Soybeans, Soyfoods, and Soy Ingredients:

Different Methods for Production, Processing and Marketing

Who regulates the terms used on soyfood labels?

In the soyfoods industry, many terms are used to describe seed source, growing and processing methods, production, and marketing of products. SANA members utilize terminology from different marketing programs to distinguish their products and services. Some terms have their origin in regulation or legislation, while others have been developed by private entities, for which there is no government oversight. SANA does not take a position on or endorse any particular system. However, SANA does advocate that companies comply with all federal, state, and local laws and rules. SANA also encourages consumers to research organizations that define and describe various methods of seed sourcing, soybean production, and soyfoods processing to make informed decisions and choices. Soyfoods make up a healthy diet regardless of which set of rules the manufacturers follow to produce, process, or market them.

What is biotechnology?

The Food and Drug Administration uses biotechnology to refer to techniques used by scientists to modify deoxyribonucleic acid (DNA) or the genetic material of a microorganism, plant, or animal to achieve specific, desirable traits. These foods are known as biotech, bioengineered, and genetically engineered foods, but the public most commonly refers to genetically engineered foods or ingredients as “GMOs” (genetically modified organisms).

What is genetic engineering?

The genetic makeup of some soybeans can be altered through a scientific process called recombinant DNA (rDNA) or genetic engineering, known also as genetically modified organisms (GMO)\(^1\). The genetic makeup of soybeans can be altered through scientific process called recombinant DNA (rDNA) or genetic engineering\(^1\). This technology has been used to alter

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soybean traits that have been not been accomplished through conventional breeding processes. Examples of this include the "Roundup ready" soybean. In addition, genetic engineering has been used to change and improve the fatty acid content of soybeans. An example of this is the development of soybean varieties which contain low levels of linolenic acid and high levels of oleic acid.

What is conventional breeding?

Traditional breeding, sometimes called selective or conventional breeding, is the practice of changing the genes of plants through several methods to produce desired characteristics and improve seed yields and varieties. Through planned, methodical cross-pollination, specific genes that express desirable traits in two different plants are combined to generate a new plant variety. Plant breeders also use grafting and in vitro techniques to produce hybrid plants with unique traits. Through cultivation, the new variety can be maintained.

What does Certified Organic mean?

USDA Certified Organic is a marketing term, carried on a food or agricultural product label that indicates that the food or product has been produced, processed, and handled following approved methods authorized by law and published regulations under the United States Department of Agriculture (USDA) National Organic Program (NOP) under the USDA Agricultural Marketing Service (AMS). These methods integrate cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity. Genetic engineering (excluded methods), irradiation and sewage sludge are...
methods that are not permitted in production of USDA NOP certified foods. Additionally, the NOP National List of Allowed and Prohibited Substances specifies the inputs (i.e. fertilizers, pesticides, ingredients and processing aids) that may be used during the production or manufacturing of an organic product. Petroleum fertilizers, synthetic pesticides, non-synthetic pesticides that are toxic (i.e. arsenic), and synthetic processing additives (i.e. flavors, colors, and solvents) are examples of inputs that are generally prohibited.

Who regulates the term Certified Organic?

The Organic Foods Production Act (OFPA) of 1990 required USDA to develop national standards for all crops, livestock, and agricultural products sold as organic in the United States to assure consumers that agricultural products marketed as organic meet consistent, uniform standards. The OFPA and the USDA NOP regulations govern USDA accredited organic certification agencies, which inspect and verify that organic farmers, ranchers, distributors, processors, and traders are complying with the USDA organic regulations. The USDA conducts audits and ensures that the more than 90 organic certification agencies operating around the world are properly certifying organic products. In addition, the USDA conducts investigations and enforcement activities to ensure products labeled as organic meet the USDA organic regulations. To sell, label, or represent products as certified organic, operations must follow the specifications set out by the USDA organic regulations and document compliance.

The USDA Agricultural Marketing Service National Organic Program follows the Code of Federal Regulations Title 7 Part 205 for “USDA certified organic” to regulate, among many factors, soil

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quality, livestock husbandry practices, pest and weed control, and the prohibition of use of
genetic engineering, sludge, antibiotics, and hormones.

**Who regulates genetically engineered foods in the U.S.?**

Jurisdiction over the varied biotechnology products is determined by their use, as has been the
case for traditional products. Depending on its characteristics, a product may be subject to
review by one or more of three agencies - the US Department of Agriculture (USDA), the
Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA) through a
Coordinated Framework for Regulating Biotechnology\(^\text{12}\). All foods, including those from
genetically engineered (GE) plants, pose the same types of inherent risks to human health: they
can cause allergic or toxic reactions, or they can block the absorption of nutrients. The federal
agencies evaluate GE foods by reviewing company supplied tests to ensure the levels of
allergens, toxins, and antinutrients in GE foods are comparable to those found in the foods’
conventional counterparts.

