EVALUATION OF THE LATE SEED-COAT DARKENING OF CARIOCA TYPE DRY BEANS

Lilian Cristina Andrade de Araújo[1]; Magno Antonio Patto Ramalho[2]; Ângela de Fátima Barbosa Abreu[3]

[1]Universidade Federal de Lavras (UFLA), e-mail: araujo.l.c.a@gmail.com, magnoapr@dbi.ufla.br; and [2]Embrapa Arroz e Feijão/ UFLA, e-mail: afbabreu@dbi.ufla.br

INTRODUCTION

Most of the dry beans grown in Brazil are of the carioca grain type, that is, cream color and beige streaks. Among the characteristics associated with the carioca grain type, the lightest possible cream color is highly desirable. Recently, a carioca cultivar was identified which has a very light grain color and, in addition, it maintains this phenotype for some time; i.e., the grains remain light colored, which leads to greater commercial value (Silva et al., 2008). The present study was performed for the purpose of estimating genetic and phenotypic parameters of late seed-coat darkening trait of grains, with a view toward directing breeders in regard to selection of individuals and/or progenies with the desired phenotype.

MATERIAL AND METHODS

Field experiments were conducted in Lavras and Patos de Minas, MG, Brazil. The population of the cross between the cultivar BRSMG-Madrepérola (carioca type grain with very light cream background and this color persists for a long period of time) and the RP-2 line (carioca type grain with cream background that darkens rapidly) was used. The progenies of the $F_{2:3}$ generation were assessed in the "dry" growing period (sowing in February 2011) in Lavras and the progenies $F_{2:4}$ in the "winter" growing period (sowing in July, 2011) in Lavras and Patos de Minas. The grain darkening score were assessed at 30, 60 and 90 days after harvest (DAH) for $F_{2:3}$ and at 30 and 60 DAH for $F_{2:4}$. For that purpose, samples of grains from the progenies, after harvest, were placed in transparent plastic bags in a dark area. These samples of the progenies were assessed by two evaluators for the grain darkening trait by means of a scale of scores ranging from 1 to 5, with 1 for light colored grains and 5 for dark colored grains.

Analysis of variance of the grain darkening scores was carried out initially per generation. For joint analysis were considered the analyses at 30 and 60 DAH, involving the $F_{2:3}$ and $F_{2:4}$ generations or the locations (environments) in the $F_{2:4}$ generation. Genetic and phenotypic parameters were estimated by the expressions presented by Ramalho et al. (2012).

RESULTS AND DISCUSSION

The progenies $F_{2:3}$ showed significant difference ($P \leq 0.00$) in relation to the grain darkening scores. Nevertheless, the interaction progenies x time periods was not significant, indicating that the behavior of the progenies coincided in the different time periods of assessment. It was observed that the estimates of heritability for selection at the mean of the progenies, increased with the age of assessment (Table 1). However, the increase was not very expressive and, in almost all cases, there was overlap in the confidence intervals. The values obtained were similar to those reported by Silva et al. (2008) and shows that that it is possible to successfully perform selection for the trait of late grain seed-coat darkening scores and that this selection may be performed earlier; that is, even at 30 DAH.

Table 1. Means of the grain darkening scores of beans and estimates of heritability (h^2) between the $F_{2:3}$ and $F_{2:4}$ progenies in different time periods of assessment, and of joint analysis of the two environments in different time periods of assessment. Lavras/ Patos de Minas, MG, 2011.

Generation/ Location / Time period	Mean	h^2
$F_{2:3}$/ Lavras / 30 DAH[1/]	3.01	72.39 (59.00-81.40)[2/]
$F_{2:3}$/ Lavras / 60 DAH	3.53	85.85 (78.99-90.47)
$F_{2:3}$/ Lavras / 90 DAH	3.72	87.03 (80.74-91.26)
$F_{2:4}$/ Lavras / 30 DAH	2.27	76.13 (64.56-83.92)
$F_{2:4}$/ Lavras / 60 DAH	2.50	85.38 (78.28-90.15)
$F_{2:4}$/ Patos / 30 DAH	3.71	85.36 (81.23-91.49)
$F_{2:4}$/ Patos/ 60 DAH	3.87	87.24 (81.05-91.40)
$F_{2:4}$ /Lavras and Patos/30 DAH	2.99	70.33 (55.91-80.04)
$F_{2:4}$ /Lavras and Patos/60 DAH	3.18	71.45 (57.56-80.79)

[1/] Days after harvest. [2/] In brackets, limits of the confidence interval of h^2.

In joint analysis involving the $F_{2:4}$ generation in Lavras and Patos de Minas, significant difference ($P \leq 0.000$) was also observed between progenies and the interaction progenies x time periods ($P \leq 0.178$) was also not significant. Nevertheless, the effect of locations, and all the interactions involving locations were significant ($P \leq 0.00$). Although the interactions progenies x locations were significant, the genetic correlation (r_G) between the means of the progenies in the two locations was $r_G=0.74$, allowing one to infer that the interaction was predominantly simple because there was no great alteration in classification of the progenies.

In joint analysis to verify the effect of growing periods/generations on the experiments conducted in Lavras, in the $F_{2:3}$ and $F_{2:4}$ generations, it was observed that the effect of progeny was significant ($P \leq 0.000$), and the interaction progenies x time period once more was not significant ($P \leq 0.082$). The effect of generations/growing period was significant, with the same occurring for the interactions progenies x generations and time periods x generations ($P \leq 0.000$). The lowest mean was obtained in the $F_{2:4}$ generation, with the experiment being performed in the fall/winter growing period and sowing performed in July.

Although the interaction progenies x generations was significant, it was observed that the genetic correlation between the two generations was $r_G=0.81$, which shows that the interaction is predominantly simple, thus not contributing to change in classification of progenies in the different generations.

ACKNOWLEDGEMENTS

To the CNPq for the fellowship granted to the authors, and to FAPEMIG for assistance granted to the Bean Genetic Breeding Program of UFLA.

REFERENCES

RAMALHO, M.A.P.; SANTOS, J.B. dos; ABREU, A. de F.B.; NUNES, J.A.R. Aplicações da Genética Quantitativa no Melhoramento de Plantas Autógamas. Lavras: UFLA, 2012. 524p.

SILVA, G.S. da; RAMALHO, M.A.P.; ABREU, A. da F.B.; SILVA, F.B. Genetic control of early grain darkening of carioca common bean. Crop Breeding and Applied Biotechnology, Londrina, v.8, p. 299-304, dez. 2008.