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*)

6/27/2019


1) Introduction
➢ Lack of management
➢ $2 billion per yr
➢ 1st pest
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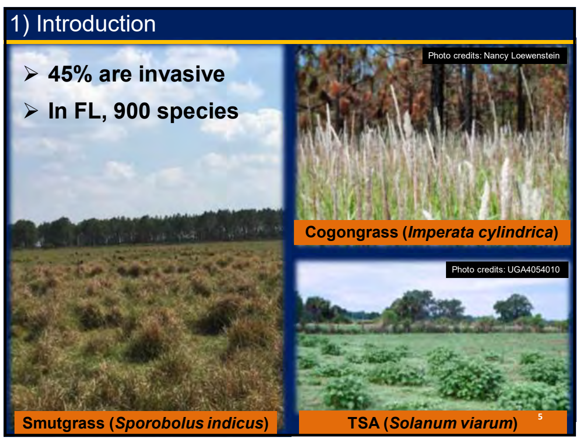
1) Introduction
➢ 45% are invasive
➢ In FL, 900 species
Photo credits: Nancy Loewenstein
Cogongrass (*Imperata cylindrica*)
Photo credits: UGA4054010
Smutgrass (*Sporobolus indicus*)
TSA (*Solanum viarum*)
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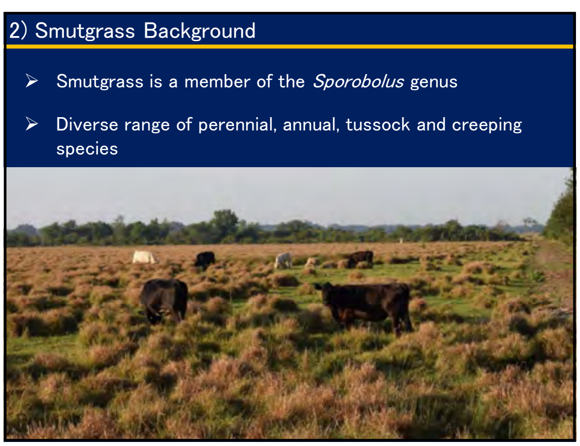
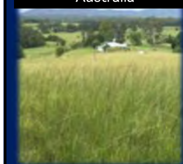

2) Smutgrass Background
➢ Smutgrass is a member of the *Sporobolus* genus
➢ Diverse range of perennial, annual, tussock and creeping species

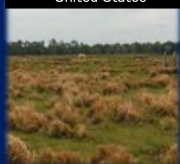
2) Smutgrass Background

- Many species have spread throughout the globe
- Important agronomic and environmental concern in many parts of the world (e.g., USA, Australia and Brazil)

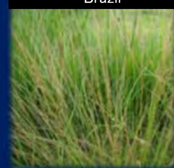
Australia



United States



Brazil



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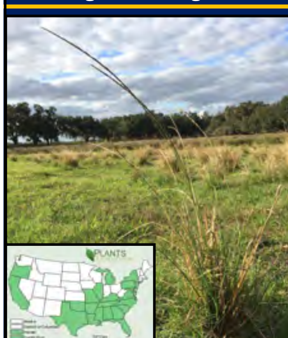
2) Smutgrass Background

- Smutgrass species problematic in the USA:
  - Found in planted grass pastures, roadsides 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


vs.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3) Why is smutgrass a serious concern?

C. Decreases desirable forages persistence

- ❖ Increases grazing pressure on desirable forages

3) Why is smutgrass a serious concern?

- Therefore:

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

Easier said than done though ….

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Research on Management Time Line

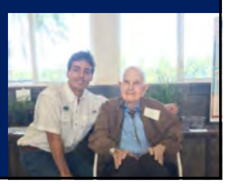
Small smutgrass first noticed as a serious weed in Florida

1950s

1960s

2019

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



4) Why effective management is 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)
  - o Broad-spectrum systemic
- ❖ Hexazinone (PSII / Photosynthesis inhibitor)
  - o Hexazinone at 4 pts A^{-1} (1.12 kg ai ha^{-1}) (≈ \$100 ha^{-1})
  - o Occasional lack of control

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  - o Occasional lack of control

