



Growing Soybean Demand: Vision for Missouri as a Net Soybean Importer



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This report summarizes new soybean market opportunities in Missouri. It highlights potential growth in overall Missouri soybean demand among Missouri manufacturers of feed, industrial products and food products.

Three separate papers examined these manufacturing sectors in-depth and provided the background information needed to develop this report. Market opportunities described in these papers could help grow the amount of soy oil and meal demanded by Missouri buyers downstream in the value chain and, therefore, support additional crush capacity within the state. Additionally, Missouri historical basis provides perspective about soybean prices.

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1. Overview

The Missouri Soybean Merchandising Council (MSMC) envisions the state’s soybean industry becoming a net soybean importer. Exhibit 1.1 shows Missouri’s soybean supply and demand balance from 2020/21 to 2022/23. Net exports refer to Missouri’s supply (production and carry-in) minus soybean volumes used in-state (crush and seed/residual use) and carry-out balances. Based on ProExporter’s projections, Missouri will have 107 million bushels in net soybean exports in the 2022/23 crop year. Those exports will go to other states or international buyers.

Exhibit 1.1. Missouri soybean supply and demand (September to August crop years)*

Item	Unit	2020/21	2021/22	2022/23
Carry-in	mil. bu.	28	20	25
Area planted	thou. ac.	5,850	5,700	5,721
Area harvested	thou. ac.	5,810	5,650	5,670
Yield	bu./ac.	51	49	50
Production	mil. bu.	296	277	284
Supply	mil. bu.	324	297	316
Disappearance (use)	mil. bu.	304	272	276
Seed/residual use	mil. bu.	7	8	8
Crush	mil. bu.	161	166	168
Use in state	mil. bu.	168	174	176
Carry-out	mil. bu.	20	25	33
Net exports	mil. bu.	136	98	107

* 2021/22 data are estimates, and 2022/23 data are projections

Source: ProExporter

Five soybean crushing facilities operate within Missouri. Exhibit 1.2 lists these facilities, their locations and daily crush capacity. Three facilities operate on Missouri’s western border, and two operate in east central Missouri. The U.S. crushed 66.2 million tons of soybeans in 2020, according to USDA. Missouri crushed about 4.3 million tons, which represents about 7% of the U.S. total. Neighboring states Iowa and Illinois crushed 13.5 million tons and 7.9 million tons, respectively.

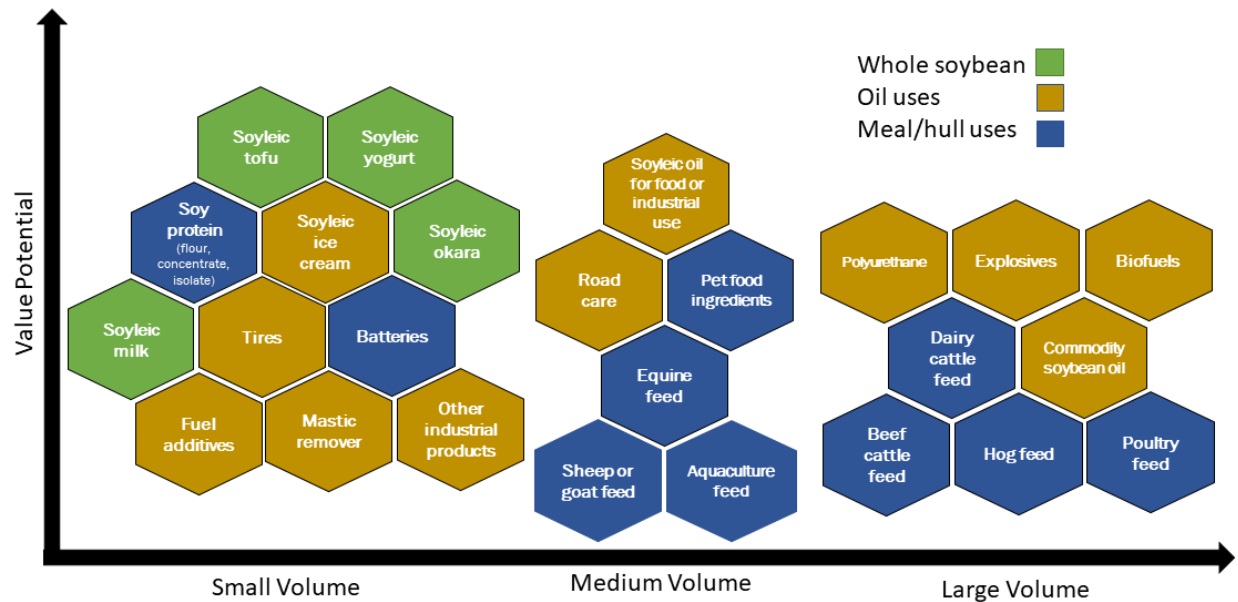
Exhibit 1.2. Missouri soybean crushing facilities by capacity

Facility	Location	Daily crush (tons/day)
Cargill	Kansas City	5,000
Ag Processing Inc.	St. Joseph	3,600
ADM	Deerfield	2,400
ADM	Mexico	1,950
Tiger Soy	Mexico	52
Total		13,002

If in-state demand for soybean co-products grows, then additional Missouri soybean processing capacity may be justified. The project team evaluated potential opportunities and strategies to improve Missouri soybean demand among three Missouri manufacturing sectors: feed, industrial products and food. Three separate papers examined these sectors in-depth and provide the background information needed to develop this report. In these papers created for each sector, the team recommended strategies and tactics to pursue that would increase soybean demand. In addition, the papers listed Missouri businesses that may represent potential buyers of soybean inputs or technologies. These market opportunities could help grow the oil and meal demanded by Missouri buyers downstream in the value chain and support additional crush capacity within the state.

Exhibit 1.3 summarizes these opportunities that have potential to increase soybean demand, including among Missouri manufacturers. Some relate to Missouri Soybean Merchandising Council-funded innovations and technologies that could be further commercialized. Others represent more generic soybean component uses or applications where Missouri manufacturers have existing capabilities. The exhibit organizes these opportunities according to the estimated soybean volumes they could demand and the potential value that can be captured in the end products or markets. Note, whole soybean uses are shaded green, oil uses are shaded gold, and meal and hull uses are shaded blue.

