

QUALISOY Glossary of Terms

Better Bean Initiative (BBI): In the 1990s, farmers representing the United Soybean Board (USB) recognized the need to engage in an ongoing dialogue with food processors and manufacturers to help guide production strategies. While the food industry offered praise for the well-balanced nutritional profile of liquid soybean oil, it indicated a need for a fatty acid profile that offered more stability in baking and frying applications. Its request was to find ways to reduce or eliminate trans fatty acids (trans fats), a byproduct of hydrogenation.

Based on that input, and emerging research on the effect of trans fats on cholesterol levels, USB put the BBI in motion. In order to accelerate development of enhanced soybean varieties, USB assembled a diverse core team of experts made up of USB farmer leaders, agribusiness veterans and soybean breeding experts. This original BBI team analyzed input from the food industry, and their work resulted in specific target traits for soybean oil, as well as improvements to soybeans' amino acid profile to make soy-based animal meal more digestible. This development would lead to reduced animal waste, thereby lessening environmental impacts of livestock operations. As the BBI evolved, the need for a more collaborative effort became evident and the concept of QUALISOY was born.

Biotechnology: The use of living organisms or other biological systems to develop food, drugs and other products. Agricultural biotechnology is an advanced technology that allows plant breeders to make precise genetic changes to impart beneficial traits to the crop plants that humans rely on for food and fiber. Plant breeders can select genes that produce specific beneficial traits and move them from one organism to another. This process is far more precise and selective than traditional crossbreeding, which involves the transfer of tens of thousands of genes, and it provides plant developers with a more detailed knowledge of the changes being made. As an example, "Bt" crops that are protected against insect damage contain selected genes found in the common soil bacteria, *Bacillus thuringiensis*. The Bt genes contain information that the plant uses to produce a protein toxic to the larvae of certain plant pests but is safe for humans, animals and other insects. Pest-protected Bt plants stop these insects from eating and destroying the plant, which improves farmers' yields and reduces the need for pesticide applications.

Competitiveness: The U.S. soybean industry identified quality as the grounds on which to compete, hence the name of the QUALISOY initiative. QUALISOY is an innovative platform for increasing U.S. soybean farmer competitiveness through quality improvements and marketing efforts. It represents collaborative soybean industry efforts to create added value and increased global competitiveness for U.S. soybean growers.

Germplasm: Refers to the total genetic variability within a given set (e.g., a seed company's collection of seeds) for a particular organism.

International Organization for Standardization (ISO): ISO is the world's largest developer of standards. Although its principal activity is the development of technical standards, ISO standards also have important economic and social repercussions. ISO is a non-governmental organization comprised of the national standards institutes of 148 countries, on the basis of one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system. Third-party certification systems evaluate whether a manufacturer conforms to ISO standards.

Pipeline: The research pipeline, in this context, refers to the stage to which a soybean variety has advanced in the development process. A number of improved soybean traits are in the research pipeline. While Select Yield and Quality (SYQ), low linolenic and mid-oleic soybeans are the first to emerge from the pipeline, other varieties will include high-oleic, low-saturate, higher metabolizable energy and low-phytate soybeans.

QUALISOY Board of Directors: A 22-member board that comprises multinational and regional technology organizations, industry associations, state soybean boards, processing associations, academia and the USDA's Agricultural Research Service. The role of the QUALISOY Board is to set research priorities, evaluate existing and emerging technologies, and determine which traits, products and processes will be eligible to carry the QUALISOY name. One of the Board's primary objectives is to facilitate industry-wide cooperation and encourage a spirit of collaboration.

QUALISOY Platform/Mission: QUALISOY creates added value and increased global competitiveness for the U.S. soybean industry through the development, commercialization and promotion of enhanced quality traits. Specifically, QUALISOY is a collaborative effort among the soybean industry to develop soybeans that result in healthier oils, reduce environmental impacts of livestock production through improved soybean meal, and improve the global competitiveness of the U.S. soybean industry.