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

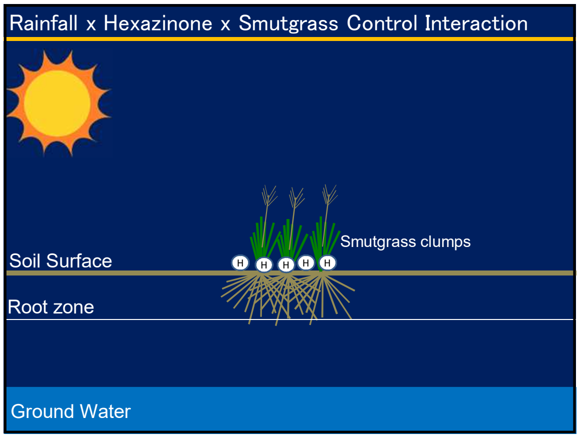
4) Why effective management is difficult to achieve?

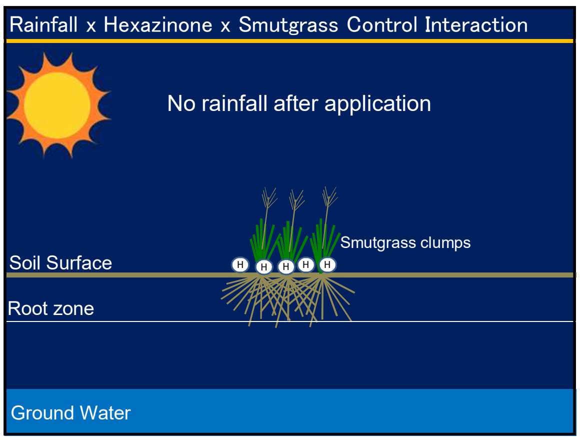
➢Chemical Properties X Uptake Mechanism X Soil Properties

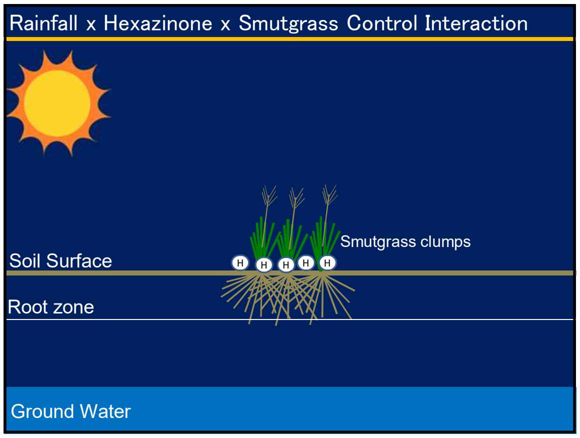
Chemical properties
- High solubility and low K_{oc}
- Xylem mobile

Uptake mechanism
- Most absorbed by roots
- Limited foliar absorption

Soil Properties
- Sandy texture
- ↓Organic Matter


Rainfall x Hexazinone x Smutgrass Control Interaction
Smutgrass clumps
Soil Surface
Root zone
Ground Water