Exhibit 1.3. Opportunities to increase Missouri soybean demand

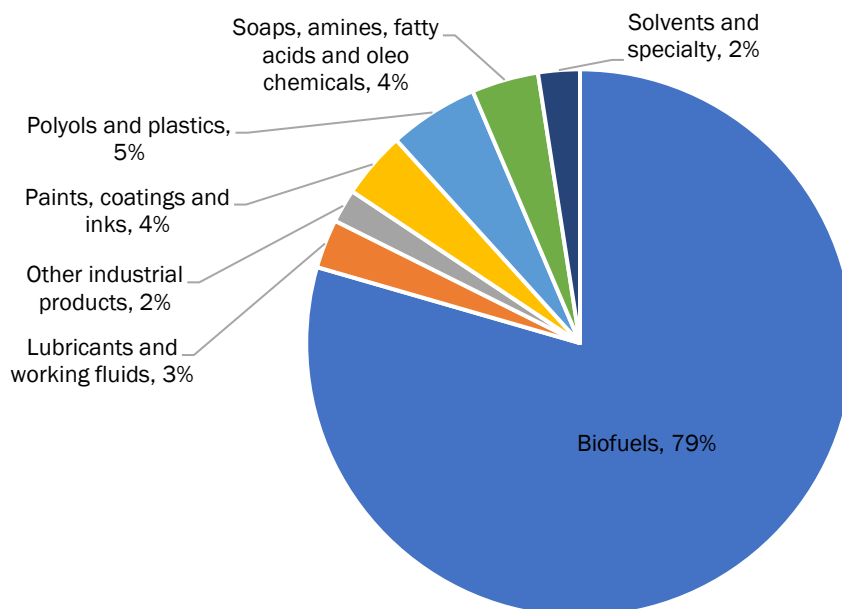


The following sections present an overview of Missouri feed, industrial products and food manufacturing sectors examined by the project team. The last section shares an analysis of soybean basis relationships in Missouri. The analysis describes price conditions and how they could evolve if changes occurred in the industry.

2. Industrial Products

Soy-based raw materials have multiple potential industrial applications, including fuels, adhesives, coatings, fibers, lubricants and plastics. Soybean oil use in industrial products is well-documented and growing. In the past 20 years, biofuel producers used more soybean oil for industrial purposes than other industrial products manufacturers. Of the approximately 5 million metric tons of U.S. soybean oil used to make industrial products in 2020, 79% found use in biofuels. See Exhibit 2.1. Other industrial use categories captured relatively smaller shares of total soybean oil. No data are available to indicate soybean meal or soybean hull use in industrial products.

Exhibit 2.1. Share of U.S. soybean oil industrial use by category, 2020



Source: Centrec and the United Soybean Board (marketviewdb.centrec.com)

In November 2021, the U.S. biodiesel industry's annual production capacity totaled roughly 2.389 billion gallons from 85 plants. Missouri ranked third with 243 million gallons of plant capacity. As such, Missouri's biodiesel industry has been a key soybean oil consumer within the state.

In the industrial sector, current soybean oil market drivers include the renewable diesel and sustainable aviation fuel industries. Proposed or announced renewable diesel projects would add 5 billion gallons or more in annual capacity by 2024. If those projects move forward and solely use soybean oil as a feedstock, then they could demand up to 67 million acres of soybeans. However, industry estimates suggest that annual production capacity will more likely range from 2 billion gallons to 3 billion gallons by 2025 because not all planned projects will ultimately operate. Still, many oil companies are partnering with agricultural companies to secure feedstock needed to produce renewable diesel and other types of fuel. Such new sources of soybean oil demand will create a more competitive industrial

marketplace for soybean oil and heighten the need for buyers, such as biodiesel producers, to strengthen feedstock relationships or contracts.

Based on the industrial products market research conducted for this project, Exhibit 2.2 identifies strengths, weaknesses, opportunities and threats related to expanding Missouri industrial use of Missouri-produced soybean components. Exhibit 2.3 names specific recommendations for increasing in-state use of soybean components.

Exhibit 2.2. SWOT analysis for Missouri soybean industry increasing in-state use of soybean components for industrial uses

<p>Strengths</p> <ul style="list-style-type: none"> • Based on jobs data, Missouri has a high concentration of industries that may use soy (e.g., manufacturers of storage batteries; power, distribution and specialty transformers; explosives; and unlaminated plastics film and sheet, except packaging). • Several Missouri firms have innovated products made from soy inputs (e.g., Express Chem, Soya System). • The MSMC industrial products investments can offer sustainability or renewable benefits. • Manufacturers may seek a local supply of soy components to stabilize access to inputs. • Emerging in-state investment infrastructure (e.g., venture capitalists, angel investors) offers financial support to startups. 	<p>Weaknesses</p> <ul style="list-style-type: none"> • In some cases, soybean oil competes with other feedstocks that have a price and first-mover advantage. • Relatively small shares of soybean oil have been used for industrial purposes — the exception being biofuels. Therefore, these markets have been relatively niche but require efforts to open and sustain. • Missouri has trailed other states in installing small and large-scale batteries — those that store energy and may use soy components. • Industrial products manufacturers may not have the margins to pay premiums for inputs, despite their claims (e.g., non-GMO) attached to those inputs.
<p>Opportunities</p> <ul style="list-style-type: none"> • Renewable diesel and sustainable aviation fuel innovations may increase soy oil use. • As building infrastructure investment grows, construction firms have the potential to demand more blasting agents and oxidizers. • To incentivize mining and construction companies to use explosives made from materials other than petroleum, an opportunity exists to create a procurement preference or get buy-in for alternatives. • Adoption of electric vehicles and deployment of large-scale storage batteries has expanded markets for batteries — potentially those made with soy carbon. • Light vehicle manufacturers may be targets to use electric batteries made from soy carbon and soy-based polyurethane materials. • Polyurethane manufacturers may use soy-based polyol in many products (e.g., building and construction materials, transportation and marine products, furniture and bedding). 	<p>Threats</p> <ul style="list-style-type: none"> • More industrial users (e.g., renewable diesel producers) sourcing soybean oil would increase the oil’s price and affect the economics of other soy-based product manufacturing (e.g., biodiesel). • Much battery manufacturing occurs overseas and may limit U.S. input sales. • Coal mining has been a major use of some explosives. Switching to alternative energy may affect explosives demand. • U.S. consumers have shown more hesitation to adopt electric vehicles than drivers in international markets. • Use of renewable inputs may rely on policy decisions, which are difficult to foresee and may change. • Most analysts don’t predict all announced renewable diesel capacity to be built. • Public and policy support of efforts such as the RFS and LCFS is needed to grow low-carbon solutions’ adoption.