QUALISOY "Seal of Quality": The objectives of the QUALISOY "seal of quality" and logo-labeling program are to recognize soybean trait-enhanced seeds that meet QUALISOY Board-approved quality standards, and to distinguish leadership among value chain organizations that have taken steps to create healthier products and improve the global competitiveness of U.S. soybeans. As an element of that recognition, the Board will offer suppliers a "seal of quality" for use on seed bags and marketing materials to further give farmers and others in the value chain assurance that the soybeans provide added value. The "seal of quality" and the trademarked logo are proprietary to the QUALISOY Board and may only be used by authorized certified companies and organizations. Soybeans endorsed by the QUALISOY Board are required to meet levels of low linolenic acid of 3 percent or less; mid-oleic acid at a minimum of 50 percent; and/or low saturated fatty acids at 7 percent. The Board will develop a procedure for companies to follow to obtain approval, and a checks and balances system to ensure long-term adherence to the guidelines.

QUALISOY Vision, Long-Term: The QUALISOY Board hopes to set new standards for increasing competitiveness of U.S. soybeans. Their long-term vision is to streamline the development of enhanced compositional traits such as a mid-oleic variety to reduce the need for hydrogenation and other solutions for the food and feed industries. Other long-term interests for QUALISOY include increased levels of amino acids to boost nutritional content of soybean meal and improved meal digestibility to reduce environmental impacts of livestock and poultry production.

QUALISOY Vision, Short-Term: QUALISOY supports the Select Yield and Quality Initiative (SYQ); please see entry. While SYQ is focused on competing with soybeans grown outside the United States, QUALISOY is dedicated to improving compositional traits that increase the competitiveness of U.S. soybeans in relation to other vegetable oils and protein sources. In addition to the efforts of SYQ, the QUALISOY Board has proposed a pipeline through which the needs of all end users – domestic and international, food and feed industries – translate quickly

into the product that U.S. soybean growers provide. The first solutions to emerge from the pipeline for the food industry are several varieties of low linolenic soybeans for improved flavor stability, which may reduce or eliminate the need for hydrogenation.

QUALISOY™: When using the QUALISOY logo, the ™ should always be visible. When writing the word QUALISOY, the ™ should appear in the first mention but does not need to be repeated throughout the document. For objectives of the logo-labeling program and protocol on who may use the logo, please see *QUALISOY “seal of quality.”*

Select Yield and Quality (SYQ): The SYQ initiative promotes an increase in the protein and oil content of soybeans, thereby increasing the value of U.S. soybeans to the industry. SYQ also helps U.S. soybeans compete against soybeans grown outside the United States on the basis of quality.

Trait: A characteristic of an organism that manifests itself through physical attributes. Enhanced soybean traits can help create soybean oils that have increased stability or decreased saturated fat.

USDA-ARS: The United States Department of Agriculture’s Agricultural Research Service (USDA-ARS), the USDA’s principal in-house research agency, works to ensure that Americans have reliable, adequate supplies of high-quality food and other agricultural products. ARS accomplishes its goals through scientific discoveries that help solve problems in crop and livestock production and protection, human nutrition, and the interaction of agriculture and the environment. Regarding QUALISOY, USDA-ARS employs researchers who strive to develop a variety of soybean trait enhancements. They participate in the QUALISOY initiative to help accelerate development and commercialization of enhanced traits.

Value Chain: A metaphorical term describing the people and industries linked together to produce and consume soybeans, food products with soybean oil and protein for human consumption, and soybean meal for livestock and poultry. This includes farmers, processors, seed industry, food industry, feed industry and finally those who consume the end-product.

Variety: Standard industry term for seed offered by technology companies to growers.

Commonly Used Terms: QUALISOY Traits in the Research Pipeline

Low Linolenic Soybean Oil: Low linolenic soybean oil can provide increased flavor stability, thus reducing or eliminating the need for hydrogenation. Several seed providers have announced the commercialization of soybean varieties with low linolenic acid, including VISTIVE™ from Monsanto; a one percent low linolenic variety from Iowa State University; and Pioneer® variety 93M20 that was developed in partnership by Bunge and DuPont. The QUALISOY Board endorses soybeans that have a low linolenic acid level of 3 percent or less.

