Affect of Toxic or Novel Endophyte Tall Fescue on Growth and Reproduction

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Fescue Toxicosis Symptoms

Health
- Vasoconstriction (narrowing of blood vessels)
- Fescue foot
- Poor thermoregulation (including heat stress)
- Fat necrosis

Production
- Low feed intake and rate of gain
- Low birth weight and weaning weight
- Low breeding rate
- Dystocia (birthing problems)
- Agalactia (poor milk production)
Fescue foot
Circulation in hoof

Healthy

Fescue Foot
Fat Necrosis

Intestine

Fat

Fat
Birth weight of lambs from ewes fed toxic or E- tall fescue seed

Duckett et al, 2014
Fescue Toxicosis: The Cause
The Endophyte:

The endophyte grows in tall fescue between the plant cells
Ergot alkaloid molecules

**ERGOPEPTINE STRUCTURE**

<table>
<thead>
<tr>
<th>R1</th>
<th>R2</th>
<th>METHYL</th>
<th>ETHYL</th>
<th>ISOPROPYL</th>
</tr>
</thead>
<tbody>
<tr>
<td>R2</td>
<td>ISOPROPYL</td>
<td>ERGOVALINE</td>
<td>ERGONINE</td>
<td>ERGOCORNINE</td>
</tr>
<tr>
<td>ISOBUTYL</td>
<td>ERGOSINE</td>
<td>ERGOPTINE</td>
<td>ERGOCRYPTINE</td>
<td></td>
</tr>
<tr>
<td>ISOPHENYL</td>
<td>ERGOTAMINE</td>
<td>ERGOSTINE</td>
<td>ERGOCRISTINE</td>
<td></td>
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</tbody>
</table>
Endophyte location in the plant
Retained winter hair coat

Cattle on KY31 E+ in summer in Missouri
## Cattle average daily gains

<table>
<thead>
<tr>
<th>State</th>
<th>E+ (lb/day)</th>
<th>E- (lb/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama (grazing)</td>
<td>1.41</td>
<td>2.18</td>
</tr>
<tr>
<td>Alabama (seed)</td>
<td>0.44</td>
<td>2.12</td>
</tr>
<tr>
<td>Alabama</td>
<td>1.00</td>
<td>1.83</td>
</tr>
<tr>
<td>Georgia</td>
<td>1.02</td>
<td>1.31</td>
</tr>
<tr>
<td>Missouri</td>
<td>0.97</td>
<td>1.41</td>
</tr>
<tr>
<td>North Carolina (heifers)</td>
<td>0.55</td>
<td>1.65</td>
</tr>
<tr>
<td>Virginia</td>
<td>1.06</td>
<td>1.47</td>
</tr>
<tr>
<td>Texas</td>
<td>0.99</td>
<td>2.14</td>
</tr>
</tbody>
</table>
Calving rate

Alabama

Kentucky

Calving Rate (%)
How Big is the Fescue Problem?

• 8.5 Million Cows
• 35 million acres
• Losses total $1 Billion!
• What do other big industry issues cost us?
  – Shipping Fever….BRD Complex

$1 Billion
The endophyte provides persistence

Endophyte-free

Endophyte-infected
KY31 E+ toxins vary throughout the year
Calving Rates: Spring vs. Fall Calving

KY31 E+

Caldwell et al, 2010
Promising approaches

• **Plant-based**
  – Suppression/clipping of seed heads
  – Aggressive and adaptive pasture management
  – **Novel endophyte varieties**
  – Legumes
  – Diversify forage systems (annuals and native warm season grasses)

• **Animal-based**
  – Fall Calving
  – Genetic markers/selection (hair coat/heat tolerance)
  – Progesterone supplementation
  – Feed through remedies
  – Supplemental feed
Tall Fescue

**Toxic Endophyte**
- Toxicosis
- Excellent persistence

**Endophyte-Free**
- No toxicosis
- Poor persistence

**Novel Endophyte**
- No toxicosis
- Excellent persistence
What a difference a strain can make!
What Could Novel Endophyte Do For Us?

- Increased ADG in growing cattle (up to 1 lb/day)
- Increased weaning weights (50 to 100 lbs)
- Increased breeding rate in Spring-calving cows (up to 90% from where you are now)
- Improved animal welfare
- Reduced need to supplement
- Improved reputation and quality of feeder cattle
- More carcasses graded as Choice
Growing cattle performance, forage quality and stand persistence of Jesup tall fescue in a stockpiling system

- Stands of Jesup tall fescue with no endophyte, or with wild type or non-toxic (AR542) endophytes were established in 1999.
- Stands were winter stockpiled in 5 consecutive growing seasons and grazed using frontal strip-grazing management.
- Summer growth was harvested for hay.
- Spring growth was grazed in 3 of 5 years.
Performance of heifers grazing fescue varying in endophyte status during winter and spring, Drewnoski et al., 2009

Growth performance of heifers consuming fescue with varying endophyte status

<table>
<thead>
<tr>
<th></th>
<th>Winter</th>
<th>Spring</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADG, lb/day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E+</td>
<td>a</td>
<td>b</td>
<td>a</td>
</tr>
<tr>
<td>E-</td>
<td>a</td>
<td>b</td>
<td>b</td>
</tr>
<tr>
<td>EN</td>
<td>a</td>
<td>b</td>
<td>b</td>
</tr>
</tbody>
</table>

a, b, c P <0.05
Percent green non-fescue in stockpiled fescue sward

Drewnoski et al., 2007
Calving Rates: Spring Calving

Conception (%)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Conception (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxic</td>
<td>40</td>
</tr>
<tr>
<td>100% Novel</td>
<td>80</td>
</tr>
<tr>
<td>25% Novel</td>
<td>80</td>
</tr>
</tbody>
</table>

Caldwell et al, 2010
Will It Pay to Convert Pastures?

• Pasture conversion is expensive
• Improvement in animal performance will eventually pay for conversion
• Time to breakeven will be impacted by several factors
Key Drivers of Renovation Economics

- Stocking rate
- Cattle performance improvements
  - Calf weights
  - Potential improvement in breeding rate
  - Potential improvement in calf crop survival
- Is pasture at its yield potential?
- Does all acreage need to be renovated to achieve benefits of novel fescue?
Do Pastures Need Renovation?
**Novel Endophyte Technology**

- **Tall Fescue** + **Toxic Strain** ➔ **Fescue Toxicosis**
  - Animal Health
  - Livestock Production
  - $1 Billion loss (cattle)

**Alliance for Grassland Renewal**

- University of Missouri Extension
- University of Kentucky College of Agriculture, Food and Environment
- NC State Cooperative Extension
- Clemson Cooperative Extension
- USDA NRCS
- Noble Research Institute
- Forage & Grassland Foundation
- agrresearch
- Barenbrug
- DLF Pickseed
- Pennington
- MV
- Mountain View Seeds
- Agrinostics
- Alliance for Grassland Renewal

www.grasslandrenewal.org
2020 Tall Fescue Renovation Workshops

- Middleburg, VA March 10
- Hickory, NC March 12
- Athens, GA March 16
- Springhill, TN March 18
- Lexington, KY March 19
- Harrison, AR March 24
- Mt. Vernon, MO March 25