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SOYBEAN—A VERSATILE COMMODITY

It is common knowledge that soybean is a crop that produces seed with both high protein and oil content. The protein component is processed to produce feed for livestock and poultry, and the oil component is processed to be used by the industrial and human food sectors of the U.S. economy.

HIGH OLEIC SOYBEAN OIL

High oleic [HO] soybean varieties offer end-users a U.S.-grown commodity that meets the needs of many food industry customers as a trans-fat-free replacement for partially hydrogenated oil [PHO]. High oleic soybeans were launched commercially in 2012, and the 2015 announcement by the U.S. Food and Drug Administration to phase out PHO's has added to the importance of HO soybean production by U.S. producers. High oleic soybeans received global regulatory approval in Jan. 2018, and this allows seed of these varieties to expand into new markets.

The positive traits of HO soybeans are provided in the article titled "[High Oleic Soybean Oil: Providing Heart-Health and Functional Benefits to the Food Industry](#)" that is sponsored by U.S. SOY [USSOY.ORG], which is fully funded by the national soybean checkoff. A list of major HO soybean traits and advantages follows.

- According to the United Soybean Board [USB] publication [High Oleic Soybeans](#), HO soybean varieties contain the same agronomic traits as traditional varieties, and their yield is competitive with that of those varieties.
- The premium paid for harvested seed of HO soybean varieties makes them attractive for soybean producers to grow to increase their profitability. See the article [here](#) for more about premiums paid for delivery of HO soybeans.
- HO soybean oil is more stable in high-heat applications, is high in monounsaturated fats and low in polyunsaturated fats, and has a longer fry-life and shelf life than conventional vegetable oils.
- HO soybeans can replace petroleum-based products in some industrial applications. For example, an article titled "[High Oleic Soy Roots Itself in a New Use](#)" describes its use as a biobased polymer that can be used in asphalt.
- HO soybean oil contains more than 70% oleic acid [a monounsaturated fatty acid], making it comparable to high oleic canola and olive oils. Oleic acid is a monounsaturated vegetable oil, which makes it more stable than polyunsaturated oils. Also, monounsaturated fatty acids such as oleic can lower levels of "bad" [LDL] cholesterol and total cholesterol while maintaining "good" [HDL] cholesterol levels in humans.
- Seed of HO soybean varieties are lower in linoleic and

linolenic fatty acids than seed of commodity soybeans.

There are choices for producers who want to grow HO soybeans.

- [SOYLEIC](#) is a patented, **non-GMO**, HO soybean trait developed by soybean breeder Dr. Grover Shannon and colleagues at the Univ. of Missouri. This trait was developed through partnerships among the Univ. of Missouri, the Missouri Soybean Merchandising Council, the USB, and the USDA, and is now available to seed developers and breeding programs in the entire U.S.
- Two mutant alleles of genes FAD2-1A and FAD2-1B are responsible for the SOYLEIC high oleic acid seed oil trait. Currently, the focus of the SOYLEIC breeding program is on MG 3 and 4 conventional [non-GMO] and Enlist E3 [GMO] varieties, with the planned release of HO soybean lines in 2022 and beyond. Go to [here](#) and [here](#) for additional information about and resources pertaining to SOYLEIC.
- [Plenish soybean varieties from Pioneer](#) contain more than 75% oleic acid [compared to about 23% in regular soybean oil], and contain a full array of Pioneer's most advanced yield and pest resistance traits. Presently, **these GMO varieties** offer only the Roundup-Ready trait for weed control, but Pioneer is working toward incorporating high oleic genetics into varieties with the Enlist E3 weed control trait [the projected date for the availability of these varieties is 2025]. A list of soybean processors that will contract for seed of Plenish varieties can be found [here](#). It is noted that all of these processors are in the midwestern and northeastern U.S.

March 2024 Update

- In a Feb. 2024 article titled "[Beck's Hybrids flexes high-oleic soybean muscle](#)", author Mindy Ward provides information about the company's plans to offer SOYLEIC HO soybean varieties in MG's II-IV to growers in four Midwestern states. The company's HO offering is being done through an agreement with [Missouri Soybeans](#) for its non-GMO SOYLEIC trait. The trait is patented by the [Missouri Soybean Merchandising Council](#), which directs the investment of Missouri soybean checkoff funds. Beck's plans to increase this offering into other states in future years.

