seed Production Area- 2014

| Sunflower Herbicides | Rates |
|---|---|
| **Prowl H2O** (Pendimethalin) | 24 oz/ac |
| **Dual Magnum** (S-metolachlor) | 21 oz/ac |
| **Spartan Charge** (Sulfentrazone) | 3.75 oz/ac |
| **Dual Magnum + Spartan Charge** | 24 + 3.75 oz/ac |
| **Prowl H2O + Spartan Charge** | 21 + 3.75 oz/ac |
| **Control** | N/A |

# Seed Production Area- 2014

| Grass Herbicides | Rates |
|---|---|
| **AAtrex** (Atrazine) | 32 oz/ac |
| **Cobra** (Lactofen) | 16 oz/ac |
| **Dual Magnum** (S-metachlor) | 21 oz/ac |
| **Goal 2XL** (Oxyflurofen) | 24 oz/ac |
| **GoalTender** (Oxyflurofen) | 36 oz/ac |
| **Prowl H2O** (Pendimethalin) | 24 oz/ac |
| **Weedmaster** (Dicamba) | 32 oz/ac |
| **Control** | N/A |

# Seed Production Area- 2014

| Forbs/Legumes Herbicides | Rates |
|---|---|
| **Clearcast** (Imazamox) | 6 oz/ac |
| **Prowl H2O** (Pendimethalin) | 24 oz/ac |
| **Plateau** (Imazapic) | 8 oz/ac |
| **Pursuit** (Imazethapyr) | 6 oz/ac |
| **Spartan Charge** (Sulfentrazone) | 3.75 oz/ac |
| **2,4 –DB** (Butyric Acid) | 32 oz/ac |
| **Control** | N/A |

# Seed Production Area- 2014

## Results

6/2/14 Dual + Spartan x2 on Sunflower

5/19/14 Spartan Charge x2 on Goat's Rue

6/16/14 GoalTender on Little Bluestem

- Now we know what doesn't work at least…
- The Goat's Rue has rebounded and is doing just fine.

# Seed Production Area – 2014
## Summary

- Goal and GoalTender were harmful to the grasses.
- AAtrex and Weedmaster worked great when applied over the grass species.
- The tank mixes (Dual + Spartan and Prowl + Spartan) were also too detrimental to Narrow-leaf Sunflower to be considered useful.
- Pursuit and Plateau each seemed to work well in Goat’s Rue and Florida Ticktrefoil.

# Imazapyr Bioassay

# Imazapyr Bioassay

- Imazapyr is a common forestry herbicide used in site preparation
- However, longleaf pine are particularly sensitive to imazapyr
- No good way to determine if the soil is still toxic
- Based on results from this study, longleaf pine may survive in soil that has been treated with imazapyr but there will be a lack of root growth and they will be severely stunted

# Imazapyr Bioassay

- 2 Soil Textures:
  - Coarse
  - Fine
- 4 Treatments
  - 30 oz/ac
  - 45 oz/ac
  - 60 oz/ac
  - Control
- 6 Indicator Species
  1) Tomato
  2) Sorghum
  3) Cucumber
  4) Lettuce
  5) Radish
  6) Cabbage