Exhibit 2.3. Recommendations to increase soybean demand in industrial products

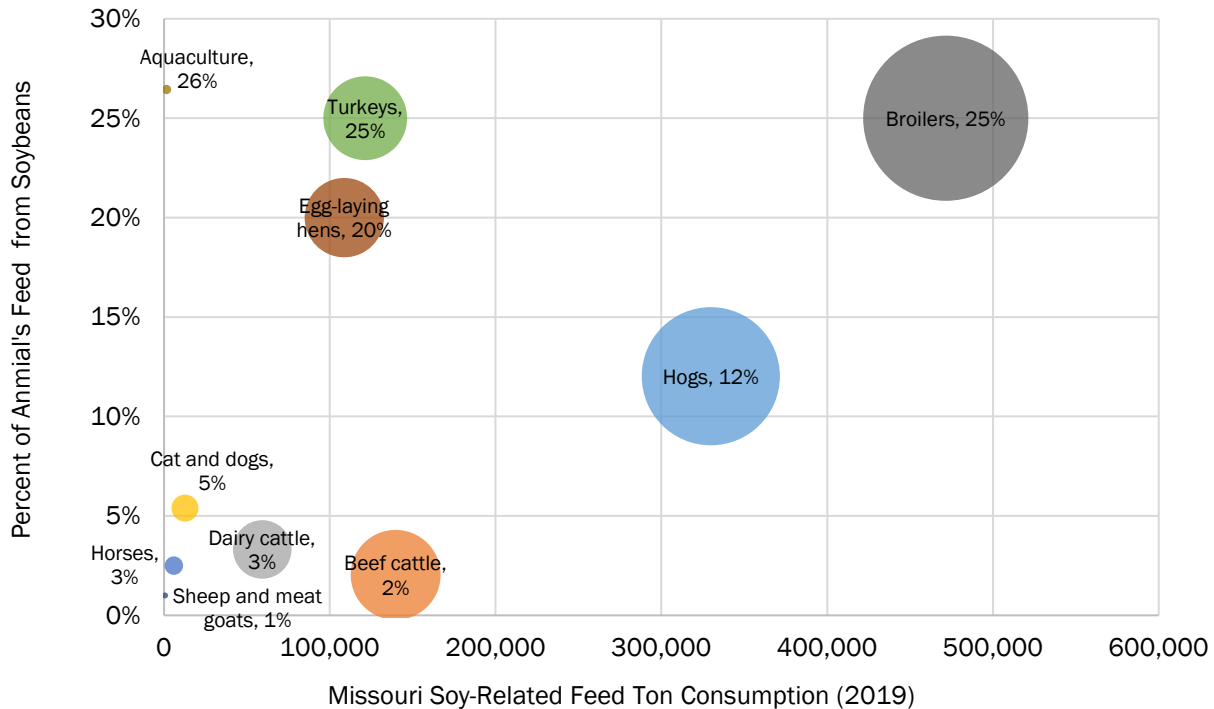
Category	Recommendations
Goal	<ul style="list-style-type: none"> • Elevate Missouri-produced soy component use in industrial products manufactured by Missouri facilities.
Strategy	<ul style="list-style-type: none"> • For each MSMC-commercialized technology, prioritize one market to understand and ultimately reach.
Tactics	<ul style="list-style-type: none"> • Weigh the market opportunity with other factors (e.g., policy environment, competition) to choose the opportunities that fit best with available resources. • Demonstrate the soy-based product's performance improvements, and document those findings in promotional materials.
Strategy	<ul style="list-style-type: none"> • Establish a boots-on-the-ground effort to convert Missouri industrial products manufacturers into soy component users.
Tactics	<ul style="list-style-type: none"> • Identify an industry liaison who can champion using soy components in key applications where MSMC has made investments. • Reach Missouri manufacturers that may demand soy components as inputs to assess their interest in choosing a Missouri-produced soy component. • Engage with industry associations that have members who make decisions about industrial products or components to source and use.
Strategy	<ul style="list-style-type: none"> • Support other Missouri industrial products manufacturers using soy components.
Tactics	<ul style="list-style-type: none"> • Connect these manufacturers with supply chain assistance to source Missouri-produced soy components. • Encourage manufacturers to participate in the Buy Missouri program, which requires that at least 51% of a product's content originates from Missouri (buymissouri.net).

3. Animal Production

Animal agriculture represents the largest customer for U.S. soybean meal. Approximately 98% of U.S. soybean meal is used to feed animals. In Missouri, feed uses demand 79% of all soy coproducts (oil, meal, hulls) by volume. In total, 58% of soybean coproducts consumed in Missouri goes into poultry. Hog production, which consumes 27% of soybean coproducts used for feed, ranks second behind broiler production for soy-based feed demand. Beef ranks third. Dairy, horse, sheep, meat goat and pet markets consume the rest.

Exhibit 3.1 details soy-related feed consumption in Missouri. For each species, it estimates the percent of the diet that is soy-related. Rations for Missouri’s monogastric animal industries – namely, poultry and hogs – depend significantly on soybean meal. Missouri’s beef cattle herd is not a major soybean meal user, but it is a large soy hull consumer.

Exhibit 3.1. Missouri soy-related animal feed consumption by species



Source: Data derived from Decision Innovation Solutions (decision-innovation.com/market-analytics/animal-food-consumption/) and other industry experts.

To quantify the opportunity for Missouri soybeans to satisfy in-state feed demand, Exhibit 3.2 estimates the soybean meal and hulls demanded by different animal species raised by operations of varying sizes. According to these estimates, raising chickens for meat production or egg production can greatly increase Missouri soy feed ingredient demand due to these diets’ high soy inclusion rates and the number of animals needed for a complex or processing plant. However, other animal species could significantly change soybean

coproduct demand if large single operations or stacked multiple units within the state adopt soy components or use more soy inputs for their animals' rations.

