

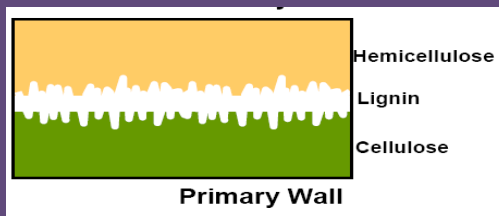
# Application of UAS in Reduced-Lignin Alfalfa Management



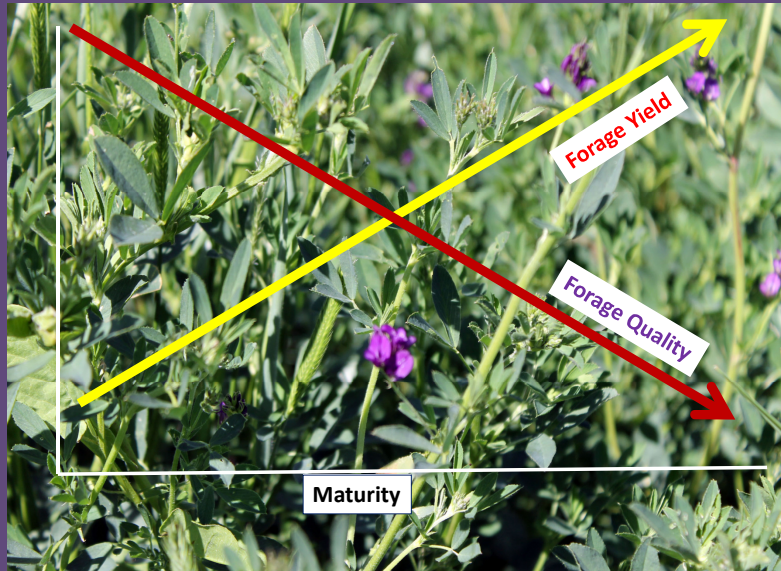
Dr. Doo-Hong Min  
Department of Agronomy  
Kansas State University

## Lignin in Alfalfa

- A complex organic compound (phenolics)
- Indigestible, 3-12% of DM, ↑ with tissue age
- Interspersed between hemicellulose and cellulose in cell wall
- Adds rigidity but ↓ 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

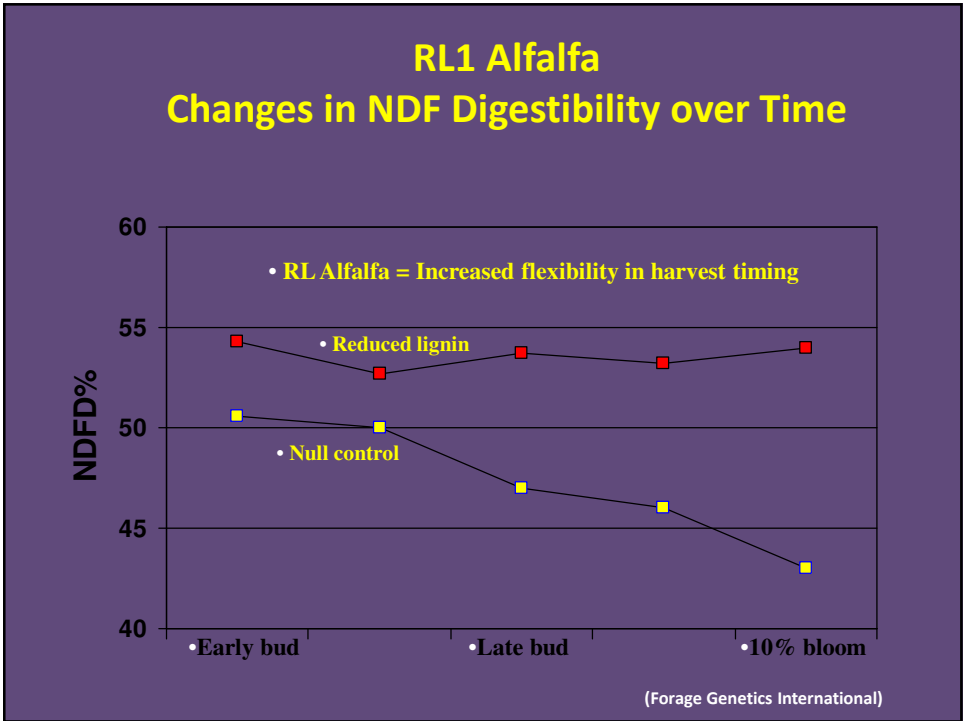
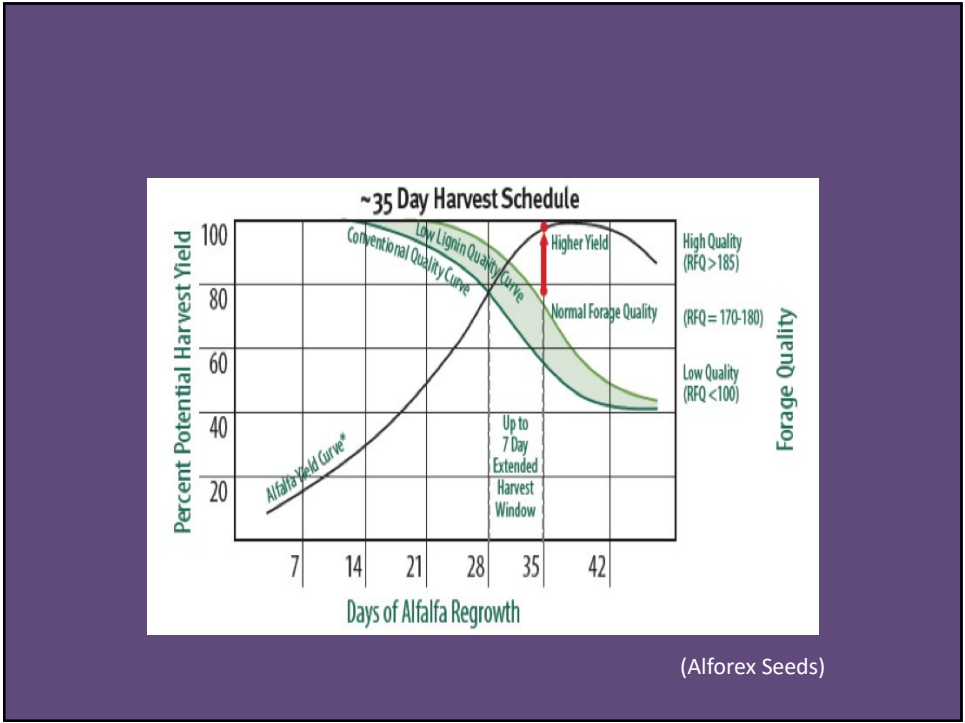
- Delayed harvest advantages
  - Fewer harvests (less traffic and fuel costs)
  - Higher forage yield
  - Improved persistence
  - Increased harvest timing flexibility (rainy weather)

