Short Communication

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EVALUATION OF CHICKPEA GENOTYPES FOR BIOLOGICAL NITROGEN FIXATION POTENTIAL

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The objective of the present study was to evaluate the promising genotypes of chickpea *(Cicer arietinum* L.) , developed by mutation breeding group of this institute, for nitrogen fixation ability using ^{15}N methodology.

Materials and Method

The experiment was conducted in pots containing a moderately calcareous silty clay loam deficient in nitrogen but medium in available P and organic matter. Ten chickpea genotypes were used. Each genotype, replicated thrice, was supplied with a starter dose of N at a rate equivalent to 20 kg N/ha in the form of urea labelled with 1 atom% ^{15}N excess. This ^{15}N enrichment was rather low; the usual enrichment used for such studies is 5%, preferrably 10% but the low enrichment used did not affect the results materially. Basal doses of P and K at the rates of 60 and 40 kg/ha were applied to each pot, at sowing, in the form of single superphosphate and potassium sulphate, respectively. The plants were allowed to grow until pod formation stage and then harvested. The data were recorded on number and dry weights of nodule per plants. The shoots, after drying in an oven at 70° and grinding in a Wiley mill, were analyzed for nitrogen content by the micro-Kjeldahl method [1]. The $^{14}N/^{15}N$ isotopic ratio in the samples was determined by an ^{15}N-analyzer (Jasco, Model N-150) using Dumas method [2].

The results (Table 1) revealed significant variations among the genotypes for various N_2-fixing parameters. The mutant CM-1918 had the highest number of nodules per plant followed by CM-1 while the mutant E-1289 had the least. The dry weights of nodules followed the same trend as they were highly significantly correlated (r=0.802) to the number of nodules (Table 2).

The mutants CM-663 and CM-141 produced the highest biomass yield (7.5 g/pot) which wa significantly ($P<0.05$) higher than the rest of the genotypes. The higher yield of these genotypes was not produced by a concomitant increase in the nodule number. The nodule number was actually nonsignificantly correlated with the biomass yield (Table 2), indicating that higher yield did not necessarily mean a higher nitrogen fixation and vice versa. Hardarson and Zapata [4] also found no significant correlation between dry matter yield and amount of N_2 fixed. The lowest biomass yield of 4.0 kg/pot was produced by the mutant CM-88.

The nitrogen concentration (%) of the above-ground parts of chickpea, which reflects the total absorption of nitrogen from fertilizer, soil and fixation sources, was highest in the mutant CM-1918 but the total nitrogen content (mg/plant), which is a product of concentration and biomass yield, was highest in C-141. The mutant CM-88 had the lowest nitrogen content.

Percent ^{15}N atom excess in the plant is a highly reliable indicator of nitrogen fixation [3]; a lower percentage indicating a higher proportion derived from atmospheric fixation and a higher percentage indicating a lower proportion from fixation. In the present study, percent ^{15}N excess was highest in the case of mutant E-1289 and lowest in the case of mutant

TABLE 1. EVALUATION OF TEN CHICKPEA GENOTYPES FOR SOME OF THE NITROGEN FIXATION PARAMETERS AND YIELDS.

Genotype	Nodules per plant		Total N	N content	% ^{15}N at. ex.		Biomass yield
	Number	Dry wt. (mg)	%	(mg/plant)	Obs.	Actual	(g/pot)
CM-1	27.3b	18.3b	3.8ba	209.0	0.10	0.004	5.5b
CM-72	13.3de	9.6cd	3.6ab	212.4	0.20	0.122	5.9b
CM-1918	36.5a	25.0a	4.0a	228.0	0.06	–	5.7b
CM-663	12.5e	8.3de	3.3b	247.5	0.25	0.165	7.5a
CM1913	12.5e	8.7de	3.4b	224.4	0.23	0.105	6.6ab
CM-88	20.0c	11.6c	3.8ab	163.4	0.16	0.050	4.3c
CM-141	18.0c	25.0a	3.7ab	277.5	0.18	0.065	7.5a
RC-32	12.8de	6.7ef	3.6ab	201.6	0.23	0.105	5.6b
E-1289	10.0e	5.0f	3.4b	221.0	0.28	0.192	6.5ab
CM-687	16.5cd	9.7cd	3.6ab	223.2	0.18	0.066	6.2b

The figures followed by the same letter in the vertical columns do not differ significantly at 5% level of significance.

CM-1918 (Table 1). Also, % ^{15}N excess was significantly and negatively correlated to nodule number and their dry weights (Table 2) indicating that N_2 fixation in mutant CM-1918 was significantly ($P<0.05$) highest and in E-1289 significantly lowest.

TABLE 2. CORRELATION BETWEEN NODULATION PARAMETERS VERSUS DRY MATTER YIELD AND ^{15}N ATOM EXCESS IN THE PLANT.

Parameters	Correlation co efficient (r value)
1. Nodule number vs Nodule dry wt.per plant	0.802**
2. Nodule dry wts. vs dry matter yield	0.047 NS
3. Nodule dry wts. vs % ^{15}N excess in plant	0.802**

** = Significant ($P<0.01$), NS = Non significant

Key words: Nitrogen fixation, Chickpea, Genotypes.

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