

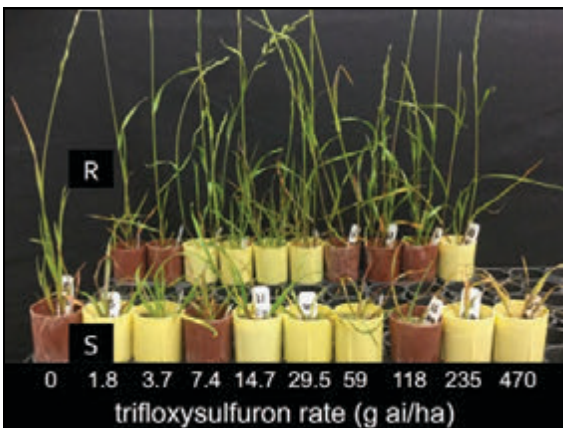
2019 Baleage and Silage Short Course:
Herbicide Resistance: A Growing Issue in
Pastures and Hayfields

Dr. Patrick McCullough
 UGA Extension Weed Scientist



Italian Ryegrass Control in Hayfields

| WSSA Group | Common Name | Trade Name |
|------------|----------------------------|---------------|
| 1 | sethoxydim | Poast, others |
| 2 | metsulfuron | Cimarron |
| 2 | nicosulfuron + metsulfuron | Pastora |
| 2 | imazapic | Impose |
| 9 | glyphosate | various |



Ryegrass Resistance

- Resistant to:
 - Glyphosate, ALS inhibitors (Pastora, Impose)
- Mechanism
 - Target site susceptibility
- Alternatives
 - Sethoxydim
 - Prowl (PRE control)



Photos: Aaron Patton, Purdue Univ.

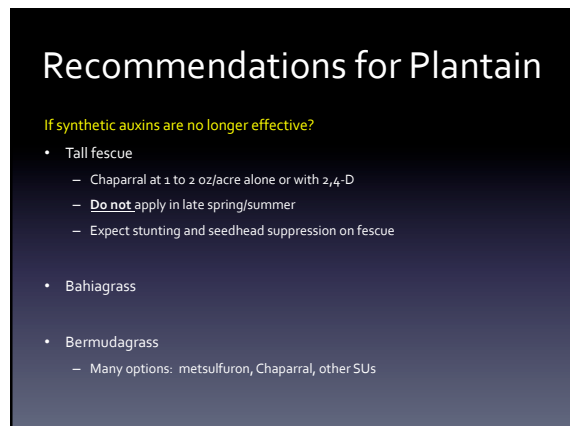
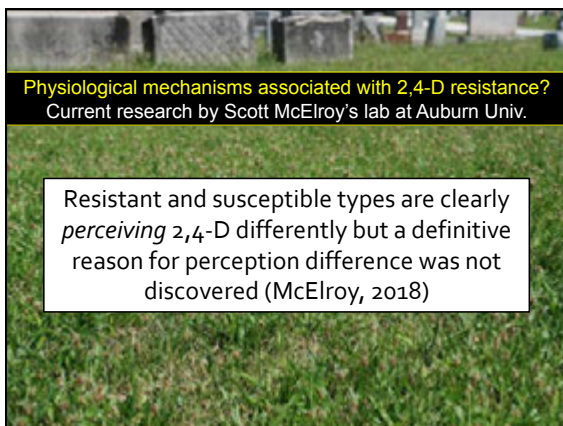
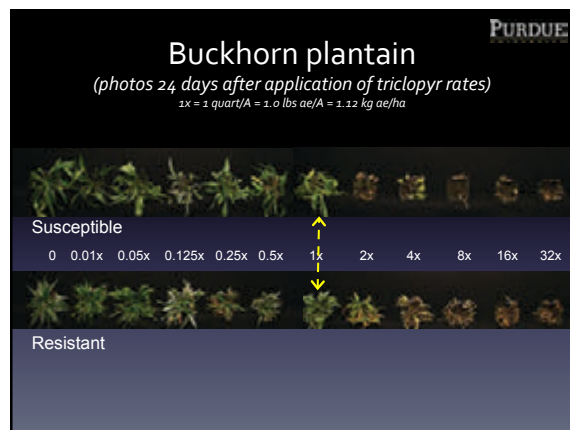
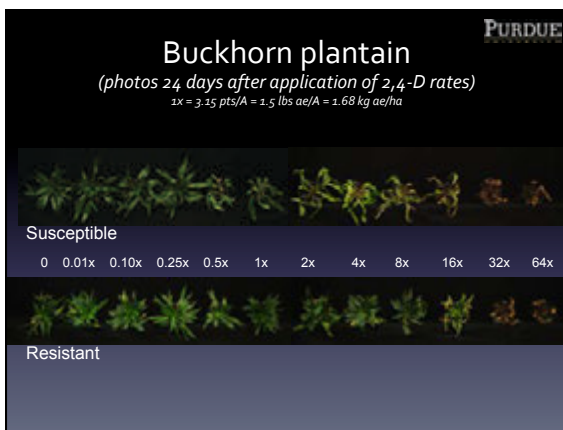


