

## SOYA

"Soya" (or "Soy" in the United States), is a legume, *Glycine max (L.) Merrill*. Soy has been grown for three millennia in Asia and, more recently, has been successfully cultivated around the world. Today, the world's top producers of soy are the United States, Brazil, Argentina, China and India.

About 85 percent of the world's soybeans are processed, or "crushed," annually into soybean meal and oil. Approximately 98 percent of the soybean meal that is crushed is further processed into animal feed with the balance used to make soy flour and proteins. Of the oil fraction, 95 percent is consumed as edible oil; the rest is used for industrial products such as fatty acids, soaps and biodiesel.

Soy is one of the few plants that provides a complete protein as it contains all eight amino acids essential for human health.



### Seed Varieties

Because soybeans are grown around the world under many different climatic conditions and have been grown for many centuries, there is wide range of soybean varieties. Genetically modified (GM) soybeans varieties began to be commercially grown in 1996, and they quickly became predominant in the major soy producing countries. Early GM soybeans were engineered to be herbicide resistant (specifically to the popular RoundUp Ready brand glyphosate) and were thus very popular with farmers. More recent generations of GM soybeans have included traits that have benefits for oilseed processors and the consumer. Seeds containing more than one of the attributes is said to have "stacked traits."

With the dramatic increase in GM crops over the last decade, soybeans that have been bred traditionally have become increasingly valuable for use in the European Union and other areas particularly sensitive to the use of genetic modification. Traditional varieties are also used in organic foods and other products for which the consumer expects a 'natural' product. Some soybeans are larger in size and higher in protein than others, while some varieties have a brown, buff or clear-colored hilum (the spot on the soybean where it connects to the pod). Soyfoods manufacturers require different types of beans for each product; for example, producers of the traditional Japanese soyfood 'natto' need a small soybean variety with a thin seedcoat and high carbohydrate content.

In order to ensure the integrity of the finished product, food makers and others who have specific requirements may purchase Identity Preserved (IP) beans. This means that details about the identity and origin of the crop is tracked from the farm all the way to the finished product. Organic and IP soybeans command a premium in the marketplace because of the additional work involved.

### **Brief Overview of Modern Market**

The first written reference to soy appears in a list of Chinese plants from 2853 B.C.; it is also referred to many times in ancient writings as one of the five grains essential to Chinese civilization. Western contact with soybeans and soyfoods was limited until Asians began to emigrate in large numbers to Europe and the U.S. in the 1800s.

Large-scale development of soybean production and processing in the U.S. began during the 1940s and 1950s spurred on by a rapid increase in both domestic and worldwide demand for protein meal and oil. Harvested acreage for soybeans in the U.S. more than tripled between 1940 and 1955, from 4.8 million acres to 18.6 million, while total production of soybeans increased nearly five-fold, from 78 million bushels to 374 million.

As the number of acres devoted to soybeans continued to grow during the 1960s, the United States became a world soybean superpower and began exporting large quantities of soybeans, as well as meal and oil, to Europe and Asia. Industry growth has slowed in recent years with increased competition, but the U.S. still produces (in the early years of this century) roughly 75 million metric tons of soybeans each year.

### **Primary Areas of Production**

Though still the largest soy exporting country (for now), the United States has lost the dominant position it once had in the global soy trade. Brazil, Argentina, China and India have all become major producers as the world's demand for soy as food, vegetable oil, and animal feed has continued to increase.

Given the amount of available arable land and water resources in Brazil, it is expected to eventually become the number one soybean-producing nation. Already, South America as a continent produces more soybeans than North America (combined U.S. and Canada production). In the past decade, large tracts of fertile land and low labor costs have fueled explosive growth in South America's soy industry. Poor road and rail infrastructure, as well as economic instability and environmental concerns, have been the primary checks to further expansion.



Growth in China, where this story began, has been plagued with inefficiencies and lags behind most major producing countries, though it is still the fourth largest soybean grower.

In the U.S., soybeans are grown mostly in the Midwest. The top soy-producing states are Iowa, Illinois, Minnesota, Indiana and Nebraska. Many farmers in this region grow corn and soybeans in rotation.

The Brazilian states with the greatest soybean production are Mato Grosso, Paraná and Rio Grande do Sul.

## Major Products

About 85 percent of the world's soybean crop is processed into meal and vegetable oil, and virtually all of that meal is used in animal feed. Some two percent of the soybean meal is further processed into soy flours and proteins for food use.

Approximately six percent of soybeans are used directly as human food, mostly in Asia. The oil component of crushed soybeans is primarily used for human consumption, although the proportion used for biodiesel production is growing rapidly, especially in the U.S.

Food uses of soybeans include traditional soyfoods such as tofu and soymilk as well as 20th century innovations – meat analogs and soy-based yogurts, for example. For more information about soyfoods, please visit our Soyfoods Facts page.

Soy ingredients have become staples in the food manufacturing industry. Lecithin is widely used as an emulsifier; since the 1970s, partially hydrogenated soybean oil has been a mainstay in the production of snacks, baked goods, salad dressings and other foods (although the trans fatty acids it contains has led to its rapid fall from grace in recent years; soy protein ingredients play functional roles in baked foods, processed meats and other products.

In addition to being used for their functional characteristics, soy ingredients are used to add nutrition to processed foods; some isolated soy proteins, for instance, are specifically designed to be used in acidic or clear beverages – products that could not, until recently, be protein-fortified.

Soybeans are also processed into many industrial products. The primary one at this time is biodiesel, or soy methyl esters, which may be used in any diesel engine. In addition, soybeans are processed into hydraulic oil, grease, solvent, ink, plastics and other products.

## Common Processing Methods

After being cleaned and dehulled, one of three processes is used to separate the soybean oil from the protein meal (this is also called "crushing" or "oil mill" operations).

### These processes are:

- Solvent extraction: This process, which is the one used most commonly around the world, uses hexane to leach or wash (extract) the oil from flaked oilseeds. This method reduces the level of oil in the extracted flakes to one percent or less.
- Continuous pressing: This process is performed at elevated temperatures, using a screw press to express the oil from ground and properly conditioned soybeans. The pressed cake is reduced to between 4 percent and 6 percent oil content by this method.
- Hydraulic or batch pressing: This is an intermittent pressing operation carried out at elevated temperatures in a mechanical or hydraulic press after the soybeans have been rolled into flakes and properly conditioned by heat treatment. It is the oldest known method of processing oilseeds.