

BioEnergy

Fueling America Through Renewable Resources

Is Biodiesel as Attractive an Economic Alternative as Ethanol?

Allan Gray

Department of Agricultural Economics
Purdue University



What Is Biodiesel?

Biodiesel is a renewable fuel alternative to standard on-road diesel. Biodiesel is made from plant oils, such as soybean oil; animal fat from slaughter facilities; or used greases. Seventy-three percent of biodiesel produced in the United States comes from soybean oil. The remaining 27% is produced from the other feedstocks.

The ability to use a variety of feedstocks to make biodiesel differentiates this biofuel market from the current ethanol market, which is dominated by corn in the U.S. and sugar in South America. The ability to use various feedstocks is one of the reasons that biodiesel production facilities are not as concentrated in the Midwest as ethanol plants.

How Is Biodiesel Used?

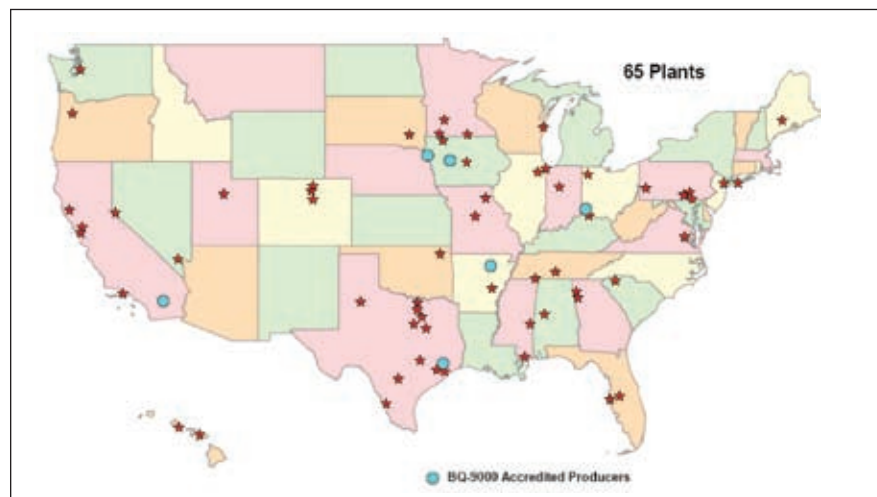
The primary uses of biodiesel at the moment are as a replacement/extender for diesel fuel

and as a lubricant additive to low sulfur diesel fuel. A change in environmental laws associated with sulfur emissions from diesel has caused the industry to move from a standard number 2 diesel to a cleaner burning number 1 diesel with much lower sulfur emission.

However, number 1 diesel fuel has a much lower lubricity than number 2 diesel, causing additional wear on diesel engines. By blending number 1 diesel with at least 2% biodiesel, the lubricity properties of the fuel can be the same as number 2 diesel fuel. And, because biodiesel contains only small traces of sulfur when burned, the sulfur emission standards can still be met.

In 2005, approximately 75 million gallons of biodiesel were produced in 65 plants scattered across the United States (Figure 1). There were approximately 63 billion gallons of distillate fuel (diesel fuel, heating oil, kerosene, etc.)

Figure 1. Commercial Biodiesel Production Plants in the United States (April 28, 2006)



Source: National Biodiesel Board



consumed in the United States in 2005, the bulk of which was diesel fuel. Thus, biodiesel is a very small proportion of the current distillate fuel market. Current projections indicate that biodiesel production will grow to 225 million gallons by 2015. Even at this growth rate, biodiesel would still be less than 1% of the total distillate fuel market.

What Are the Economics of Biodiesel Production?

Production Efficiency

The economics of biodiesel are not as strong as the economics associated with ethanol production. Current technology allows for 1 bushel of soybeans to produce 1.49 gallons of biodiesel, while 1 bushel of corn can produce approximately 2.7 gallons of ethanol. Another way to look at the conversion of soybean oil to biodiesel is that 1 gallon of soybean oil produces 1 gallon of biodiesel.