Buckhorn plantain in Georgia



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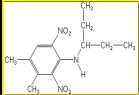
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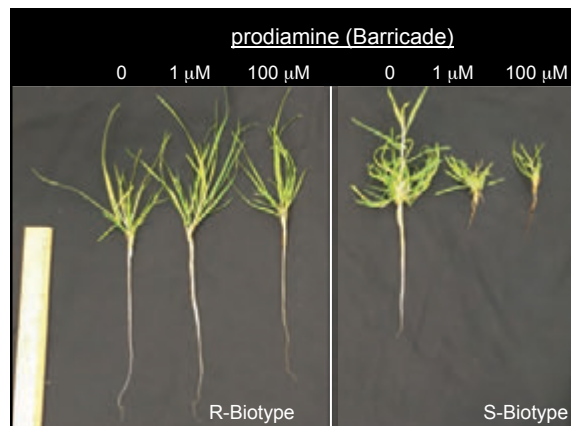
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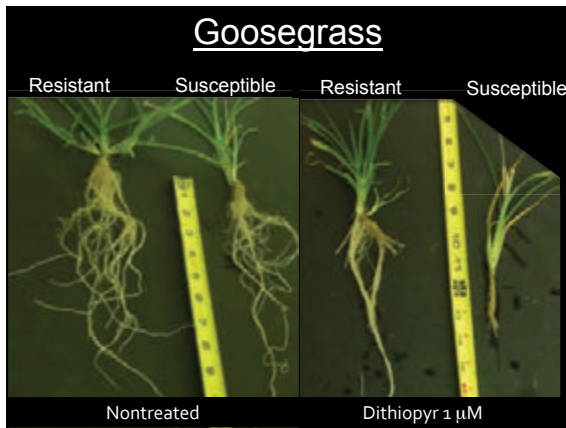
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pendimethalin



- Trade Name: Prowl H₂O (3.8SL)
 - Family: Dinitroaniline
 - Mode of action: Mitosis inhibition
- Applications: 1.1 to 4.2 qt/acre
- Maximum Use: 4.2 qt/acre per year
- Use in perennial grass pastures

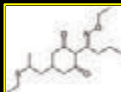




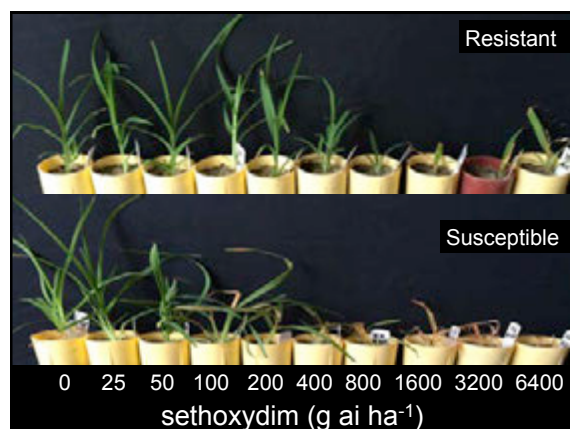
Implications for Hayfields

- Bermudagrass, bahiagrass, and alfalfa
 - Prowl H₂O is the only PRE herbicide labeled
 - Exclusive use will lead to selection pressure for resistant biotypes
- Other pasture species
 - No PRE herbicides available

