

RECURRENT SELECTION PROGRAM FOR ANGULAR LEAF SPOT RESISTANCE IN CARIOCA SEEDED COMMON BEAN

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The common bean (*Phaseolus vulgaris* L.) crop is susceptible to different diseases. The majority of them causes significant yield losses and drastically affects grain quality. One of these diseases is the angular leaf spot (ALS), caused by the fungus *Pseudocercospora griseola* (Sacc. Ferr). Losses caused by ALS can affect up to 80% of grain yield when bean plants are early infected. A desirable method to control this disease is the use of resistant cultivars. However, the development of cultivars with effective resistance is being a challenge for the common bean programs worldwide. The reason for that is because ALS resistance is a complex trait, controlled by major and minor genes (Caixeta *et al.* 2005; Borel *et al.* 2010). Thus, a breeding method proposed and used in Brazil by the Embrapa common bean breeding program aiming to develop resistant cultivars is the recurrent selection (RS). RS is a dynamic and continuous breeding process involving the development of individual genotypes and progenies, their evaluation for different traits, followed by the selection and intercrossing of the superior ones. The objective of this breeding strategy is to increase the frequency of favorable alleles associated with the expression of the traits under selection. The main goal of this work was to develop and evaluate carioca seeded common bean SR populations and progenies resistant to ALS.

The initial population was formed during the years 2008 and 2009 using a conical crossing design between eight different ALS resistance sources previously identified. The initial parents were the lines: MA-1-15-13, 2003200396, CNFC10755, MA-1-2-10-1, CNFN10284, MA-1-8-9, 203200330, and CF220249. The C₀S₀ population formed by about 5,000 plants was evaluated at Embrapa Research Center, in Santo Antônio de Goiás, GO, during the winter season of 2009. Then, the resulting C₀S₁ and C₀S₂ generation were evaluated during the fall and summer seasons of 2010, respectively, in Ponta Grossa, PR. Aiming a better field screening of the C₀S₂ generation for ALS resistance, it was also evaluated during the fall season of 2011, in Santo Antônio de Goiás and Ponta Grossa.

Using the results obtained from the multisite evaluation accomplished in three different environments, 613 individual C₀S₂ plants were selected based on grain yield and resistance to ALS. The resulting C₀S_{2:3} seeds were grown for generation advancement and seed increase during the winter season of 2011, in Santo Antônio de Goiás, GO. The subsequent C₀S_{2:4} progenies were grown during the fall season of 2012, in Santo Antônio de Goiás and Ponta Grossa. Out of these C₀S_{2:5} progenies, 55 were selected as superiors based on their agronomic performance in both environments, mainly considering grain yield, aspect of carioca grains, and ALS resistance. These selected 55 C₀S_{2:5} progenies and two carioca seeded control cultivars (BRS Sublime - resistant to ALS, and BRS Horizonte - susceptible) were evaluated during the fall season of 2013 in Ponta Grossa, PR. This field trial used a randomized complete block design with two replications, being each plot formed by two rows three meters long. All treatments were evaluated for ALS reaction and for the reaction to other diseases, in addition to grain yield, architecture of plants and resistance to lodging according to Melo (2009).

The results obtained during the fall season trial in Ponta Grossa, PR were used to select 10 C₀S_{2.5} progenies as superiors based on grain yield, ALS resistance and other important agronomic traits (Table 1). Out of these progenies, four (SRCMA.127, SRCMA.23, SRCMA.26 and SRCMA.320) presented ALS mean severity scores lower than the score presented by the cultivar BRS Sublime, the resistant control (Table 1). SRCMA.23 and SRCMA.26 were among those presenting high yield. Based on these results, these 10 selected progenies are being used to develop elite lines and for recombination aiming to obtain a new cycle of recurrent selection (C₁S₀ generation).

Table 1. Average yield, ALS mean severity score and other important agronomic traits presented by the 10 selected C₀S_{2.5} carioca seeded progenies derived from the Embrapa common bean recurrent selection program for ALS resistance. Fall season of 2013, Ponta Grossa, PR, Brazil.

Progeny	AY (Kg/ha) ^a	Mean score (1-to-9 scale) ^a				
		AN	ALS	CBB	AP	RL
SRCMA.26	3,226.4	5.5	2.5	3.0	6.0	5.5
SRCMA.23	2,449.4	3.5	2.5	3.0	6.0	3.5
SRCMA.73	2,375.4	2.5	4.0	5.0	5.0	4.5
SRCMA.34	2,197.8	2.0	3.5	6.0	5.5	4.0
SRCMA.320	2,153.4	6.0	2.5	4.5	5.5	4.0
SRCMA.75	1,909.2	3.0	3.5	3.0	5.0	4.0
SRCMA.28	1,779.7	4.5	3.5	4.5	6.5	7.5
SRCMA.127	1,391.2	4.0	2.0	2.5	5.0	4.5
SRCMA.29	1,391.2	6.5	3.5	4.0	7.0	7.0
SRCMA.147	1,328.3	3.5	3.0	3.0	5.0	3.0
BRS Sublime	1,180.3	8.0	3.0	5.0	5.5	4.5
BRS Horizonte	799.2	1.0	9.0	6.0	5.0	3.0
Mean	2,020.2	4.2	3.5	4.1	5.6	4.6
CV (%)	13.4	36.9	22.4	22.2	11.0	26.0
Tukey (5%)	1,073.3	6.5	4.8	5.0	2.7	5.4
F-value	8.4	3.3	3.7	2.1	2.4	2.5

^aAY: average yield; AN: anthracnose severity; ALS: angular leaf spot severity; CBB: common bacterial blight severity; AP: architecture of plants; RL: resistance to lodging.

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