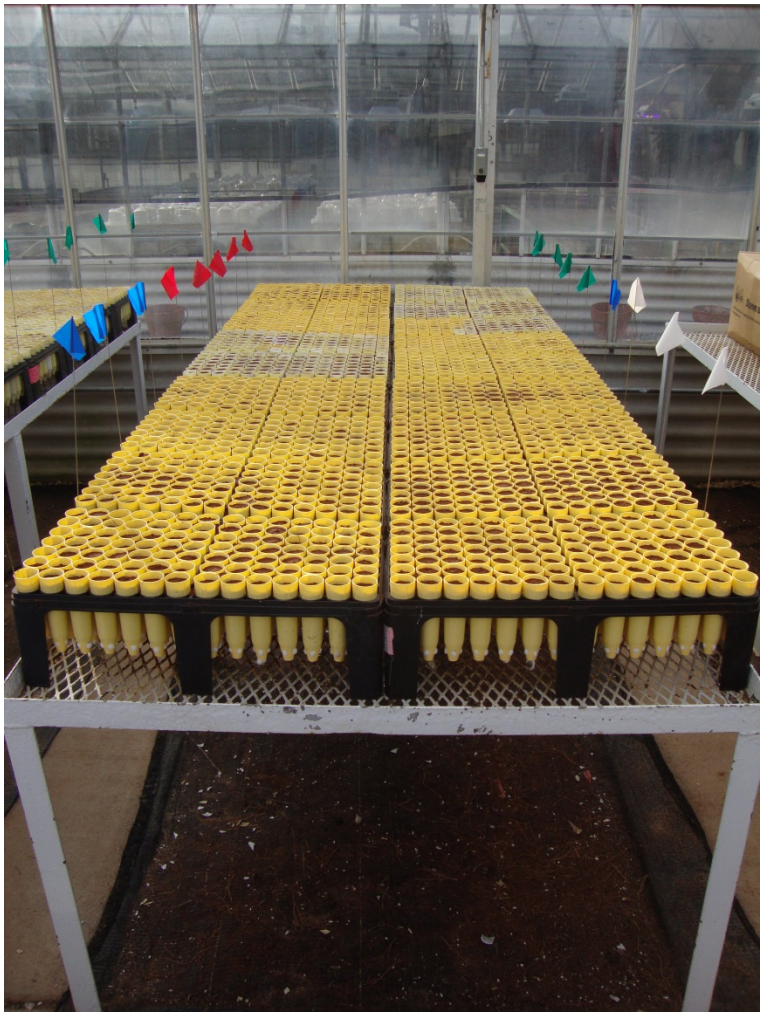
  \+ Longleaf Pine

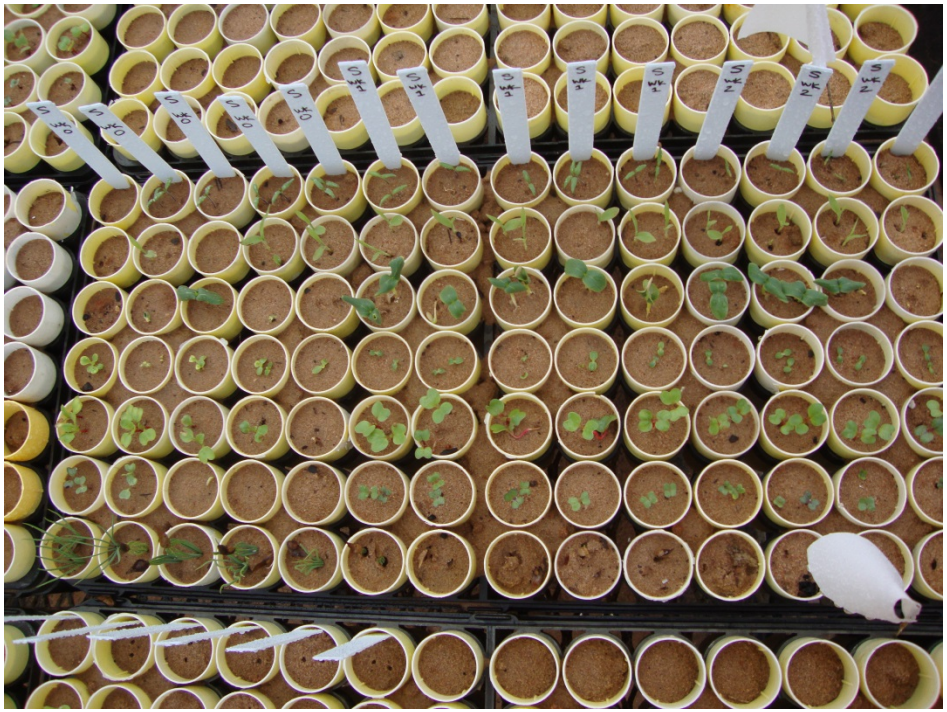
- All plants are sown from seed weekly for 14 weeks.
- Data is collected weekly (still ongoing)
  - Survival
  - Chlorosis
  - Injury (wilting, insect damage, stunting, etc.)
- Dry weight biomass is also collected once the plants are 16 weeks old

# Imazapyr Bioassay

- Quick and easy way to determine the toxicity in soil.
- Indicator plants determine if the herbicide concentration in the soil is safe to sow/plant longleaf.
- When one of the possible indicator species and the longleaf both germinate and establishes root growth, it is assumed that the imazapyr levels in the soil are low enough to allow longleaf to be planted.

