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Energy: Leopold Center Grants and Special Projects

Key words	Competitive Grants and Special Projects
Biomass Industry Producers	**Shaping a functional and sustainable biofuels industry through bridging industrial needs with farmer production capabilities** *P2009-06* Richard M. Cruse, Agronomy, Iowa State University The goal of this one-year project is to coordinate the needs of the developing cellulosic biofuel industry with the ability Iowa farmers to supply biomass.
On-farm energy Energy production Energy conservation	**Farm energy working group** *XP2009-01* Kamyar Enshayan, Center for Energy and Environmental Education, Northern Iowa University This working group was formed to support the implementation of a variety of energy conservation, efficiency and renewable energy practices to meet the needs of Iowa's small and mid-sized farms. The group consists of farmers, key organizations, and individuals.
Beef Forage Commercial	**Economic costs of energy in forage-only or commercial production cow herds** *ESP2009-02* Denise Schwab, Beef specialist, ISU Extension This on-going project is 1) comparing the fuel and utilities used in commercial and forage-only cow-calf operations, and 2) documenting producers' attitudes toward energy conservation in beef cow production. This work is being conducted via a survey of producers.
Swine Hoop barn Conventional Life cycle analysis Nitrogen	**Energy use in pig production systems** *E2008-03* Mark Honeyman, Animal Science, Iowa State University; Pete Lammers, Animal Science and Sustainable Agriculture, Iowa State University This project investigated Iowan swine gestation and grow-finish systems designed to produce 15,600 pigs. Conventional confinement or hoop barns were compared. The life cycle analysis findings indicated minor differences between the two systems on the basis of non-renewable energy use and 100-yr. greenhouse gas potential. The proposed key to reductions in these two areas was in the management of nitrogen.
Corn Soybeans Low-external-input Multi-year rotations	**Agronomic, ecological and economic comparisons of conventional and low-external-input cropping systems** *E2007-09* Matt Liebman, Agronomy, Iowa State University; Craig Chase, ISU Extension; Michelle Wander, Natural Resources and Environmental Sciences, University of Illinois Urbana-Champaign This multi-year project has compared the fossil fuel inputs required for a conventional two-year corn and soybean rotation and a low-external-input four-year multi-crop rotation. Findings indicate that relative to the four-year system, the two-year rotation requires over twice the fossil fuel input while overall profitability is nearly equivalent.
Ethanol Greenhouses Aquaculture	**Potential to operate greenhouses and aquaculture in conjunction with Iowa's ethanol plants** *M2007-08* Ray Hansen and Connie L. Hardy, ISU Extension Value Added Agriculture Program The project describes situations in the United States where greenhouse and/or aquaculture operations have been paired with power plants to take advantage of inexpensive energy. The contributing authors offer opinions about the hurdles that need to be overcome to make these businesses successful and suggest plant crops and fish species that would be valuable in the marketplace.

Beef Dried distillers grains	**Dried Distillers Grains and Impacts on Meat Quality** *ESP2006-03* Mark Honeyman and Dan Morrical, Animal Science, Iowa State University This research compared the live performance and carcass traits of yearling cattle finished on pasture with combinations of either soyhulls-dried distillers grains with solubles or corn-dried distillers grains with solubles. The researchers found that live performance and carcass traits were not affected by the modifications in diet.
Double-cropping Corn Triticale Sorghum-sudangrass Sunn hemp	**Productivity and nutrient dynamics in bio-energy double-cropping systems** *ESP2006-02* Matt Liebman, Andrew Heggenstaller, and Lance R. Gibson, Agronomy, Iowa State University; Rob Anex, Agricultural and Biosystems Engineering, Iowa State University This project examined the economic and environmental impacts of double-cropping bio-energy crops. The researchers evaluated productivity and nutrient utilization in a conventional corn production system (sole-crop corn) and three bioenergy double-cropping systems. Though the resultant biomass was rich in nutrients, the researchers determined sustained removal of large quantities would necessitate increased fertilizer inputs, or recycling the nutrients contained in the biomass.
Transaction costs Local marketing Regional marketing Meat Dairy Vegetables	**Transaction Cost Case Studies for Six Iowa Food Producers** *M2006-02* Clyde Walter, College of Business, Iowa State University; Randy Boeckenstedt, Center for Transportation Research & Education, Iowa State University; Craig Chase, ISU Extension, Tripoli The focus of the project was to illustrate, through six case studies, the transaction costs incurred by Iowa-based food producers who distribute to in-state and regional markets. Two producers or producer groups were selected from each of three product categories of meat, dairy, and fresh fruit or vegetables. Transaction costs, also referred to as logistics costs, include cash payments and amortized costs associated with post-production handling, packaging, storage, inventory carrying, and transportation functions.
Biobased business planning Supply chain partners	**Supply chain options for biobased businesses** *2004-M13* Rhonda L. Lummus, College of Business, Iowa State University This research paper investigated and evaluated the supply chain structures being used in biobased businesses. Corollary examples of supply chains in businesses of all types (in the United States and abroad) were also presented. The investigator considered non-biobased agricultural business supply chain practices and discussed their use. A complete description of each business structure was developed and the writer then evaluated their effectiveness for farmers and others in the value chain.
Biomass Corn stover Erosion Tillage	**Effects of biomass harvest on soil erosion** *E2003-07* Tom Richard and Amber D. Widman, Agricultural and Biosystems Engineering, Iowa State University; John M. Laflen, USDA-ARS, Buffalo Center This project used the Water Erosion Prediction Project (WEPP) model to estimate the effects of harvesting corn residue on soil erosion. The study found that high rates of stover removal are possible on gentle slopes with no-till management or extended crop rotations that include perennial crops. On steep slopes, more intensive tillage systems (moldboard plow or even minimum tillage) are not sustainable in corn-bean rotations regardless of biomass removal rates.