Mid-Oleic Soybean Oil: One soybean trait modification prioritized by the QUALISOY initiative is increased oleic acids. The mid-oleic variety makes significant progress towards an improved end product by increasing stability and resistance to rancidity. Mid-oleic soybeans that will be endorsed by the QUALISOY Board would be required to have a minimum mid-oleic acid level of 50 percent.

Low-Phytate Soybean Meal: Low-phytate crops can improve efficiency of phosphorus utilization in monogastric animals, which lack the ability to digest phytates easily. Reducing their phytate excretion may help decrease water pollution problems due to release of phosphate in the environment. See *phytate* under feed industry terms.

Phosphorus: Animal agriculture can lessen environmental impacts by feeding low-phytate soybean meals that improve the digestibility of phosphorus. In aquaculture, low-phosphorus protein meals containing soy may help lower phosphorus excreted into the water by trout without significantly impacting performance. See *low-phytate soybean meal* and *phytate* under feed industry terms.

Food Industry Terms

Alpha-Linolenic Acid (ALA): An omega-3 fatty acid, as are the fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). EPA and DHA are found primarily in fish while ALA is highly concentrated in certain plant oils such as soybean, flaxseed, canola and walnut oils. Once ingested, the body converts ALA to EPA and DHA. See *omega-3 fatty acid* and *essential fatty acid*.

Antioxidant: A synthetic or natural substance or agent that neutralizes free radicals and helps prevent cell damage that may lead to cancer or heart disease. The isoflavones found in soy, such as genistein, are good antioxidants.

In terms of soybean oil-based trans fat solutions, edible oils used in food applications often require the addition of some type of natural or synthetic antioxidant to prevent rancidity and extend shelf life. The most-commonly used synthetic antioxidants are butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), propyl gallate and tertiary-butylhydroquinone (TBHQ). Studies have shown that adding just 0.02 percent TBHQ to soybean oil increases stability almost four times of that observed in soybean oil without added antioxidants. The most

commonly used natural antioxidants are tocopherols, which are naturally found in soybean oil up to 1000 ppm. While processing removes some tocopherols, companies can modify deodorization conditions to make sure an appreciable amount remains in the oil to help prevent oxidation.

Blending: A processing technique for creating trans fat-free products with soybean oil, blends can be formulated with traditional oils or oil fractions that do not contain trans fat and specially processed oils that contain little or no trans. Blends either combine fully hydrogenated “hard stock,” which is trans-free, with unsaturated, non-hydrogenated oil or more stable oils with partially-hydrogenated oils. Suppliers have developed blended shortening products that support low/no-trans labeling for essentially all baked products.

Chemical Interesterification: Variant term for *traditional interesterification*.

Degumming: Phosolipids are removed by a water-washing step to minimize deterioration of the oil under heating conditions in baking and frying applications. Degumming technologies include modified citric acid pretreatment, soluble silicate treatment, silica gel treatment and enzymatic treatment.

Enzymatic Interesterification: An alternative to hydrogenation, enzymatic interesterification allows for precision and control over achieving specific melting profiles. The catalyst is a 1,3-specific lipase. The natural enzyme rearranges the fatty acids in the 1-and 3-positions. (In contrast, all three positions shift randomly in traditional interesterification.) The reaction is relatively slow and can be stopped at any time to ensure the right degree of interesterification. The enzymatic process does not involve chemicals and produces no harmful byproducts, thereby offering a precise, cost-effective, environmentally friendly method of altering the melting profile and creating more stability. Common uses for enzymatic interesterification include margarine, baked goods and confections.

Essential Fatty Acids: Fatty acids necessary for human health that can only be obtained from dietary sources. This type of fatty acid is not produced by the human body. Soybean oil contains two essential fatty acids, linoleic and linolenic.

Fry Life: The length of time an oil lasts in a fryer before it turns rancid, becomes dark in color or forms free fatty acids. Stable oils have a longer fry life.

