# IMPLICATIONS OF EARLY SELECTION FOR GRAIN TYPE IN COMMON BEAN GENETIC BREEDING*

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Seed color is one of the most important factors for acceptance of a common bean cultivar. It is essential for farmer adoption for planting because commercialization at a good price requires that the grain color meets the demands of wholesalers and consumers. In Brazil, pale cream seeds with brown stripes without a halo, the "carioca" type, are preferred. The cream color should be the palest possible. Common bean seed color is controlled by many genes (Leakey, 1988; Basset, 1996) which are probably distributed among all the chromosomes. Therefore, early selection for this trait is expected to cause a significant reduction in the variability of other traits such as grain yield, which is the main objective of most breeding programs. This study was carried out to investigate the effect of selection for seed color in the $F_2$ generation on grain yield, which is selected in more advanced generations.

The Ouro Negro cultivar (black seeds) was crossed with the Pérola cultivar ("carioca" type seeds) in a greenhouse at the Federal University of Lavras, Lavras, Minas Gerais, Brazil. The $F_1$ and the $F_2$ generations were sown in the experimental field to produce $F_3$ seeds. The $F_3$ generation seeds were harvested and divided into two groups. One was submitted to selection for grain type: cream colored seeds with brown stripes as similar as possible to the "carioca" type were selected. No selection was made on the other group. Selected and unselected seeds were sown and 199 plants were randomly sampled from each group to form the $F_{3:4}$ families. The 398 families and the parents were assessed in the dry season of 2000 in Lavras, MG. The experimental design was a simple 20 x 20 lattice. The plots were formed by a single 1-meter row with 15 seeds/m and were spaced at 0.5m. Only the seed yield data was recorded.

In the $F_{3:5}$ generation, all the families were again assessed but now in the winter season of 2000 (sowing in July). The experiments were carried out in Lavras and Patos de Minas, MG, Brazil. A 20 x 20 simple lattice design with three replications was used. The plots were formed by a single 2-meter row with sowing density and spacing as in the previous experiment. The grain yield was assessed in the two locations but seed type was only assessed in the experiment at Lavras. For seed type evaluation a scale with scores ranging from 1 to 6, similar to that used by Ramalho, Pirola and Abreu (1998), was used. Scores 1 to 5 were attributed to seeds characterized as within the "carioca" type and score 6, to seeds with a different pattern, such as the black and brown types. The experimental data were submitted to individual and joint analysis of variance for estimation of the genetic and phenotypic parameters.

The means of the selected and unselected families in the three environments (Lavras in the $F_{3:4}$ and $F_{3:5}$ generations and Patos de Minas in the $F_{3:5}$ generation) were 379.0 g/m$^2$ and 378.8 g/m$^2$ (Table 1), respectively. This indicated that early selection for seed type did not affect the yield of these two groups in the advanced generations. A similar situation was detected for yield variability. There was practically no difference among family genetic variance nor in the heritability estimates (Table 1). The data suggest that although seed color and yield are quantitative traits, they are controlled by independent genes which are most probably

independently distributed along all the chromosomes. Another important result which emphasizes the advantage of early selection is that among the selected group, 105 families had commercially acceptable grains while among the unselected group, only seven were acceptable.

The implications of these results are very favorable to common bean breeding programs carried out in Brazil since the seed type, as already mentioned, is one of the main factors for cultivar success. Early selection for seed type was efficient because the trait has high heritability. Therefore, the breeder can concentrate his efforts on assessing other traits on individuals or families with commercially acceptable seed type. Selection for grain yield will only be performed on more advanced generations, based on the mean performance of the families along these generations. Thus, assessment can be made on a smaller number of families, enabling a reduction in work, or alternatively, allow greater number of replications and/or locations to improve the experimental accuracy.

**Table 1.** Estimates of the genetic and phenotypic variance components obtained from the assessment of $F_{3:4}$ families in Lavras and $F_{3:5}$ families in Lavras and Patos de Minas, MG, Brazil, 2000.

| Gerações $F_{3:4}$ e $F_{3:5}$ em Lavras | | | Geração $F_{3:5}$ em Lavras e Patos de Minas | | |
|---|---|---|---|---|---|
| Estimativas | A[1/] | B[1/] | Estimativas | A | B |
| $Média_{F_{3:4}}$ | 387,49 | 377,62 | $Média_{Lavras}$ | 332,41 | 327,88 |
| $Média_{F_{3:5}}$ | 332,41 | 327,88 | $Média_{Patos}$ | 417,26 | 430,99 |
| $\hat{\sigma}^2_{G_{F_{3:4}}}$ | 2795,827 | 3275,880 | $\hat{\sigma}^2_{G_{Lavras}}$ | 1044,778 | 1526,099 |
| $\hat{\sigma}^2_{G_{F_{3:5}}}$ | 1044,778 | 1526,099 | $\hat{\sigma}^2_{G_{Patos}}$ | 1850,568 | 1199,440 |
| $\hat{\sigma}^2_{\bar{F}_{3:4}}$ | 6943,985 | 7424,038 | $\hat{\sigma}^2_{\bar{F}_{Lavras}}$ | 2412,19 | 2983,52 |
| $\hat{\sigma}^2_{\bar{F}_{3:5}}$ | 2412,195 | 2983,516 | $\hat{\sigma}^2_{\bar{F}_{Patos}}$ | 3465,00 | 2812,85 |
| $h^2_{F_{3:4}}$ | 40,3 | 44,1 | $h^2_{Lavras}$ | 43,3 | 51,5 |
| $h^2_{F_{3:5}}$ | 43,3 | 51,2 | $h^2_{Patos}$ | 53,4 | 42,6 |

[1/]: **A: selected families for "carioca" grain type; B: unselected families**

## REFERENCES


BASSET, M.J. List of genes – *Phaseolus vulgaris* L. **Annual Report of the Bean Improvement Cooperative**, New York, v. 39, n. 39, p. 1-19, Mar. 1996.

LEAKEY, C.L.A. Genotypic and phenotypic markers in common bean. In: GEPTS, P. (ed.). **Genetic resources of *Phaseolus* beans**: Their maintenance, domestication, evolution, and utilization. Netherlands: Kluwer Academic Publishers, 1988, p. 245-327.

RAMALHO, M.A.P.; PIROLA, L.H.; ABREU, A. de F.B. Alternativas na seleção de plantas de feijoeiro com porte ereto e grão tipo carioca. **Pesquisa Agropecuária Brasileira**, Brasília, v.33, n.12, p.1989-1994, dez. 1998