

Underutilized Yet Nutritious: Broad Beans as a Food Security Crop

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Introduction

Broad beans (*Vicia faba* L.), also known as faba beans, have been cultivated for millennia but remain underutilized in modern agriculture. Broad bean thrives in temperate and subtropical regions, making it the world's fourth most important legume after dry beans, peas and chickpeas. Young green beans of this crop can be eaten raw and fresh, along with their green, thick and fleshy pods, which are also edible. Rich in protein, fiber, vitamins and minerals, they offer significant nutritional benefits. Their ability to fix atmospheric nitrogen enhances soil fertility, reducing the need for chemical fertilizers. Despite its potential, broad bean cultivation has steadily declined worldwide over the past century. This manuscript explores the potential of broad beans to enhance food security, improve human health and promote sustainable agricultural practices.



Fig. 1. Tender green pods of broad bean in plant

(Source-

<https://www.istockphoto.com/photo/broad-bean-plants-gm1169588927-323380027>)

The Status of Broad Bean Cultivation in India

Out of over 50 nations that produce broad beans, the European Union (EU), Asia and Africa account for about 90% of global production (FAO, 2020). In 2020, China and the global production of broad beans amounted to 1.69 million and 56.8 million metric tons, respectively, followed by Ethiopia,

Australia and the United Kingdom. Cultivation of broad bean in India is not widespread and confined to limited acreage in Bihar, Madhya Pradesh and some part of Uttar Pradesh and hence it is classified as an unutilized, minor, less utilized and yet underexploited crop in India. Despite their nutritional richness and agronomic strengths, broad beans remain underutilized in both diets and agricultural systems in India and globally. One key reason for their limited popularity is the unavailability of high-quality seeds for efficient cultivation.

The Protein Crisis: Broad Beans Provide a Sustainable Answer

The growing demand for protein in both human and animal diets, coupled with the rising cost of animal-based proteins like meat and fish, has spurred an increased reliance on legumes for dietary protein and calories. However, traditional legumes in India such as green grams (*Vigna radiata*), field peas (*Pisum sativum*), lentils (*Lens culinaris*), grass peas (*Lathyrus sativus*), black grams (*Vigna mungo*) and lablab beans (*Lablab niger*), can only meet a small portion of the country's protein needs due to their small seed size and low yield. Global food security is also increasingly threatened by population growth, climate change and resource constraints. To tackle these challenges, diversifying crops with nutrient-rich and environmentally sustainable options is essential. To address this, there is a need to explore larger-seeded, high-yielding legumes and broad beans may play a crucial role in enhancing nutrition in India.

Nutritional Profile and Health Benefits of Broad Bean

Broad beans are a nutrient-packed food, delivering a perfect blend of protein, fiber, carbohydrates vitamins and minerals like other beans. Dietary phytochemicals, including phenolic acids, flavonoids, alkaloids, carotenoids, minerals and vitamins, exhibit lower potency than pharmaceuticals. However, their consistent intake through regular diets provides significant long-term health benefits. The low calcium-to-phosphorus ratio in broad beans may hinder calcium absorption, making it essential to pair

them with calcium-rich foods like dairy and leafy greens. However, the presence of anti-nutritional factors like phytohemagglutinins, protease inhibitors, polyphenols, saponins and phytates limits the broader

nutritional utilization of this bean. The approximate composition of various nutrients per 100 grams is given in Table 1.

