

# A New Concept in On-Farm Biofuel Production

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For many social, political, and economic reasons, biofuels are moving quickly from the fuel of tomorrow to the fuel of today. Researchers at the University of Kentucky are working on a new system of biofuel production that involves on-farm processing of biomass. This factsheet provides a general overview of this new concept that could have a great impact on agriculture and the fuel-production industry.

## What are Biofuels?

Biofuels are fuels produced from biological source materials (feedstock). Many types of biofuel exist. Most people are familiar with ethanol that is made mostly from cornstarch, sugar cane or sugar beets. Ethanol is similar to gasoline, and most of the U.S. gasoline supply is a blend of at least 10 percent ethanol. Biodiesel is another biofuel that is becoming more prevalent for use in diesel engines. Biodiesel commonly is made from oil feedstock, such as soybean or other vegetable oils, but also can be produced from waste oil or animal fat.

Federal mandates dictate that at least 9 percent of the U.S. gasoline and diesel fuel supplies in 2012 will be from renewable sources, and that standard likely will increase every year. Also, there is a cap on the amount of ethanol that can come from corn. Therefore, we must look to other sources such as biomass for our renewable fuels.

## Biofuels from Biomass

Many recent research efforts have been focused on the use of biomass for energy. Biomass is any kind of plant material that can be used for energy. Biomass can be combusted for thermal energy—for example, using firewood to heat a home or co-firing bales of biomass with coal in power plants to create electricity. Biomass also can be converted to liquid fuels such as ethanol.



An on-farm biomass processing facility would cut costs and inefficiency in biofuel production.

One of the main challenges of using biomass for production of biofuels is its relatively low energy density (the amount of energy per ton of biomass). As an example, a 3-foot-by-4-foot-by-8-foot rectangular bale of corn stover or wheat straw, which weighs about 1,000 pounds, could potentially produce about 40 gallons of ethanol. That means a tractor-trailer load of bales (about 25 bales) would produce about 1,000 gallons of ethanol. By comparison, a semi fuel tanker holds about 7,500 gallons of fuel. The bottom line is that it takes about eight truckloads of biomass to produce one truckload of ethanol.

## The Old Way

The few biomass-to-ethanol conversion systems that have been developed require the biomass to be hauled to a centralized processing facility where it is converted to ethanol. The byproducts of the conversion must then either be hauled back to the farms for land application or disposed of in some other way. Depending on the proximity of the farm to the processing plant, this transportation of low energy-density products makes the current systems inefficient and costly.

## The New System

The new concept that researchers at UK are exploring involves some on-farm processing of the biomass. They are working on a simple process that would allow individual producers to treat biomass bales on the farm to extract a liquid that is a crude form of the fuel butanol (See publication AEN-111 for a description of butanol). This crude fuel, which is much more energy dense than the raw biomass (four to five truckloads of biomass to one truckload of crude butanol), could be transported to a centralized processing facility where specialized equipment would be used to refine it into a usable fuel. The plant material byproducts that remain after the on-farm processing can easily be land-applied at the farm with common spreader equipment. Depending on the management of the process, these byproducts might even have some increased fertilizer value to the land or possibly some feed value for livestock.

It is unclear what the exact on-farm process will be, but early investigations indicate that the fermentation could be conducted in a relatively simple bunker-type facility. Bales of biomass would be stacked into the bunker and treated



Biomass is collected during a grain harvest.

periodically with water and inoculants (reaction agents). The leachate from the bunker would be collected and concentrated by evaporating the water from the resulting butanol mixture. The crude then would be stored until it could be transported to a refining facility. The time to process a batch of bales may be from several weeks to a couple of months. The

equipment required likely would be relatively simple components such as storage tanks, pipes, pumps, and charcoal filters.

Researchers anticipate this new system will not only revolutionize the production of biofuels, it will provide an additional revenue stream for farmers to make them more profitable in a difficult economic climate.

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