



## Common Bean: A Highly Potential Pulse Crop for Nutrition and Health Benefits

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### Summary

The common bean is the most significant legume crop grown worldwide. It is a rich source of complex carbohydrates, crude fiber, protein, minerals, and other micronutrients. Its leaves and pods are eaten as a vegetable and grain as pulses. This crop is extremely diverse in terms of genetic makeup, manufacturing methods, surroundings, development patterns, and phenotypes. It mostly consists of the Andean and Mesoamerican gene pools. In the present scenario, many germplasm banks have been established, which are having five domesticated wild spp., and stock collection. Additionally, it is significant because it possesses disease-curing qualities, including anti-cancer, anti-diabetic, and low cholesterol compounds. Previously restricted to a few states in India, commercial production of common beans has increased over the past 20 years and is now available on regional, national, and international markets.

### Introduction

The common bean (*Phaseolus vulgaris* L.) is a highly significant grain legume crop, third in significance behind the soybean and peanut but first in direct human consumption (Broughton et al. 2003). Latin America's Mesoamerican and Andean regions can be identified as their genetic origins (Blair et al., 2006). Brazil and Mexico are the two largest domestic producers of common beans, although the United States, Canada, Argentina, and China are all significant international suppliers. It is commonly called Rajma or Rajmash in the northwestern Himalayan foothills of India. It is predominantly cultivated in the Indian states of Maharashtra, Himachal Pradesh, Uttarakhand, Jammu & Kashmir, Gujarat, and parts of Sikkim. However, India offers significant expansion potential for rajmash cultivation. Recently, farmers in the tribal zones of the district of Visakhapatnam (Andhra Pradesh) have successfully cultivated the rajmash variety on an area of around 10,000 hectares, particularly in Gudem Kothaveedhi, G Madugula, and Chiuntapalli. On the other hand, its cultivation throughout Rabi and summer is gaining favor in the northern Indian plains. Traditionally, Rajmash is grown in the Himalayan slopes during Kharif, but improved management in the lowlands allows for a greater harvest in Rabi.

### Botanical description

Domain	:	Eukaryota
Kingdom	:	Plantae
Phylum	:	Spermatophyta
Subphylum	:	Angiospermae
Class	:	Dicotyledonae

Order	:	Fabales/ Rosales
Family	:	Fabaceae
Subfamily	:	Papilionoideae
Tribe	:	Phaseoleae
Genus	:	<i>Phaseolus</i>
Species	:	<i>Phaseolus vulgaris</i>
Chromosome no.	:	2n=22
Common Name	:	Kidney bean, French Bean, Common bean

The common bean is an herbaceous annual plant in the Fabaceae family that is farmed for its edible green bean and pulses. The common bean can be bushy, vine-like, or climbing, depending on the cultivar. The primary stem has a cross-section that is cylinder-shaped or somewhat angular. Concerning branches, it has a larger diameter. The leaves are green or purple, alternately arranged on the stalks, and split into three oval leaflets with smooth edges. The leaves can reach 6-15 cm in length and widths 3-11 cm. It produces papilionaceous flowers about 1 cm in diameter and a wide range of flower color variations such as white, pink lilac, or purple observed with 1 standard, 2 wings, a bracteole, and a pedicel, and keels. Bean pods have an upright prostrate position in the plant and are 8-20 cm long by 1-1.3 cm broad. They can be green, yellow, black, or purple. Pod characteristics like length curvature and fleshiness might differ between species. There are four to six smooth, kidney-shaped bean seeds in each pod. A wide range of seed color variations was observed from Dark red to purple mottled and black to white and yellow. The size of common bean plants varies significantly, from bushy types 20-60 cm in height to vines or runner beans that can be 2-3 m in length.

### Uses

The common bean has numerous pre-harvest and post-harvest applications. It is commonly utilized in a variety of traditional Indian dishes. Green beans make vegetable salads, pickles, and other dishes. They can also be used to freeze food for later use. Besides, it is used as green fodder since it contains a high quantity of crude fiber, protein, and minerals. On the other hand, dried grain is used in various meals such as soups, curries, chaat, and kabab. Rajma Chawal is a popular dish among the Indian Punjabi community. Common beans have distinct aromas based on their climatic region. Uttarakhand's Munsiyari Rajma holds a GI (Geographical Indication) label, indicating that the unique taste and aroma are limited to a specific place. Its leaves are used to control household insects by some tribal groups in India. Because of their anti-inflammatory properties, its seeds have been utilized as herbal treatments. Smallholder farmers in the western Himalayas choose to plant traditional (landraces) and contemporary kinds of beans. They do this because they believe it makes the beans more resistant to local pests and diseases and improves yield stability.



**Figure 1: Wide range of variations for seed traits such as color, shape, and size in common bean.**

### Nutritional composition of common bean grains

According to reports, dry beans are a good source of protein and nitrogen (20–30%). One serving of cooked beans (90 g or 1/2 cup) contains 7 to 8 g of protein, or about 15% of the recommended daily requirement for a 70 kg adult. There are minor differences in values between species for histidine, isoleucine, lysine, phenylalanine, threonine, and valine, and some varieties contain arginine. Compared to cultivated crops, wild species have greater quantities of amino acids. Carbohydrates make up 55–65 percent of the dry weight of beans.

