EMBRAPA COMMON BEAN BREEDING PROGRAM: MAIN OBJECTIVES AND OPPORTUNITIES FOR COLLABORATIONS

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Brazil is a major producer and consumer country of common bean worldwide (FAO, 2019). In 2018, around 2.25 million tons of beans were harvested on 1.50 million hectares (Feijão, 2019). Several commercial classes are grown in three distinct growing season, on the majority states of the country. The national market is divided into approximately 70% carioca beans, 20% black beans, and 10% other commercial classes.

The Embrapa common bean breeding program is one of the pioneers in Brazil, being developed for over four decades (Melo, 2009; Faria *et al.*, 2013). From 1984 to 2019, 71 new varieties were released, which currently cover over 50% of the Brazilian seed market share. The Embrapa breeding program objectives include the release of varieties adapted to different production systems and regions in Brazil, with high yield and production stability, besides commercial, culinary, nutritional and functional seed quality. In addition, the program aims to develop varieties resistant to major biotic and abiotic factors restricting production, efficiency in nutrient uptake and use, including efficiency in biological nitrogen fixation. Different breeding methods are used, such as backcrossing, recurrent selection, and modified pedigree and bulk methods. Marker-assisted selection and genetic engineering have also been used for disease resistance and seed quality traits (Melo, 2009; Faria *et al.*, 2013; Souza *et al.*, 2018; Rodrigues *et al.*, 2019).

In addition to the carioca and black commercial classes, varieties from several other market classes have also been developed, including "mulatinho", "roxo", "rosinha", "jalo", "rajado" (medium-sized cranberry-sugar bean), "vermelhinho" (medium-sized red seeded beans), white, cranberry-sugar bean, dark red kidney, light red kidney and calima types, focusing on internal gourmet or international markets.

Technical and/or financial collaborations have been established with 31 research centers and institutions, including 10 Embrapa research centers, nine Brazilian state research institutes, nine universities and three international research institutions (CIAT, Cali, Colombia; USDA, Beltsville, EUA; and NARO, Kampala, Uganda). However, there is room, opportunity and interest in establishing collaborations with the world scientific community to advance knowledge and to develop technical solutions to improve the common bean crop.

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