Renewable Energy in the Feedlot & Dairy

Federal Initiative Accomplishments

2K5

Funding Agency:
U.S. Department of Energy, Golden, CO field office

Lead Agency:
Texas Engineering Experiment Station

Partners:
Texas Agricultural Experiment Station, Texas Engineering Experiment Station

Texas Agricultural Experiment Station
a member of The Texas A&M University

Purpose:

To conduct systems-oriented research to improve environmental sustainability, enhance added-value uses of cattle (beef and dairy) biomass (CB) residuals in CAFO facilities, and provide technologies for utilization as an alternative fuel and emission reduction agent. Improved properties of cattle manure biomass can be obtained through the use of a combination of technologies, including: feedlot surfacing materials; improved manure collection practices; separation or extraction technologies or cattle ration adjustment including reduction in phosphorus content or other specified minerals which can be problematic.

This project will focus on (a) developing technologies for extracting energy from renewable cattle biomass using thermochemical energy conversion and anaerobic digestion approaches; and (b) to determine amounts, locations and net energy potential, including transportation logistics of CB.

Accomplishments/Impacts:

- Research was conducted to determine the effects of manure management practices on feedlot biomass (FB) characteristics for energy conversion systems involving reburn or co-firing with coal (or lignite) as the base fuel.
- FB from fly ash-paved cattle feed pens was 114 percent higher in heating value (HHV) compared to FB from traditional soil-surfaced pens, both before and after partial windrow composting for 51-55 days. The non-combustible (ash) content was 66 percent lower in paved feedpen-FB compared to soil-based feedpen-FB, while bulk density was one-third lower, pointing to possible field estimations of FB quality.
- Project data on FB characteristics and 19 tons of FB from a research feedlot was used by a commercial company to conduct pilot plant combustion tests which lead to the design of a feedlot biomass (FB) cotton gin residue combustion facility to provide heat energy to an ethanol plant near Hereford, TX.
- Preliminary engineering and fertility evaluations began on FB combustion ash.
- A U.S. patent was issued for “Reburn System with Feedlot Biomass” (K. Annamalai and J.M. Sweeten) depicting a method of reducing nitrous oxide (NO_x) emissions from coal or lignite-fired power plants by firing pulverized manure above coal-fired burners. Reburn tests continue to show 90% NO_x emissions reduction using pulverized FB vs. 40% or less for baseline coal.
- TCEQ-sponsored studies began on use of FB or DB as reburn fuel to potentially capture mercury emissions.
- Bovine carcass compost representing 1.5 tons of mortality liveweight was produced for upcoming studies of thermochemical gasification or combustion. The composting process is expected to improve the biological and chemical stability of premature livestock mortalities, leading to increased, long-term on-farm storage capacity for those carcasses and reducing the risk of disease transmission from them.
- An anaerobic digestion system to be monitored for methane generation in this project was constructed in Central Texas.
- A map of dairy biomass distribution in Central Texas is being developed in relation to regional power plant locations to evaluate transport and logistics issues.
- Manure streams from 12 dairies throughout Texas were sampled in the winter to assess DB characteristics for renewable energy.
- An Industry Advisory Committee was appointed, representing cattle feeding and dairy industries, electric utilities, renewable energy technology providers and private consultants who provided valuable suggestions and guidance.