

FOOD & FUEL

Meeting the Challenges of Feeding the World and Creating Renewable Fuels



Presented by the United Soybean Board

Contents

Abstract	3
Introduction	4
Topics	
Demand for Alternative Fuel Sources	4
The Role of Biofuels in Energy & Environmental Issues	5
Food vs. Fuel: The Debate	6
Corn Ethanol	7
Soy Biodiesel Provides Food and Fuel	8
Conclusion	10

Abstract

The inception of biofuels has been a vital step in the renewable energy movement. As with any new energy source, there continue to be questions from industry leaders, politicians and consumers about the safety and impact of the processes involved. Among the most-discussed is the debate on whether using biofuels for energy diverts resources away from human food uses.

This debate was most recently brought to the forefront in 2008, due to increases in food prices in the U.S. and around the world. Some industry leaders and media faulted biofuel production as the sole culprit of the increased prices, citing increased prices as a negative impact of using crops for fuel.

This paper aims to analyze those claims and address the role of the two most popular biofuels, corn ethanol and biodiesel produced from soybeans.* Biofuels offer part of the solution to America's energy needs and have a smaller environmental impact than fossil fuels. Several key differences between ethanol and biodiesel are worth considering.

Soybean biodiesel, for example, only requires the use of soybean oil. This leaves approximately 80 percent of the soybean to be used for protein in animal feed and human food. In addition, only three percent of the domestically consumed soybean crop is used in biodiesel production.

In contrast, ethanol production requires the starch portion of the corn kernel (about two-thirds of the kernel by weight) and uses the remaining elements for processing animal feed, commonly known as distillers grains. Ethanol production also requires more than 20 percent of the U.S. corn crop. These differences are explained in detail on pages 7-9.

Biofuels are not, however, the only solution for solving current and future energy problems. Instead, biofuels play an important role as part of the energy portfolio needed to meet growing demand.

*For the purposes of this paper, the term biodiesel will be used to describe soy-based biodiesel unless stated otherwise.

Introduction

Fossil fuels are a cornerstone of human civilization. Fuel heats our homes, runs our cars and lights our buildings – but at what cost? Recent world politics have given some insight into the issues at hand, including the price, environmental impact and availability of fossil fuels. These factors are creating exponential growth in demand for renewable sources of fuel, such as ethanol and biodiesel – the two most popular and commercially-produced biofuels.

Biofuels are derived from organic residue, either obtained directly from plants or indirectly from agricultural, commercial, domestic and/or industrial wastes. Ethanol is a biofuel created by processing corn, sugarcane and other grains. Biodiesel is created from natural oils, such as canola, palm and soybean oils. New processes are also creating biofuels from straw, switchgrass and even algae – all helping satisfy global needs for alternatives to fossil fuels.

Biofuel production and usage is currently low compared to that of fossil fuels but it is growing. **In 2007, biofuels were only four percent of the total world consumption of liquid fuels. But by 2030, it is projected that they will account for almost 20 percent.**¹

This current and projected growth has led some to speculate on what the impact might be in the short- and long-term. It has also raised concerns about what is most important to U.S. agriculture – ensuring a safe and affordable food supply or developing a new fuel market to lessen dependence on foreign oil. It is clear that the issues are complex.

The United Soybean Board (USB) is confident about meeting the needs of both food *and* fuel today and in the future. Current numbers show that only three percent of the domestically consumed soybean crop is used in biodiesel production. In addition, U.S. soybean crops have historically outpaced demand.^{2,3}

First triggered by the oil shocks of the 1970s, production of biofuels – principally ethanol from sugarcane in Brazil and corn in the U.S. – grew rapidly for some years, but then stagnated during the 1990s.

After 2000, as oil prices edged upward, it began to gain momentum again. Europe, meanwhile, led by Germany and France, was starting to extract biodiesel from oilseeds.