Table 1: Nutritional composition of broad beans (per 100 g) and their functions

Composition	Quantity/ 100 grams	Functions
Macronutrients		
Energy	341 kcal	Provides fuel for body functions and metabolism
Protein	26-30 g	Essential for muscle growth, tissue repair and enzyme production. High protein content is ideal for livestock feed. They provide a plant-based protein alternative, beneficial for vegetarians and those reducing meat intakes.
Carbohydrates	58-60 g	Primary source of energy
Dietary Fiber	25 g	Aids digestion, supports gut health and regulates blood sugar
Sugars	5 g	Quick energy source
Fat	1-2 g	Supports cell function, hormone production and nutrient absorption
Vitamins		
Vitamin B1 (Thiamine)	0.5 mg	Helps convert food into energy and supports nerve function
Vitamin B6	0.4 mg	Involved in protein metabolism, neurotransmitter production and red blood cell formation
Vitamin B9 (Folate)	423 µg	Essential for DNA synthesis, cell division and red blood cell formation
Vitamin C	1.5 mg	Boosts immunity, promotes collagen formation and acts as an antioxidant
Minerals		
Iron	6-7 mg	Supports oxygen transport in the blood and prevents anaemia
Magnesium	100-120 mg	Regulates muscle and nerve function, blood sugar and bone health
Phosphorus	400 mg	Essential for bone strength, energy metabolism and cell repair
Potassium	1,000 mg	Regulates fluid balance, nerve signals and muscle contractions
Zinc	3 mg	Supports immunity, wound healing and enzyme functions
Other Beneficial Compounds		
L-Dopa (Levodopa)		A precursor to dopamine, potentially aiding in the management of Parkinson's disease symptoms.
Polyphenols and Antioxidants		Help combat oxidative stress and inflammation.

Broad Beans and Food Security

Incorporating broad beans into agricultural practices can strengthen food security by:

- **Diversifying Diets:** In India, where protein deficiency remains a challenge, incorporating broad beans into local diets can provide a vital, sustainable source of nutrition, improving overall dietary quality and addressing gaps in protein

availability, especially in rural and underserved areas.

- **Increasing Resilience:** *Vicia faba* is a climate-resilient species, capable of enduring drought, frost and suboptimal soils, making it a sustainable choice across varied environmental conditions.
- **Enhancing Livelihoods:** Broad beans hold great importance in global agriculture due to their exceptional yield potential, surpassing other

grain legumes. By cultivating them, farmers, particularly in developing countries, can unlock valuable economic opportunities and boost their livelihoods.

- **Multi-Utility Crop:** The cultivated broad bean serves as a source of human food in developing nations, whereas in developed nations it functions as a key component of animal diets, primarily for pigs, poultry, horses and pigeons. Green and dry cotyledons of broad bean are consumed as vegetable and pulse crop respectively, in the Eastern States of India, particularly in the hilly regions. In the Nilgiris District of Tamil Nadu, broad beans are used in culinary preparations during important occasions and festival times.
- **Animal Fodder:** Broad bean is a high-protein, sustainable fodder used for livestock, poultry and aquaculture, in various forms like raw feed, silage, green manure and processed by-products, with proper treatment to enhance digestibility and reduce anti-nutritional factors.

Agronomic Benefits

Broad beans promote sustainable agriculture by:

- **Nitrogen Fixation:** Broad bean is a nitrogen-fixing legume that forms a symbiotic relationship with *Rhizobium* bacteria, enriching soil and reducing the need for synthetic fertilizers, fixing 100-200 kg of nitrogen per hectare annually, depending on environmental conditions. This reduces the need for chemical fertilizers and enhances soil health.
- **Soil Structure Improvement:** Incorporating its residues into the soil can improve porosity, organic matter content, bulk density and enhance water retention capacity of soil and fix nitrogen even up to 200 kg ha⁻¹.
- **Crop Rotation:** Broad bean serves as a valuable "break crop" in regions where cereal monoculture systems are prevalent, contributing to soil nutrient renewal through biological nitrogen fixation and reduced susceptibility to biological pests.

Challenges and Considerations

While broad beans offer numerous benefits, there are several challenges that slow their widespread adoption:

- **Cultural Preferences:** Existing dietary habits and tastes may limit their acceptance.
- **Agronomic Issues:** The bean's vulnerability to specific pests and diseases necessitates effective pest management. Providing farmers with high-quality, a high-yielding seed is key to expanding cultivation and boosting productivity.
- **Economic Considerations:** Market demand and profitability play a key role in farmer's choices to grow broad beans.

Conclusion

Broad beans hold significant potential as a food security crop due to their nutritional richness and agronomic benefits. Overcoming barriers to their widespread adoption requires a strategic approach encompassing scientific research, farmer education and policy interventions to enhance their role in sustainable diets and agricultural systems.

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