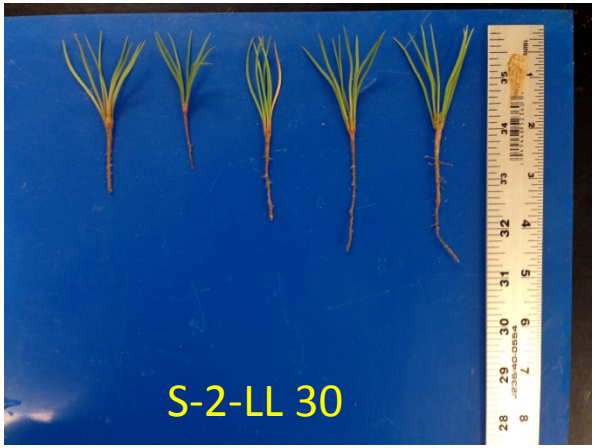
# Imazapyr Bioassay





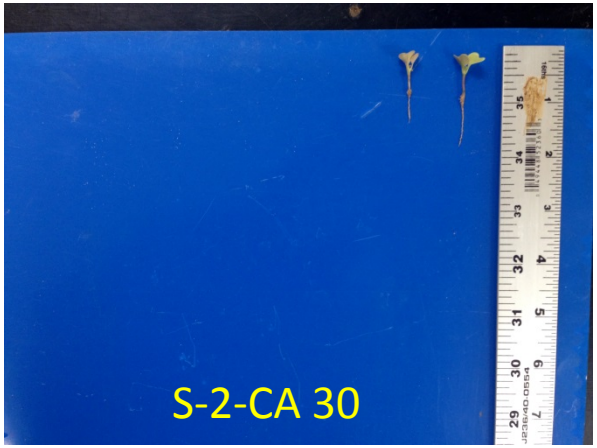
# Imazapyr Bioassay

## Longleaf Pine



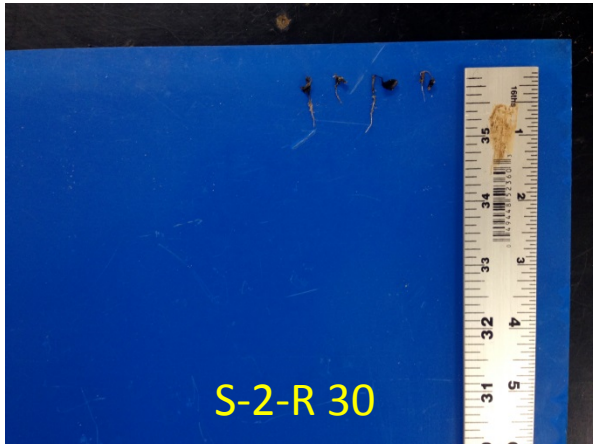


## Cabbage





## Radish

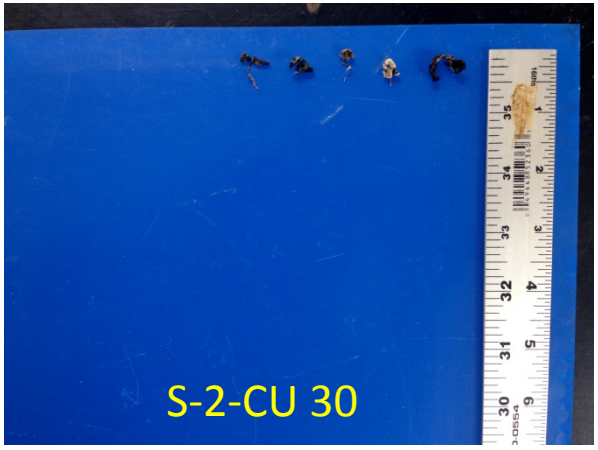


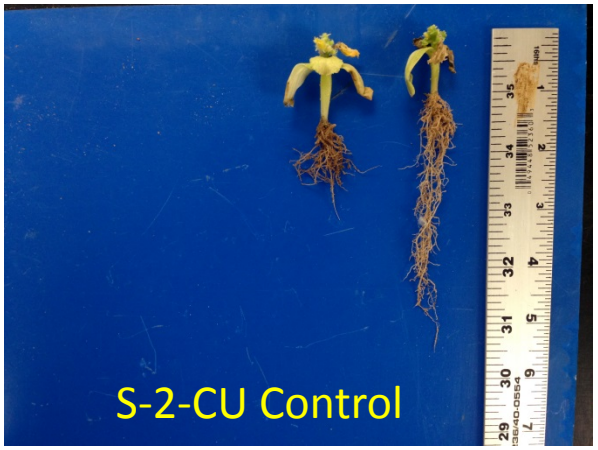

# Imazapyr Bioassay

## Lettuce

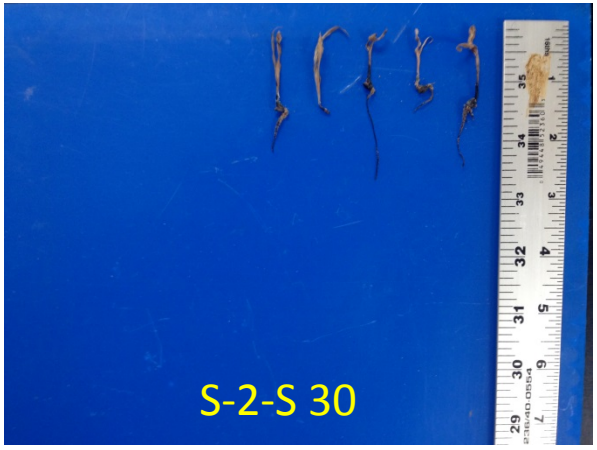


## Cucumber




## Sorghum




# Imazapyr Bioassay

## Tomato


# Imazapyr Bioassay

- Preliminary Data…
- Sorghum seems to be the best indicator species.
- Turns red in treated soil in about 2-3 weeks.
- Ideally, if sorghum is planted in treated soil and after 2-3 weeks if it is not red, then the soil is safe for longleaf seedlings.

# Acknowledgements

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# Questions?