Lester Brown, *How Food and Fuel Compete for Land*²

Demand for Alternative Fuel Sources

The economic and environmental impacts of dependence on oil are far-reaching. The U.S. houses one-third of the world's automobiles (230 million) and uses 25 percent of the world's oil, making it the largest oil consumer on the planet.^{5,6} This day-to-day dependence was brought to the forefront during the past five years, when petroleum prices in the U.S. hit historic levels.⁷ Though these prices have subsided since their peak in 2008, officials from the Energy Information Administration (EIA) predict that they will continue to remain high in the future, relative to historic standards.⁸

Perhaps more important are the environmental impacts of oil consumption. Scientists are seeing increasing signs of climate change due to the impact of greenhouse gases such as carbon dioxide (CO₂). The issue does not have an easy fix: The U.S. is the second largest contributor of CO₂ (behind China) and projections show that the greenhouse gas emissions from our transportation sector will grow by nearly 40 percent through 2030.^{6,9}

The Role of Biofuels in Energy & Environmental Issues

Though relatively new, the economic effects of biofuels can already be seen in the wallets of consumers. The U.S. Department of Energy (DOE) estimates that ethanol alone has already helped keep gasoline prices lower. According to their projections, gasoline would be 20 to 35 cents per gallon higher without ethanol. For a typical household, this equates to \$150 to \$300 in annual savings.¹⁰

Biofuels also offer a promising outlook for the environment. They can be sourced from renewable, organic residue and emit less greenhouse gases than fossil fuel products. As a whole, scientists estimate that 13 million tons of greenhouse gases were avoided in 2007 due to biofuels' production and use.¹⁰

“Advanced renewable transportation fuels will be one of the nation’s most important industries in the 21st Century. Combined with improved energy efficiency, biofuels are the primary near-term option for insulating consumers against future oil price shocks and for lowering the transportation sector’s carbon footprint.”

President Barack Obama, *Letter to the Governors’ Biofuels Coalition*¹²

Key Advantages of Biodiesel:

- Biodiesel reduces net CO₂ emissions by up to 78 percent compared to petroleum diesel, according to a biodiesel lifecycle study jointly sponsored by the DOE and the U.S. Department of Agriculture (USDA).¹²
- Biodiesel is also the only alternative fuel to have fully completed the health effects testing requirements of the Clean Air Act. The testing concluded that biodiesel is non-toxic and biodegradable, posing no threat to human health.
- The use of biodiesel in a conventional diesel engine results in substantial reduction of unburned hydrocarbons, carbon monoxide and particulate matter compared to emissions from diesel fuel. The exhaust emissions of sulfur oxides and sulfates (major components of acid rain) from diesel are essentially eliminated with biodiesel.¹²

The U.S. government, too, has noticed the need for cleaner, alternate fuel sources and has created legislation to help support their development. Congress passed the Renewable Fuel Standard in 2007, requiring 36 billion gallons per year of biofuels to be produced domestically by 2022.⁶ This would more than triple the current biofuel production in the U.S.¹⁴

U.S. Production of Biofuels by Year

(Millions of Gallons)^{12,13}

	2007	∴	2008
Biodiesel	491	∴	700
Ethanol	6499	∴	9000

Food vs. Fuel: The Debate

The economic and environmental effects detailed above cast a positive light on the importance of biofuels. But, skeptics argue that using crops for biofuels will divert resources away from human consumption, causing a choice in whether the crops can be used for food or fuel. Furthermore, this reasoning connects biofuels to global hunger issues and increased food prices. This argument was especially prevalent in 2007 and 2008, when the all-food Consumer Price Index (CPI) in the U.S. had the highest annual increase since 1990.¹⁷