Gelling: When modifying the fat profile of a food product, one must analyze fat’s function in the particular application. Hydrogenating a liquid oil to make it more solid not only improves stability and extends shelf life, but it often addresses specific system needs such as bulking effects and mouthfeel characteristics, namely body and creaminess. Gelling and texture building agents help sustain some of these desirable characteristics. Reformulation of foods with less saturated and non-*trans* fats using liquid oils requires the use of gelling and texture stabilizing agents such as hydrocolloids like pectins, caraginan, gum arabic, gelatin and xantan gum.

High Palmitic and Stearic Soybean Oil: Soybean oil high in palmitic and stearic acids could provide stability without hydrogenation. Two references include Neff and List (1999) and Wilson (1999). Also see *palmitic acid* and *stearic acid*.

High-Palmitic Soybean Oil: Soybean oil high in palmitic acid could provide stability without hydrogenation. Two references include Neff and List (1999) and Shen et al (1997). Also see *palmitic acid*.

High-Stearic Soybean Oil: Soybean oil high in stearic acid could provide stability without hydrogenation. Two references include Neff and List (1999) and Knowlton et al (1999). Also see *stearic acid*.

Hydrogenation: The process of chemically adding hydrogen in the presence of a catalyst to the unsaturated “hydrogen short” portions of a natural fat. The addition of hydrogen reduces the reactivity of the fat toward oxygen and thus stabilizes and retards rancidity development in the fat. Hydrogenation usually raises the melting point of a fat or changes it from a liquid oil to a solid fat. Partial hydrogenation is the degree to which a fat is hydrogenated. Completely hydrogenated fats are solid and, therefore, more stable. Partially hydrogenated fats are used in various applications, such as crackers and baked goods.

Interesterification: A process that rearranges fat molecules without adding hydrogen molecules; a possible alternative to hydrogenation. See *enzymatic interesterification* and *traditional interesterification*.

Linoleic Acid: One of the two polyunsaturated fatty acids found in soybean oil. Dietary polyunsaturated fatty acids can lower blood lipid levels and thus lower cholesterol. Liquid soybean oil contains approximately 50 percent of this essential fatty acid.

Linolenic Acid: An omega-3 polyunsaturated acid found in many seed-derived oils such as soybean oil and fish oil. Liquid soybean oil contains approximately eight percent of this essential fatty acid, and is one of the few non-fish oils that is rich in linolenic acid.

Low Linolenic Soybean Oil: Low linolenic soybean oil can provide increased flavor stability, thus reducing or eliminating the need for hydrogenation. Several seed providers have announced the commercialization of soybean varieties with low linolenic acid, including VISTIVE™ from Monsanto; a one percent low linolenic variety from Iowa State University; and Pioneer® variety 93M20 that was developed in partnership by Bunge and DuPont. From early crushings, soybean oils have been created that contain between one and three percent linolenic acid.

Monounsaturated Fatty Acid: A type of unsaturated fatty acid in which the chain of carbon atoms is missing one pair of hydrogen atoms. Monounsaturated fat is found mostly in vegetable oils such as olive, canola, soybean and peanut. Because it aids stability, oils high in monounsaturated fatty acids are good for frying applications. Soybean oil contains approximately 24 percent monounsaturated fatty acids. When substituted for saturated fat, monounsaturated fat helps lower Low-Density Lipoproteins (LDLs, also known as “bad” cholesterol while leaving High-Density Lipoproteins (HDLs, also known as “good” cholesterol) unchanged.

Mid-Oleic Soybean Oil: One soybean trait modification prioritized by the QUALISOY initiative is that of increased oleic acids. The mid-oleic variety makes significant progress towards an improved end product by increasing stability and resistance to rancidity. Soybeans that will be endorsed by the QUALISOY Board would be required to meet levels of low linolenic acid of 3 percent or less; mid-oleic acid at a minimum of 50 percent; and/or low saturated fatty acids at 7 percent.

Oleic Acid: A monounsaturated fatty acid. An oil high in oleic acid is stable and resists rancidity. Oleic acid also contributes to increased shelf life.

Omega-3 Fatty Acids: A type of polyunsaturated fatty acid that has been recognized as having health benefits, including helping to regulate blood pressure and blood lipid levels. Omega-3

fatty acids also may help to lower the risk of heart disease, help prevent cancer, and may be essential for brain development in infants. They are found primarily in fish oils but are also found in a few plant sources like soybeans.