In a 1992 policy\(^\text{13}\), the FDA applies the same legal and regulatory framework for labeling of
foods derived from biotechnology that it uses for labeling or assessing food safety for any other
processing or production technology. The FDA states it has no basis for concluding that
bioengineered foods differ from other foods in any meaningful or uniform way, or that, as a
class, foods developed by the new techniques present any different or greater safety concern
than foods developed by traditional plant breeding.

**Can the different type of soybeans be kept separated?**

Yes, identity preservation is a system that is used to ensure that the end user receives the
soybeans that have been bred with specific traits using specific breeding techniques and
agricultural practices. With this system, the soybean supply is segregated from seed production
through growing, harvest and processing. However, no segregation system can guarantee
100% purity of the soybean.

**For what uses are soybeans grown in the United States?**


\(^{13}\) “Statement of Policy – Foods Derived from New Plant Varieties,” 57 Federal Register 104 (29 May 1992), pp
Soybeans are a major field crop produced in the United States, representing 23 percent of all acreage planted in 2012, second only to corn.\(^{14}\) Most of the soybeans grown in the United States are used for animal feed (soybean meal) and soybean oil. Except for those used for soybean oil, soybeans produced for human consumption constitute a very small share of those grown in the U.S.\(^{15}\) Most soyfoods in the U.S. are made from whole soybeans, soy flour, defatted flour, or soy protein ingredients.

How do soybeans used for soyfoods differ?

There is much variability in different types of soybeans, depending on their genetic make-up. One of the gene characteristics for which breeders select is nutritional content. Soybean varieties differ in color, taste, size, and certain levels of nutrients.\(^{16,17}\) Some soybeans might have a higher protein content, higher carbohydrate and sugar content, phytates, or different fatty acid profile. These nutritional changes would need to be identified on foods made with these soybeans. Depending on the end use, different soyfood manufacturers require different varieties of beans. For example, a seed might be modified to have more sucrose for use in soymilk or it may be bred to have a higher content of protein for use in tofu and soy-based meat alternatives.\(^{18}\) Through biotechnology, the high oleic bean was genetically modified to have a higher content of oleic oil and less saturated fat content compared to a conventional bean (and less saturated fat compared to palm oil) which gave manufacturers the ability to create trans-fat free products\(^{19}\).

Some of the common types of soybeans used for food include:

- **Clear Hilum**: These beans have a clear hilum (from where the soybean sprouts) rather than black hilum. The entire clear hilum soybean is cooked to make the lighter colored liquid used for soymilk, soy yogurt, and tofu production.
- **High Protein**: This type of bean has a protein level of 37 percent or more. Producers of soymilk, soy yogurt, tofu, baked goods, puddings, cheeses, and meat analogs prefer these high protein beans.

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\(^{15}\) Informa Economics, Inc. Food use of soy protein market study. October 2010.


• High Sucrose: These beans are lower in the indigestible carbohydrates (90 percent less) and contain about 40 percent more sucrose. Producers of soymilk, soy yogurt, baked goods, puddings, cheeses, and meat analogs often prefer the less fibrous, sweeter soybean.

• Natto: This type of bean is small in size, with a clear hilum, thin seed coat, and a high carbohydrate content. Normally these are grown and shipped to Japan where they are fermented.

How can production of soy beans that are used in soyfoods and ingredients differ?

Besides deciding the specific traits and type of breeding to meet customer requirements, soybean processors and soyfood manufacturers decide the type of agricultural practices and processing methods – conventional or organic – that will be used. To qualify for a “certified organic” label, producers and processors must be certified to the USDA NOP regulations and undergo annual inspections carried out by USDA accredited certifying agents. Certified operators must comply with the organic regulations by adhering to restricted production methods (i.e., no genetic engineering, ionizing radiation or sewage sludge) and by using only allowed inputs (i.e. fertilizers, pesticides, ingredients and processing aids) that are listed on the NOP National List of Approved and Prohibited Substances.

There are no specific definitions for conventional farm practices and processing methods but conventional methods usually rely on synthetic/chemical inputs. Depending on size and region of the country, conventional farmers may use no till or minimum till practices that reduce greenhouse gas emissions, as well as conservation practices to decrease soil and water use. No matter what the seed source or agricultural production methods, soy production is governed by local, state, and/or federal rules to ensure consumers receive healthy and safe soyfoods.

Do consumers have a choice in the type of soyfoods they can buy?

Soyfoods on today’s market shelves have been derived from a variety of soybeans bred using different methods, and grown and processed using specific practices. Some consumers may seek soyfoods that are made with ingredients that are organically produced or that are not from genetically engineered soybeans, commonly known as “non-genetically modified organism” (non-GMO). To permit consumer choice, many soyfoods manufacturers use soybeans and/or ingredients from soybeans that have not been genetically engineered or are certified organic, which by USDA regulations exclude genetic engineering methods. Consumers can find numerous varieties of soymilk, soy yogurt, tofu, edamame, meat alternatives and nutrition bars that are labeled “organic” or “made from non-GMO soybeans”. Depending on
the product, some manufacturers state on the front of the package or the ingredient list if the soybeans are organic or “non-GMO”. There are a number of organizations that provide 3rd party non-GMO verification.

