Application of UAS in Reduced-Lignin Alfalfa Management

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Lignin in Alfalfa

• A complex organic compound (phenolics)
• Indigestible, 3-12% of DM, \( \uparrow \) with tissue age
• Interspersed between hemicellulose and cellulose in cell wall
• Adds rigidity but \( \downarrow \) cellulose digestibility
• High in stem/reproductive tissue
Alfalfa Yield and Quality

Reduced-Lignin Alfalfa
Reduced Lignin Alfalfa

• Reducing lignin content should increase fiber digestibility and alter change in quality w/ maturity.

• Genetic engineering can be used to reduce lignin content in alfalfa
  – “knockout” genes for key enzymes in the lignin biosynthetic pathway.

Reduced Lignin Alfalfa Potential Benefits

• Delayed harvest advantages
  – Fewer harvests (less traffic and fuel costs)
  – Higher forage yield
  – Improved persistence
  – Increased harvest timing flexibility (rainy weather)
Reduced Lignin Alfalfa Potential Benefits

• Forage quality advantage
  – Higher likelihood of harvesting premium quality hay
    - increase a whole plant NDFD
    - enables a delayed harvest

• Market flexibility
  - Short supply and high price alfalfa:
    Producers can delay harvest to increase yield

Reduced Lignin Alfalfa

• The USDFRC estimates that a 10% increase in fiber digestibility would:
  • Increase milk/beef production by $350M/yr
  • Decrease manure production by 2.8M T/yr
RL1 Alfalfa

Changes in NDF Digestibility over Time

- RL Alfalfa = Increased flexibility in harvest timing
- Reduced lignin
- Null control

(Forage Genetics International)
Three Companies Working on RLA

- Forage Genetics International (HarvXtra) (12 – 18% less lignin)
- Alforex Seeds (Hi-Gest) (7 – 10% less lignin)
- Pioneer Hi-Bred International (54Q14) (5% less lignin)

Advantage in the ration

- By increasing 1% in neutral detergent fiber digestibility (NDFD),
  the relative forage quality (RFQ) increases between 2 and 3%,
  milk per ton fed increase by 21 lbs and milk per acre increase by
  167 pounds (Alforex, 2015)
Advantages of Using Drone Images

• To help predict alfalfa yield and nutritive value change and determine the optimum time for harvesting alfalfa

• To help detect abiotic and biotic stresses during the growing season

• To help correlate the images with botanical composition and stand persistence
Reduced Lignin Alfalfa Research

- One Ph.D. Student is working on RLA research
- 3 different varieties (RLA, RRA, COA)
- 3 different seeding rates (15, 18, and 21 lbs/A)
- 2 different cutting dates (optimum vs. 7 days later)
- 4 replications
Alfalfa-Grass Binary Mixture Research

• One Ph.D. Student is working on RLA-Grass Mixtures

• 3 different alfalfa varieties (RLA, RRA, COA) and 2 different cool-season grasses (smooth bromegrass and tall fescue)

• 2 different nitrogen treatment (0 and 50 lbs/A at greenup)

• Measurements: dry matter yield, forage quality (crude protein, ADF, NDF, TDN, digestibility, botanical composition, stand persistence, lodging, and drone images)

• 4 replications

K-State Forage Bowl Team Win (2015 and 2016)

St. Louis, MO, Jan.11-14, 2015

Baton Rouge, LA, Jan.10-13, 2016
Thanks

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Questions?