Cost Structure

The typical historical price of soybean oil indicates that the raw feedstock (the primary ingredient of the fuel) costs would range between \$1.50 and \$2.10 per gallon. This would be compared to raw feedstock costs for ethanol from corn of \$0.74 to \$1.11 per gallon if corn prices were \$2 or \$3 per bushel, respectively.

In comparison, the cost of crude oil, the raw feedstock for petroleum-based fuels, ranges from \$1.19 per gallon for \$50 per barrel oil to \$1.67 per gallon for \$70 per barrel oil. Thus, the feedstock costs for biodiesel are substantially higher than for the conventional feedstock, putting biodiesel at a cost disadvantage to conventional diesel.

Government Subsidies

To offset the cost disadvantage of the higher feedstock cost, biodiesel production receives a \$1.00 gallon blender's tax credit. (The subsidy for biodiesel is actually \$0.01 per percent blended into conventional diesel fuel. Thus, the \$1.00 gallon subsidy is not fully attainable because it must be blended to receive the tax credit, but for all practical purposes, the subsidy is equivalent to \$1.00 per gallon.)

This tax credit allows blenders to pay a higher price for soybean oil, thus compensating the producer for the higher cost of production for biodiesel. At current soybean oil, crude oil, and tax credit levels, biodiesel can be a profitable business. But the generally higher cost feedstocks from soybean oil make the economics much less robust than the current economics for ethanol.



What Are the Prospects for Technological Improvements in Biodiesel Production?

Unlike ethanol, technological improvements that might be made in the production of biodiesel from soybean oil are somewhat limited. It is hard to imagine improving the efficiency of a conversion rate of 1 gallon of soybean oil to 1 gallon of biodiesel. Thus, technological advances in the biodiesel industry are more likely to come from improvements in oil production from the renewable source (mainly oil crops).

One possible technological improvement is to increase the oil production from soybeans. This may be possible, and several companies are working on this. But an increase in oil production usually means a decrease in soybean meal production, and right now, soybean meal continues to be the main economic engine for the value of soybeans, making it difficult to envision a large shift in soybean production to focus on oil production.

Alternatively, the biodiesel industry may seek alternative oil crops to source their feedstock. For example, a typical Midwest soybean farm can produce approximately 56 gallons per acre of soybean oil, but a typical acre of canola (the primary feedstock for biodiesel in Europe) can produce 111 gallons of oil. This difference in oil production from current varieties of each crop suggests that alternative feedstocks may be the wave of the future for biodiesel production. Of course, agronomic issues will determine where these crops might be grown.

Conclusion

In conclusion, biodiesel is a very small industry compared to its ethanol companion in renewable fuels. Current government policy combined with economics of traditional fuel markets are helping garner interest in growing the biodiesel market. Current projections show that biodiesel may grow relatively rapidly over the next few years, but it will likely remain a small part of the overall diesel market.

The growth of biodiesel may not have as much impact on Midwestern agriculture as ethanol because there are numerous alternatives to soybean oil as a feedstock that could be used for biodiesel production. For the foreseeable future, soybean oil will likely be the dominant feedstock, but the search for technological improvements may lead to alternative crops being the primary source for biodiesel production in the future.

Further Information

The Agricultural Marketing Resource Center <<http://www.agmrc.org/agmrc/commodity/energy/biodiesel/>>

Coltrain, D. "Biodiesel: Is It Worth Considering?" <<http://www.agmrc.org/NR/rdonlyres/513C6A14-28DE-4B54-A57E-EA7FE052E399/0/bdconsider.pdf>> (August 2002).

Ginder, R. "Evaluating Biodiesel as a Value-Added Opportunity" <<http://www.agmrc.org/NR/rdonlyres/CF9ADDED-C9DA-4B59-8F34-49C00529FBE4/0/biodiesellopportunity.pdf>> (July 2004).

The National Biodiesel Board <<http://www.biodiesel.org>>

Visit <<http://www.ces.purdue.edu/bioenergy>> for free, downloadable copies of all of the publications in the Purdue Extension BioEnergy series.