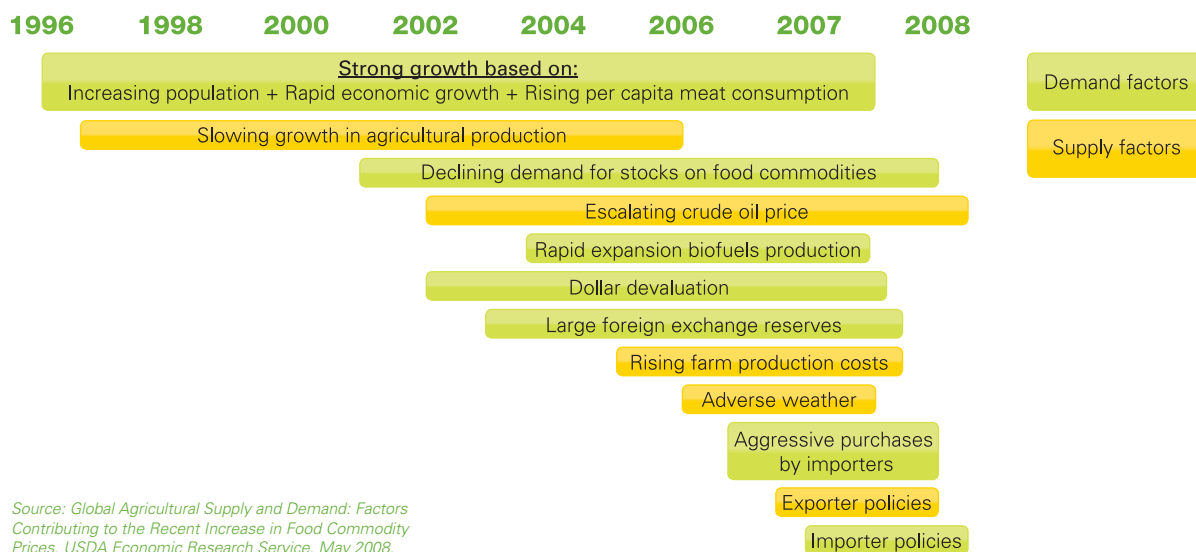
Some environmental groups, international and national politicians and food industry representatives attributed this extreme rise in food prices to biofuel production.¹⁸ Specifically, some food industry groups claimed that more than one quarter of the corn crop was being diverted from food to ethanol production, driving up the price of corn and other commodities to historic highs.

However, we now know that the high commodity prices were likely caused by a combination of elements and no single factor was responsible.²¹ In fact, a USDA study published at the peak of last year's commodity price run-up identified approximately 14 factors from 1996 to 2008 that were responsible for driving food commodity prices.

These factors ranged from escalating crude oil prices (2002 to 2008), severe weather (2006 to 2007; including droughts in Australia, Europe and Russia, and floods in the U.S.), dollar devaluation (2002 to 2008), growth in demand caused by increasing population, strong economic growth and rising per capita meat consumption (1996 to 2008).²²

A rise in food prices can have global hunger effects. Low income countries are disproportionately affected by higher food prices because a greater portion of income is spent on food.

In 2007, the Economic Research Service estimated that people in Indonesia and China spend 45.7 and 34.9 percent, respectively, of their household income on food consumed at home, compared to U.S. consumers at about 5.7 percent.²¹



It is important to note that the core issue of the food vs. fuel debate is focused on world hunger and using crops for fuel rather than to feed the hungry. There has yet to be a choice between the two. In fact, the U.S. corn supply has outpaced demand since 1989.²³

Corn Ethanol

There are two types of corn used in commercial production: field corn and sweet corn. Sweet corn is what grocery shoppers purchase fresh, frozen or canned for eating. Field corn is grown on more than 99 percent of all corn acres in the U.S. and is used to produce corn cereal, corn starch, corn oil and corn syrup for human consumption. But, it is primarily used for livestock feed, ethanol production and other manufactured goods.

The processing of field corn into ethanol also results in other important food products. The 3.7 billion bushels used for ethanol production in 2008 resulted in approximately one billion bushels of distiller grains to be used as livestock feed.²⁵

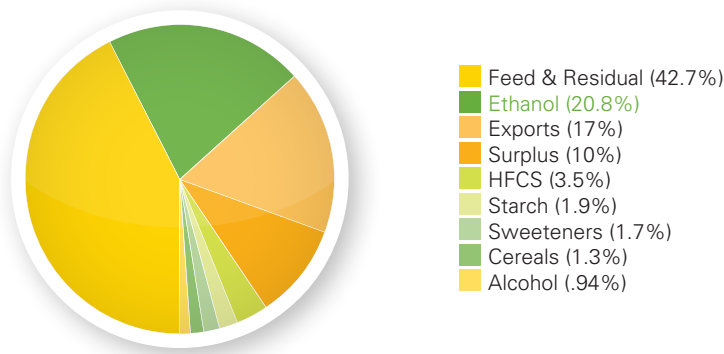
Because ethanol currently dominates the alternative fuel market in the U.S., much of the dialogue around food vs. fuel has centered on corn. The National Corn Growers Association has communicated its position consistently – it is confident that both the growing ethanol market and the ever-important human food market can be satisfied with projected corn production. ²⁶