Biomass Switchgrass Education Outreach	**Development of switchgrass as a viable agricultural commodity for farmers in southern Iowa** *2002-26* Dora Guffey, Chariton Valley, Resource Conservation and Development, Centerville This project was part of the larger Chariton Valley Biomass Project which aimed to transform switchgrass, a native warm-season grass used primarily for conservation and wildlife habitat, into a cash energy crop for farmers in southern Iowa. This particular project funding enabled the Chariton Valley Biomass Project to implement an education and outreach program. These outreach activities have served to increase awareness of the potential for switchgrass to be used as biomass in southern Iowa.
Biomass Switchgrass	**Development of switchgrass as a viable agricultural commodity for farmers in southern Iowa** *1998-14* Dora Guffey, Chariton Valley, Resource Conservation and Development, Centerville The Chariton Valley Biomass project involved transforming switchgrass into a cash energy crop for southern Iowa farmers. Tests conducted at the Ottumwa Generating Station determined that there was no technological barrier to using switchgrass as a fuel to generate electricity. With consideration given to the production costs and yields in southern Iowa, the economic feasibility of using switchgrass as a fuel to generate electricity depends on public policy, i.e., use of land in the Conservation Reserve Program and the renewable energy tax credit.
Corn Soybeans Precision farming Nitrogen	**Economic analysis of variable rate management for corn and soybean systems** *1997-48* William D. Batchelor, Ramesh Kanwar, and Sunday Tim, Agricultural and Biosystems Engineering, Iowa State University; Bruce Babcock, Agricultural Economics, Iowa State University; Alfred Blackmer and Rick Cruse, Agronomy, Iowa State University; Tom Colvin, National Soil Tilth Lab Using computer models, the investigators sought to analyze how inputs can be applied at optimal rates variably across a field in order to match inputs with crop needs. Over the long term, only modest increases were shown in gross returns from these practices. However, gross returns for individual years can be substantial.
Agroforestry Biosolids Synthetic fertilizer Municipal	**Demonstration of an agroforestry system to minimize pollution hazards from land application of treated municipal sludge** *95-47* Joe Coletti, Rich Schultz, and Carl Mize, Forestry, Iowa State University; Michael Thompson and Irv Anderson, Agronomy, Iowa State University Iowa has over 700 communities that generate municipal biosolids by various treatment means. These biosolids contain valuable nutrients. In this study, municipal biosolids are applied to trees, perennial grasses, and corn/soybean crops in an alley cropping (repeated tree strips combined with crops) system. The goal is to produce economical quantities of biomass and grains with reduced use of fossil fuel-based fertilizers and minimal environmental
Biomass Ethanol Sweet sorghum Corn	**Biomass production and ethanol potential from sweet sorghum** *91-46* Irvin C. Anderson, Agronomy, Iowa State University; Dwayne R. Buxton, U.S.D.A./Agricultural Research Service; Arne J. Hallam and E. Hunter, Economics, Iowa State University The objectives of this study were to evaluate the productivity of a group of sweet sorghum cultivars of varying maturity and morphology, to determine sugar accumulation patterns in the cultivars, to examine cultivar growth patterns, and to evaluate sweet sorghum as an energy crop by producing ethanol from the cultivars processed as silage. The findings from this study were compared to that or corn as a biomass crop.