Exhibit 3.2. Estimated soybean demand from potential animal industry growth

Sector	Operation or complex size	Annual soybean meal and hull demand (tons)	Bushels needed	Acres needed*
Broilers	50 million birds/complex	75,000	3,225,806	64,516
Egg-laying hens	2 million birds/complex	17,000	731,183	14,624
Dairy cattle	3,500 cows/operation	3,686	153,200	3,064
Breeding hogs	1,200 sows/operation	326	14,022	280
Market hogs	2,480 head/operation, 2 turns	290	12,473	249
Turkeys	10,000 birds/building, 2 turns	140	6,022	120
Beef stockers	1,000 head backgrounded, 2 turns	105	4,364	87
Beef fed cattle	1,000 head capacity, 2 turns	100	4,167	83
Aquaculture	60-acre pond, catfish production	85	3,656	73

*Assumes 50 bushels per acre yield.

Based on research conducted for this project, Exhibit 3.3 identifies strengths, weaknesses, opportunities, and threats related to the Missouri soybean industry's opportunity to expand soybean use within Missouri animal agriculture industries. Specific recommendations for increasing in-state use of soybean components can be found in Exhibit 3.4.

Exhibit 3.3. SWOT analysis of Missouri’s future animal agriculture growth

<p>Strengths</p> <ul style="list-style-type: none"> • Farms are likely to position new sow units in remote, biosecure locations instead of hog production-dense areas in the Corn Belt. • Chicken consumption continues to grow, and Missouri is just north of a dense broiler production cluster in Arkansas. • Expanding Missouri’s beef slaughter capacity will lead to finishing more cattle in the state. • Growth in free-range layer facilities will likely occur at the same latitude where these facilities have already emerged in Missouri. 	<p>Weaknesses</p> <ul style="list-style-type: none"> • State permitting and local planning and zoning restrictions affect the potential for new CAFO facilities to start up and operate. • For businesses that run large confinement dairies or open feedlots, Missouri’s climate is not as attractive as the climate in other states. • Access to immigrant labor affects where processors decide to locate and where new production complexes have the most opportunity.
<p>Opportunities</p> <ul style="list-style-type: none"> • Consumers’ emerging health and animal welfare preferences open the potential for producing more eggs with specialty characteristics. • The commodity egg industry will rebuild layer housing to adhere to cage-free rules, which a segment of consumers has demanded. • Poultry and pork meat exports from the U.S. will become more competitive with meat produced in other countries. This will be due to soybean meal prices declining as the soybean meal supply increases – a side effect of trying to meet demand for renewable diesel, which may use soybean oil as a feedstock. 	<p>Threats</p> <ul style="list-style-type: none"> • Broiler and layer facility location decisions depend on choices made by a few critical corporate decision-makers. • Consumer acceptance of plant-based substitutes may hinder sales growth potential for animal products. • Animal producers in competing states have access to less expensive soybean meal because of their proximity to new crush plants. • New animal production capacity tends to locate near existing industry clusters.

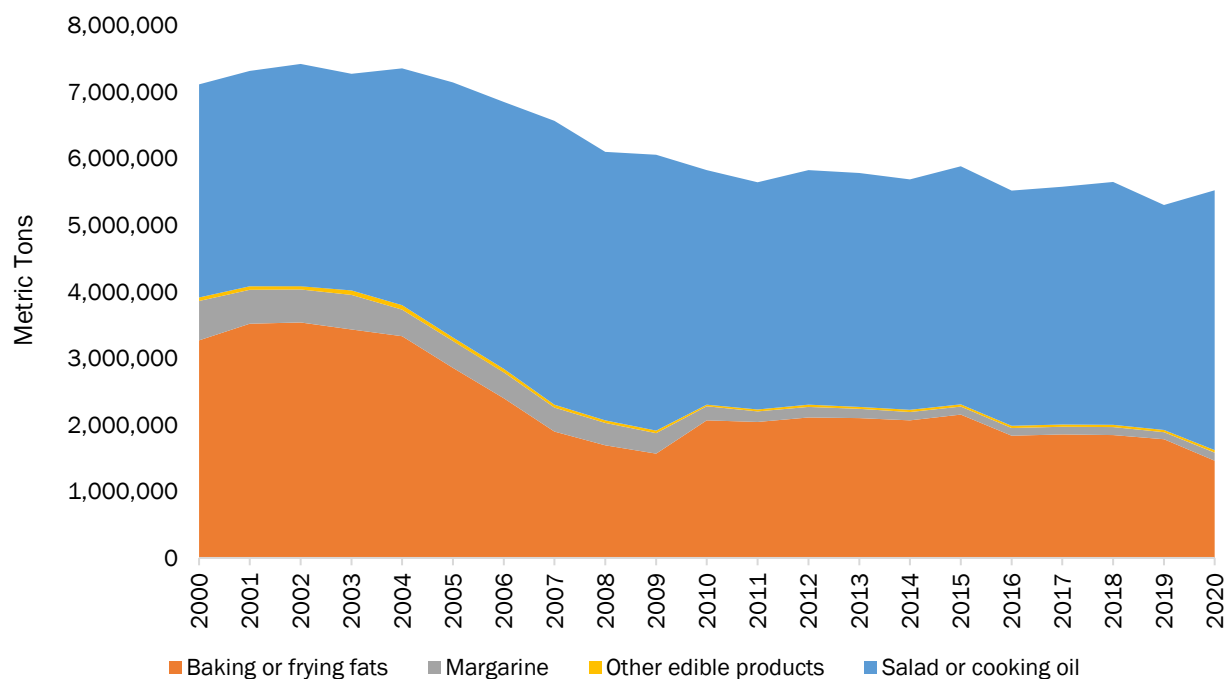
Exhibit 3.4. Recommendations to increase soybean demand by animal sector