HO soybeans must be treated as an identify-preserved [IP]



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crop, which means seed of these varieties must be kept separate from seed of commodity soybeans. Thus, planters, seed handling equipment, combines, and seed hauling equipment must be cleaned to ensure that they contain no other seeds before using for/with HO soybean varieties. This also means that seed of the **non-GMO SOYLEIC** varieties must be kept separate from seed of the **GMO Plenish** varieties even though both are HO soybean varieties.

According to information in an article titled “[Demand Far Exceeds Supply for High Oleic Soybeans](#)” by Larry Lee that appeared in Brownfield Agnews on July 28, 2022, there are not enough HO soybean varieties being grown to meet the current and projected future demands. A USB-funded project is being conducted to expand the available soybean varieties in MG’s 1 through 5 to increase availability of varieties with the HO trait.

A Nov. 7 2022 article from the USB titled “[Checkoff Encourages Farmers to Take Advantage of High Oleic Soybean Contracts](#)” provides information about how U.S. soybean producers can obtain premiums for HO soybean production. Information about securing contracts for HO soybeans can be found [here](#). Presently, there are no HO soybean elevators in the Midsouth, but current projections indicate there will be in the near future. This is something for Midsouth soybean producers to be mindful of in the coming years.

An article titled “[Top 10 Reasons to Grow High Oleic Soy](#)” from USB provides a list of factors that will support the decision to grow HO soybeans as part of a crop management plan. Several links in this article provide information on the increased profit potential from raising HO soybeans, finding an elevator that is close to the production site for marketing HO soybeans, and pest control strategies that are available for this IP crop.

NON-FOOD PRODUCTS DERIVED FROM SOYBEAN

The industrial/consumer products segment of the U.S. economy is now finding that soybean oil can be valuable for uses other than food preparation. Below are recent innovations that include non-food uses for soybean oil.

[BIORESTOR Asphalt Rejuvenator](#). This product from BioBased Spray Systems LLC is a restorative asphalt modifier that is applied just after paving to increase the lifespan of asphalt pavement. Asphalt treated with this bio-based oil [i.e. soybean oil] cracks less, is more flexible/less brittle, and has reduced pot holes. BIORESTOR is applied to preserve and protect asphalt pavements, and to increase their longevity and

surface quality.

[Goodyear Tires with Soybean Oil](#). According to Goodyear, the use of soybean oil in their tires improves the flexibility of the tires in lower temperatures, as well as enhancing traction in both rain and snow. Since soybean oil is a natural, sustainable, and renewable resource, its use in Goodyear tires provides yet another market for this versatile commodity that is produced by U.S. farmers. Four of Goodyear’s best-selling premium tires are manufactured with soybean oil. Goodyear has a goal of eliminating petroleum-based oils in their tires by 2040, and replacing them with soybean oil is one way of meeting this goal.

[Skechers Goodyear Shoe Line](#). Skechers has developed and is marketing shoes with Goodyear soy-based rubber outsoles that are touted to have better traction, stability, and durability on myriad terrains and in myriad weather conditions.

[ROOF MAXX](#). As asphalt roof shingles age, they lose their oil component and become dry and brittle. Roof Maxx is a soy-oil product that is applied to aging shingles to restore their flexibility, which allows the shingles to withstand changing temperatures and extreme weather. According to information on the company’s website, a Roof Maxx treatment every 5 years can extend the life of an asphalt shingle roof up to 15 years.

High Oleic Soybean Oil. High-Oleic soybeans can replace petroleum-based products in some industrial applications. For example, an article titled “[High Oleic Soy Roots Itself in a New Use](#)” describes its use as a biobased polymer that can be used in asphalt. Tests have confirmed that HO soybean oil outperforms other oils such as petroleum in asphalt application, and can increase the reuse rate of asphalt grindings. [Biosynthetic Technologies](#) has developed a [bio-based synthetic motor oil](#) for passenger cars that uses HO soybean oil. The company will market both 5W-20 and 5W-30 motor oil that is biodegradable and is a proven alternative to petroleum-based motor oil.

Renewable Diesel

[Renewable Diesel](#) [RD—also known as hydro-treated vegetable oil] has become a hot topic in this country because of its capability to replace petroleum-based diesel fuel. This biofuel is quite different from biodiesel because it is produced by a different production process that yields a hydrocarbon product that is molecularly identical to



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standard fossil fuel diesel. Thus, RD can be used in any diesel engine with no required modifications to that engine—i.e., it can be used as a “drop-in” fuel. Also, it does not have to be blended with petroleum-based diesel to maintain performance in standard diesel engines. RD emits significantly less emissions than standard fossil fuel diesel and gasoline. It is easier to refine than gasoline, has the potential to power myriad commercial vehicles, and can replace coal and other fossil fuels for generating electrical power. Current biofuel producers are planning expansion principally using soybean oil as a feedstock.

