

Looking Toward the Next Generation of Agricultural Energy Crops

By Joel Tallaksen, West Central Research and Outreach Center, Morris, MN

In the last decade, energy produced in the agricultural sector has become increasingly important to the region and the United States as a whole. We have begun the process of reducing our dependence on foreign oil and made new markets for local grain. The new markets and processing facilities have provided local jobs and kept revenue in the community. In addition, the switch to these ag-based renewable energy sources will provide long-term environmental benefits. In order to maintain the momentum of the last decade, it is important to prepare for the future of agricultural in the new energy environment.

Corn and Soybeans were the first generation of agricultural products to go into the energy sector. The ethanol and biodiesel blends produced with these crops are used in many of the nation's vehicles. Unfortunately, Ethanol and biodiesel production can't supply the full energy demands of the American consumer. Also, the economic feasibility of producing these ag-based fuels is reduced as grain prices increase. In addition, Industrial use of large amounts of corn and soybeans has implication for human food and livestock feed prices. Production of ethanol and biodiesel also requires a significant amount of energy.

Therefore to expand and improve on the ethanol and biodiesel successes, a new generation of ag-based energy production is under development. This second generation of farm based energy uses plant biomass for energy. Current plans are to use agricultural residues (usually the leaf and stem material) remaining on cropland after the grain has been harvested. Corn stover is perhaps the most commonly cited example of biomass for energy production. Traditionally, few farmers have collected stover after harvested because it has little market value. However, it does contain large amounts of energy that can be extracted and harnessed using specialized equipment. Similarly, a wide variety of plant biomass can be used to produce energy.

The two main technologies for extracting energy from plant biomass are cellulosic ethanol production and gasification. Production of cellulosic ethanol is an emerging technology which uses micro-organisms or enzymes to breakdown plant biomass into simple sugars that are fermented similar to corn ethanol production. Gasification is an older technology that is re-emerging as fossil fuel prices increase. During gasification, plant biomass is heated with limited oxygen. The biomass is chemically changed into gaseous vapor, which can be burned similar to natural gas, chemically changed to liquid fuels, or used to generate electricity.

One of the important issues in generating energy from biomass is maintaining a supply of biomass. The largest gasification facilities use 100,000's of tons of biomass material per year. Because there is not currently an organized system of harvesting and transporting material, a biomass market will need to be established. At the farm level, it is unclear how much producers will be offered for the biomass. It may take time for the market to stabilize as farmers weight the benefits of harvesting biomass. Efficient transportation is also an issue; most field residues are bulky and can't be transported great distances economically.

The environmental impact of removing crop residue is another limiting factor in the biomass supply. Crop residue is often tilled into fields to maintain the amount of organic material in the soil. Some soils will be susceptible to erosion and loss of organic matter if residues aren't left in the field. Farmers will have to balance the amount of residue that they can safely remove with the added financial gain from selling the biomass.

The current construction of gasification plants and the potential use of biomass in cellulosic ethanol points toward the increasing importance of biomass as the next generation farm based energy

crop. The biomass market supplying these facilities will likely help the farm economy in the very near future. Looking farther in the future, a new generation of crops strictly for biomass may be on the horizon. Already, fast-growing hybrid poplars are being bred as energy 'crops' for forested areas. Similarly, native perennials and prairie grasses are being tested as biomass crop for poor soils or marginal lands. These alternative crops could also become an important means of removing carbon from the atmosphere and putting it into plant root systems.

In a joint project, the West Central Research and Outreach Center and the University of Minnesota Morris along with several other partners have begun a community-scale biomass to energy project. Our goal is to use the gasification facility being designed for the Morris campus to study using agricultural biomass to produce heat energy. Our study will examine the economic, environmental and technical issues of gasifying agricultural products. By staying at the forefront of this new technology, we hope to expand the market for agricultural products and provide a reasonably priced source of energy for the community. As the project continues, we will be holding informational meetings to discuss biomass energy and gasification. We encourage you to follow along with us as we explore the next generation of energy crops.