Sector	Category	Recommendations
Poultry	Goals	<ul style="list-style-type: none"> • Attract new broiler, egg-laying hen and turkey complexes into Missouri. • Strengthen soybean coproduct use in existing Missouri broiler, layer and turkey diets. • Develop demand for SOYLEIC non-GMO soybean meal.
	Tactics	<ul style="list-style-type: none"> • Identify an industry liaison experienced in the Missouri poultry industry. • Connect with key poultry stakeholders and nutritionists from leading Missouri companies and other leading U.S. businesses. • Identify areas of Missouri that accept poultry production, have farmers willing to be contract-producers and offer the labor force necessary for poultry processing.
	Contacts	<ul style="list-style-type: none"> • The Poultry Federation • Missouri Poultry Yearbook from Missouri Department of Agriculture • Top U.S. poultry companies from Watt Global Media • U.S. Meat Export Federation
Hogs	Goals	<ul style="list-style-type: none"> • Add sow inventory and farms in Missouri. • Finish more Missouri-born pigs within state.
	Tactics	<ul style="list-style-type: none"> • Identify areas in Missouri suitable for swine production. • Work with existing swine integrators to locate feeding barns in Missouri.
	Contacts	<ul style="list-style-type: none"> • Smithfield Foods, JBS and Pipestone have sow operations in Missouri. • Missouri Pork Association
Beef cattle	Goals	<ul style="list-style-type: none"> • Encourage additional beef stocker/backgrounding production in Missouri. • Encourage additional beef cattle finishing in Missouri.
	Tactics	<ul style="list-style-type: none"> • Connect with larger Missouri backgrounding and feedlot operators. • Support intentional crossbreeding of beef on dairy for dairy grazing herds.
	Contacts	<ul style="list-style-type: none"> • Veterinarians, semen companies, regional livestock markets and universities
Dairy cattle	Goals	<ul style="list-style-type: none"> • Attract new large-scale confinement dairies to Missouri. • Develop demand for SOYLEIC non-GMO soybean meal.
	Tactics	<ul style="list-style-type: none"> • Partner with Missouri Department of Agriculture and Missouri Dairy Growth Council to facilitate large dairies starting or moving to Missouri. • Connect with feed mills and nutritionists. • Connect with Mid-South Dairy Records for top-producing Missouri cow herds.
	Contacts	<ul style="list-style-type: none"> • Organic/non-GMO contact: NEMO Feed • Mid-South Dairy Records • Kurt Olsen, Missouri Department of Agriculture
Aquaculture	Goals	<ul style="list-style-type: none"> • Add soybean coproducts to Missouri aquaculture diets.
	Tactics	<ul style="list-style-type: none"> • Develop new aquaculture enterprise budgets, and increase educational programming around aquaculture in Missouri. • Connect with existing Missouri aquaculture businesses about soybean coproduct usage in their operations.
	Contacts	<ul style="list-style-type: none"> • Missouri Aquaculture Directory • Missouri Aquaculture Association • MU Aquaculture/Fisheries Extension and Lincoln University Extension

4. Food Products

Making soy foods from whole soybeans consumes a relatively small share of the world's soybeans. Just 6% of the soybeans produced globally are used to make whole soybean products such as tofu and soy milk. Other food products containing soy ingredients feature oil or meal. Exhibit 4.1 details U.S. soybean oil consumption by food use category from 2000 to 2020. Consumption for food use totaled 6.35 million metric tons in 2020. During the mid- to late 2000s, soybean oil demand for baking and frying uses dropped, and the industry saw an uptick in the oil's use as a salad or cooking oil.

Exhibit 4.1. U.S. soybean oil food use by category, 2000 to 2020



Source: Centrec and the United Soybean Board (marketviewdb.centrec.com)

U.S. soybean cake and meal produced for edible uses is a small U.S. industry. Animal feed has been the predominant cake and meal user. Of all soybean cake and meal produced, the portion directed to edible protein products has been relatively small – just 1.1% to 1.7% from 2016 to 2020. Production for edible uses has averaged 584,597 tons in the past three years (2019 to 2021).

The Missouri Soybean Merchandising Council has invested in developing several innovations that have the potential to open or expand markets for soybeans in Missouri-produced food products. Those include high-oleic soybean oil, vitamin B12-fortified soy foods such as soy milk and tofu, nondairy ice cream made from high-oleic soybean oil and spray-dried powder to substitute for soy protein isolate. Other market opportunities with the potential to expand soy-related demand in Missouri-produced food include meat substitutes, snack bars, cheese, breakfast cereal, bread, beverages and supplements.

Based on the market research conducted for this project, Exhibit 4.2 identifies strengths, weaknesses, opportunities and threats related to expanding Missouri food manufacturers' use of Missouri-produced soybean ingredients. The recommendations in Exhibit 4.3 share ideas about how to increase in-state use of soybean components.

Exhibit 4.2. SWOT analysis for Missouri soybean industry increasing in-state use of soybean-derived food ingredients

<p>Strengths</p> <ul style="list-style-type: none"> • Several industries with the potential to use soy ingredients concentrate in Missouri, based on jobs data. Those include breakfast manufacturing; pasta, dough and flour mixes; ice cream and frozen dessert manufacturing; fats and oils refining and blending; and flour milling. • Soyleic oil allows high-oleic oil users to make non-GMO claims on packaged goods. • Soy protein derived from Soyleic soybeans has some advantages relative to commodity soy protein. Those include desirable color, blending potential and shelf life. • With widespread production, soybean ingredients represent an economical ingredient option. 	<p>Weaknesses</p> <ul style="list-style-type: none"> • The premium associated with Soyleic non-GMO soybean oil may make the ingredient cost-prohibitive for some food companies. • Relative to other states, Missouri firms have made minimal investments in processing capacity to produce whole soy foods (e.g., soy milk, tofu). • Protein products made from soy may have consumer acceptance problems because of the ingredient's allergen risk and flavor.
<p>Opportunities</p> <ul style="list-style-type: none"> • Soyleic's non-GMO attribute especially appeals to consumers purchasing food to eat at home – a category that grew during the pandemic. • Supply chain constraints caused by the pandemic led some consumers to choose products, such as tofu, they hadn't used consistently. Those buyers may be maintained in the long term. • MSMC-funded research into fortifying soy foods with vitamin B12 has the potential to make a plant-based product fortification standard – just as dairy milk is typically fortified with vitamin D. • The Show-Me Food, Beverage and Forest Products Manufacturing Initiative may recruit more processors that could use Missouri-produced soy. • The St. Louis region has been identified as a hub for plant-based food manufacturing. • Blending soy with other proteins may improve the “completeness” of those other proteins while balancing some of soy's drawbacks, such as flavor. 	<p>Threats</p> <ul style="list-style-type: none"> • Soy ingredients face competitive threats from alternative ingredients. For example, in the alternative milk category, soy milk has lost significant share to almond and oat options. • Because plant-based product manufacturers are relatively new, they may be more open to choosing novel ingredients and scaling their supply chains over time to provide enough of those novel ingredients. • Although an opportunity, plant-based foods (e.g., meat alternatives) may be perceived as highly processed compared with traditional alternatives (e.g., animal meat). Consumers interested in minimal ingredients may choose not to switch to plant-based options.