## 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



## 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)

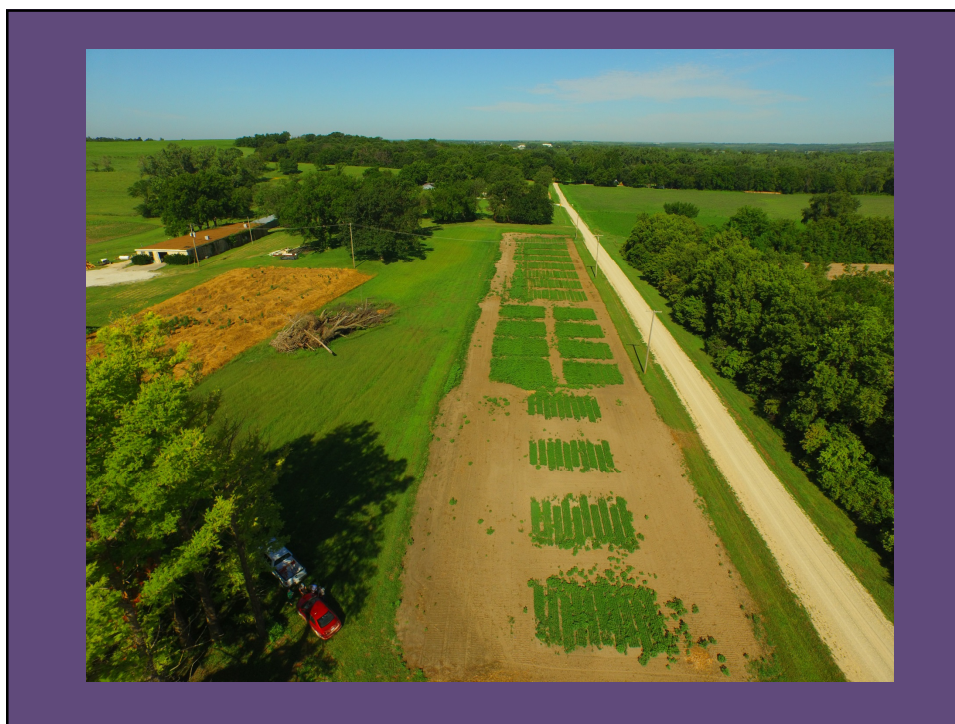
## Advantage in the ration

- 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



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

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

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



**Thanks**

**&**

**Questions?**

