Implementation of Integrated Strategies to Manage Giant Smutgrass (*Sporobolus indicus* var. *pyramidalis*) in Bahiagrass Pastures

06/11/2019 - José Luiz Carvalho de Souza Dias – RCREC/UF

Presentation Outline

1. Introduction
2. Smutgrass background
3. Why is smutgrass a serious concern?
4. Why effective management is difficult to achieve?
5. Rainfall studies and conclusions

1) Introduction

- ≈ 42% of U.S. land area
- ≈ 33% of FL land area
- 790,000 calves in 2017
- Forages and cattle nutrition
- Efficient use forage
- Bahiagrass (*P. notatum*)
1) Introduction

- Lack of management
- $2$ billion per yr
- $1^{st}$ pest

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1) Introduction

- $45\%$ are invasive
- In FL, $900$ species

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2) Smutgrass Background

- Smutgrass is a member of the *Sporobolus* genus
- Diverse range of perennial, annual, tussock and creeping species
Many species have spread throughout the globe
Important agronomic and environmental concern in many parts of the world (e.g., USA, Australia and Brazil)

2) Smutgrass Background
- Smutgrass species problematic in the USA:
  - Found in planted grass pastures, roadides and disturbed waste places
  - There are 21 species of which two were introduced (Asia)
    - Small smutgrass (Sporobolus indicus)
    - Giant smutgrass (Sporobolus indicus var. pyramidalis)

2) Smutgrass Background
- Small smutgrass (Sporobolus indicus var. indicus)
- Giant smutgrass (Sporobolus indicus var. pyramidalis)
3) Why is smutgrass a serious concern?

A. It is an invasive weed
   - Successfully establish, become naturalized, and spread to new natural habitats apparently without further assistance from humans
   - Category I (list of nuisance plants, FLEPPC 2019)

3) Why is smutgrass a serious concern?

B. Impacts on forage production
   - Decreases pastures production potential
   - Medium and high infestations reduced bahiagrass monthly HM by 51 to 87%, respectively
   - Estimated to cost $25 to $50 acre⁻¹ depending on density

3) Why is smutgrass a serious concern?

C. Decreases desirable forages persistence
   - Increases grazing pressure on desirable forages
   - Over stocking
Therefore:

Smutgrass management is a major component of successful forage-based livestock operation systems.

Easier said than done though ….

3) Why is smutgrass a serious concern?

- Smutgrass first noticed as a serious weed in Florida in the 1950s.

1960s

- Many different weed control methods:
  - Biological
  - Mechanical
  - Cultural
  - Chemical

4) Why is effective management difficult to achieve?

1. Its biological and ecological features:
   - Can germinate and emerge throughout the entire growing season
   - Prolific seed producer
   - Large and long-lived seed bank
   - Can be easily dispersed
4) Why effective management is difficult to achieve?

2. Very limited herbicide options
   - Glyphosate (EPSP synthase inhibitor)
     - Broad-spectrum systemic
   - Hexazinone (PSII / Photosynthesis inhibitor)
     - Hexazinone at 4 pts A⁻¹ (1.12 kg ai ha⁻¹) (~ $100 ha⁻¹)
     - Occasional lack of control

   - Hexazinone characteristics
   - Soil properties (sandy texture)
   - Rainfall pattern (lack or excess of rainfall)

4) Why effective management is difficult to achieve?

   ➤ Chemical Properties X Uptake Mechanism X Soil Properties

   Chemical properties
   - High solubility and low Koc
   - Xylem mobile

   Uptake mechanism
   - Most absorbed by roots
   - Limited foliar absorption

   Soil Properties
   - Sandy texture
   - Organic Matter
Rainfall x Hexazinone x Smutgrass Control Interaction

Soil Surface

Root zone

Ground Water

No rainfall after application
Rainfall x Hexazinone x Smutgrass Control Interaction

Soil Surface

Root zone

Ground Water

Smutgrass clumps
4) **Why effective management is difficult to achieve?**

- Therefore, it is necessary to:
  - Develop new management strategies to effectively control giant smutgrass
  - Optimize the use of hexazinone by investigating how rainfall impacts its efficacy
    - Greenhouse and field experiments

5) **Rainfall Studies – Greenhouse**

- **Objectives:**
  - To determine the effects of increasing simulated rainfall volumes on hexazinone activity at two different rates
- **Hypothesis:**
  - Lack or excessive amounts of simulated rainfall will decrease hexazinone activity, regardless of the rate
- **Goal:**
  - To determine this optimum rainfall range for peak of hexazinone activity
Greenhouse experiments were conducted three times
Pots were filled with soil collected at site (Placid fine sand)
Plants were grown in the greenhouse for ≈ 2.5 months

Treatments included the 2 x 7 factorial arrangement of:
- Two hexazinone rates:
  - 2 and 4 pts A⁻¹ (0.56 and 1.12 kg ai ha⁻¹)
- Seven simulated rainfall volumes:
  - 0; 0.25; 0.5; 1.0; 2.0; 4.0 and 8.0 inches
- Single pots were considered the experimental unit

Herbicide treatment application:
- CO₂ pressurized back-pack sprayer; 3.0 miles h⁻¹
- 20 gal/A (187 L ha⁻¹)
5) Greenhouse Rainfall Study – Materials & Methods