Exhibit 4.3. Recommendations to increase soybean demand by soy ingredient

Product	Category	Recommendations
Oil	Goal	<ul style="list-style-type: none"> • Open new in-state markets for Soyleic non-GMO, high-oleic soybean oil. • Increase sales of Missouri-grown soybean oil to Missouri food manufacturers.
	Strategies	<ul style="list-style-type: none"> • Educate Missouri food businesses about the advantages of Soyleic oil. • Engage an industry liaison or third-party business to champion Missouri-produced soybean oil as an ingredient option. • Introduce soybean oil to emerging food businesses.
	Tactics	<ul style="list-style-type: none"> • Invest in Soyleic use trials that demonstrate fry life or shelf life improvements attributed to the high-oleic trait. • Contact Missouri manufacturers in key categories that may use soybean oil. (This report lists Missouri manufacturers by product category.) • Communicate with foodservice establishments (e.g., restaurants) based in Missouri to identify potential markets for soybean oil. • Reach out to Bright Future Foods, a St. Louis food incubator that operates as a subsidiary of Post Holdings. The incubator has invested in two climate-friendly food brands: Airly Oat Clouds and EverGrain. • Build awareness of soy ingredient applications through the Missouri Food Entrepreneur Network (MO-FEN). • Support value chain stakeholders such as Tiger Soy, Moberly Natural Crush and Benson Hill as they grow and add value to Missouri-produced soybeans.
Protein	Goals	<ul style="list-style-type: none"> • Open new in-state markets for Soyleic soy protein. • Increase sales of Missouri-grown soy protein to Missouri food manufacturers.
	Strategies	<ul style="list-style-type: none"> • Educate Missouri food businesses about Soyleic soy protein's advantages. • Engage an industry liaison to build relationships with Missouri food manufacturers. • Participate in industry conversations to raise soy protein's profile as a food ingredient.
	Tactics	<ul style="list-style-type: none"> • Aggregate research findings that show how Soyleic protein's attributes (e.g., color, blending potential, shelf life) offer advantages. • Package those findings into promotional materials. • Contact Missouri firms that manufacture foods that list soy protein as an ingredient. (This report lists Missouri manufacturers by product category.) • Reach out to Bright Future Foods, a St. Louis food incubator that operates as a subsidiary of Post Holdings. The incubator has invested in two climate-friendly food brands: Airly Oat Clouds and EverGrain. • Build awareness of soy protein applications through the Missouri Food Entrepreneur Network (MO-FEN). • Assess whether to support the University of Minnesota's Plant Protein Innovation Center or replicate the effort with Midwest soy centers at the University of Missouri, Purdue University and Iowa State University. • Collaborate with soybean checkoff organizations in neighboring states to create a program modeled after the Plant Protein Highway formed in the Upper Midwest and Canada. • Support value chain stakeholders such as Tiger Soy, Moberly Natural Crush and Benson Hill as they grow and add value to Missouri-produced soybeans.

5. Missouri Soybean Basis

Basis involves prices of two attributes of a product. *Quality Basis* relates to the price difference between two different qualities of the same commodity; example: high oil content soybeans minus Grade 1 standard soybeans. *Spatial Basis* is the difference in prices of the same product at two different locations; example: Grade 1 yellow soybeans in Cape Girardeau, Missouri minus St. Joseph, Missouri. The core economic story for a price difference over space is transportation cost. If spatial basis exceeds cost to transport a product between two locations, the product will be moved from lower to higher price locations. *Temporal Basis* is the difference in price between the same product at two different points in time; example cash soybean price, St. Louis, Missouri (futures contract delivery point) minus July 2022 Chicago futures price. Temporal basis is economically expressed as the cost of storage. If temporal basis exceeds storage cost, an incentive exists to store the product. Storage costs include (a) physical storage cost, (b) interest opportunity cost, and (c) insurance (for physical destruction of product). Transportation arbitrage and storage costs are two primary ways grain elevators generate revenue from trading grain.

Basis tends to follow historical and seasonal patterns in Missouri. The market economy of the United States allows grain to flow through an interconnected transportation system to the highest buyers, meaning basis is influenced by transportation cost, ocean shipping spreads, ending stocks, and interest rates regardless of destination. Basis can be a signal of demand strength but is primarily a tool end users and merchandisers use to control the flow of grain in and out of the market. In cases where futures markets are not providing the signal for soybean producers to sell, grain merchandisers might be required to increase basis to encourage the flow of grain into a receiving location. The opposite is true if futures prices are rising on high global demand or short supplies. Therefore, it is incorrect to say strong demand increases basis. Proximity to end users does impact the magnitude basis values change regarding variations in transportation costs. Areas with multiple demand sources like Southeast Missouri, where export markets compete with domestic users for soybeans, tend to have stronger basis values but also increased volatility.

Exhibit 5.1 illustrates the seasonality of Missouri basis for Mexico, Missouri. Basis has tended to weaken rapidly late summer into the fall. Historically, soybean basis has strengthened considerably from early October through December. Although specific to one geographical region of the state, most basis values follow the same spot basis seasonal pattern except those serving international export demand. Large soybean export demand early in the marketing year increases the need for grain flow in areas serving export markets. Chicago futures prices are usually weakest at harvest compared to the rest of the year due to the new crop hitting the market. For end users and grain merchandisers needing soybeans to fill export contracts, the decline in futures prices sends the wrong signal to producers holding grain. Figure 5.2 illustrates how stable basis is throughout the year for western regions of Missouri that primarily serve livestock meal demand compared to the seasonal nature of the Mississippi River export market. The U.S. exports most of its annual soybean exports between October and March. Basis swings in export markets are difficult for domestic end users who buy soybeans throughout the year to navigate.

