

## Soy Food Processing, Potential and Utilization Avenues

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Soybean is known as the “GOLDEN BEAN” of the 20th Century. Though Soybean is a legume crop, yet it is widely used as oilseed. After groundnut, soybean has become the second largest oilseed in India. It has a remarkable potential as a highly nutritious and protein-rich food. Soybean contains nearly 40% of vegetable protein, including all the essential amino acids, especially glycine, tryptophan, and lysine, similar to animal proteins and cow's milk. Soybean and its products are cost-effective sources of protein, widely recognized for their exceptional nutritional and functional properties. Due to its high protein and calorie content, soybean can effectively combat protein-calorie malnutrition (PCM) prevalent in India and other developing countries. Despite its Chinese origins, soybean is now an American crop that thrives in various agro-climatic conditions. The United States is the world's leading soybean producer, with soybean also benefiting the environment by enriching the soil.

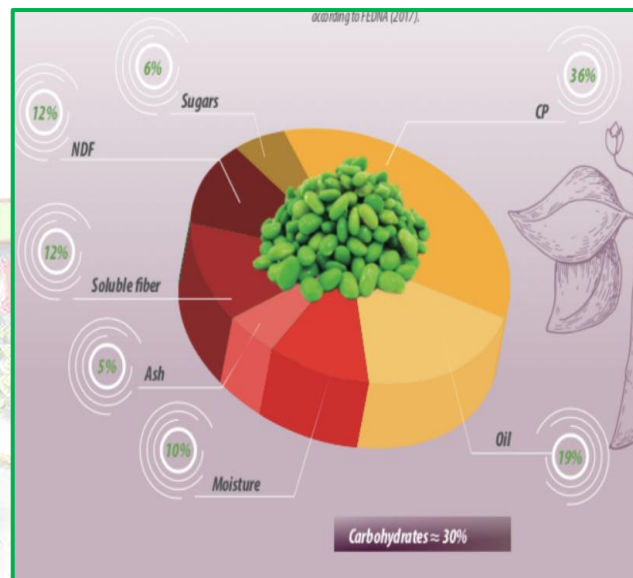


Figure 1-chemical composition of soybean

Source-Use of soybean products in animal feeding. Part I – Nutritional value (nutrinews.com)

### Major health benefits from regular use of soybean in daily diet

Soy-based nutrients	General health benefits on regular eating
Protein	Lowers blood cholesterol
Carbohydrates	Relieves constipation, good for diabetics
Fat	Prevents cardiovascular diseases
Mineral	Overall health promotion
Vitamin	Overall health promotion
Phytochemicals	Prevents cancer, helpful in menopause and osteoporosis

### Soybean Production in India and MP

Globally, India occupies the fourth position in terms of land area with 11.34 million hectares (28.02 million acres), which represents 9.41% of the world's total land area. Additionally,

India ranks fifth in soybean production, producing 11.22 million tonnes (3% of global production). Among all the states in India, Madhya Pradesh achieved the highest soybean production of 55.84 lakh hectares, followed by Maharashtra (46.01 lakh ha), Rajasthan (10.62 lakh ha), Karnataka (3.82 lakh ha), Gujarat (2.24 lakh ha), and Telangana (1.51 lakh ha) in the year 2022. Madhya Pradesh accounts for 45% of the total soybean production in the country, making it the leading soy state in India.

**Plant protein sources-** Plant-based protein sources include a variety of foods such as beans, lentils, edamame, tofu, tempeh, grains, green peas, nuts, seeds, plant-based beverages, nutritional yeast, vegetables, and faux meat products. When considering pulses and soybeans as the primary sources of plant-based protein, Madhya Pradesh's contribution to the country's plant-based protein production is approximately 38%. This significant contribution of Madhya Pradesh to the national plant protein production visibly assures the nutritional security of the country. The per capita production of protein per year in Madhya Pradesh is 5.05 kg.

