Advances in breeding and biotechnology of legume crops

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Abstract

Legume crops are relevant globally to the feeding and the nutrition of humans and animals because of their relatively high seed content of protein and essential amino acids. Additionally, they are related to sustainable agriculture, considering their ability to associate with atmospheric nitrogen fixing bacteria (Rhizobia). Despite this, several technical constraints of legumes crops have maintained their worldwide production far behind from cereals. This review article focuses in current information about recent advances in breeding and biotechnology of the major leguminous crops. Conventional breeding has mainly focused in improving multiple vegetative and reproductive traits that have associated to distinct heritability values, which reflects how amenable each character is for genetic improvement. Legumes have strongly entered into the genomics era through the complete genome sequencing of several species in the last decade. Moreover, a wealth of tools and techniques of Fabaceae genomics are now available and discussed throughout this article. In addition, there is an increasing amount of quantitative trait loci, candidate genes, and genes associated to abiotic and biotic resistance and to agronomic traits that have been reported, which will potentially allow more rapid progress of legume genetic improvement. Two successful examples of genetically modified legume crops are examined in this paper: glyphosate-resistant transgenic soybean and transgenic common bean resistant to Bean golden mosaic virus. Finally, legumes genomics and breeding programs, using classical breeding methods, marker-assisted selection, and biotechnological tools face a promising momentum for further application of technology and information that could boost their global production.