Rainfall x Hexazinone x Smutgrass Control Interaction
No rainfall after application
Smutgrass clumps
Soil Surface
Root zone
Ground Water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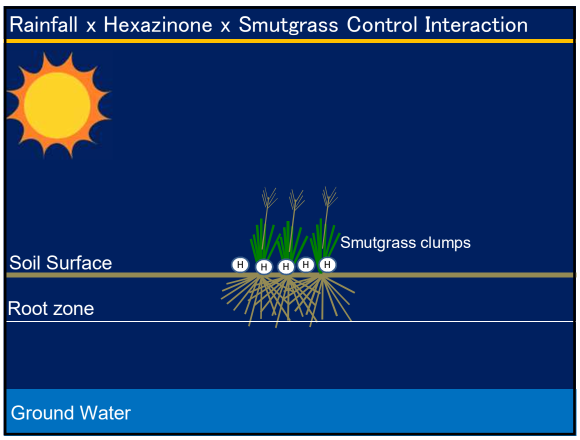
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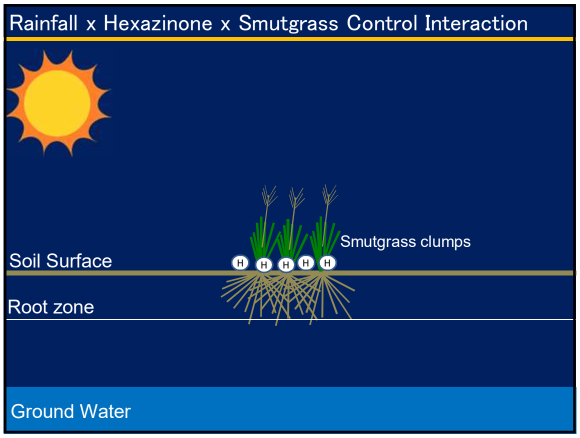
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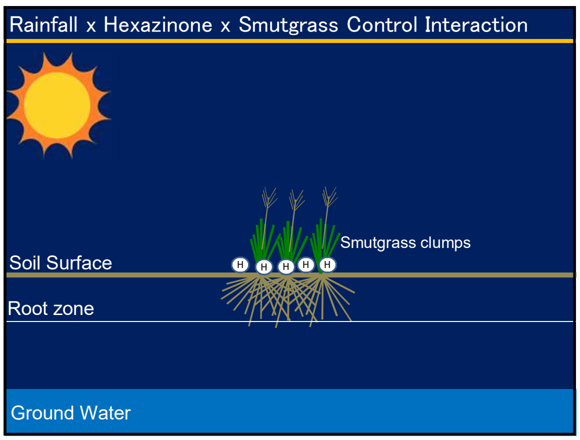
Rainfall x Hexazinone x Smutgrass Control Interaction
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Soil Surface
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Ground Water

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 hexazinone by investigating how rainfall impacts its efficacy
    - Greenhouse and field experiments

Rainfall Effects on Giant Smutgrass Control with Hexazinone
Greenhouse Study

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

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5) Greenhouse Rainfall Study – Materials & Methods

- 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


5) Greenhouse Rainfall Study – Materials & Methods

- 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

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5) Greenhouse Rainfall Study – Materials & Methods

- Herbicide treatment application:
  - CO_2 pressurized back-pack sprayer; 3.0 miles h^{-1}
  - 20 gal/A (187 L ha^{-1})

5) Greenhouse Rainfall Study – Materials & Methods

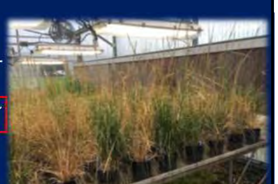
- Simulated rainfall treatment application:
  - 2 hours after herbicides application
  - Tlaloc 3000 rainfall simulator
  - 2.8 x 2.3 m^2 area
  - Central nozzle at 3.0 m above
  - ≈ 2.0 inches h^{-1}

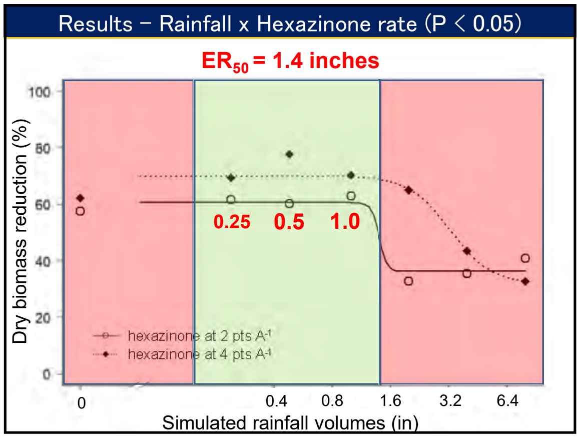
5) Greenhouse Rainfall Study – Materials & Methods

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

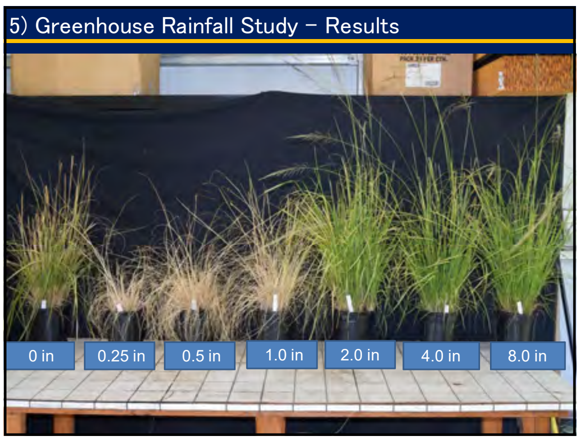
5) Greenhouse Rainfall Study – Materials & Methods

