VARIABILITY IN SYMBIOTIC NITROGEN FIXATION IN COMMON BEAN

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Introduction

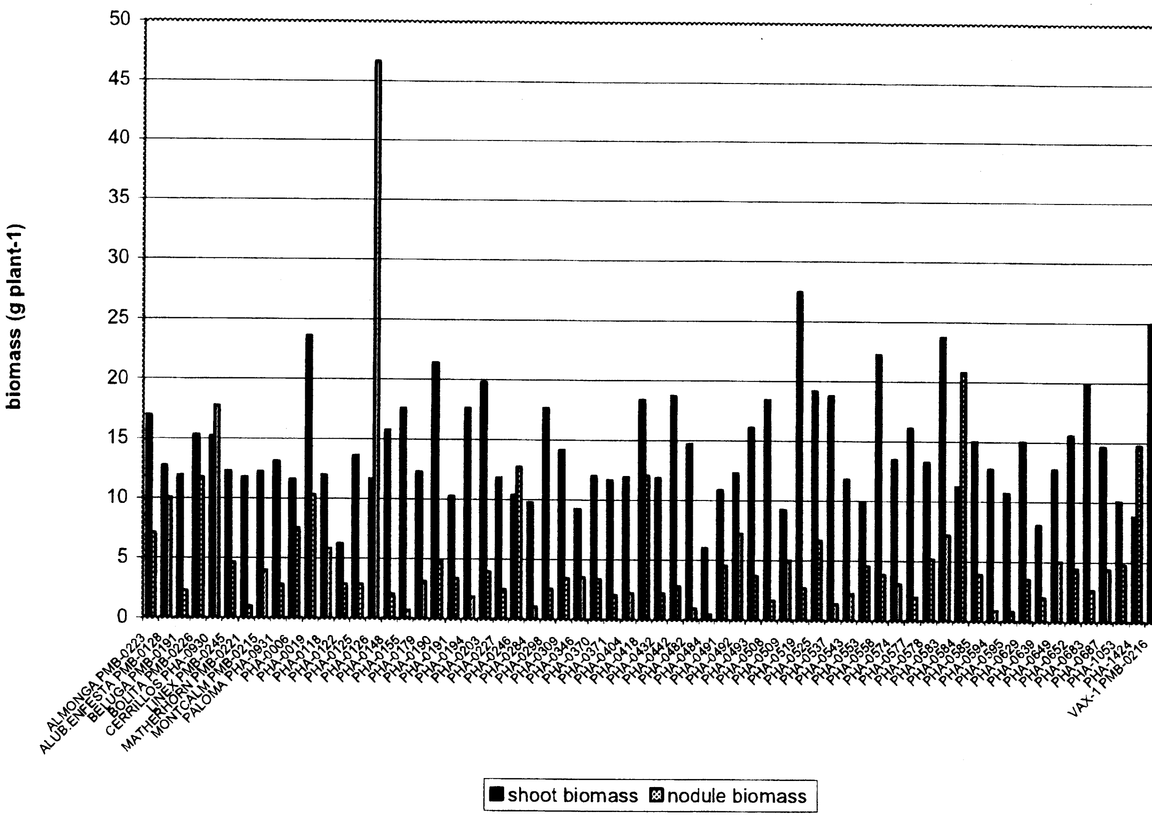
Yield responses of bean are often limited by the nitrogen deficiency, being the limiting factor more common for the growth of the plants. Common bean (*Phaseolus vulgaris* L.) is often considered as a poor N_2-fixing legume. Thus, it is often cultivated with a complement of mineral nitrogenous fertilization to correct this deficiency and to raise the yields. The symbiotic nitrogen fixation (SNF) provides an ecologically acceptable alternative to the high applications of nitrogenous fertilizers, especially in Europe, and an economic alternative to the limited access to these fertilizers in the developing countries. The objectives of the work are i) to study the genotypic diversity represented by local populations of bean, ii) to identify those populations who can be useful to improve SNF potential as well as iii) to determine the degree of genetic diversity of the native populations of rhizobia that nodulate *P. vulgaris* in the soils of Galicia and their potential to fix N_2 with local populations of bean.

Material and Methods

Sixty four landraces from the common bean collection of the Misión Biológica de Galicia-CSIC were chosen after to screen the nodulation of beans in glasshouse hydroponic-culture. The evaluation in the field were carried out in 2004 and in three locations, Pontevedra (42° 25'N, 8° 38'W 20 masl), Xinzo (42° 5'N, 7° 43'W, 620 masl) and Ponteceso (43° 16'N, 8° 44'W, 400 masl). The experimental design was a randomized complete block with two replications. Each plot consisted of a single 5 m row, with row spacing of 50 cm and plant spacing of 20 cm. At flowering stage, five plants were collected by excavating 20 cm around the root system. The plant was separated immediately from surrounding rhizospheric soil. For each individual plant, the shoot was separated from the root at the cotyledonary node; the number of nodules was recorded and the nodule and shoot dry weight were measured after drying at 80 °C. At maturity, yield components were measured. Rhizobial strains used in this study were isolated from root nodules from plants grown on soil samples. Pure strains were usually cultivated on YEM media (Vincent, 1970) and they were stored at -20 °C in 50% YEM glycerol for future studies.

Results and Discussion

There is an important genotypic variability associated with SNF potential. The data in the figure 1 shows that the landraces PHA-0519, PMB-0216, PHA-0583, PHA-0019, PHA-0558 and PHA-0190 had a highest shoot dry weight, while PHA-0126, PHA-0584, PHA-0093, PHA-1424, PHA-0246, PHA-0418, PMB-0226, PHA-0019, PMB-0128 had the highest nodule dry weight. This variability emphasizes the need to explore the potential of indigenous rhizobial strains for improving the symbiotic performance of *P. vulgaris*. The existence of genetic variation in symbiotic N_2 fixation among bean landraces opens a real possibility for enhancing N_2 fixation through selection and breeding. An extensive analysis of genetic polymorphism in the bean crop and in their nodule bacteria will enable to characterize the genetic potential to be used for improvement of symbiotic N_2 fixation. These results indicated that the following accessions had the best characteristics for SNF: PHA-0019, PHA-0190 and PHA-0583. Those varieties that stand out will be able to be incorporated into programs of genetic improvement, having an important role in the future of the agriculture, as parents in breeding programs. This work can help to improve the growth of legumes along with reducing the costs of production and preserving the environmental quality (Vance et al., 2000). Besides, it contributes to food quality for health and to new cropping systems including for the agriculture in less favoured regions and adverse environmental conditions.



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