Soy Biodiesel Provides Food and Fuel

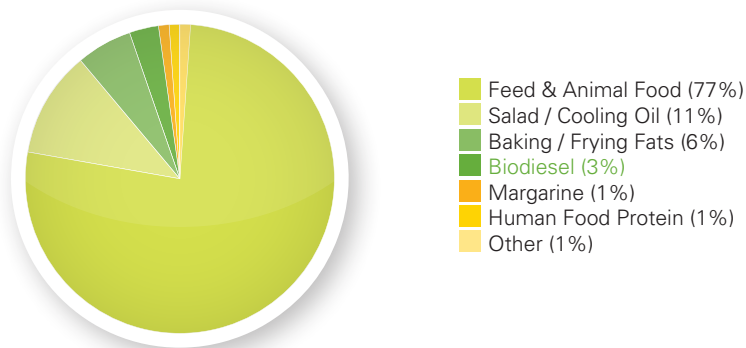
The United Soybean Board recognizes that U.S. soybean producers can help feed and fuel the world with sustainable agriculture practices. To evaluate soy-based biodiesel effectively, it may help to understand some of the key differences between soy biodiesel and other biofuels.

The first major distinction is the amount of each crop being used for biofuel production. Whereas more than 20 percent of the U.S. corn crop goes to ethanol, only three percent of the domestically consumed soybean crop is used in biodiesel production.³

Domestic Corn Consumption 2007/2008



Domestic Soybean Consumption 2007/2008

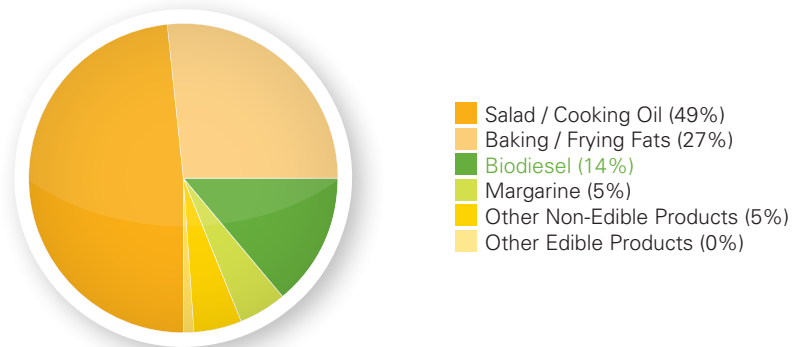


The second distinction relates to what is produced when soybeans are processed. Soybeans yield both solid and liquid products. The solids, called soybean meal, are approximately 80 percent of the soybean and are a high quality, in-demand protein ingredient for animal feed (swine, beef, poultry, dairy and fish) and human food protein (tofu, soymilk, meat analogs, protein powder and soynuts).

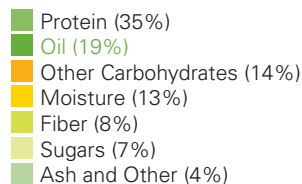
Soybeans are an especially important ingredient because they are the highest natural source of dietary fiber and are a complete protein, containing all eight essential amino acids necessary for human nutrition.

Soybeans also produce a liquid, known as soybean oil, in addition to the meal. This product has a variety of food applications, including salad and cooking oil, baking and frying fat, and margarine. Soybean oil is relatively low in harmful saturated fat, contains zero grams of trans fat, and is high in poly- and monounsaturated (“good”) fats. It’s also the principal source of omega-3 fatty acids in the U.S. diet and the primary commercial source of vitamin E.