What do the various organic labels mean?

If a product label has the “USDA organic seal,” the product is certified organic and has at least 95 percent organic content. When packaged products indicate they are “made with organic [specific ingredient or food group],” the food contains at least 70 percent organically produced ingredients. All of the non-organic ingredients in a product that is 70 or 95 percent certified organic must be “organic compliant.” These ingredients are produced without using prohibited practices (i.e., sewage sludge, irradiation, and genetic engineering), follow NOP guidelines, and are on the NOP National List of Allowed and Prohibited substances. “Made with organic” products will not bear the USDA organic seal, but, as with all other organic products, must still identify the USDA-accredited certifier. You can look for the identity of the certifier on a packaged product for verification that the organic product meets USDA’s organic standards.²⁰

What percentage of soybeans is genetically engineered and what percentage is not?

The USDA reported that 93 percent of all soybean crops planted in the U.S. were genetically engineered, an increase from 54 percent in 2000, and 7 percent of all soybean crops planted in the U.S. were not genetically engineered, according to 2012 data from the USDA Economic Research Service (ERS).²¹ Using data from the U.S. Department of Commerce Current Industrial Report, M311J from 2001-2009, Informa Economics, Inc., a market research, analysis, and evaluation company, calculates that U.S. production of soy protein for human consumption accounts for about 11 percent of non-GMO soybean production—or slightly less than 1 percent of total soybean production. The actual amount of non-GMO soybeans used in human food markets may be somewhat higher than these figures because they do not include whole non-GMO soybeans used in the production of soymilk, tofu and other products (such as edamame).²² There is no “official” source that collects data on the proportion of soybeans used for soyfoods (such as soymilk, soy yogurt, tofu, tempeh, and soy nuts) versus soy ingredients (such as soy flour, soy protein isolates, and soy protein concentrates.)

What percentage of soybeans is organically grown?

In 2008 (the most recent USDA data available), only about 0.6 percent of all U.S. farmland (cropland and pasture) was certified organic, with 0.2 percent belonging to soybeans (69,490 acres of land).23 Only a small portion of the non-GE soybeans grown are certified organic as most are grown conventionally.24

Are soybeans sustainable?

There are many factors that affect how sustainable a crop may or may not be. The USDA’s National Agricultural Library’s Alternative Farming Systems Information Center (AFSIC)’s publication, Sustainable Agriculture: Definitions and Terms, includes brief descriptions of some of the methodologies and practices currently associated with sustainable agriculture.25 Growing soybeans in a conventional or organic system can be environmentally sustainable. Soybean production compared to livestock production has proven to be a more favorable and environmentally sustainable source of protein because of the high protein quality and nutritional value of soybeans and the efficient use of land, water, and energy of soybean production. Soy-based foods deliver the highest protein density for human consumption per amount of fossil energy inputs.26 Soybeans deliver 941 pounds of protein per acre of U.S. land compared to chicken, milk, pork, or beef (141, 119, 53, and 16 pound of protein per acre of U.S. land respectively).27 It is estimated that by 2025, water scarcity could cause the loss of up to 350 million metric tons of food.28 Among sources of high quality protein, soybeans use water more efficiently.29,30

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27 LMC International estimates based on USDA reported yields and conversations with USDA subject specialists. Protein contents were derived by LMC from the ARS nutritiet database - http://www.ars.usda.gov/main/site_main.htm?modecode=12-35-45-00. Note: Livestock efficiencies vary drastically in accordance with production practices.
Why are soyfoods important for a sustainable planet?

As the demand for protein increases and water and land resources become more strained, the environmental sustainability of protein sources, such as soyfoods, intensifies. Soy protein is valued for its unique position as the only widely available plant-based complete protein. In the future, agriculture practices that promote sustainability will be necessary to ensure that top soil does not erode, water resources are not depleted, water, air and land are not polluted, and the crops remain healthy throughout drought and other severe climate conditions. In addition, these practices will need to help provide an adequate food supply for the growing population.

Are there any nutritional differences resulting from the various growing and production methods?

There have been many efforts to compare various nutritional components among organic, conventional, and genetically engineered soybeans. There are no reports that show consistent differences in nutritional qualities or nutrition superiority among the various growing methods. The nutritional content of food is more likely to vary based on the soil in which it is grown, the water used, growing conditions, and the genetic make-up. Depending on the end use, some soybeans might have been bred for a higher protein content, higher carbohydrate and sugar content, fewer phytates, or different fatty acid profile. These nutritional changes that differ from the original soybean would need to be identified on foods made with these soybeans.

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