Figure 5.1. Three-year and five-year average soybean basis for Mexico, Missouri*

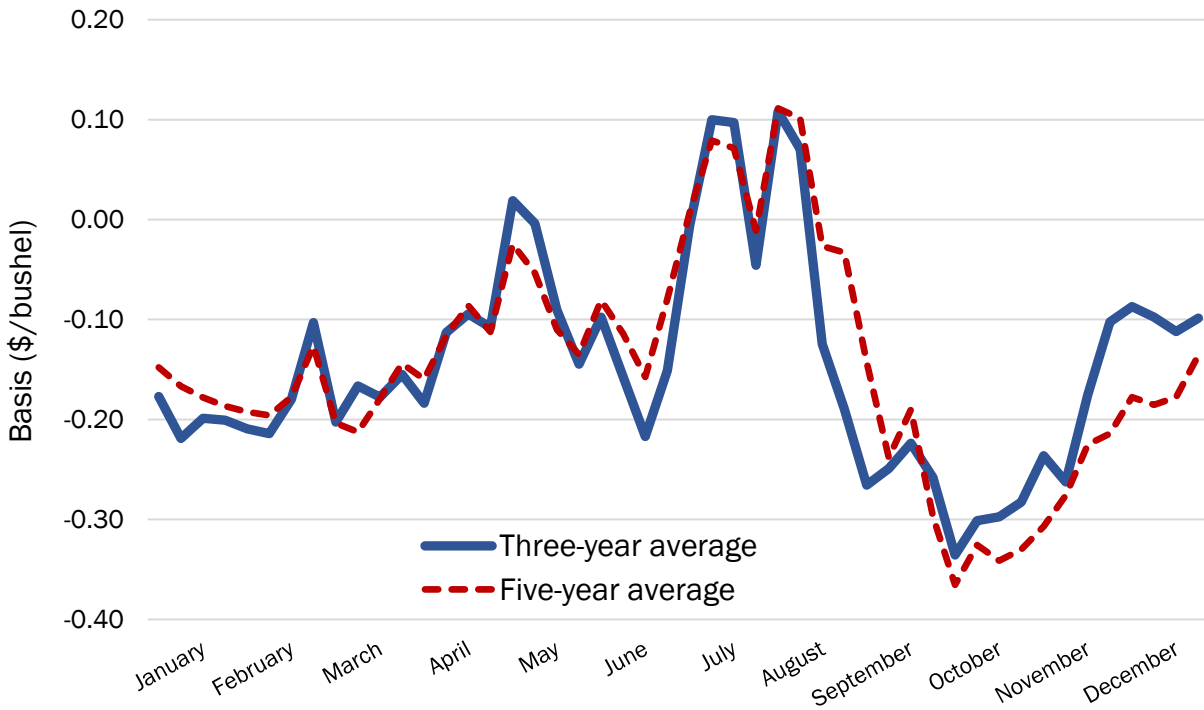
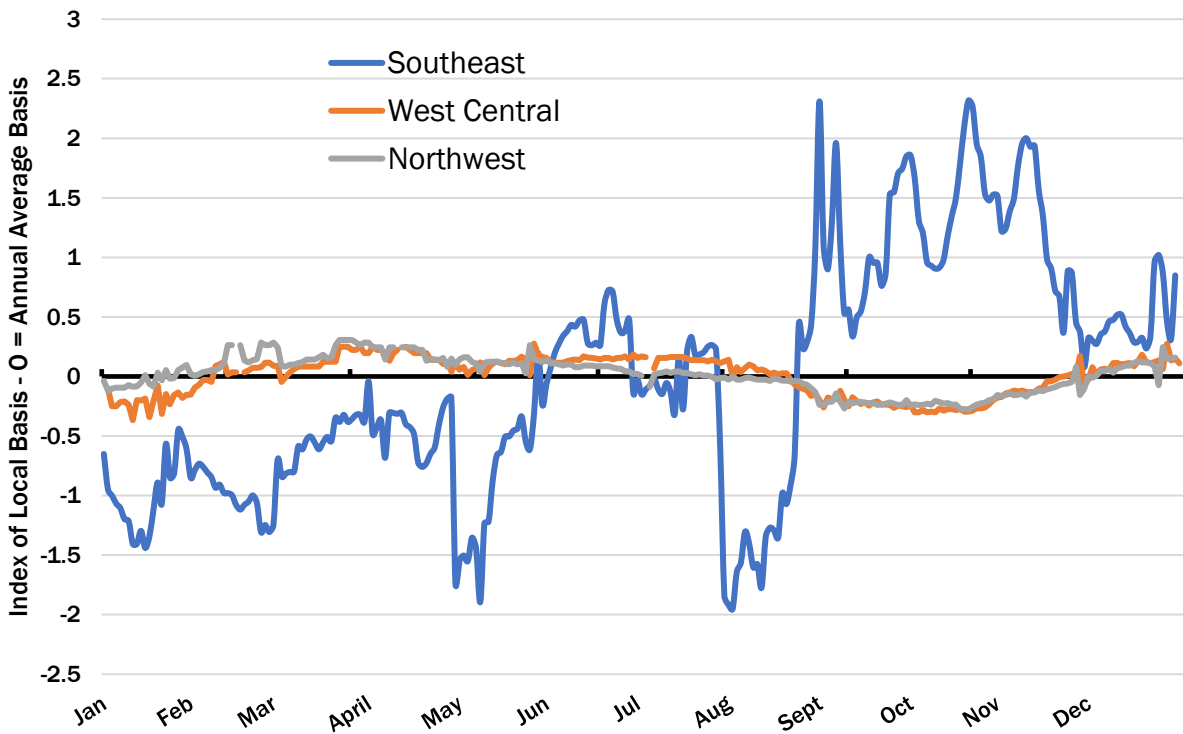


Figure 5.2. Three-year index* of Missouri basis intensity by geographical region



* Five-year average represents 2016 to 2021; three-year average represents 2018 to 2021

Exhibits 5.3 and 5.4 illustrate Missouri soybean spatial basis (Missouri location minus New Orleans, LA) on July 20, 2020, and October 20, 2020, respectively. These dates were selected because they represent two different points in the marketing year (July and October) and two different marketing years 2019/20 and 2020/21. Even with these differences, similar patterns emerge. Missouri basis is highly connected to a transportation network that serves all soybean end users. As long as international buyers demand U.S. soybeans, the Mississippi river market will have the stronger basis bids compared to the rest of the state due to lower transportation costs. However, this international demand is currently seasonal, leading to relatively large swings in basis prices.