sethoxydim

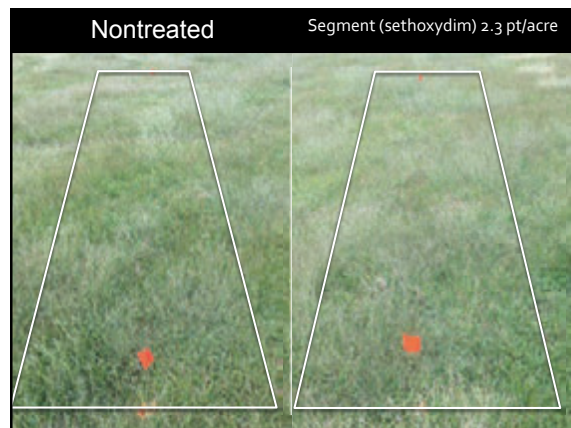
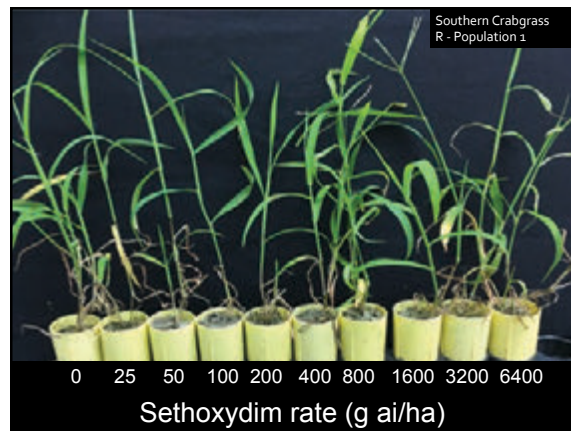
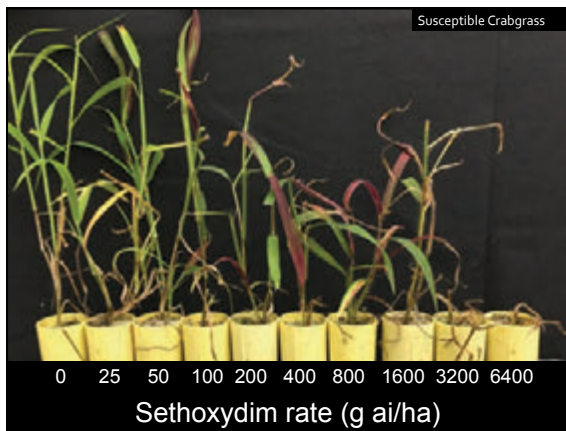
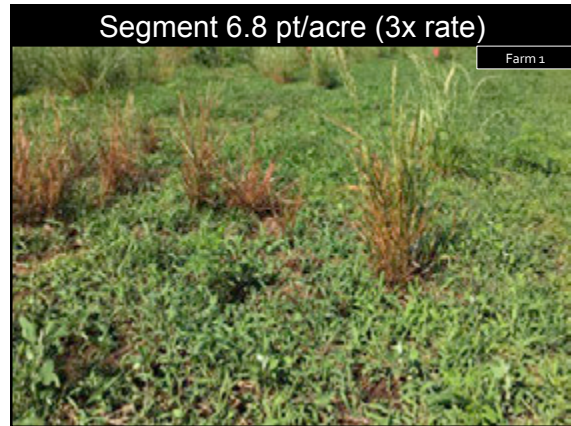
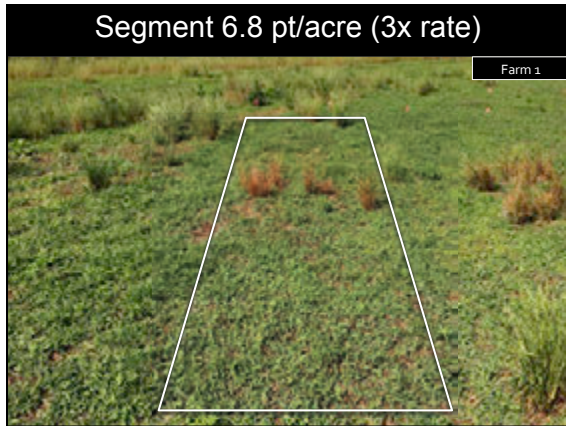


- Characteristics
 - Trade names: Segment, Poast, others
 - Mechanism of action: ACCase inhibitor
- Postemergence control of grassy weeds
 - Crabgrass, goosegrass, crowsfootgrass, bermudagrass, others
- Advantages for weed control in Georgia
 - Efficacy for selective weed control