Palmitic Acid: A saturated fatty acid very stable for frying purposes. Soybean oil contains approximately 10 percent palmitic acid.

Polyunsaturated Fatty Acid: A type of unsaturated fatty acid in which the chain of carbon atoms is missing two or more pairs of hydrogen atoms. Polyunsaturated fatty acids are found in nuts and vegetable oils such as soybean, safflower and sunflower, and in fatty fish. When used instead of saturated fats, polyunsaturated fats tend to lower LDL (“bad”) cholesterol levels. Soybean oil contains approximately 61 percent polyunsaturated fatty acids.

Rancidity: The stage in fat oxidation characterized by development of easily recognized sharp, acrid and pungent off-flavors and odors. An oil or fat becomes rancid when oxygen is allowed to break it down. Oils higher in unsaturated fatty acids are more prone to rancidity than oils high in saturated fat.

Saturated Fatty Acids: Saturated fats are among the most common fats in our diet. They are found predominantly in animal foods like meat, poultry and full-fat dairy products, and in tropical oils like palm and coconut. Diets high in saturated fats are associated with higher risks of heart disease, certain cancers and stroke. Soybean oil is considered one of the most well-balanced vegetable oils, with a low saturated fat content of 15 percent.

Shelf life: The length of time a product lasts on the shelf before becoming rancid. The more stable an oil is, the longer the shelf life of the finished product and the oil.

Stability: The ability to maintain proper flavor and odor. Oils may develop off-flavors and rancid odors over time, but soybean oils with decreased levels of linolenic acid and/or increased levels of oleic acid can help food products stay shelf-stable longer.

Stearic Acid: A saturated fatty acid very stable for frying purposes. Stearic acid is solid at room temperature. Many studies show saturated fatty acids raise blood cholesterol. However, other studies show that some saturated fatty acids like stearic acid may not affect or may even lower total blood cholesterol.

Texture Building Agents: See *gelling*.

Traditional Interesterification: In this processing technique, the goal is to reach the right melting profile of a blend of saturated and unsaturated fats. The fatty acids of the triglycerides are randomly shifted and exchange positions through the use of a chemical catalyst. While this method offers less control than hydrogenation, traditional interesterification provides an option for reducing the melting point and increasing stability and creaminess without producing *trans* fatty acids, and the process takes only a few minutes. The most common chemical catalysts are sodium methylate (methoxide) or sodium ethylate (ethoxylate). Common uses for this process are margarine, baked goods and confections.

Trans Fatty Acids: *Trans* fatty acids (also known as trans fats) are produced during the hydrogenation of vegetable oils, a process that adds hydrogen to unsaturated fatty acids in vegetable oil and changes the fat from a liquid to a soft or solid state. Partially hydrogenated vegetable oils can replace naturally solid, saturate-rich fats, such as lard and beef tallow, in margarines and baked foods, as well as commercial frying where vegetable oils cannot be used.

Trans fatty acids occur naturally in small amounts in meats and dairy products. *Trans* fats account for only two to four percent of the average American's total calories. Regular, non-hydrogenated soybean oil does not contain *trans* fatty acids.

Trans Fat Regulations: Effective January 1, 2006, the U.S. Food and Drug Administration (FDA) will require food manufacturers to include *trans* fatty acids as a line item on a food product's Nutrition Facts panel. Products containing 0.5 grams or more of *trans* fats will be subject to mandatory labeling.

Trans Fat Solutions: A number of soybean oil-based alternatives exist to hydrogenation. These range from relatively simple processing techniques, such as interesterification and blending, while others involve complex seed breeding technologies, whether through traditional breeding or advancements in biotechnology.

Unsaturated Fatty Acids: Unsaturated fatty acids are found in foods from both plant and animal sources. Unsaturated fatty acids are further divided into monounsaturated fatty acids and polyunsaturated fatty acids.

Vegetable Oils: A naturally occurring fat or oil derived from a plant or vegetable. Soybean oil is the most commonly used vegetable oil in the United States. Vegetable oils are low in saturated fatty acids.