Exhibit 5.3. Missouri soybean spatial basis, July 20, 2020

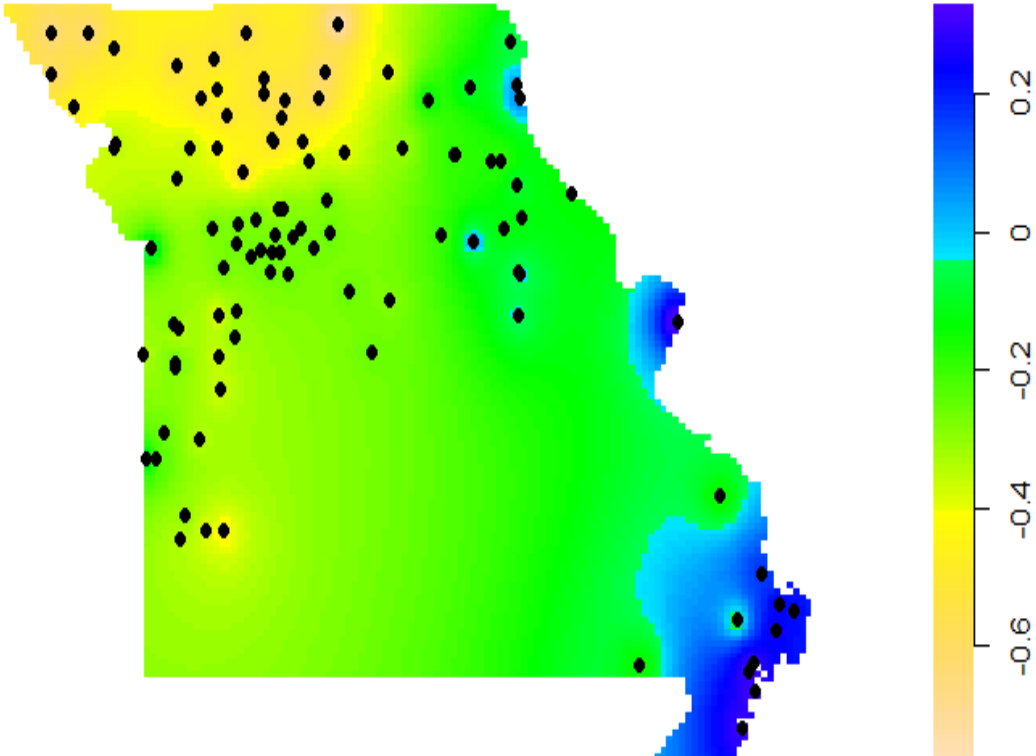
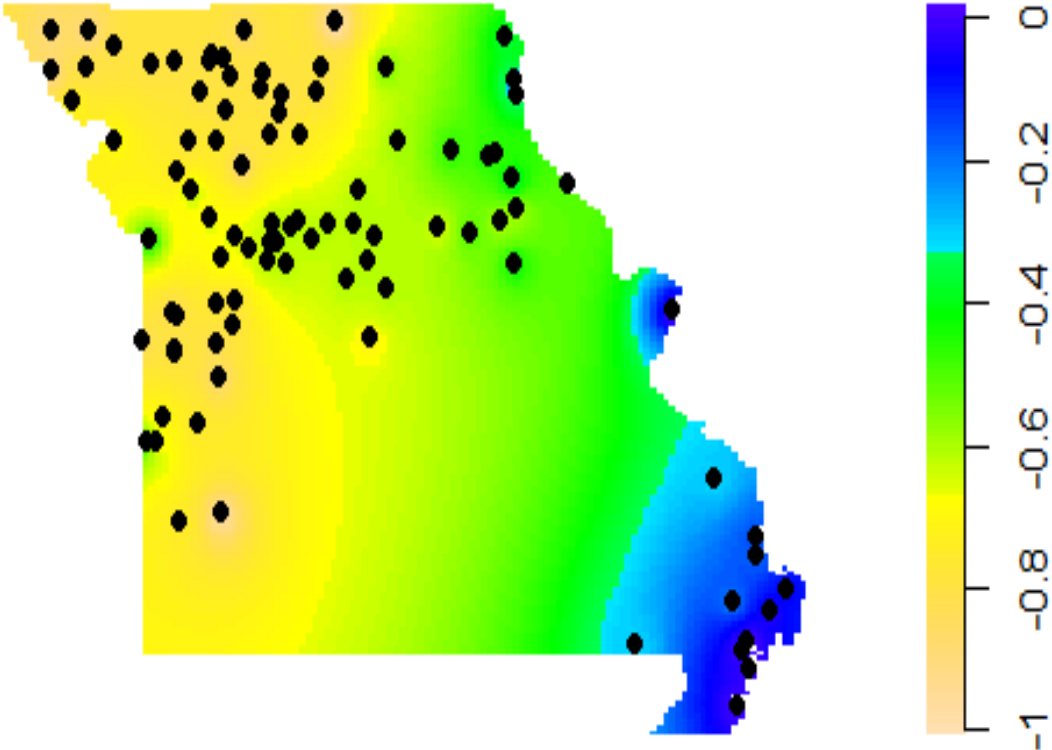


Exhibit 5.4. Missouri soybean spatial basis, October 20, 2020



In summary, basis is a tool used by end users and merchandisers to control the flow of grain in a local market. There are multiple variables that impact basis values in any one location including quantity of storage, transportation costs, interest rates and local supply. Basis across Missouri has been relatively stable over time. As global and local demand for soybeans has increased, regional production has increased as well and returned local basis to its long run average.