GENETIC PROGRESS AFTER FIVE CYCLES OF PHENOTYPIC RECURRENT SELECTION FOR EARLY FLOWERING OF CARIOCA COMMON BEAN

Flávia Barbosa Silva[1]; Magno Antonio Patto Ramalho[1];
Ângela de Fátima Barbosa Abreu[2]

[1]Universidade Federal de Lavras, Lavras, MG, P. O. Box 3037, e-mail: flaviabs28@hotmail.com; magnoapr@ufla.br
[2] Embrapa Arroz e Feijão/Universidade Federal de Lavras, Lavras, MG, P. O. Box 3037; e-mail: afbabreu@ufla.br

Introduction

In the environmental conditions of Brazil, common bean has one of the shortest cycles among cultivated species (normally between 85 and 90 days). This is the main reason for the trend to cultivation under irrigation and in rotation with other species. Moreover, owing to the short cycle, three growing seasons per year are possible. Nevertheless, the search for even earlier cultivars is still going on, mainly to reduce water consumption, energy for irrigation as well as the production costs, and to attain a greater flexibility of crop rotation.

In this setting, this study was conducted to verify the efficacy of phenotypic recurrent selection in common bean for the number of days to flowering and evaluate the response correlated to selection in other important traits.

Material and Methods

The recurrent selection program for early flowering in common bean was conducted on an experimental field of the Universidade Federal de Lavras, in Lavras, Minas Gerais, Brazil. Firstly, the base population was developed by means of a partial diallel mating system from five early lines and ten of normal cycle. From this diallel, 49 F_1 hybrids were derived. These were evaluated for early flowering and the 11 hybrid populations with the lowest number of days to flowering selected. Then 300 carioca seeds were collected from each population. The seeds were all mixed to form the base population S_0 (cycle 0) of the recurrent selection program.

The plants of the S_0 population that presented the first flower buds were crossed on the field. This intercrossing was repeated for five successive days. The hybrid seeds were blended to obtain cycle I of the recurrent selection program. The procedure was repeated to obtain cycles II, III, IV, and V.

To estimate the genetic progress 53 $S_{1:2}$ progenies of each cycle were used. The $S_{1:2}$ progenies were evaluated in February 2006. The experiment was arranged in a 18 x 18 simple lattice design, with 318 $S_{1:2}$ progenies and six controls. Plots consisted of a 2m row, with a sowing density of 15 seeds per meter. The following traits were evaluated: number of days from emergence to flowering; severity of angular leaf spot; number of days from plant emergence to physiological maturity; grain yield in grams per plot and grain type.

Results and Discussion

Significant differences were observed in the mean performance of the progenies between the selection cycles for the trait number of days to flowering, indicating the existence of

variability, an essential condition for the selection process. A tendency towards a reduction in the number of days for the beginning of flowering was observed along the selection cycles. It was further observed that the average number of days to flowering of the progenies was 15.3% smaller than of the controls. It is further noteworthy that the mean number until flowering of cultivar Pérola, one of the most planted in Brazil, was about 34 days. The progenies were therefore in the mean eight days earlier.

The genetic progress estimated for the number of days to flowering (earliness) of -0.73% can basically be considered as a small magnitude (Table 1). Some points must however be taken into consideration. Firstly, of the 49 hybrid populations developed in the beginning, involving the crossing of lines of early and normal cycle, only the 11 earliest were selected to form a base population of the recurrent selection program. In the literature, there are reports that earliness is controlled by few major genes (Bassett, 2004), although the existence of modifier genes is evident (Singh, 1991). It is therefore probable that the population selection targeted the major genes. The action of recurrent selection was towards the minor genes, letting one expect a smaller response to selection, since the base population was already quite early.

Another point is that the phenotypic selection is applied in all growing seasons, that is, one cycle of recurrent selection per growing season. In the south of Minas Gerais, three growing seasons per year are possible, which allows three selection cycles per year, resulting in a progress of -2.2% per year.

No association was stated either of the beginning of flowering with grain yield (r_G=0.07) and severity of angular leaf spot (r_G=0.00), indicating the possibility of selecting early-flowering progenies associated to good yield and resistance to angular leaf spot.

TABLE 1. Estimates of the coefficients of linear regression between number of cycles (x) and the trait mean (y): number of days to flowering (NDF), number of days to maturation (NDM), grain yield (GY), severity grades of angular leaf spot (ALS) and grain type grades (GTG) obtained in the evaluation of $S_{1:2}$ progenies of the recurrent selection cycles.

Traits	b_0	b_1	P	R^2 (%)	Progress(%)
NDF	26.92	-0.197	0.040	65.45	-0.73
NDM	72.81	0.053	0.921	0.27	-
GY	312.4	-0.717	0.872	0.71	-
ALS	5.14	-0.031	0.650	5.48	-
GTG	2.79	-0.018	0.541	9.67	-

b_0 – intercept; b_1 – linear regression coefficient; P – probability of significance by t test; R^2 – determination coefficient; progress (%) computed by the equation b_1/b_0 x 100.

References

BASSETT, M. J. List of genes – *Phaseolus vulgaris* L. Bean Improvement Cooperative. nº 47. p. 1-24. 2004.

SINGH, S. P. Bean genetics. In: A. VAN SCHOONHOVEN; O. VOYSET. 1991. Common beans, research for crop improvement. Mexico: C.A.B. CIAT.