

**BASIC**  
FORAGE RESEARCH



## Opportunities and limits to perturbing forage plant biochemistry, growth, and development for improving forage nutritional benefits in dairy systems

This Basic CRIS project is one of six main areas of research emphasis at the U.S. Dairy Forage Research Center

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### Objectives:

1. Identify chemical, biochemical, and genetic factors of plant development that alter biomass production and identify how changing environmental conditions alter these processes.
2. Determine the impact of genetic modifications in biosynthetic pathways upon fundamental physiological, biochemical, and anatomical development of plants to uncover key structural/functional relationships that affect forage quality, digestion, and biomass conversion efficiency.
3. Determine the biochemical/chemical/genetic basis for biological systems needed to inhibit degradation of forage proteins during harvest, storage and utilization to minimize nitrogen waste.

### Approach:

1. Cell wall screening methods will be developed based on 2D-NMR and FTIR applying chemometric approaches to relate specific structural/compositional information to cell wall utilization (e.g., cell wall digestion, ethanol conversion efficiencies, formation of bioproducts).
2. Basic molecular approaches will be utilized to identify key steps in complex metabolic processes such as cell wall biosynthesis, sugar nucleotide biosynthesis and lignin biosynthesis that altered plant structure and function.
3. Combinations of agronomic and molecular approaches will be used to define the roles of polyphenols and polyphenol oxidases in the preservation of forage protein during on-farm storage and degradation in the rumen. New strategies may include guidelines for management of crops to optimize harvest/storage conditions and development of genetic approaches to produce new plants with improved protein characteristics.
4. Molecular techniques afford a selective approach to test for changes in metabolic pathways (e.g., cell wall biosynthetic pathways) resulting in positive or negative impacts upon digestibility and agronomic characteristics. Altering plant developmental characteristics will have to strike a balance between improved feed characteristics and resistance to environmental stresses.

**U.S. Dairy Forage Research Center**

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