Review Article

Rediscovery of Common Bean landraces at Tribal regions of Balaghat (MP)

Abstract

Common bean is the most important grain legume for direct and indirect human as well as animal consumption on a global scale and this crop shows great phenotypic variation, which enables its production in a wide range of agroecosystems and cropping systems. They are proven superfoods, but still many of those *Phaseolus* species are not mainstreamed in our food system. In the tribal blocks of Balaghat district of Madhya Pradesh (Baihar, Birsa, Paraswada, Lanji, and Kirnapur) high amount of genetic diversity in common bean (*Phaseolus vulgaris* L.) their wild populations and also in the traditional varieties or primitive landraces are found and many of them are maintained at College of Agriculture Balaghat (MP).

The importance of common bean landraces in agriculture cannot be neglected. Beans are not just a convenient plant source of protein and dietary fiber, they also boast a number of nutrients, too. Consumption of unbalanced foods affects billions of people worldwide, and leads to poor health and socio-economic conditions. Many primitive landraces have medicinal properties, they contain folate, iron, thiamin, vitamin K, phosphorus, magnesium, manganese, and potassium. Their health benefits include promoting heart health, stabilizing blood sugar, boosting digestive functions, maintaining and repairing the body, and supporting weight loss. Beans are edible in fresh, dried, and canned form, most types of dry beans are rich sources of iron, which makes them important for vegetarians and vegans who do not get an animal source of iron.

Conservation of the genetic resources of common beans for agricultural development and global future food and feed security is imperative, including cultivated species, and wild relatives. The growing phenomenon of genetic erosion implies the identification and conservation of such type important and neglected crop plants.

Keywords: Conservation, Genetic Resources, Landraces, Tribal, Variety

Introduction

The conservation of crop genetic resources is a fundamental step for further breeding of traits of interest. The common bean (*Phaseolus vulgaris L.*) has a major role in agriculture and has tremendous ecological and nutritional value also. The genus *Phaseolus L.* consists of 76 species from the New World (1), and five species, tepary bean (*P. acutifolius* A.), runner bean (*P. coccineous* L.), lima bean (*P. lunatus* L.), year-bean (*P. polyanthus*) and common bean (*P. vulgaris* L.), are under cultivation in the world (2,3). Among the cultivated species, the common bean is dominant with a growing area ratio of 90% (4). Its production declined in recent years to the extent that its diversity is being threatened with extinction (5).

Common beans are a New World crop with worldwide significance for human nutrition. Bean is a traditional grain legume cultivated and bred in Romania. The legume is cultivated principally for its dry(mature) beans, shell beans (seeds at physiological maturity), and green pods. When consumed as seed, beans constitute an important source of dietary protein (22% of seed weight) that complements cereals (6).

