Value-Added Products from Forages and Biomass Energy Crops

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

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Objectives:

1. Develop harvesting, fractionation and storage processes for forages and bioenergy crops that are economical, and that retain product quality.
2. Identify specific varieties of energy crops that display maximum fermentability when grown at specific locations under defined environmental conditions.
3. Develop switchgrass germplasm having broad adaptation to the northern USA and improved fermentability for conversion to value-added products.
4. Develop and improve fermentations for direct bioconversion of cellulosic biomass to value-added products (viz., ethanol, chemical feedstocks, and novel bioadhesive components).

Approach:

1. New harvesting strategies will be developed that economically separate forages and bioenergy crops into higher and lower-value fractions.
2. An in vitro ruminal fermentation assay will be used to rapidly screen large numbers of biomass samples from several bioenergy crop species, provided by ARS agronomists from throughout the U.S. The data will be correlated to ethanol bioconversion capability, and NIRS calibration equations will be developed for ruminal fermentability and ethanol production.
3. Switchgrass germplasm improvement will be carried out by recurrent phenotypic selection for vigor, lodging and disease resistance to extend adaptation and biomass yield in several eco-regions. Switchgrass hybrids will be selected for enhanced biomass yield and fermentability.
4. Consolidated bioprocessing of bioenergy crops, using anaerobic bacteria that produce their own cellulolytic enzymes and ferment the products to ethanol and other valuable products, will be improved through optimization of strains and culture conditions. Value-added co-products, such as adhesives produced by the fermentative bacteria, will be identified and their utility will be determined.

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