Domestic Soybean Oil Consumption 2007/2008



Distribution of the Soybean: Soybean Composition



According to the USDA Economic Research Service, soybean oil represents 71.3 percent of U.S. fats and oils consumption, significantly outpacing all other types of edible oils combined. Even with biodiesel production, soybean oil maintains its lead position in domestic edible oils, as no other major vegetable oil has reached the 10 percent mark.²⁷

Soybean oil also has a variety of industrial applications, including the production of biodiesel. In regard to diverting resources to fuel rather than food, it is important to note that **soybean oil is the only part of the soybean used in biodiesel**. This means that the solids can continue to be used for animal and human protein consumption and remain completely unused by the biodiesel process. **Currently, 14 percent of the soybean oil consumption goes to biodiesel.**³

Thanks to the laws of supply and demand, soybean meal prices generally fall with increased production of soybeans. If future biodiesel demands require more soybean oil, soybean meal users will likely see lower prices.²⁸ **As with corn, U.S. soybean crops have historically outpaced demand. In 2008, there was an excess of more than 200 million bushels of soybeans.**²

Biodiesel production is spurring the growth of the U.S. soybean industry, making even more food and fuel available for the future.

National Biodiesel Board, *Biodiesel: A Sustainable Choice*²⁹

Conclusion

The issues of the food vs. fuel debate are dynamic. The U.S. and the world continue to struggle with economic and environmental issues, stressing the importance of short- and long-term energy solutions. Biofuels, including soy-based biodiesel:

- Offer cleaner energy sources than petroleum-based fuels
- Help to limit dependence on oil
- Are produced from renewable resources that can be produced abundantly within the U.S.

Most importantly, crops such as soybeans and corn can be utilized for both food *and* fuel without having to sacrifice one over the other.

At the same time, biofuels should not be expected to solely solve current and future energy needs. It is important to understand the key points of differentiation for every biofuel and how each can play an important role as part of the energy portfolio needed to meet growing demand.

While the emphasis of this paper has been on domestic food and fuel sources, South America typically produces a similar quantity of soybeans as the U.S., further ensuring there are ample soybeans in the world for food and fuel.

