EFFECT OF SEED SIZE ON SEED YIELD AND ON NITROGEN FIXATION RELATED TRAITS IN BUSH BEAN CROSSES COMBINING ANDEAN AND MIDDLE AMERICAN GENE POOLS

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ABSTRACT

The literature documents that crosses made between races Mesoamerica and Nueva Granada have increased seed yield of large-seed-derived lines by 30%. However, no crosses between these gene pools have been made to improve nitrogen (N_2) fixation of common beans (*Phaseolus vulgaris* L.).

In the present research Paragachi and Imbabello, two large seed commercial cultivars from Ecuador, were chosen as recipient parents. Puebla 152, a medium-seed-size landrace from Mexico, and RIZ 21, a CIAT-bred line of small seed size, were chosen as donor parents for high N_2 fixation. Following hybridization combining the donor parents and recipient parents, the four populations were advanced to the F_3 generation and evaluated. The objectives were to investigate the effect of seed size on seed yield and on N_2 fixation-related traits in F_3 families, and, to research the potential for selecting large seed, high fixing, high yielding families.

Forty-eight F_3 families were evaluated in the greenhouse during Fall, 1995, in a low-N soil medium. Plants were transplanted, one per 15 cm plastic pot and inoculated twice with *Rhizobium tropici* strain CIAT 899 --5 days after planting (DAP) and immediately following transplanting. Pots were arranged in a 3-stage nested design with 4 replicates. Four greenhouse benches were used, with each representing one randomized replicate and containing 96 F_3 plants (2 plants per entry). At 50 DAP, 50% of the plants were sacrificed from each entry in each replication and nodule mass and stover mass weighed. At maturity, days to maturity, stover mass and seed yield was recorded on the remaining 50% of the plants. Canopy N, stover N and seed N also were obtained.

F_3 families derived from Puebla 152 tend to be higher in all

traits, whereas crosses derived from RIZ 21 were earlier in maturity. Although there were no differences ($P > 0.05$) among crosses, each cross expressed negative heterosis for days to maturity and positive heterosis for canopy N, seed N and seed yield. In thirteen large seed F_3 families and seven small seed F_3 families surpassed the midparent for these traits. Moreover, large seed F_3's tended to surpass small seed F_3's for nodule mass, stover mass, canopy N, seed N and seed yield, except in Imbabello x RIZ 21. These findings suggest the possibility of selecting early, high fixing and high yielding large-seed-derived lines.

The higher relationship between seed size and both nodule mass and stover mass at 50 DAP may have been due to higher reserves of nutrients present at germination in the greater mass of seed material and to its early translocation to the plant and to the nodules. The high values for 'r', regardless of seed size, among nodule mass, stover mass at 50 DAP, canopy N, seed N and seed yield suggest the use of either canopy N and seed yield or seed N and seed yield as selection criteria for improving N_2 fixation and seed yield.

Consequently, improvement of Andean germplasm by using interracial crosses may be possible. A larger number of crosses involving a greater number of parents from both gene pools should be made.