A Sept. 2022 report titled “[Renewable Diesel Projected to Turbo Charge Biofuel Growth](#)” by K. S. Zuckerberg, Lead Economist with [CoBank](#), provides positive news for U.S. soybean producers as they look for new markets for their soybeans. Key points from that report follow.

- Biofuels such as RD are liquid fuels that are produced from plant feedstocks, and are being promoted to reduce the use of fossil fuels.
- Consumption of energy from renewable sources has increased across the globe, and this will likely continue as more governments mandate a shift to less carbon-intensive energy sources.
- All current and proposed RD projects will require the U.S. to vastly increase production of the feedstocks used for RD production, and the most available and important feedstock source will be soybean oil.
- A key element of the [2022 Inflation Reduction Act](#) that was enacted by the U.S. Congress is the subsidizing of private sector investment in domestic production of clean energy.
- Ethanol [alcohol fuel produced from corn feedstock] and biodiesel [diesel fuel made by processing vegetable oils and other fats] are biofuels that have to be blended with petroleum gasoline and petroleum diesel, respectively. Since RD is chemically similar to petroleum diesel, it does not have to be blended with traditional petroleum diesel. It can be used in any diesel engine with no required modifications to that engine—i.e., it can be used as a “drop-in” fuel.
- Electric vehicle [EV] sales are increasing; however, production of batteries needed to power these vehicles is being hampered by high elemental lithium prices and supply chain issues. Also, disposal of spent batteries used by EV’s likely will be a future issue.
- RD is a “greener” fuel [carbon intensity score of 41] than petroleum diesel [carbon intensity score of 90], and thus produces lower greenhouse gas emissions.
- Of all the crops that can provide oilseeds for RD production, soybeans occupy by far the largest acreage in the U.S. Thus, it is the crop that presently is the primary source of feedstock for U.S. RD production.
- Growth in U.S. RD production is expected to rise from today’s production of approximately 1 billion gallons to 6.5 billion gallons by 2030, and this will require 3.4 billion new bushels of soybeans. Using a projected U.S. soybean yield estimate of 51.9 bu/acre, and assuming the stoppage of all soybean exports (projected to be 2.5 billion bushels in 2030), this would require an additional 17.9 million U.S. soybean acres to produce the 927 million bushel shortfall needed to meet the projected RD demand.
- Acres that would have been devoted to corn will likely be the primary source of new soybean acres needed to meet projected RD demand. This may not be an issue if electric vehicle adoption reduces the need for corn-based ethanol (historically, ~35% of U.S. corn production has been used for ethanol production), which in effect would lower the needed U.S. corn acres.
- According to information in an article titled “[Economist’s Angle: Soybean Processing Growth is Crushing It](#)” by Scott Gerlt, ASA Chief Economist, the soybean processing industry plans to grow significantly over the next few years. Much of this planned expansion is in response to the anticipated growth in demand for RD. Announced plans for 23 new or expanded crushing plants in the U.S. would increase crush by 34%, and would add about 750 million bushels per year in crush capacity. Of course, this planned expansion of U.S. crush capacity that is based on growing RD production will only come about as the RD industry grows. The locations, capacities, and timelines of these planned U.S. plant expansions are presented graphically in the preceding linked article.
- Since soybean oil is now and is projected to be the primary feedstock for RD production, U.S. soybean producers are in a position to play a major role in reducing greenhouse gas emissions by providing the raw material for producing RD that has a lower carbon footprint vs. petroleum diesel. This will result in an increased demand for soybeans, and will likely cause a shift to more soybean acres in this country to meet this increased demand for RD feedstock.

Mar. 2024 Update

- Information in a Feb. 2024 article titled “[Serious Oversupply looms for renewable diesel](#)” paints a gloomy picture for RD producers in 2024 and beyond barring a change in the [Renewable Fuel Standard](#) mandate set by the U.S. government, which is already below the U.S. capacity to produce biodiesel and RD. This will likely result in some plants closing or



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reducing production, as well as plans for new plants being shelved.

April 2024 Update

A [soy-based bar and chain oil that is biodegradable](#) has resulted from a research and development endeavor that was conducted in partnership with Dewalt and Dynamic Green Products. This environmentally friendly product is readily available to consumers and farmers through various retail and online outlets. This product was developed as part of a USB collaboration with the [Airable Research Lab](#) [a division of the [Ohio Soybean Council](#)], and is being acclaimed as a sustainable option to current products that are derived from petroleum sources.