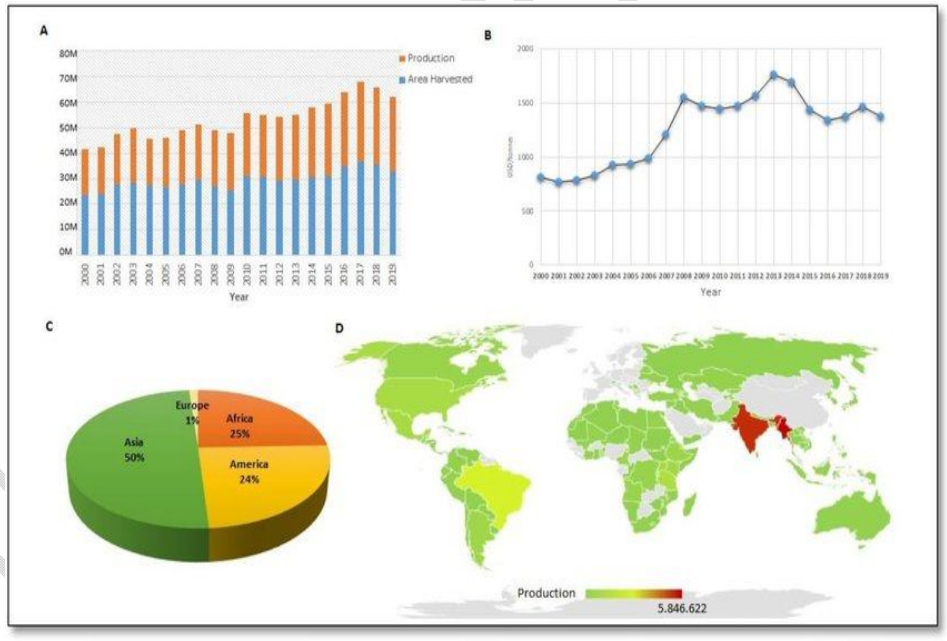

Figure 1: common bean production in the world. (a) evolution of common bean seed production and area under cultivation from 2000 to 2019. (B) evolution of sale prices of common bean seed from 2000- 2019. (c) production share of common bean seed by continent in 2019. (D) map of production quantities of common bean seed by country in 2019 (7)

Common bean is an important landrace-rich grain legume widely produced for direct human consumption and it is known to be an affordable source of dietary proteins to low-income households in many developing countries (8,9). This crop is also called kidney bean, haricot bean, French bean and field bean. Understanding the nutritional properties, and positive impact on soil health as well as using values that allow its maintenance in our agricultural system is a prerequisite to developing efficient strategies for its conservation.

Common bean is a diploid annual plant that belongs to the Fabaceae family in the genus *Phaseolus*, which has about 50 species globally and is joined by two other species (lima bean, *Phaseolus lunatus* , and scarlet runner bean, *Phaseolus coccineus*) (10). Common bean is widely and commonly cultivated throughout the world for multiple functions. The species produces white, yellowish, pink, or violet-purple flowers and ovate or ovate-rhombic, acuminate, pubescent leaflets and a mosaic of seed colors, sizes, and shapes. The species is mainly self-pollinated with some degree of out-crossing (11). Therefore, collecting, identifying and documenting common bean landraces is essential for future utilization, conservation, and improvement. Understanding the extent and distribution of common beans in the bean-growing tribal region of balaghat. This study focused on the documentation of the diversity and the ethnobotany of common bean landraces in selected zones of its high production areas in Balaghat.

Back to the wild

Landraces are repositories of gene pools that enrich biodiversity and sustainably stabilize ecosystems to make them functional. Man through over-exploitation of some plant species with utter neglect to some others either deliberately or otherwise through modern agricultural systems that promote the cultivation of a few high-input and high-yielding crop species caused disaffection to biodiversity with consequences of the reduction in its regulatory services. Beans are proven superfoods, but still many of those *Phaseolus* species are not mainstreamed in our food system. Among other things, the landrace of beans is distinguishable by its adaptability to a particular environment, resilience, cultural values, and organoleptic properties. It is a population having a historical origin, and distinct identity and lacks formal crop improvement being locally adapted and associated with traditional farming systems (12)

Beans diversity in a tribal region

The knowledge of tribal people in traditional agriculture is invaluable. Their farming practices are truly sustainable in many ways. As the world increasingly switch to sustainable

farming practices, tribal communities such as Gond and Baiga of Balaghat District appeared to be the pioneers of the technique. They grow conventional varieties such as millet, rice, legumes, and vegetables. The incredible diversity is observed in 60 landraces of common beans collected from Baihar, Birsa, Paraswada, Lanji, and Kirnapur tribal blocks of Balaghat district of Madhya Pradesh, India.

The high variability was observed in morphological traits like seed color, shape, size, twining habit, time of flowering, anthocyanin pigmentation in the stem, leaflet size, flower color, flower size, and 100-seed weight. Some landraces have developed tolerance to particular abiotic and biotic stresses, (13) many of which show resistance to pathogens, pests, and various biotic stresses. (14) They are morphologically distinct in the eyes of farmers who consider a combination of characteristics that include morphological, growth, food quality as well as ecological adaptation to delimit one from the other (15).

Figure 2: Diversity in bean

Figure 3: Variation in Sshape size and

Nutritional value of beans

Beans were pearled to evaluate the feasibility of increasing antioxidant activity and phenolic antioxidants. Beans are highly nutritious fresh as well as in dried form, the health benefits of beans are endless. There is no cholesterol present in beans, which makes them heart-healthy vegetables. Beans are high in both soluble and insoluble fibers. Thus, they absorb the bad cholesterol present in the body (16) According to a survey, a person can lower the bad cholesterol level by 10% in 6 weeks by eating one cup of cooked beans on daily basis. This consumption of beans automatically reduces the risk of heart disease by 20% (17,18). Lectins/hemagglutinins are a type of carbohydrate-binding proteins which are abundantly stored in legumes. Their eminent pH stability allows them to survive digestion and remain active in the intestine where they may have direct contact with colorectal tumors. It is therefore interesting to explore the direct interaction between lectins/hemagglutinins and colorectal cancer (19).