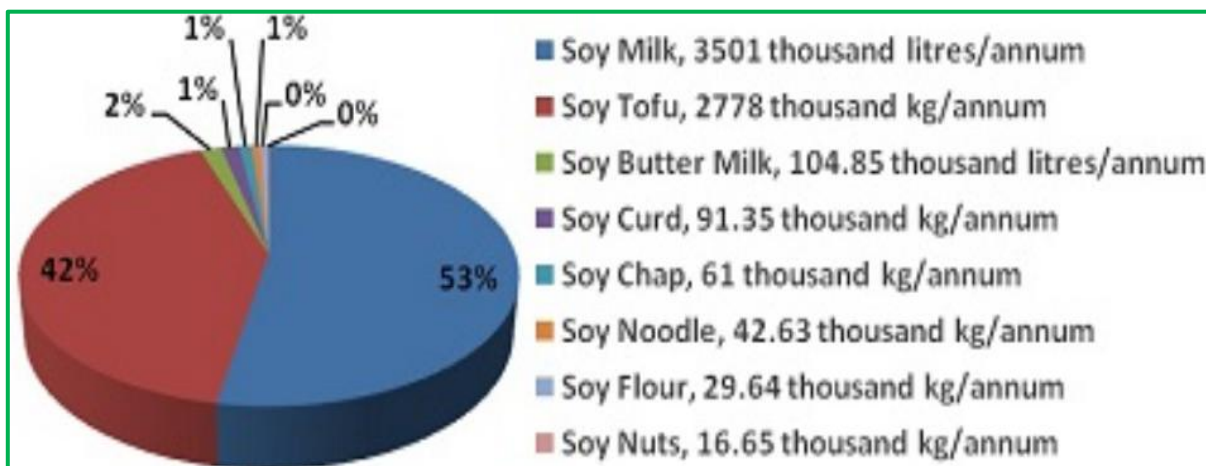
### Soy Foods

In Asian countries, peoples utilize soybeans mainly for producing traditional soy food. The soy foods, those prepared from whole soybeans, are typically categorized into two groups: non-fermented and fermented.

- **Traditional non-fermented soy foods** include fresh green soybeans, whole dry soybeans, whole-fat soy flour, soymilk, tofu, okara, soy nuts, soy sprouts and yuba. Whole-fat soy flour, prepared from whole dried soybeans, is used in bakery applications in the place of milk powder or as a substitute for whole-wheat flour.
- **The fermented soy foods include** tempeh, miso, soy sauces, natto and fermented tofu (sufu) and soymilk products.

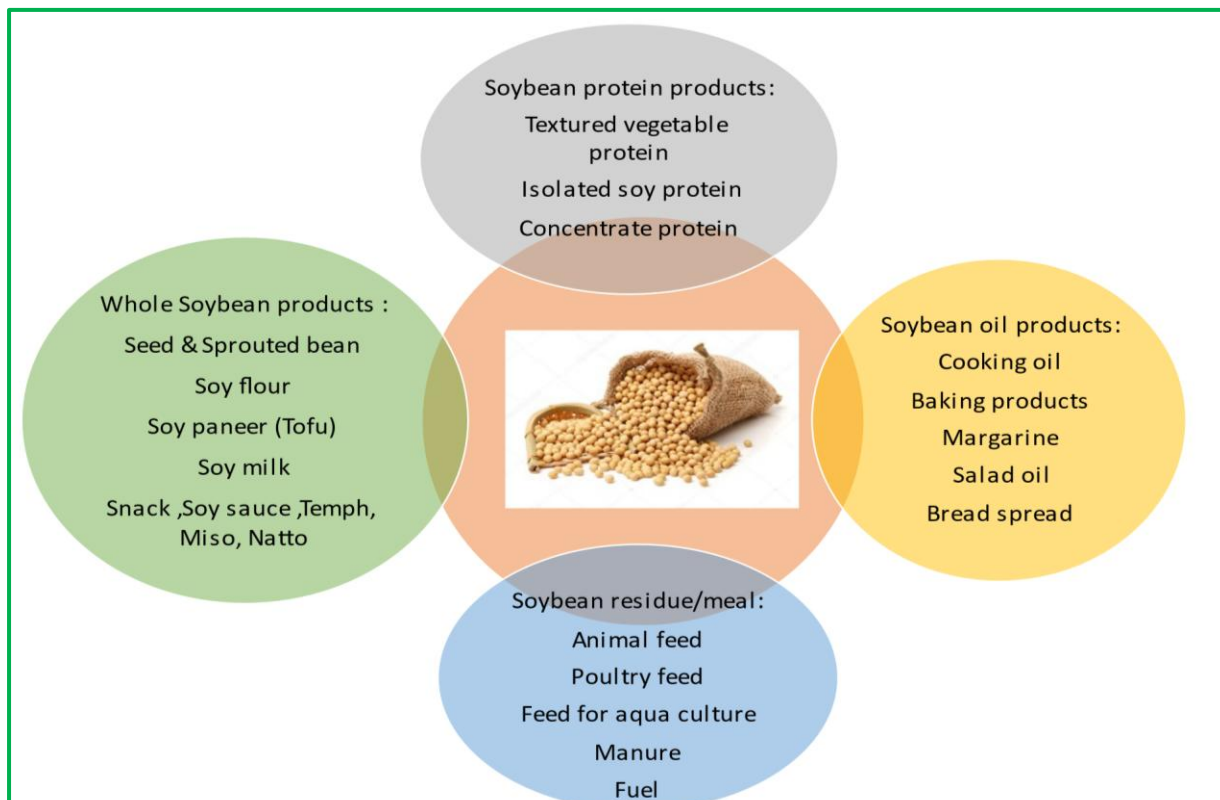
### Production and %share of different soy products in country