[SoyFoam TF 1122](#) is a soy-based, biodegradable firefighting foam that is made with soy flour, and is being manufactured by [Cross Plains Solutions](#). Extensive testing of this new product was supported by checkoff dollars through the USB. SoyFoam is free of intentionally-added PFAS's [have been linked to certain human health problems] that are contained in current fire-fighting foams. It is capable of extinguishing Class A [ordinary combustibles] and Class B [flammable liquids] fires, and is compatible with foam inductors and aerating nozzles currently used by fire departments.

The above products showcase a few of the many uses of soybean outside the food industry, and also show soybean's versatility to supply raw materials that can be used in myriad industrial applications. Much of the research that resulted in the development of the above products was funded by the [United Soybean Board](#), which uses soybean checkoff dollars to identify and advance viable new technologies derived from soybeans.

There is concern that the many new products derived from soybean [especially biofuels] will cause a significant rise in food prices since it is assumed that the diversion of soybean oil toward these new uses will mean less is available for the food industry. The USB funded a study conducted by Purdue Univ. to determine whether or not the increased use of soybean oil in biofuels has contributed to a rise in retail food prices. Results from that study are reported in a Nov. 2022 article titled "[Food and Fuel: Modeling Food System Wide Impacts of Increase in Demand for Soybean Oil](#)" by Jayson L. Lusk. Pertinent points from that report follow. [Click [here](#) for a summary of this report by Paul Murphy-Spooner of the USB].

- The share of soybean oil going to biofuel production has

quadrupled over the past decade. In the most recent marketing year, 43% of the soybean oil used in the U.S. went toward biofuel production.

- The cost of wholesale soybean oil is only a small portion of the overall cost of producing retail food items. In fact, for every \$1 that consumers spend on food items, only about \$0.14 is a result of the cost of raw farm commodities. Thus, the effect of a rise in the cost of a commodity such as soybean oil that is used to produce food items is far outweighed by the increasing costs for labor, packaging, transportation, and energy associated with production of those food items in the U.S.
- The overall impact of the increased demand for soy-based biofuels on the Consumer Price Index [CPI] was mixed, but reductions in meat, dairy, and egg prices partially offset the increase in the price of soy oil. Thus, the overall "food at home" [i.e. groceries] portion of the CPI was essentially unaffected.
- In the final analysis, it is estimated that the 21% increase in the quantity of soybean oil that is used for biofuel production in the most recent marketing year increases the "food at home" component of the CPI by only 0.05%.
- **These results show that the increased use of soy oil in biofuel production has had a negligible impact on inflation at the grocery store.**

At the 2024 [Purdue Student Soybean Innovation Competition](#), soy-based products developed by student teams were showcased. As stated in the article written by Staff Reporter Amanda Petty, "the goal of the competition is for a student team to create a novel product or material using soybeans, or to improve an existing product in some way using soybeans, with the emphasis on the product having the capability to be brought to market." A [FarmProgress article by Allison Lund and Tom Bechman](#) contains a slide show featuring some of the entries in the competition, which is sponsored by the [Indiana Soybean Alliance](#). Some of the awarded and/or highlighted entries follow.

- **Insectisoy.** Team members developed an insect repellent that is touted to be safe for people and pets.
- **SoySilk.** These plastic-free, biodegradable, soy-based baby wipes are promoted to perform better than existing products.
- **SoyBox.** This soy-based material can be used in the manufacture of cartons made for consumable liquids.
- **Green Eggs, No Ham!.** This is a soy-based egg substitute.
- **Soylish Nails.** Team members created a soy-based,



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biodegradable fingernail strip that is said to help grow and strengthen fingernails.

- **Ambrosia Bar.** This is a soy-based nutrition bar that is said to be high in protein and energy.
- **SoyAid.** This is a soy-based bandage product that can be used in place of commercially available bandage products, and is touted to promote wound healing.
- **Soyper.** This soy-based paper can be used as a packaging material alternative.
- **Gly-Soy.** These soy-based test strips provide an inexpensive alternative for glucose testing in humans with diabetes.
- **Nutrisoy.** This organic, soy-based fertilizer was developed to add live bacteria to soil in order to potentially decrease the need for inorganic fertilizers.
- **Soyshine.** This is a soy-based wax that can be applied to fruits and vegetables that are to be sold in stores.

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