Biomass Riparian buffer strips Water Quality	**Sustainable tree-shrub-grass buffer strips along waterways** *90-07* Richard Schultz, Joe Colletti Carle Mize, Steven Jungst, Paul Wray, Lita Rule, and Richard Hall, Forestry, Iowa State University; William Simpkins, Geology and Atmospheric Sciences; Michael L. Thompson, Irvin C. Anderson, Agronomy, Iowa State University; Duane R. Buxton, Agronomy and USDA-ARS, Iowa State University This project was the beginning of long-term work on the Bear Creek buffer by a team of agroecologists. This goal of the project was to restore native vegetation along the Bear Creek in the form of *constructed multi-species riparian buffer strips* (CMRBS), to study their capacities, their optimal configuration(s), and the best approaches for managing them. One of the specific objectives of was to measure the biomass and potential energy productivity of CMRBS.
Education On-farm demonstrations	**On-farm demonstration program to reduce energy consumption and environmental impacts from row crop production** *88-25* Richard Thompson, Practical Farmers of Iowa; Rick Exner, ISU Extension This demonstration project enabled Practical Farmers of Iowa (PFI) to organize nine field days, visiting 23 farms. To reduce energy consumption and negative environmental impacts from row crop production, PFI farmers demonstrated a number of cost and energy-saving techniques to those who attended the demonstrations.
Tillage Nitrogen Water quality	**Nitrogen efficiency with no-till and conventional tillage cropping systems for energy conservation and water quality benefits** *88-20* Rameshwar S. Kanwar, Piyush Singh, and Christ Everts, Agricultural and Biosystems Engineering, Iowa State University This water quality study provided information about the amount of recharge that occurs through infiltration as well as the pathways various chemicals use to reach groundwater systems. In addition, at the time, this project helped to define the best experimental methods for making such determinations. The researchers determined that although it is difficult to control the amount of subsurface drainage water, chemical-leaching losses could be governed by controlled chemical input and selective management techniques. In effect these findings supported reductions in synthetic N application and therefore reduced fossil fuel inputs.
Vegetables Irrigation Fertilizer Pesticide Fungicide	**Irrigation and disease management of vegetables** *88-16* Henry Taber, Horticulture, Iowa State University; Mark Gleason, Plant Pathology, Iowa State University; Steward W. Melvin, Agricultural and Biosystems Engineering, Iowa State University Wise use of irrigation may help farmers to reduce fungicide applications on vegetable crops. Such a reduction is potentially significant when one considers that irrigation, fertilizer, and pesticide use account for more than 50 percent of the energy expended in fresh vegetable production.
Tillage Reduced inputs	**Tillage and crop rotation system demonstration for energy and environmental efficiency** *88-10* Mark Honeyman, Outlying Research System, Iowa State University; Rameshwar S. Kanwar, Agricultural and Biosystems Engineering, Iowa State University; George F. Czapar, Agronomy, Iowa State University At Iowa State University's Northeast Research Farm near Nashua, Iowa, a large, ongoing, conservation tillage experiment established in 1978 has investigated the effects of four tillage systems (plow, chisel plow, ridge-till, and no-till) on energy consumption, yields, erosion, economic returns, and groundwater quality. The short-term objective of this project was to equip a field hydrology laboratory at the site in order to collect the data necessary to study more fully the effects of the four tillage systems. In the long-term, this project has helped develop practices that reduce both energy use (through less tillage and more efficient fertilizer and pesticide use) and groundwater contamination (by developing practices that reduce the leaching potential of these chemicals).

Timber	**A wood-fired furnace and timber management research and demonstration system** *88-08* *(All from Iowa State University)* Mark Honeyman, Outlying Research System; Paul Wray, Forestry Extension; Thomas H. Greiner and Steve Marley, Agricultural and Biosystems Engineering; Mark Huss, Ag. and Home Economics Experiment Station Engineering Services; David Countryman, Forestry This project sought to demonstrate how to transfer dependence on heating energy derived from imported fossil fuel to on-farm timber resources. With improved management practices, woodlands can become an economically viable part of Iowa's farming system. Specific objectives included monitoring BTU (British Thermal Unit) usage for heating buildings and drying grain, in order to determine efficient burner sizes and configurations, and demonstrating the following: a central, wood-fired furnace using hot-water distribution for heating; grain drying; safe wood harvesting practices; proper timber management; proper heating plant operation; the economics of wood burning; the energy plantation concept; and employment of off-season farm labor.
Biomass Liquid Fuel Multi-species	**Selection of herbaceous energy crops for sustainable agriculture** *88-01* Irvin C. Anderson, Agronomy, Iowa State University; Dwayne R. Buxton, U.S.D.A./Agricultural Research Service; Arne J. Hallam, Economics, Iowa State University The objectives of this experiment included (1) comparing biomass production from various cropping combinations under sole, double, and intercropping systems; and (2) obtaining measurements of the quality of the biomass from each system in order to determine its efficiencies of combustion or conversion to liquid fuels. These measurements can be used to indicate the amount of adverse combustion by-products in these crops. Species used in this research are as follow: alfalfa, reed canarygrass, switchgrass, big bluestem, sweet sorghum, a sorghum-sudangrass hybrid, corn, soybeans, and winter rye.
Food Miles Local Foods Life Cycle Analysis	Other Leopold Center funded grants involve questions of energy use and consumption, particularly those concerning food miles and life cycle analysis. Visit: http://www.leopold.iastate.edu/research/topics/community.htm

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