Soymilk and tofu are gaining popularity as low-cost alternatives to traditional dairy products, particularly for lactose intolerant individuals. Soybean seed fiber is known for its nutritional and functional properties. Because of its nutritional advantages, including essential amino acids, unsaturated fatty acids, carbohydrates, vitamins, and minerals, soybean is becoming increasingly preferred as a component of a balanced and healthy diet, and is also widely used as an animal feed source. Soymilk is utilized to create soy yogurt, which is similar to Western dairy yogurt and typically made with a mixture of soymilk, whey, and sucrose. Soybean proteins are utilized in various forms for human food, such as infant formulas, flours, protein isolates and concentrates, and textured fibers. In commercial production of mayonnaise and salad dressings, soybean oil is the primary vegetable salad oil utilized in the United States.



Consumption of soy foods is rising due to their reported beneficial effects on nutrition and health. These effects include reducing plasma cholesterol, preventing cancer, diabetes, and obesity, and protecting against bowel and kidney diseases. Therefore, soybean plays a significant role in preventing and treating chronic diseases such as heart disease, osteoporosis, cancer, kidney disease, and menopausal syndromes. Additionally, soybean offers a wide range of possibilities for manufacturing various processed food products.

### Potential of soybean: Uses of soybean and its derivatives



**Soybean meal (SBM)** is widely used as the primary source of protein and amino acids (AA) in animal feed formulations, particularly for monogastric species. Soybean provides a high-quality vegetable protein source with a relatively consistent chemical composition, as compared to other protein sources. As the average income of people in Asia and Africa continues to rise, the demand for livestock products is increasing. Soybean meal is currently the primary source of protein for livestock feed worldwide, and the demand for soybean meal is expected to continue to increase in the near future.

**Industrial applications:** Only a small proportion of the protein (0.5%) and oil (2.6%) produced from soybeans grown in the United States is used for industrial purposes. The industrial applications of soybean that are economically feasible include paper coatings, wood veneer adhesives, plastics, textile fibers, alkyd resins, printing ink, and oleochemicals. Soy flour is believed to be the main wood-bonding component due to its protein content, although the presence of 35% carbohydrates may also contribute to adhesion.

Soybean oil has traditionally been considered too thick and reactive to be used in fuels, cosmetics, lubricants, and chemical additives. However, there is growing interest in the potential for soybean oil to be used in the production of adhesives, plastics, construction materials, and other industrial products due to factors such as more stringent environmental standards, increased costs for petroleum-derived products, the ability to tailor soybean oil for improved performance properties, and more cost-effective chemical conversion processes. Soybean molasses can be used to produce ethanol through alcoholic fermentation, making it a



viable biofuel source. The byproduct of this process is commonly known as soapstock, resulting from caustic refining of soybean and other oils which consists of soap, neutral oil, phosphatides, and some unsaponifiables. Soybean based industrial products Soybean has a great future in cosmetics, plastics and rubber, **pharmaceuticals and pesticide industry**.

**Economic impact:** 198 entrepreneurs in India are involved in processing soybean to make a variety of products. These units work for 203 days a year and provide employment for an average of 4.73 workers per unit. The total employment generated by these units is about 190,000 man-days per year, and they provide a monetary benefit of Rs. 5.70 crores to the 936 workers employed in running the units. On average, each entrepreneur earns a gross return of Rs. 28.18 lakh per year with an expenditure of Rs. 17.00 lakh per year. This leads to an annual net return of Rs. 11.20 lakh per entrepreneur and a benefit-cost ratio of 1.66. The total gross monetary benefit generated from these entrepreneurs is about Rs. 56 crores per year. The soy-based food processing industry, operating at the cottage and small scale level, has been successful in generating income and employment opportunities. In total, the 198 soybean processing units in India are generating employment for over 178,000 man-days per year and providing a monetary benefit of about Rs. 51 crores per year.

*Promotion of value-added soy food products will perfectly fit in to various Government programs such as Make in India, Atmanirbharta, enhancing rural income through FPOs etc. Setting up exclusive soy incubation centres will go a long way to promote entrepreneurship and provide start-up opportunities for young entrepreneurs in the area of nutrition and health foods.*