References

- 1 *Annual Energy Outlook 2009 with Projections to 2030, Figure Data*, Energy Information Administration (2009). Available at: <http://www.eia.doe.gov/oiaf/aeo/execsummary.html>.
- 2 *Soystats 2009, Ending Stocks*, American Soybean Board. Available at: <http://soystats.com/2009/Default-frames.htm>.
- 3 *Soybean Oil Consumption 2007/2008*, United Soybean Board Market View Database (2009). Available at: <http://usb.adayana.com:8080/usb/jsp/login.jsp>.
- 4 *How Food and Fuel Compete for Land*, Lester Brown, The Globalist (February 2006).
- 5 *Short Term Energy Outlook, International Energy Annual 2006, Table 3a*, Energy Information Administration (2006). Available at: http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=US.
- 6 *National Biofuels Action Plan*, Biomass Research and Development Board (October 2008). Available at: <http://www1.eere.energy.gov/biomass/pdfs/nbap.pdf>.
- 7 *Retail Gasoline Historical Prices*, Energy Information Administration (May 2009). Available at: http://www.eia.doe.gov/oil_gas/petroleum/data_publications/wrpg/mogas_history.html.
- 8 *Why Are Oil Prices So High and Where are They Going?*, Guy F. Caruso, Energy Information Administration. Presented at the Global Finance Forum (March 2008).
- 9 *Top 20 Emitting Countries by Total Fossil-Fuel CO2 Emissions for 2006*, Carbon Dioxide Information Analysis Center (2006). Available at: http://cdiac.ornl.gov/trends/emis/tre_tp20.html.
- 10 *Fact Sheet: Gas Prices and Oil Consumption Would Increase Without Biofuels*, The U.S. Department of Energy (June 2008). Available at: <http://www.energy.gov/news/6335.htm>.
- 11 *Ethanol Facts: Environment*, Renewable Fuels Association. Available at: <http://www.ethanolrfa.org/resource/facts/environment/>. Accessed on May 18, 2009.
- 12 *Biodiesel Resources: Frequently Asked Questions*, National Biodiesel Board. Available at: <http://www.biodiesel.org/resources/faqs/default.shtm>. Accessed on May 18, 2009.
- 13 *Letter to Governor Hoeven and Governor Culver of the Governors' Biofuels Coalition*, President Barack Obama (May 27, 2009). Available at: <http://ncga.com/files/pdf/WhiteHouseLetteronBiofuels5-27-09.pdf>.
- 14 *Biofuels in the U.S. Transportation Sector*, Energy Information Administration (February 2007). Available at: <http://www.eia.doe.gov/oiaf/analysispaper/biomass.html>.
- 15 *Alternative and Advanced Fuels, Biodiesel Production*, United States Department of Energy, Energy Efficiency and Renewable Energy. Available at: http://www.afdc.energy.gov/afdc/fuels/biodiesel_production.html.
- 16 *Estimated U.S. Biodiesel Production*, National Biodiesel Board. Available at: http://www.biodiesel.org/pdf_files/fuelfactsheets/Production_Graph_Slide.pdf. Accessed on July 9, 2009.
- 17 *Food CPI and Expenditures: Analysis and Forecasts of the CPI for Food - Overview*, The United States Department of Agriculture Economic Research Service (March 2009). Available at: <http://www.ers.usda.gov/Briefing/CPIFoodAndExpenditures/>.
- 18 *GMA Blames Biofuels for Spike in Food Prices*, Clarisse Douaud, Food Navigator-USA (April 2008). Available at: <http://www.foodnavigator-usa.com/Financial-Industry/GMA-blames-biofuels-for-spike-in-food-prices>
- 19 *Feed Outlook*, United States Department of Agriculture Economic Research Service (January 2008). Available at: <http://www.scribd.com/doc/2095436/USDA-ERS-Feed-Outlook-12008>.
- 20 *Biofuel Industry Leaders Weigh in on World Food Summit*, PRNewswire-USNewswire (May 2008). Available at: http://www.redorbit.com/news/business/1413121/biofuel_industry_leaders_weigh_in_on_world_food_summit/index.html.
- 21 *Fluctuating Food Commodity Prices: A Complex Issue With No Easy Answers*, Amber Waves, USDA Economic Research Service (November 2008). Available at: <http://www.ers.usda.gov/AmberWaves/November08/Features/FoodPrices.htm>.
- 22 *Global Agricultural Supply and demand; Factors Contributing to the Recent Increase in Food commodity Prices*, United States Department of Agriculture Economic Research Service (May 2008).
- 23 United States Department of Agriculture Economic Research Service via the ProExporter Network (2008). Note: 08-09 is based on ProExporter Network projections.
- 24 *Food CPI and Expenditures: 2007 Table 97*, United States Department of Agriculture Economic Research Service (2007). Available at: http://www.ers.usda.gov/briefing/CPIFoodAndExpenditures/Data/Table_97/2007table97.htm.
- 25 *A Tale of Two Corns*, National Corn Growers Association (April 2009). Available at: <http://ncga.com/files/pdf/TwoCorns4-09.pdf>. Sourced from the U.S. Department of Agriculture (March 2009).
- 26 *U.S. Corn Growers: Producing Food & Fuel*, National Corn Growers Association (October 2008). Available at: <http://www.ncga.com/files/pdf/FoodandFuelPaper10-08.pdf>.
- 27 *2008 ERS Oilseed Yearbook*, United States Department of Agriculture Economic Research Service (2008).
- 28 *Biofuel Mandates Increase Demand for Corn, Soy Oil*, Duane Dailey, Cooperative Media Group, University of Missouri (January 2008). Available at: <http://deltafarmpress.com/biofuels/energy-demand-0108/>.
- 29 *Biodiesel: A Sustainable Choice*, National Biodiesel Board (2008). Available at: http://www.biodiesel.org/resources/sustainability/pdfs/brochureSustainabilityfinal_0708.pdf.

About USB

A farmer-led organization comprised of 68 farmer-directors, USB oversees the investments of the soybean checkoff on behalf of all U.S. soybean farmers.

Soybean oil produced from our soybeans has always offered desirable characteristics to the food industry, such as:

- Neutral Flavor
- Balanced Fatty Acid Profile
- Competitive Pricing

That's why soybean oil is the most widely used edible oil in the United States, accounting for about 71%* of U.S. consumption.

*U.S. Department of Agriculture, Economic Research Service, 2008

