Soy Protein

Agricultural Utilization Research Institute

Minnesota Overview

Estimates of Minnesota's soybean yields in 2016 were 52.5 BU/acre and total sales were $3.6 billion. Minnesota's average price for soybeans in 2016 was $9.25/bushel, slightly below the national average of $9.50/bushel. The lower per bushel rates can benefit Minnesota soy protein ingredient manufacturers by reducing soy protein production costs. Additionally, soybeans are eligible for price loss coverage under the 2014 Farm Bill, offsetting some of the monetary risks for farmers related to control of weeds and disease.

Nutritional quality

Soybeans are generally comprised of more than 40% protein, making them more protein-rich than other legumes. The PDCAAS score for soy protein ranges from 0.9 – 1.0, depending on processing conditions. Having a high PDCAAS score means sole consumption of soy protein at a level of 0.6 g protein/kg body weight is sufficient to meet the protein needs of children and adults; hence, classifying soy protein as a complete protein source.

Currently available protein ingredient forms

There are three basic types of soy protein ingredients: soy flour (50 – 60% protein, dry basis), soy protein concentrate (65 – 80% protein), and soy protein isolate (> 90% protein). To achieve desired biological or physicochemical functions, soy protein isolate is commonly subjected to enzymatic hydrolysis to produce soy protein hydrolysates. Extruding, steam injecting, or jet-cooking soy flour, SPC or SPI generates texturized soy protein.

Potential functionality and applications

Soy protein ingredients are elements of several food applications for their viscosity, gelation, water absorption and binding, emulsification, foaming, and flavor-binding properties. The different functional properties of soy proteins are dependent on its solubility, so processing conditions impact their effectiveness, which in turn affects the solubility. If soy proteins are texturized they can be used as meat replacements, extenders, or texturizers. In meat-less products, they can mimic the texture of meat, and in meat products, they can improve texture. The nutritional quality and diverse functionality of soy protein makes it useful in a variety of foods.

Soy Facts

High in Protein

High PDCAAS score

Three available protein forms

High quality complete protein

Ideal for several food applications

Can mimic texture of other protein sources

Requires less fertile soil than other crops

Soybeans fix nitrogen in soil

Advantages

Soy protein has several agricultural, nutritional, functional, and technological advantages. Soybeans require less fertile soil for growth than other crops like corn, making their production possible in inhospitable regions. Also, soybeans can fix nitrogen in the soil, reducing fertilizer needs and benefitting subsequent crops in a rotation. In terms of nutritional advantages, soy protein is a high quality, complete protein, making it suitable for those on vegan and high protein diets.

Barriers

In soy protein ingredients, earthy and bitter/astringent off-flavors can be problematic. As some of the off flavors are related to lipid oxidation, a reduction in off flavors has been achieved when using soybeans bred with little or no lipoxygenase, or by following effective extraction methods to remove excess oil. The two main issues, however, are consumer acceptance of biotech derived crops and soy protein allergenicity (one of the “big 8” allergens).

Feasibility

Soybean production in Minnesota is clearly feasible despite the low frost tolerance of soybeans. However, Minnesota farmers must determine whether they wish to grow GM or non-GM soybeans. GM soybeans are more herbicide tolerant and/or insect resistant, but may deter consumers; while non-GM soybeans attract less negative attention, contracts often require them to be grown using certified seeds and specific procedures.

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