- **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)

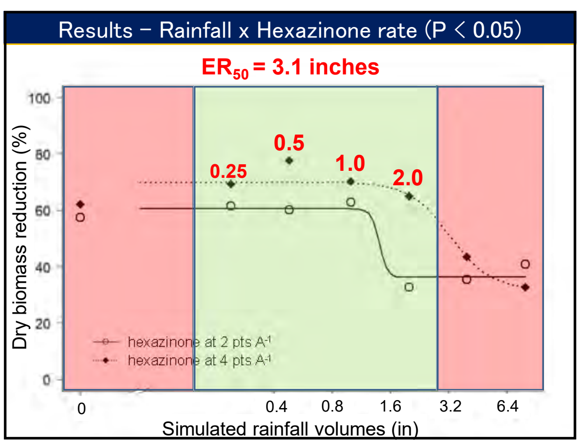




Results – Rainfall x Hexazinone rate (P < 0.05)
ER$_{50}$ = 1.4 inches
0.25
0.5
1.0
Dry biomass reduction (%)
100
80
60
40
20
0
hexazinone at 2 pts A^{-1}
hexazinone at 4 pts A^{-1}
0
0.4
0.8
1.6
3.2
6.4
Simulated rainfall volumes (in)



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



Results – Rainfall x Hexazinone rate (P < 0.05)
ER$_{50}$ = 3.1 inches
0.5
0.25
1.0
2.0
Dry biomass reduction (%)
100
80
60
40
20
0
hexazinone at 2 pts A^{-1}
hexazinone at 4 pts A^{-1}
0
0.4
0.8
1.6
3.2
6.4
Simulated rainfall volumes (in)

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?

Rainfall Effects on Giant Smutgrass Control with Hexazinone Field Study

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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})

2 and 4 pts A^{-1}

05/05/2017 05/12/2017 05/19/2017 05/26/2017 06/02/2017 06/09/2017 06/16/2017 … 09/08/2017 09/15/2017 09/22/2017 09/29/2017

5) Field Rainfall Study – Materials & Methods

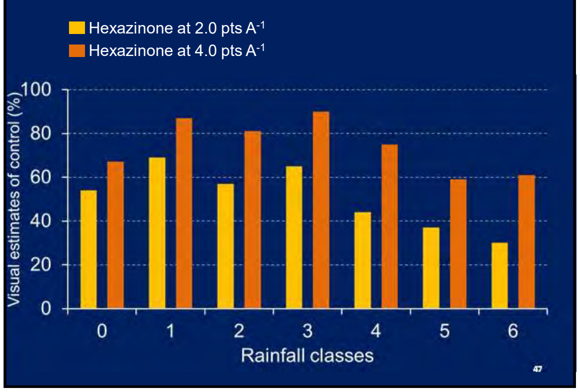
- Twenty-two weekly applications were performed from May until November with a tractor-mounted sprayer
- Visual estimates of control 35 DAT and measuring the % of density reduction (6 to 11 MAP).

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 (6 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 ($P \leq 0.05$)

Rainfall class	Rainfall recorded 7 DAT
0	0 to 0.35 in
1	> 0.35 ≤ 1.0 in
2	> 1.0 ≤ 2.0 in
3	> 2.0 ≤ 3.0 in
4	> 3.0 ≤ 4.0 in
5	> 4.0 ≤ 5.0 in
6	> 5.0 in

