NATURAL SELECTION FOR NITROGEN USE EFFICIENCY IN COMMON BEAN POPULATIONS

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INTRODUCTION

The nitrogen (N) biological fixation in the common bean does not supply all the demand of the culture, by this, most studies that evaluate N levels presents positive response (Vieira, 2006). Whereas in Brazil there is huge diversity of farmers, ranging those of family agriculture that employ no fertilizers, to the big farmers that use high levels, it is necessary to obtain lines that have good yield under conditions of low N availability and/or also responsive to the nutrient application. However, a question that arises is whether natural selection in environments with and without stress of N would increase the chance of select specific lines for such environments. Of the above, the objective of this study was to verify if natural selection in populations obtained from crosses between lines differing in the nitrogen use efficiency is acting to get specific populations for environments with and without stress of N.

MATERIALS AND METHODS

In previous stage of the breeding program of the common bean in the Federal University of Lavras - UFLA (South of Minas Gerais, Brazil, 21°14'S, 44°59'W and average altitude of 919 m) were identified two tolerant lines to low nitrogen availability (Ouro Negro and VC-5) and also two responsive lines to the nitrogen application (CI-107 and IAPAR-81). It was obtained the F_1 generation of crosses involving the lines Ouro Negro x CI-107, VC-5 x IAPAR-81 and VC-5 x CI-107. From the F_2 those populations were advanced by the "bulk" in two environments. The first one received 100 kg ha^{-1} of N, being 1/3 applied at sowing and the remainder in cover, and the ammonium sulfate as a source of N. In the second, no nitrogen fertilizer was used. In both environments the crop fertilization was the same, ie, 80 kg ha^{-1} of P_2O_5 and K_2O.

Each bulk was constituted by 2,000 plants. After harvested, the seeds from each environment were mixed and used for seeding the next generation. This procedure was repeated until the F_5 generation. The six populations, three from the environment with N and three without N, were evaluated in randomized blocks design in F_6, F_7 and F_8 generations. The plots were constituted by four lines of four meters in length. Data for grain yield were submitted to variance analysis.

RESULTS AND DISCUSSION

It was detected significant difference ($P \leq 0,01$) between the generations (seasons). The F_8 generation was the most yield and there was no difference between the other two (Table 1). The generations x levels interaction significant ($P \leq 0,05$), indicates that the effect of N stress was not coincident in different generations. It was observed that the nutrient response occurred in two of the three

generations evaluated. It was found that the generations x populations x origins x levels interaction was significant, indicating that the behavior of populations was not coincident in different origins, levels and generations. Because of this fact, and considering that the biggest interest is in the interactions involving levels and origins, the results will be discussed considering the two generations of greater response to N, ie, F_6 and F_7.

In the average of the two generations, grain yield with N was 22% higher than with no N (Table 2). The population with higher average yield, regardless of origin and level of N, was the IAPAR-81 x VC-5, and there was no difference between the other two. Regarding the origin, if the population was advanced with or without N, was detected significant difference ($P \leq 0,08$). The same occurred with populations x origins, populations x levels and populations x levels x origins interactions.

The most significant result was that populations advanced in the environment without N presented higher yield in this environment, except the population CI-107 x Ouro Negro. The same occurred with the populations advanced in the environment with N. This fact shows, in principle, that during the progress of populations, the natural selection has acted to select more adapted individuals to that particular environment.

Table 1. Grain yield (kg ha^{-1}) of common bean populations, obtained with and without nitrogen application, in the different generations of evaluation.

Generations	Levels		with N/without N	mean
	with N	without N		
F_6	2363	1938	1,22	2151
F_7	2365	1938	1,22	2152
F_8	2463	2495	0,99	2479

Table 2. Grain yield (kg ha^{-1}) of common bean populations, in the different origins, evaluated with and without nitrogen application.

Segregating Population	Environment of evaluation						with N/ without N	mean
	with N			without N				
	Origin of the bulk			Origin of the bulk				
	with N	without N	mean	with N	without N	mean		
Ouro Negro x CI-107	2416	2208	2312	2141	1488	1815	1,27	2064
VC-5 x IAPAR-81	2483	2286	2385	2139	2251	2195	1,08	2290
VC-5 x CI-107	2461	2326	2394	1610	1997	1804	1,33	2099
Mean	2453	2273	2363	1963	1912	1938	1,22	2151

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