

FIELD SCREENING AND SELECTION OF COMMON BEAN CARIOCA SEEDED PROGENIES WITH MULTIPLE RESISTANCE TO BCMV, BGMV AND CPMMV

Thiago Lívio P. O. Souza^{1*}, Rodrigo S. Silva², Josias C. Faria¹, Adriano M. Knupp¹,
Marcelo S. Aguiar¹, Helton S. Pereira¹, and Leonardo C. Melo¹

¹Embrapa Arroz e Feijão, Santo Antônio de Goiás, GO 75.375-000, Brazil;

²Universidade Federal de Goiás (UFG), Goiânia, GO 74.690-900, Brazil;

*Corresponding author: thiago.souza@embrapa.br

INTRODUCTION

Common bean (*Phaseolus vulgaris* L.) is among the most important edible legume crops in the world, mainly because of its social and economic importance as well as its high nutritional value. Brazil is the world's largest producer and consumer country of common bean (FAO, 2017). Approximately 70% of beans consumed by Brazilians come from the carioca market class (light beige seeds with light brown stripes, nearly full elliptical shape, opaque, not shiny), making it the most popular commercial class in Brazil, although it has very restricted consumption in other countries (CONABE, 2017). Despite the genetic progress obtained in the last decades, the common bean crop still present an average seed yield below its yield potential in Brazil. One of the factors that compromise the yield performance and reduce the commercial quality of seeds is its susceptibility to a large number of diseases. Among these diseases, viruses caused by *Bean common mosaic virus* (BCMV), *Bean golden mosaic virus* (BGMV) and *Cowpea mild mottle virus* (CPMMV) are major concerns, mainly in Central Brazil. Seed yield losses ranging from 40 to 100% are being reported, depending on the rate of occurrence, time of sowing, time of plant infection, and cultivar choice (Faria *et al.*, 2016). The main goal of the present work was to evaluate common bean elite progenies from the carioca market class in the field and select those with multiple resistance to BCMV, BGMV and CPMMV.

MATERIAL AND METHODS

Two field nurseries were carried out at Embrapa Arroz e Feijão (Santo Antonio de Goiás, GO, Brazil) during the rainy growing season of 2016 and the dry growing season of 2017. Thirty-nine elite progenies were evaluated, all harboring the transgenic event Embrapa 5.1 which confers resistance to BGMV, as well as three carioca seeded control cultivars (BRS Estilo, BRS FC402 and BRS FC401 RMD). Of these 39 progenies, 10 derived from the cross BRS Estilo × CNFCT 16206, on generations BC₄F_{4:6} and BC₃F_{5:7}, and 29 from the cross BRS Sublime × BC₃F₁ (BRS Estilo × CNFCT 16206), on generations F_{3:6} and F_{4:6}. Both nurseries were carried out in a randomized block design with three replicates, using the regular technologies recommended for the crop but without control of diseases and pests. The plots consisted of four 4.0 m–rows with 0.5 m between rows and 10–12 plants/m. The scoring scale used to evaluate virus severity ranged from 1 (absence of disease symptoms and signs of pathogens) to 9 (80-100% disease severity or plant death) (Melo, 2009). Individual and combined variance analyses (p <0.01) were performed using the F test. The comparison of means were accomplished by the Scott-Knott method (p <0.05).

RESULTS AND DISCUSSION

The combined analysis for virus severity showed variability between progenies, environments, and the presence of $G \times E$ interaction ($P \leq 0.01$). As expected, this differential response of the progenies to the environments is because of the highest natural pressure of viruses in the dry growing season (Souza *et al.*, 2017). All progenies showed effective resistance to BCMV and BGMV, exhibiting mean severity scores of 1.0, whereas the conventional controls were susceptible to BGMV, exhibiting mean severity score ≥ 6.0 . It was not possible to evaluate the severity of CPMMV in the control cultivars since the symptoms were totally confused or hidden by the symptoms of BGMV. For this reason, as previously reported by Souza *et al.* (2017), the severity of CPMMV was evaluated only in elite progenies. Twelve progenies showed mean score for CPMMV severity ≤ 3.0 and, therefore, they were selected as resistant to BCMV (gene *I*), BGMV (event Embrapa 5.1) and CPMMV (resistance gene(s) under characterization). Individual plants were selected from these 12 progenies to develop carioca seeded inbred lines homozygous for the resistance to the three viruses. This breeding step is being aided by marker-assisted selection and artificial inoculation. The resulting inbred lines will be further tested in final field trials for a wide agronomic performance evaluation beginning next year.

ACKNOWLEDGMENTS

This work is supported by Brazilian Agricultural Research Corporation – Embrapa (Grant No. 02.14.01.004.00). T.L.P.O. Souza, H.S. Pereira and L.C. Melo are supported by Brazilian Council for Scientific and Technological Development (CNPq).

REFERENCES

- CONABE – Companhia Nacional de Abastecimento. 2016. Indicadores da agropecuária. <http://www.conabe.gov.br> (accessed on 29 Nov. 2017).
- FAO – Food and Agriculture Organization of the United Nations. 2016. Faostat. <http://faostat3.fao.org/browse/Q/QC/E> (accessed on 29 Nov. 2017).
- Faria J.C., Aragão F.J.L., Souza T.L.P.O., Quintela E.D., Kitajima E.W., and Ribeiro S.G. 2016. Golden mosaic of common beans in Brazil: management with a transgenic approach. APS Features. doi:10.1094/APSFeature-2016-10.
- Melo L.C. 2009. Procedimentos para condução de ensaios de valor de cultivo e uso em feijoeiro-comum. Embrapa [Documentos, 239]. Embrapa, Santo Antônio de Goiás, GO.
- Souza T.L.P.O., Faria J.C., Aragão F.J.L., Del Peloso M.J., Faria L.C., Wendland A., Aguiar M.S., Quintela E.D., Melo C.L.P., Hungria M., Vianello R.P., Pereira H.S., and MELO, L.C. 2017. Agronomic performance and yield stability of the RNAi-based Bean golden mosaic virus resistant common bean. Crop Science, in press (doi:10.2135/cropsci2017.06.0355).