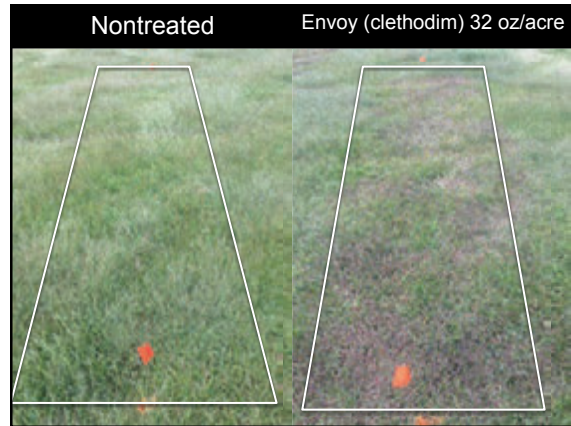
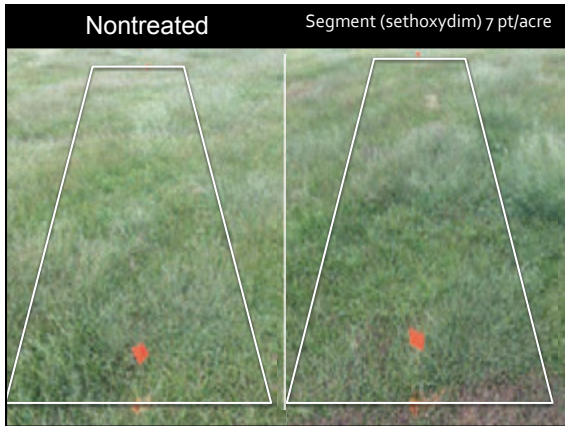
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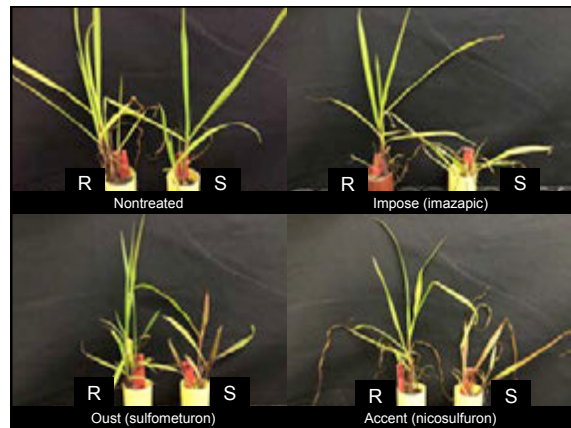
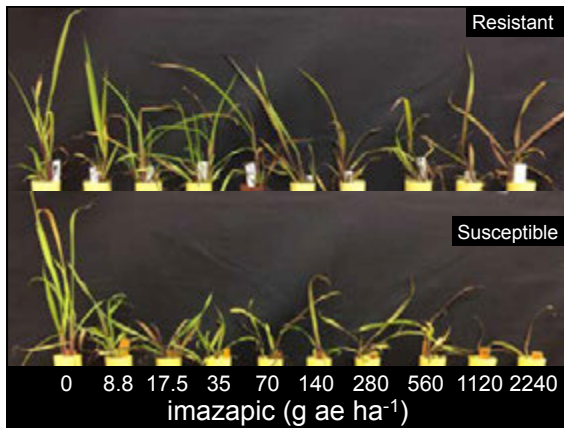
Crabgrass and Goosegrass Control in Hayfields

| WSSA Group | Common Name | Trade Name |
|------------|----------------------------|---------------|
| 1 | clethodim | Select |
| | sethoxydim | Poast, others |
| 2 | nicosulfuron + metsulfuron | Pastora |
| | imazapic | Impose |
| 9 | glyphosate | various |



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Vaseygrass Control in Hayfields

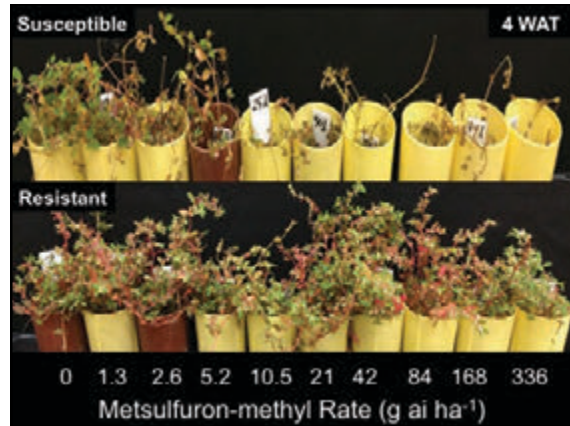
| WSSA Group | Common Name | Trade Name |
|------------|----------------------------|---------------|
| 1 | sethoxydim | Poast, others |
| 2 | nicosulfuron + metsulfuron | Pastora |
| 2 | imazapic | Impose |
| 9 | glyphosate | various |

- ALS-Resistant Vaseygrass**
- Resistance was greater than 80x of the susceptible biotype
 - Target site inhibition
 - ALS enzyme activity was not inhibited
 - Glyphosate or sethoxydim will control it