Vitamin E: Vitamin E is a fat-soluble antioxidant vitamin that prevents cell damage that may lead to cancer. By inhibiting the oxidation of LDL cholesterol, Vitamin E may reduce the risk of heart disease. Vitamin E is found in vegetable oils like soybean oil.

Feed Industry Terms

Amino Acids: Amino acids are the fundamental building blocks of proteins. There are 20 naturally occurring amino acids in animals and approximately 100 more amino acids found in plants. Increasing the levels of certain essential amino acids, particularly methionine and lysine, adds more nutritional value to soybean meal and thus decreases the need for animal nutritionists to supplement the meal with more expensive sources of amino acids when developing their feed formulations. For example, high-methionine soybeans could eliminate the need for methionine as a feed supplement in poultry diets.

Digestibility: Improved animal digestion efficiencies will lessen the environmental impact of animal waste. This can be accomplished by developing soybean meal with a better balance of amino acids.

Environmental Impacts: Environmental opportunities exist for lowering the levels of manure components generated per animal fed. Components targeted include both nitrogen and phosphorus. Both are present and growing environmental concerns relative to high-density animal production areas. Nitrogen can be addressed by improving the amino acid balance and soybean meal digestibility. Phosphorus can be addressed by increasing the extent to which the phosphorus present in the meal can be digested and productively utilized by the animal.

Low-Phytate Soybean Meal: Low-phytate crops can improve efficiency of phosphorus utilization in monogastric animals, which lack the ability to digest phytates easily. Reducing their phytate excretion may help decrease water pollution problems due to release of phosphate in the environment. See *phytate*.

Metabolizable Energy (ME): ME is the resulting amount of energy available from animal feed once the energy from feces, urine, and combustible gases has been subtracted. Essentially, ME is the energy left for the animal's body to use once all digestion is complete. Soybeans with higher ME constitute one goal of the QUALISOY initiative.

Monogastric Animals: Single-stomach animals, namely swine and poultry, lack the phytase enzyme needed for digestion of phytate, also known as inositol hexaphosphate. Thus, they excrete most of the phytate in their meal. See *low-phytate soybean meal* and *phytate*.

Oligosaccharide: Oligosaccharides are undigestible sugars. In particular, stachyose passes to the intestines where bacteria ferment it into gases, instead of being digested in the stomach. Low-stachyose soybeans replace it with the easily digested sugar sucrose. Low-stachyose soybeans also are higher in energy content than traditional soybeans, making them doubly useful as an ingredient in young animal diets. For example, researchers found that the incorporation of low-stachyose soybean meal in pre-starter pig diets tended to improve growth performance.

Phosphorus: Animal agriculture can lessen environmental impacts by feeding low-phytate soybean meals that improve the digestibility of phosphorus. In aquaculture, low-phosphorus protein meals containing soy may help lower phosphorus excreted into the water by trout without significantly impacting performance. See *low-phytate soybean meal* and *phytate*.

Phytase: An enzyme, naturally occurring in ruminants but absent in monogastric animals, that can help increase phosphorus availability. Phytase supplements may be added to animal feed in order to lessen environmental impacts.

Phytate: Phosphate naturally present in traditional varieties of soybeans exists primarily in the form of an insoluble salt called phytate. Also known as inositol hexaphosphate. See *low-phytate soybean meal*.

Ruminant: This type of livestock includes hoofed, even-toed, usually horned mammals such as cattle, sheep, goats, deer, and giraffes, characteristically having a stomach divided into four compartments and chewing a cud consisting of regurgitated, partially digested food.

Soybean Meal: Used in poultry, swine, beef, dairy, pet food and other animal feeds, soybean meal sets the value standard for supplemental protein/amino acid sources used in animal production nutrition, and it remains the most used and preferred protein source in animal feed worldwide. Nevertheless, soybean meal is not perfect, and many view improving upon some of its nutritional limitations as an opportunity worthy of pursuit. One goal of QUALISOY is accelerating the development of enhanced soybean germplasm with superior meal attributes, such as reduced phytate-bound phosphorus and increased metabolizable energy.

Learn More About QUALISOY

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