Common bean (*Phaseolus vulgaris*), also called black bean, is an important staple food in Guatemala, where it is widely produced and consumed, occupying a second place as source of food after maize. Bean production in Guatemala predominantly occurs in poor small-scale hilly farms characterized by degraded land where yields are low and most production is used for home consumption. High climatic variability in these areas has been further aggravated in recent years by the presence of long periods of drought, which are challenging bean production in combination with increased incidence of pests and diseases. These problems are particularly severe in the Dry Corridor of Guatemala, a semi-arid region characterized by frequent periods of drought, heat, and poor soil. Given that many farming communities depend on common bean for subsistence, the increasing heat and drought being registered in the country are a major concern that can cause significant losses of this crop with very serious effects for food and nutrition insecurity of the population.

In this context, the cultivation of tepary bean (*Phaseolus acutifolius*) represents an interesting option for tackling many of the above-mentioned problems which challenge common bean production in Guatemala. Tepary bean, which belongs to the secondary gene pool of common bean (viable hybrids between the two species have been realized by breeders), is a species well-adapted to arid conditions, exhibiting a high level of drought, heat, and cold tolerance. The species has a short biological cycle (typically producing seeds only after 60 versus 90 days in common bean), its seeds have a high nutritional value (especially in terms of fiber, carbohydrates, and protein) and its plants have shown greater tolerance to common bacterial blight than common bean. Tepary bean is fairly high yielding, outperforming common bean by at least 50% in hot environments. Its introduction to semi-arid zones has potential to bring important benefits for farmers as a
strategic ally in making production and food systems more resilient to climate change. The high iron content of tepary bean (10.7%) can also be strategic for improving nutrition, as it is higher than that in navy (6.4%), red kidney (6.7%), and pinto (5.9%) beans.

Tepary bean originated in Mesoamerica and the south-western USA has been cultivated historically in Guatemala, although today it is only very rarely produced in this country and the crop has nearly been forgotten. Owing to tepary bean’s strategic features, Bioversity International and the Universidad del Valle de Guatemala (UVG) have been investigating the potential for tepary bean to diversify bean production for better resilience under climate change. As the market potential and willingness of farmers to adopt a new bean species are critical factors that would affect the success of this strategy, an investigation was carried out in 2017 to assess bean value chain stakeholder perspectives and potentials for adopting and commercializing this species. The study deployed a Rapid Market Appraisal methodology to collect qualitative data through semi-structured interviews of different stakeholders engaged in the value chain of common bean, including producers, producers’ organizations, wholesalers, processing industry, consumers, indirect actors and other informed participants.

### Tepary beans in Guatemala

Tepary bean is occasionally grown on small-scale farms in Guatemala, mainly in home-gardens on the south-western coast. Production, consumption and marketing of this crop in the country are extremely limited. In 1998, Otzoy and colleagues from Universidad de San Carlos de Guatemala (USAC), carried out a germplasm collecting mission in the Departments of Suchitepéquez, Quetzaltenango, Retalhuleu and San Marcos of Guatemala, during which 36 traditional tepary bean varieties were gathered. The sampled populations were characterized and evaluated for supporting future breeding activities. According to these authors tepary beans were found to be widely used by people for the preparation of traditional food recipes typical of the surveyed regions, especially among Maya Quiché, Mam, and Tzutuhil ethnic groups. Interestingly, in 2016 the same researchers returned to the same areas for a follow up collection but they were
not able to find any tepary bean variety, which made them conclude that a heavy genetic erosion had taken place on this crop in Guatemala. These investigators hypothesized that the main reasons that contributed to the neglect of tepary bean in the southwestern coast of the country was the increasing occurrences of prolonged droughts, erosion of traditional food cultures among indigenous communities, decrease of consumers’ interest on the species partly due to the small seed size compared with common bean, culinary characteristics (tepary bean requires longer cooking time) and seed coat color (which is mostly white, brown, and speckled, and notoriously Guatemalans appreciate black beans in their food preparations). Other factors that were recorded in farmers’ interviews conducted during this mission include limited access to land, low market demand, poor information on tepary bean’s performance and ways to improve its cultivation.