Fresh Beans

One cup of green beans (100g) provides 31 calories, 1.8g of protein, 7g of carbohydrates, and 0.2g of fat. Green beans are an excellent source of vitamins C, K, and A. The following nutrition information is provided by the USDA.(20) Like many other vegetables, green beans are a healthy addition to almost any eating plan because they are a low-calorie, low-fat energy source. They are also nutrient-dense, providing many beneficial

vitamins, minerals, and antioxidants without many calories. This combination makes them an ideal food for a diet promoting a balanced weight. .(21) The B vitamins found in green beans can help lower levels of a compound called homocysteine in the blood. High levels of homocysteine can impair cognitive function. .(22) They have a high fiber content, and therefore are helpful for controlling diabetes by reducing insulin generation and glucose levels that enter the bloodstream. As well, those with non-insulin dependent diabetes can prevent the requirement of insulin by up to 40% by consistently consuming green beans, according to researchers. .(23,24)

Dry Beans

Dry beans are rich in both soluble and insoluble fibers (25). Dry beans also provide substantial amounts of insoluble fiber, which help attract water to the stool and keep you regular. This may help to combat constipation, colon cancer, and other digestive health conditions (26). It contains Complex carbohydrates, which are referred to as dietary starch, and are made of sugar molecules strung together like a necklace. Complex carbohydrates are typically rich in fiber. The majority of the calories in dry beans come from carbohydrates in the form of starch, resistant starch, and small amounts of non-starch polysaccharides. Being rich in complex carbohydrates, as well as a good source of protein, beans have a low glycemic index. This makes them an ideal food for the management of insulin resistance, diabetes, and hyperlipidemia. (27,28). Beans contain some complex sugars called oligosaccharides, which are non-digestible, fermentable fibers. They are broken down by beneficial bacteria in the colon, which may result in gas production and flatulence. There is increasing research and attention on the health of the gut or gastrointestinal (GI) tract, and how certain foods benefit or harm the gut (29,30).

Impact of bean cultivation on soil health

Beans, are widely grown not only as an important protein source for food and feed but as a component in different cropping systems to improve soil quality. Beans are grown using different soil management practices, moreover, legume seeds are often inoculated before sowing. Microorganisms, introduced in the soil as an inoculum, affect not only inoculated plants, but these microorganisms can remain in the soil for the next growing season and can also affect the subsequent crops (31). Due to the ability to form nodules, can fix nitrogen from the atmosphere, and thus they contain one or more types of microorganisms (32). Beans in association with Rhizobium can fix from 25 to 120 kg N / h. As a legume, it supplies nitrogen to the soil by forming a symbiotic or mutually beneficial partnership with rhizobia

through the biological nitrogen fixation process. The use of biofertilizers can provide quality products for human consumption by way of reduction of the chemical residues and also reduces the risk of environmental pollution (33). However, due to the increase in the prices of chemical fertilizers and also with a view to maintaining the ecosystem of soil, it has become necessary to minimize the use of chemical fertilizers by adding organic ones to the soil more particularly biofertilizers of microbial origin. Now a day's use of biofertilizers such as consortia, Rhizobium, *Azotobacter, Azospirillum*, PSB and Pseudomonas etc. have been found to be very effective tools for improving yield and quality of the crop as well as maintains fertility status of the soil (34).

Conclusions

Traditional values associated with common bean landraces in the central region of India increase their chance of survival in the farming systems. Socio-demographic characteristics and the medicinal properties of respondents which influence common bean use values must be taken into account in future programs of conservation. However, an assessment of diversity and analysis of the distribution of the extent of common bean landraces in the study area is a necessity for the development of an efficient strategy for the conservation of this genetic resource. Conservation of this remarkable genetic diversity is recommended for future propagation, breeding, and the investigation of genetic relationships.

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