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



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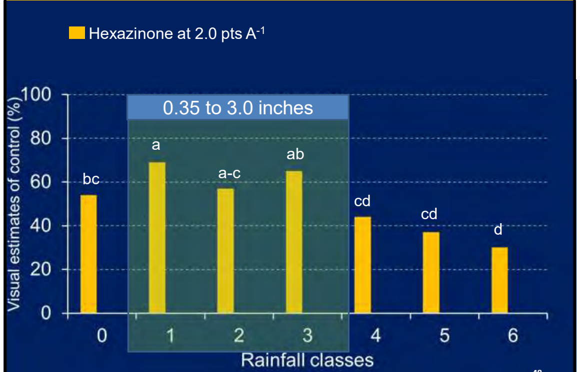
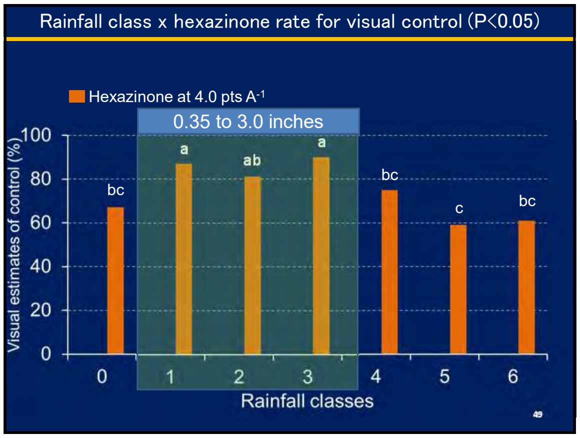
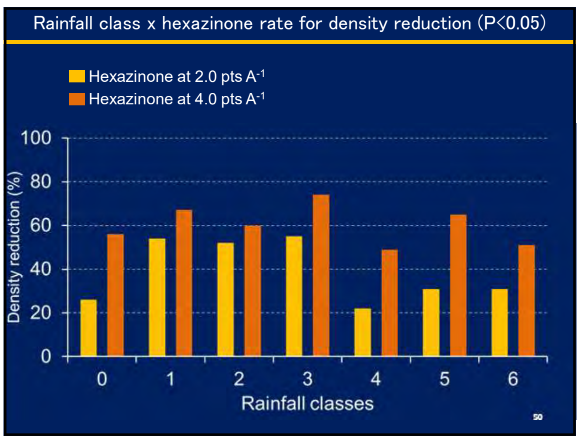
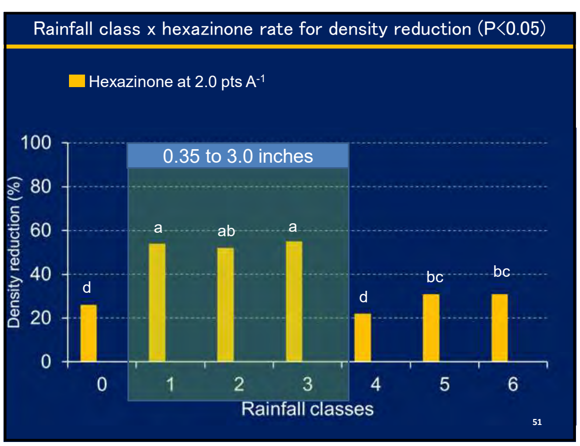



Rainfall class x hexazinone rate for visual control (P<0.05)
Hexazinone at 4.0 pts A-1
0.35 to 3.0 inches
Visual estimates of control (%)
100
80
60
40
20
0
bc
a
ab
a
bc
c
bc
0
1
2
3
4
5
6
Rainfall classes
49


Rainfall class x hexazinone rate for density reduction (P<0.05)
Hexazinone at 2.0 pts A-1
Hexazinone at 4.0 pts A-1
Density reduction (%)
100
80
60
40
20
0
0
1
2
3
4
5
6
Rainfall classes
50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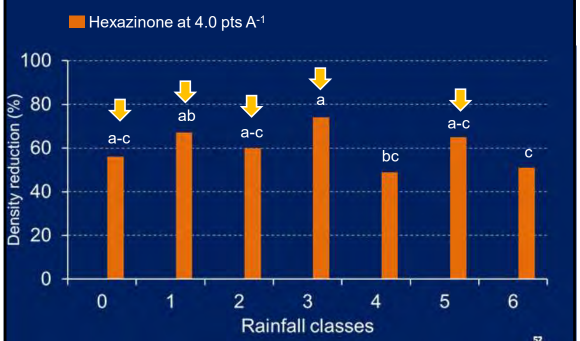
100
80
60
40
20
0
d
a
ab
a
d
bc
bc
0
1
2
3
4
5
6
Rainfall classes
51

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



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- 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

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➢Thank you

- Dr. Sellers
- Dr. Ferrell
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- Dr. Vendramini
- Dr. Moriel

- USDA-NIFA-CARE grants program
- Florida Cattlemen Enhancement Board
- All the people who helped with my research

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