**Tackling problems and seizing opportunities**

During the value chain study carried out by Bioversity and UVG in 2017, additional traits that hinder the popularization of tepary beans were recorded, including the presence of wrinkles on the seed coat which makes people believe tepary beans are coming from old harvests and thereby needing longer cooking time, small seed size (smaller than most other bean types), round seed shape (Guatemalans prefer kidney-shaped beans), and opaque color (shiny types are preferred). Tepary bean moreover has specific culinary features, which could pose a challenge for its popularization, including a distinctive flavor (nutty and sweet), production of thin clear broth when cooked (rather than a preferred thick and dark broth), and longer cooking time as compared to common bean. The long cooking time is particularly disadvantageous in areas where fuel supplies are scarce. With regard to cultivation practices, tepary bean has been found to be susceptible to golden mosaic virus, its thin pod walls are prone to shattering and seed rotting in wet climatic conditions, and laboriousness during harvests was also recorded because of small pod size and thin pod skin. It can be considered that these pitfalls are the result of a lack of research investments for this neglected and underutilized species, which could improve its productive and culinary characteristics with similar success as has been achieved in the development of common bean.

In spite of these limitations, common bean value chain actors interviewed during our study showed keen interest in tepary bean, especially for its heat and drought tolerance traits, nutritional content and ability to achieve higher yields under stress conditions compared with common beans. Producers’ organizations, wholesalers, processing industry and consumers expressed the desire to have access to the germplasm of tepary beans in order to try it out and see by themselves their productive, culinary, market, and processing potentials. Leaders from the bean producers’ organizations remarked that as long as tepary beans have good productive features, their flavor or appearance would not be such a limiting factor, given that they would prefer harvesting some beans than to have nothing at all. Hence, the leaders from these organizations, which are comprised by 550 bean producers, were optimistic that tepary beans could be a good alternative for food security, especially in the Dry Corridor, where drought has become such a limiting factor for growing common beans.

An additional important reflection came from wholesalers, who stated that the best moment to introduce a new type of bean to the market is during the period when beans are less present in the market; so, they suggested to sell tepary beans in the May-August period, during which common beans harvests are very low (sharp shortages of this crop occurring especially in June-July). During these months, markets are

![Cooking with tepary beans. Credit: Bioversity International/N. Amaya](image-url)
supplied with reserves of stored beans or with grain imports at very high prices and hence selling tepary bean would advantageous. Interestingly, consumers view on that regard is also positive: as beans are an essential food in their diets they are willing to accept the different features of tepary bean (such as size, shape or texture of the grain), as long as they have a good taste and are sold at reasonable price.

A very encouraging result of our survey was also the fact that the food industry is willing to carry out initial controlled trials to analyze the industrial potential of tepary beans and ascertain whether this crop can meet some of those basic needs that the industry requires (e.g. consistency, size and nutritional content after cooking).

**Recommendations**

Tepary bean is a strategic crop for building more resilient production and food systems in Guatemala. To popularize its use, it is recommended to evaluate a set of varieties in participatory trials to identify the varieties that may present more desirable characteristics for Guatemalan consumers e.g. thick and dark broth, smooth surface, soft shell (easier to digest and shorter cooking time), good taste and cooking time less than 60 minutes. The remarkable drought tolerance of tepary bean could help ensure a more stable and resilient source of protein-rich food and to that regard, farmers can cultivate a small plot of tepary bean to compensate recurrent losses faced in common bean fields. Tepary bean deserves further research attention to assess and promote its potentials as an alternative and complementary source of food for subsistence and vulnerable farmers in rural areas affected by severe drought, such as those in the Dry Corridor, where the species would be a reliable drought-insurance crop. With regard to marketing strategies for tepary bean, it will be important to choose the most suitable period for its commercialization, so as to avoid competition with common beans. Tepary bean can be promoted not in competition with common bean, but rather as a complementary crop for a diversified farm portfolio. Producers should also know that tepary beans production costs may be lower than those encountered in common bean, because the former requires less water, chemicals and labor, which can have an added value for female producers, who have less access to these resources than men.

A variety of dishes cooked with tepary beans. Credit: Bioversity International/N. Amaya