With tiny but significant levels of mono-, di-, and oligosaccharides, the principal components of these are the polysaccharide. Resistant starch, soluble and insoluble dietary fiber and non-digestible oligosaccharides are non-digested carbohydrates that pass through the colon. Common beans mostly include the cations calcium, magnesium, and potassium. Calcium is more readily available than magnesium or potassium. Wild genotypes had higher average mineral concentrations for copper (18 mg/kg), iron (60 mg/kg), manganese (23 mg/kg), zinc (29 mg/kg), and sulphur (234 mg/kg). Several antinutritional elements in raw beans may restrict ingestion. Some negative consequences are growth inhibition, poor nitrogen balance, reduced intestinal absorption of carbohydrates and amino acids, and a changed immunological response. Beans include phenolics, trypsin inhibitors, lectins, phytates, and non-digestible oligosaccharides among other antinutritional compounds, derivatives, and non-derived starch (dietary fiber). Beans are abundant in non-digestible carbs, which can be fermented in the large intestine, and slow-digesting carbohydrates. but Common beans play a significant role in human alimentation over the world

**Table.1 Nutritional components of cultivated domestic common beans**

Component	<i>P.vulgaris</i>	<i>P.mungo</i>	<i>P.lunatus</i>	<i>P.angularis</i>
Water (g/100 g)	12.1	9.05	10.17	13.44
Energy (kcal)	337	347	338	329
Carbohydrates (%)	69.11	68.85	70.55	72.67
Protein (%)	25.4	26.23	23.89	22.95
Fat (%)	1.7	1.26	0.768	0.612
Ash (%)	3.78	3.66	4.79	3.77
Fibre (%)	17.4	17.92	21.15	14.67
Sugars (%)	4.41	7.25	9.46	–
Starch (%)	37.42	–	–	–
Saturated fatty acids (%)	0.193	0.382	0.179	0.221
Monounsaturated fatty acids (%)	0.145	0.177	0.069	0.058
Polyunsaturated fatty acids (%)	0.993	0.422	0.344	0.131
Calcium (mg)	167	145	90.17	76.25
Cooper (mg)	0.949	–	–	–
Iron (mg)	6.24	7.41	8.36	5.75
Magnesium (mg)	199	208	249	147
Manganese (mg)	1.613	–	–	–
Phosphorus (mg)	463	403	428	440
Potassium (mg)	1348	1370	1919	1449
Sodium (mg)	5.69	16.49	20.04	5.78
Zinc (mg)	4.15	2.95	3.15	5.82
Vitamin A (IU)	0	114	–	17
Thiamine (mg)	0.882	0.683	0.564	0.526
Riboflavin (mg)	0.186	0.256	0.225	0.254
Niacin (mg)	2.489	2.475	1.711	3.038
Pantothenic acid (mg)	0.846	–	–	–
Vitamin C (mg)	–	5.28	–	0
Folate total (mg)	0.414	0.687	0.44	0.718
Vitamin B6 (mg)	0.487	0.42	0.57	0.405
Choline total (mg)	99.4	–	–	–
Betaine (mg)	0.113	–	–	–
Tocopherol total (mg)	2.5	0.56	0.8	–

**Note:** All values were given per 100 gm of raw seed on a dry basis\* values for minerals and vitamins higher than 0.1 mg; Data marked as (-) were not available (USDA, 2011)

## Health benefits of common bean

**Lowers Cholesterol:** Eight weeks of consuming one cup of baked beans by hypercholesterolemic individuals showed a marked reduction of total cholesterol (6%) and LDL (5%). Long-term feeding of beans reduces cholesterol and LDL (Low-Density Lipoprotein) serum levels. Hence lowering total cholesterol and LDL cholesterol (the bad cholesterol) reduces the risk of heart disease. The antioxidant properties of polyphenol lie in its ability to neutralize free radicals and the chelation of transition metals. Thus, they counteract the initiation and propagation of oxidative processes.

**Prevention of Cancer:** Epidemiological studies have found that beans and legumes consumption relates to a lower risk of breast cancer. Other epidemiological and preclinical studies evaluating colon and prostate cancer have provided additional evidence about an inverse relationship between bean consumption and cancer development. Black and Bayo cultivars of common beans contains fermentable substrates with a non-digestible fraction that prevents early and advanced development of colon cancer.

**Suitable for Diabetics:** The regular consumption of common beans is beneficial in preventing and managing diabetes. Clinical studies show that consuming three or more servings of beans in a week decreases the menace of diabetes by almost 35%, compared to less or non-consumption of beans. In vivo studies have also demonstrated that beans containing phenolic compounds reduce blood glucose, glycosylated hemoglobin, and elevated insulin levels in the animals, and black beans containing total phenolic, tannins, and anthocyanins, ameliorate type-2 diabetes.

## Conclusion

Common bean has several beneficial biological activities in humans, as an antioxidant source, cholesterol- and low-density lipoprotein-lowering properties, antimutagenic and anticancer effects, cardiovascular disease, diabetes, and obesity. Therefore, it is essential to increase the consumption of beans and take advantage of the benefits.

## References

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