Registration of Ineffective Nodulation Mutant R69 And Nonnodulation Mutant R99 Common Bean Genetic Stocks

The common bean (Phaseolus vulgaris L.) genetic stocks R69 (Reg. no. GS-245, PI 641003) and R99 (Reg. no. GS-246, PI 641004) are ineffective and nonnodulation mutants of navy bean cultivar OAC Rico, respectively. They were selected in a dry bean breeding program conducted by Agriculture and Agri-Food Canada Greenhouse and Processing Crops Research Centre at Harrow, ON. The mutant lines were obtained during the development of white, dry edible beans with improved nodulation and N₂ fixation in the presence of nitrate.

About 4500 water-soaked seeds of OAC Rico were immersed in a solution of 0.04 M ethyl methane sulphonate (EMS) and incubated for 6 h at 22°C. The mutagenized M₁ seeds were rinsed in running tap water for 30 min before sowing in a greenhouse in 1985 (Park and Buttery, 1988). The plants were sown and M₂ seeds were harvested individually from 175 M₁ plants as they matured. For initial screening of nodulation in the M₂ population in 1987, 12 seeds harvested from 75 individual plants were sown in black plastic pots filled with a mixture of vermiculite and perlite (1:2 v/v). Seeds were inoculated with Rhizobium leguminosarum bv. phaseoli (Buchanan) Jordan strain TAL 182, applied as turbid yeast–mannitol broth culture (ca. 10⁷ cell mL⁻¹, 1 mL seed⁻¹) at seed level before covering the seed with potting medium. Pots were watered until seedlings emerged and thereafter received 330 mL of N-free nutrient solution daily. After 4 wk, when nodulation was expected to be near maximum, plants were carefully removed from the potting medium and visually rated for nodulation (Park and Buttery, 1988).

Putative M₂ plants lacking effective nodules were replanted and given 5 mM nitrate to increase plant growth and to boost seed production. In 1988 we screened 95 additional M₂ lines and the M₃ and M₄ plants from the 1987 tests in the same manner, except that 1 mM nitrate was added to the nutrient solution to increase seed production because plants were otherwise too chlorotic and weak. Putative nonnodulating or ineffectively nodulating mutant plants were identified, some of which either did not produce seed or did not breed true.

Progeny tests with M₃ plants of two M₂ families confirmed two nodulation mutants, R69 and R99. R69 was sparsely nodulated with tiny pale white nodules which appeared to be non-functional (ineffective) in N₂ fixation as evidenced by chlorotic shoot growth. R99 produced very few tiny nodules or no nodules. Both R69 and R99 are presumed to be incapable of fixing N because in the absence of nitrate they both form small yellow shoots that die after 7 to 8 wk without setting seed. In the same test, the wild-type OAC Rico produced large pinkish nodules with four- to five-fold higher nodulation scores than those of the mutants. The M₄ progenies of both mutants bred true for the nodulation characteristics (Park and Buttery, 1992). Subsequently R69 and R99 mutants were backcrossed to OAC Rico to BC₄ to recover vigor and other agronomic characteristics of the wild type during 1992 through 1994. After the final backcrossing, BC₄ F₃ plants were bulked to form basic seed for future trials.

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It is noteworthy that the nodulation mutants were obtained from the potting medium and visually rated for nodulation (Park and Buttery, 1988). Putative nonnodulating or ineffectively nodulating mutant plants were identified, some of which either did not produce seed or did not breed true.

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