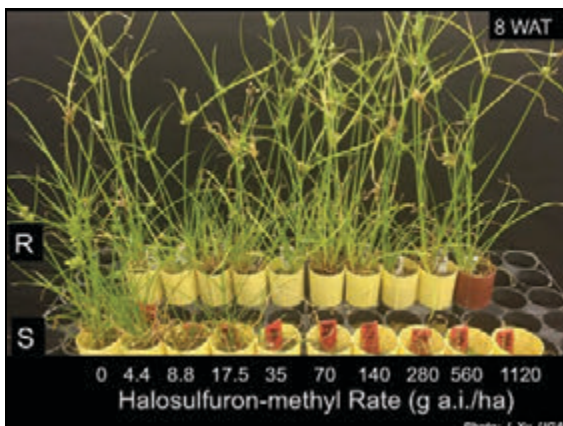
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Metsulfuron Resistant Spurge

- Gene mutation that confers resistance to all ALS inhibitors
- Alternatives to control
 - Dicamba, triclopyr, others



Gene Sequencing for the ALS Enzyme
 (McElroy, Auburn University)

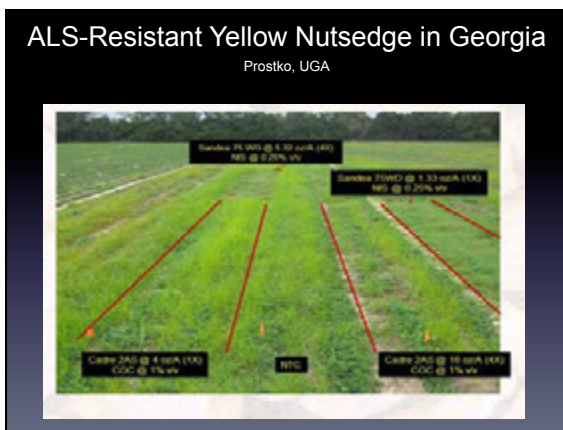
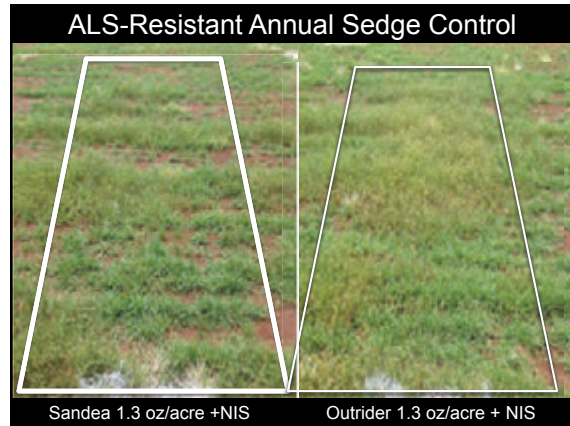
Pro-197

| | |
|---------------------|---|
| Antibiotic | GAATCCGCGGCTGATGATGCTGACAGCGGCTTCAAGGCGCCGATGCTGCGGCG |
| Translation ORF/CDS | Q V P R S W I G T G A F Q E T P I V E V |
| Susceptible | GAATCCGCGGCTGATGATGCTGACAGCGGCTTCAAGGCGCCGATGCTGCGGCG |
| Translation ORF/CDS | Q V P R S W I G T G A F Q E T P I V E V |
| Resistant | GAATCCGCGGCTGATGATGCTGACAGCGGCTTCAAGGCGCCGATGCTGCGGCG |
| Translation ORF/CDS | Q V R R M I G T G A F Q E T P I V E V |



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- ### ALS-Resistant Sedges Confirmed
- Yellow nutsedge (*Cyperus esculentus*)
 - Small flower umbrella sedge (*C. difformis*)
 - Rice flatsedge (*C. iria*)
 - Fragrant flatsedge (*C. odoratus*)
 - Shortleaf spike sedge (*C. brevifolis*)
- Busi et al. 2006; Heap 2015; Kuk et al. 2004; Merotto et al. 2010; Ortiz et al. 2015; Riar et al. 2015; Tehranian et al. 2015a,b

Herbicides for Sedge Control in Hayfield

| WSSA Group | Common Name | Trade Name |
|------------|---------------|------------|
| 2 | imazapic | Impose |
| | halosulfuron | Sandaea |
| | sulfosulfuron | Outrider |
| 9 | glyphosate | various |

- ### Herbicide Resistance Should Only Be Suspected When
- The same herbicide or herbicides with the same mode of action have been used year after year.
 - One weed normally controlled is not
 - Healthy weeds are mixed with controlled weeds (same species)
 - Patches of uncontrolled weeds are spreading.
- Causes of herbicide failure are ruled out



Causes of Herbicide Failures

- weed size**
- rate
- moisture
- application method
- temperature
- calibration
- humidity
- others

All possible reasons for poor performance should be investigated before considering the possibility of resistance!!!

Herbicide Resistance

Managing Herbicide Resistance

- Rotate herbicides from year to year
- Rotate herbicides with different mode-of-action.

Questions

