1. History and Background
2. Management of Existing Stands
3. Managing Non-Toxic Stands
4. Management

Photo Courtesy of University of Missouri, Robert Kallenbach, and Greg Bishop-Hurley
The Endophyte

- *Neotyphodium coenophialum*
- Fungus found in stem, leaf sheaths & seed
- Increases progressively season long
- Cannot survive outside of the plant host

Roberts and Andrae, 2004
Neotyphodium coenophialum

- Produces alkaloids which confer pasture pest resistance
  - Peramine
  - Lolines
- But, can also cause animal health problems
  - Ergovaline
Other Important Alkaloids

• Medicinal Alkaloids
  – Morphine, quinine, atropine, vincristine

• Addictive Alkaloids
  – Cocaine, heroin, caffeine, nicotine

• Very toxic in small amounts
  – Strychnine, coniine
Problems with Toxic, Endophyte-Infected Tall Fescue

- Lower conception rates
- Reduced milk production
- Reduced feed intake
- Rough hair coat
- Increased core body temperature in summer (leads to heat stress)
- Frozen nose, ears, tails, etc (in winter)
- Fescue foot
Problems with Toxic, Endophyte-Infected Tall Fescue

- Lower conception rates
  - Males and Females Effected
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- Fescue foot
Economic Impact of Fescue Toxicosis

- US beef industry over $600 million annually
- Missouri beef industry over $160 million annually
- All US livestock sectors over $1 billion

(Roberts and Andrae, 2010)
Endophyte-Free Tall Fescue

Bouton et al., 2002
www.noble.org
Adaptation and use of tall fescue in the U.S.

Endophyte generally necessary for persistence south of this line

(West, 1998)
• Mutualistic Symbiosis
• Plant provides habitat and nutrition for the endophyte
• Endophyte (fungus) provides plant with multiple benefits
  – Drought Tolerance
  – Insect Resistance
  – Increase Nutrient Acquisition
  – Grazing Tolerance
  – Others

Robert et al., 2002
Non-Toxic Endophyte-Infected Tall Fescue

E+ tall fescue: infected with toxic endophyte
E- tall fescue: not infected, or “endophyte-free”
E++ tall fescue: re-infected with “beneficial” endophyte

Roberts and Andrae, 2004
Non-Toxic Endophyte-Infected Fescue

- Non-toxic endophytes (Novel or Friendly)
  - Retain persistent qualities
  - Animal performance similar to E-

Experimental

Estancia with ArkShield
Non-Toxic Endophyte-Infected Fescue

• Available Varieties:
  – Jesup Tall Fescue with MaxQ
  – Bar-Optima with E34
  – Texoma with MaxQII
  – Estancia with ArkShield
  – Martin with Protek
Animal performance similar to E-
Animals perform better than E+

<table>
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<tr>
<th>Location</th>
<th>AR4</th>
<th>E-</th>
<th>E+</th>
<th>Average Daily Gain (lb)</th>
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<td>Fayetteville, AR</td>
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</table>

West et al., 1998
Manage vs. Replace

• Manage Existing Stands
  – Alkaloid Management
  – Incremental Improvement

• Replace Toxic KY31 with Improved Varieties
  – Manage for Persistence
Incremental Improvement

Roberts and Andrae, 2004
• Moving cattle to summer pasture greatly increases animal performance
  – High temperatures can intensify the toxic effect of infected fescue
• 88°F may be a threshold for significantly decreased gain
• After moving, cattle should remain off of infected tall fescue for the entire summer
• Thompson et al. (1993) summarized data from 12 independent studies
  – Concluded that interseeding legumes into E+ pastures increased steer ADG during spring and summer grazing periods
Dilute with Legumes

• Replacement with nontoxic forages has greater benefit.
  – Steer ADG is lower when grazing E+ tall fescue with clover compared to E- tall fescue with clover, even in E- pastures containing no clover

• Furthermore, interseeding legumes into highly infected (>50%) E+ stands may not always dilute the effects of fescue toxicosis.
  – Highly infected stands with and without clover had similar animal performance.
Other Strategies:
1. Limit N Fertilizer
2. Clip Seedheads
Cattle that previously grazed E- and E++ tall fescue entered the feedlot 117 pounds heavier finished 108 pounds heavier than cattle that grazed E+ tall fescue.
Coffee et al. (2012) Study

• 5 Treatments
  – Spring Calving – All E+
  – Spring Calving – 75% E+ 25% NTE
  – Fall Calving – All E+
  – Fall Calving – 75% E+ 25% NTE
  – Spring Calving – All NTE

• Year-round grazing management
Calving Rates

All 4 contrasts were significant (P < 0.05)
## Calf Performance

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<thead>
<tr>
<th>item</th>
<th>fall</th>
<th>spring</th>
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<td>Act. Wean Wt&lt;sup&gt;ABC&lt;/sup&gt;</td>
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<td>232</td>
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<tr>
<td>Adj. Wean Wt&lt;sup&gt;ABC&lt;/sup&gt;</td>
<td>473</td>
<td>522</td>
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</table>

- **Fall vs. spring** ($P < 0.05$)
- **NE100 vs spring NE25**
- **100% E+ vs. 25% NE+** ($P < 0.10$)
Managing NTE

• The question of persistence
  – Under normal grazing conditions, it is reasonable to expect that NTE tall fescue will survive as well as toxic E+ tall fescue and will persist much better than E- tall fescue.
    • Grazing Practices
    • Fertility
    • Hay Supplementation
Prevent Reinvansion of KY31

- Proper renovation is a must
  - Spray/Smother/Spray
  - 75% of toxic plants are those that survive the renovation process
Prevent Reinvansion of KY31

• Minimize seed transfer in manure and hay
  – KY31 seed can be transferred in the manure or on hair/wool
    • Seed transfer is minimized in dense stands
  – Do not feed KY31 hay on NTE Stands
• Cherokee Red Barn, Welch, OK  
  – Monday, March 28, 2016

• Southwest Research Center, Mt. Vernon, MO  
  – Tuesday, March 29, 2016

• Beef Research & Teaching Farm, Columbia, MO  
  – Wednesday, March 30, 2016

• Forage Systems Research Center, Linneus, MO  
  – Thursday, March 31, 2016
Things to Remember

• Diluting existing stands is possible, but takes work
  – Try to achieve less-than 50% toxin in diet
  – Legumes
  – Rotation to summer pasture
  – Grain or other supplements

• Livestock perform best on NTE
  – KY31 is hard to kill . . . do a good job removing it during the renovation
  – Rotational grazing is a must
Thank You!

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