Renewable Energy in the Feedlot and Dairy

Federal Initiative Accomplishments

2006

Lead Agency:
Texas Engineering Experiment Station

Partners:
Texas Agricultural Experiment Station; U.S. Department of Energy, Golden, CO; Texas Cooperative Extension

Texas Agricultural Experiment Station
THE TEXAS A&M UNIVERSITY SYSTEM

Texas Cooperative EXTENSION
The Texas A&M University System

Purpose/Objectives

To convert cattle biomass (CB) to renewable energy. This includes adapting, developing, and refining technologies to extract energy from waste streams or renewable resources. To develop biomass resource technology. This includes the production, collection, harvesting, and characterization and evaluation of CB as fuel, as well as a focus on the economic and environmental qualities of this biofuel.

Accomplishments/Impacts

- Found that co-firing biomass with coal and/or using it as a reburn fuel in power plants will reduce nitrogen oxide and mercury emissions; reduce carbon dioxide from fossil fuels; lower fuel costs; and reduce water, soil, and air pollution.
- Developed a Web-based information system that provides fuel data and energy conversion technology. Disseminated information through publications, presentations at professional conferences, and periodic project Industry Advisory Committee meetings.
- Initiated life-cycle analysis that includes quantifying the production of harvestable animal waste for renewable energy production, along with determining economic analysis of CB management and transportation schemes.
- Characterized combustion/gasification ash in terms of potential uses as fertilizer products or construction materials.
- Constructed a pilot-scale digester for CB and cattle carcasses for production of methane.
- Project data on feedlot manure characteristics of high-ash CB provided for pilot plant tests were used by a commercial company to design a 1,500 ton/day gasification/combustion facility using CB as biofuels to supply heat energy for a 115 million-gallons-per-year ethanol plant near Hereford, Texas.
- Found that the heating value of CB from paved cattle feedlots equaled the heating value of lignite and had twice the heating value, volatile matter, and carbon content for thermochemical conversion of manure from traditional soil-surfaced pens, while containing only one-third of the ash.
- Found that partial composting of CB for 50 days reduced heating value by 2%–20% and that air-drying to less than 10% moisture protected heating value "shelf-life" with less than 10% loss of volatile matter and heating value after 10 months.
- Found the heating value of harvested and partially composted CB to be significantly higher following dry weather conditions, as in 2006, than following wet weather conditions, as in 2005.
- Analyzed eight manure streams at 12 dairies to assess biofuel properties. Manure from dairy free-stall barns with composted dairy manure bedding, and mechanically separated dairy manure solids showed the highest heating value and lowest ash content.
- Developed a map of dairy biomass (DB) distribution in central Texas in relation to regional power plant locations within 200 miles to evaluate transport and logistics issues. Despite major economic considerations, use in coal-fired plants will export manure and nutrients out of the watershed of the Upper North Bosque River. Other areawide benefits include added employment and enhanced economic activity.