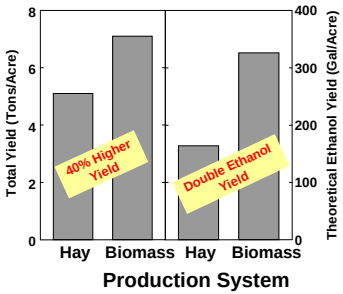
Alfalfa--a bioenergy crop for replacing nitrogen fertilizer and improving environmental protection

ARS Biomass-Type Alfalfa Germplasm Plus the Biomass-Management System Doubles Potential Ethanol Yield and Maintains Leaf Protein Yield.



A. What is this research project?

This project is focused on: 1) developing alfalfa to use in rotation with corn in a bioenergy cropping management system; 2) assessing ethanol yields derived from new alfalfa germplasm developed for bioenergy; 3) determining alfalfa genes that control sugar/cell wall deposition; and 4) evaluating ecosystem services of using alfalfa as a bioenergy crop.

B. What problem does it address?

The focus of bioenergy crops is mainly on monocropping of grass species (corn, switchgrass, sorghum, sugarcane). Monocropping of grass species requires nitrogen fertilizer addition to obtain sufficient yield to be useful as a bioenergy crop. Continuous monocropping of grass species not only will require nitrogen fertilizer but also will reduce biodiversity and deteriorate soil health.

C. How is the project different from or how does it enhance other projects?

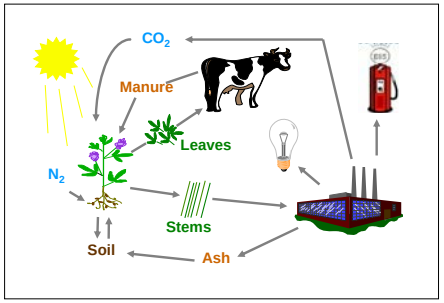
Our project addresses how to make long-term production of agricultural bioenergy crops less dependent upon nitrogen fertilizer, economically sustainable, and environmentally friendly through the use of an easily grown legume, alfalfa, in rotation with corn.

D. What are the potential benefits of partnering with ARS on this research?

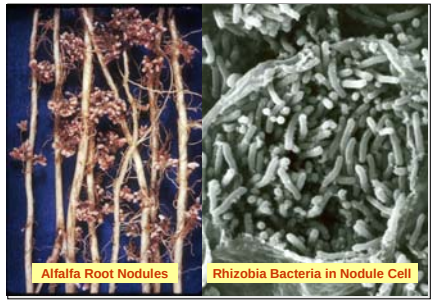
Partnering with the Plant Science Research Unit in St. Paul, MN, will give you access to the only public alfalfa improvement team conducting research from the gene level to ethanol production. You will have access to scientific expertise in: plant breeding, genetics, pathology, animal science, soil science, biochemistry, and genomics.

E. Who are the potential customers?

Milk and beef producers, corn producers, ethanol producers, seed companies, and environmental protection organizations.



Alfalfa can provide protein feed for livestock (leaves), bioenergy (stems), N fertilizer, erosion control, and soil carbon sequestration.



Alfalfa in symbiosis with rhizobia bacteria in root nodules can make nitrogen fertilizer thereby improving soil health and saving money.

Stage of Development

We have developed alfalfa germplasm with bioenergy traits and incorporated those traits into agronomically adapted backgrounds. We have shown that alfalfa managed for biomass increases ethanol potential in a two-cut production system. We have demonstrated that alfalfa can remediate nitrate-contaminated groundwater. We have identified a suite of alfalfa genes important to cell wall and sugar development.

PARTNERSHIP OPPORTUNITY

Moving Forward

Additional research is needed: 1) under field conditions to verify that a rotation of 2 years corn – 2 years alfalfa is profitable, and 2) to determine the conversion efficiency of alfalfa as compared to other cellulosic bioenergy resources.

Researchers

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