- Simulated rainfall treatment application:
  - 2 hours after herbicides application
  - Tlaloc 3000 rainfall simulator
  - 2.8 x 2.3 m² area
  - Central nozzle at 3.0 m above
  - ≈ 2.0 inches h⁻¹

- Pots were allowed to drain for 3-h before returning
- All pots were sub-irrigated with 60 ml of water as needed

5) Greenhouse Rainfall Study – Materials & Methods

- Response variables:
  - Visual % of control at 30 DAT
  - Biomass reduction at 30 DAT

- Statistical analysis:
  - CRD with 4 replicates
  - Mixed-effect models
    - Run (random effect)
    - Rainfall and rate (fixed effect)
  - Non-linear regression analysis (log-logistic models)
Results – Rainfall x Hexazinone rate (P < 0.05)

ER<sub>50</sub> = 1.4 inches

Dry biomass reduction (%) vs. Simulated rainfall volumes (in)

hexazinone at 2 pts A⁻¹
hexazinone at 4 pts A⁻¹

ER<sub>50</sub> = 3.1 inches

Dry biomass reduction (%) vs. Simulated rainfall volumes (in)

hexazinone at 2 pts A⁻¹
hexazinone at 4 pts A⁻¹

5) Greenhouse Rainfall Study – Results

0 in 0.25 in 0.5 in 1.0 in 2.0 in 4.0 in 8.0 in

ER<sub>50</sub> = 5.1 inches

Dry biomass reduction (%) vs. Simulated rainfall volumes (in)

hexazinone at 2 pts A⁻¹
hexazinone at 4 pts A⁻¹
5) Greenhouse Rainfall Study – Results

5) Greenhouse Rainfall Study – Conclusions

➢ These data indicated that:

1. Rainfall after hexazinone application did impact hexazinone activity, regardless of the rate

2. Hexazinone peak of activity appears to occur from:
   ❖ 0.25 to 1.0 inches for hexazinone at 2.0 pts A⁻¹
   ❖ 0.25 to 2.0 inches for hexazinone at 4.0 pts A⁻¹

3. What about natural rainfall effects in the field?
5) Field Rainfall Study – Materials & Methods

- Field experiments were conducted at the RCREC in 2017, and repeated in 2018.
- Rainfall data-logger (RainWise RainLog TM 2.0).

5) Field Rainfall Study – Materials & Methods

- Twenty-two weekly applications were performed from May until November with a tractor-mounted sprayer.
  - Flat fan nozzles
  - 25 gal A⁻¹ (233 L ha⁻¹)

5) Field Rainfall Study – Materials & Methods

- Visual estimates of control 35 DAT and measuring the % of density reduction (6 to 11 MAP).
5) Field Rainfall Study – Materials & Methods
- Twenty-two weekly applications were performed from May until November with a tractor-mounted sprayer
- Visual estimates of control 35 DAT and measuring the % of density reduction (0 to 11 MAP).
- Based on the rainfall amount recorded during the first 7 DAT, a rainfall class was designated to each EU
- Analysis of covariance
  - Rainfall class and rate (fixed effects)
  - Year and block (random effects)
- Fisher’s LSD (P ≤ 0.05)

<table>
<thead>
<tr>
<th>Rainfall class</th>
<th>Rainfall recorded 7 DAT</th>
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<tbody>
<tr>
<td>0</td>
<td>0 to 0.35 in</td>
</tr>
<tr>
<td>1</td>
<td>&gt; 0.35 ≤ 1.0 in</td>
</tr>
<tr>
<td>2</td>
<td>&gt; 1.0 ≤ 2.0 in</td>
</tr>
<tr>
<td>3</td>
<td>&gt; 2.0 ≤ 3.0 in</td>
</tr>
<tr>
<td>4</td>
<td>&gt; 3.0 ≤ 4.0 in</td>
</tr>
<tr>
<td>5</td>
<td>&gt; 4.0 ≤ 5.0 in</td>
</tr>
<tr>
<td>6</td>
<td>&gt; 5.0 in</td>
</tr>
</tbody>
</table>

Rainfall class x hexazinone rate for visual control (P<0.05)

Rainfall class x hexazinone rate for visual control (P<0.05)
Rainfall class x hexazinone rate for visual control (P<0.05)

Rainfall class x hexazinone rate for density reduction (P<0.05)
Rainfall class x hexazinone rate for density reduction (P<0.05)

- Hexazinone at 4.0 pts A⁻¹

- Application on 08/11/2017 fb 4.3 in 7 DAT (avg 84% control)
- Greatest rainfall event recorded during this period was 1.1 in on the 6th day.

Rainfall Studies Main Findings and Implications
- Management with hexazinone (4 pts A⁻¹) (1.12 kg ha⁻¹)
- Hexazinone dynamic mobility in sandy soils
- Peak of activity appears to occur when followed by 0.35 to 3.0 inches 7 DAT
- Ranchers should check the rainfall forecast
- Several factors can still impact activity
- Hexazinone should not be used as a single control tool
- Future research should be conducted over longer experimental periods and more locations
Thank you

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