

# ENERGY

*from the land*

by Andrew H. Baker, *Farmpark Administrator*



**THERE IS A LOT OF DISCUSSION** over the relationship between energy costs and the cost of food. The high demand for oil, coupled with high demand for grain industrializing countries, combined with a lower valued dollar and weather related crop fluctuations has created an unprecedented opportunity for grain farmers and a consequent impact on other forms of agricultural production. This all ultimately impacts food prices. While many have pointed the finger at policies that encourage farmers to raise corn or soybeans to produce ethanol or biodiesel, there is a range of opinions as to whether ethanol is the major culprit.

The truth of the matter is complex and the situation we are in is an indication of how dependent food production is on petroleum, how pervasive corn is in our food chain, and what an impact a changing diet in emerging nations such as China and India can make. The connection between these variables is finally hitting us in the stomach so to speak. The use of petroleum in agriculture began in the early 1900s. At that time much of our transportation and tractive fuel was raised on the farm in the form of hay and oats that provided us horse power. The transition to tractors in the 1920s and 1930s led to a dramatic decline in the amount of land needed for oats and hay. Much of this land ended up in soybean production which became Ohio's top crop in acreage by 2000.

The application of petroleum in the

form of fertilizer and pesticides in the late 1940s dramatically increased the productivity of all Ohio crops, particularly corn. The yield of corn rose from 38 to 150 bushels between 1940 and 2007. As a result, our food production became more corn based and even more petroleum based. Cattle, sheep, dairy cows, swine and poultry saw less and less grass and more and more corn. To cut production costs, Coca-Cola made the conscious decision in 1980 to switch from sugar to high fructose corn syrup. Other food processors followed suit and now more than a third of our sweetener (158 pounds per capita) comes from corn.

Because food production is now so dependent on fossil fuels, the price of energy has a direct impact on food costs. Additionally, corn and soy are also energy crops and as the price of petroleum rises the return on energy derived from crops becomes more competitive with petroleum itself. Government efforts to combat air pollution and reduce U.S. dependence on foreign oil provide additional incentives for farmers to sell their crops to producers of ethanol and biodiesel.

Whether the government incentives are worthwhile or even counterproductive is the subject of much debate. "Food Before Fuel," a coalition of food industry, retail, and environmental groups has called for a re-examination of the government biofuels incentives because of the

impact that high corn prices have on food. Another issue revolves around the efficiency of biofuels, whether the energy received is greater than the energy invested (EROEI). Some that claim that if all the inputs are factored in, corn takes more energy to produce than it produces in fuel. Most recent studies show a gain of approximately 25 to 50% if the energy in the byproducts used for feed and the greater efficiencies in processing are included. However if other biofuel sources, such as sugar cane, wood chips, corn stalks, and switchgrass are considered, the net energy received is much greater.

Switchgrass, mentioned by President Bush in his State of the Union address, is potentially one of the more productive biofuels and can yield up to five times its cost in energy. Additionally, with most biofuels there is no net increase in CO<sub>2</sub> going into the atmosphere. Whatever is released in production is recaptured by the next crop. Furthermore, crops like switchgrass have less impact on prime farmland since it can be grown on lands that are marginal for grain crops and as a perennial crop there is little erosion.

There is no simple answer to our energy situation though conservation is one of the easiest and most important actions we can take. While biofuels may be part of the solution they are not the sole solution. Even pasture or hay land put into switchgrass means less land for grazing livestock and higher prices for

Switchgrass (behind) photo by Peggy Greb, USDA Agricultural Research Service

Mature soybeans (left)

photo by Scott Bauer, USDA Agricultural Research Service

A typical ethanol plant in West Burlington, Iowa (Big River Resources, LLC).

photo by Steven Vaughn, USDA Agricultural Research

livestock products. However, the less biofuels being used in our cars the more petroleum we need and the higher the price of oil and consequently the costs of producing food. Some researchers estimate that in the Midwest the price of gasoline would go up as much as 40 cents a gallon if biofuels were taken off the market. Even without subsidies the price of corn will stay closely tied to the price of gasoline. If that price stays high so will the cost of food.

At least temporarily we are at a volatile point where a change in one variable has a dramatic impact on our food supply. The continued conversion of farmland for development will have an even greater impact. Weather disturbances around the globe will be felt even sooner in our own food markets. Our present patterns of energy consumption and food production will be hard to maintain cheaply with our present resource base, particularly as the rest of the world begins to meet the consumption patterns of those in the west. Excess farmland, which became a cheap commodity 80 years ago as we adopted tractors and fertilizers, is becoming rarer. As farmland used for agricultural production receives record prices, farmers are expected to increasingly take lands that are suitable for crops out of conservation reserve programs in this country and out of the rainforest in places like Brazil. While other technologies will help, we may still find that the days of peak oil coincide with the days of peak agricultural land.

## How Ethanol is Made

ETHANOL PLANTS ARE BASICALLY BIG STILLS, fermenting sugar to produce alcohol. Sugar is readily obtained from corn seed and sugar cane so they are the easiest crops to process. Ethanol made from cellulosic plants like switchgrass or wood chips is more complicated because it requires an extra step to separate the cellulose from the lignin and then break it down to release the sugar. This can be done either chemically using acids or using enzymes.

The enzymatic process in effect mimics the process that occurs in ruminants such as cows, who break apart the fiber as they chew their cud, break down the cellulose with enzymes and then ferment it in the large stomach compartment called the rumen. Ruminants are accused of contributing to global warming because methane is a byproduct of this fermentation. In ethanol plants, unlike in cows, this gas is captured and distilled.

### EROEI (Energy Returned on Energy Invested)

There is a wide range depending on how easy the energy is to extract and the technologies involved. Oil takes more and more energy to extract as we have already tapped most of the easy reserves. Energy has stayed inexpensive in the past because we have imported oil from the higher EROEI foreign reserves.

U.S. Oil 3:1

Saudi Oil 10:1

Ethanol Corn 1.2:1 to 1.5:1

Biodiesel 3:1

Switchgrass 4:1 to 5:1

*To learn more about our corn based food system read [The Omnivore's Dilemma: A Natural History of Four Meals](#) by Michael Pollan (NY: The Penguin Press, 2006).*

*For a general overview of energy and environmental issues see Lester R. Brown, [Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble](#) (NY: W.W. Norton & Co., 2006).*

photo by Doug Wilson, USDA Agricultural Research Service