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Plant Growth, Symbiotic Performance and Grain Yield of 63 Common Bean Genotypes Grown Under Field Conditions at Malkerns Eswatini

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Abstract : Common bean is the most importantly high protein grain legume grown in Southern Africa for human consumption and income generation. Although common bean can associate with rhizobia to fix N_2 for bacterial use and plant growth, it is reported to be a poor nitrogen fixer when compared to other legumes. N_2 fixation can vary with legume species, genotype and rhizobial strain. Therefore, screening legume germplasm can reveal rhizobia/genotype combinations with high N_2-fixing efficiency for use by farmers. This study assessed symbiotic performance and N_2 fixation in 63 common bean genotypes under field conditions at Malkerns Station in Eswatini, using the ^{15}N natural abundance technique. The shoots of common bean genotypes were sampled at a pod-filling stage, oven-dried (65oC for 72h), weighed, ground into a fine powder (0.50 mm sieve), and subjected to $^{15}N/^{14}N$ isotopic analysis using mass spectrometry. At maturity, plants from the inner rows were harvested for the determination of grain yield. The results revealed significantly higher modulation ($p \leq 0.05$) in genotypes MCA98 and CIM-RM01-97-8 relative to the other genotypes. Shoot N concentration was highest in genotype MCA 98, followed by KAB 10 F2.8-84, with most genotypes showing shoot N concentrations below 2%. Percent N derived from atmospheric N_2 fixation (%Ndfa) differed markedly among genotypes, with CIM-RM01-92-3 and DAB 174, respectively, recording the highest values of 66.65% and 66.22 % N derived from fixation. There were also significant differences in grain yield, with CIM-RM02-79-1 producing the highest yield (3618.75 kg/ha). These results represent an important contribution in the profiling of symbiotic functioning of common bean germplasm for improved N_2 fixation.

Keywords : nitrogen fixation, %Ndfa,^{15}N natural abundance, grain yield
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