AN ANALYSIS OF THE SYMB10TJC PROPERTIES OF PEA MUTANTS

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According to current concepts, the plant provides the symbiotic fixation of molecular nitrogen needed to cover the energy expenditures of legumes.

Experimental mutagenesis appeared promising as a method to produce wider genetic variability for nitrogen fixation in legumes, especially in self-pollinators.

The aim of this study was to analyze the variations in the nitrogen fixation activities of mutants induced by the chemical mutagens EMS, EI, and NMM in the pea varieties 'Parvus' and 'Torsdag'. It was hoped that this analysis would allow us to identify forms with improved symbiotic properties.

The pea plants were grown in pots containing keramsite and vermiculite. Before sowing, the seeds were inoculated with a three-day-old culture of Rhizobium leguminosarum. The plants were grown under conditions of nitrogen deficiency. At the beginning of flowering, nitrogen fixation (nitrogenase activity) was determined by the acytelene method in l5-20 plants of each line; stem length, the weight of fresh and dry biomass, and nodule number were also determined.

Nitrogen fixation was estimated as 1.86 mkg N/hr/plant for Parvus; the respective values varied from 0.05-43.45 mkg N/hr/plant for the mutants (Table 1).

On the basis of their nitrogen fixation values, the mutants were assigned to three groups: Group 1 - decreased as compared with the Initial line (IL) (No. 676, 629, 646, and 630); Group 2 - not different from the IL (No. 653, 1073, 662, 1070, 681, and 614); Group 3 - increased as compared with the IL (No. 620, 623, 613, 622, 1087, 612, and 679).

No significant relation was established for nodule number and nitrogen fixation. However, nodule number was quite high in the mutants of Group 3.

In Group 1 mutants with the lowest nitrogen fixation, the weights of dry biomass were the smallest (No. 676, 629); in those, of Group 3 with the highest nitrogen fixation, the respective values were twice as high (No. 1087, 612, 679).

Four mutants with improved symbiotic properties were identified. 0f these, two had compact stems and dark green leaves (No. 679, 1087), and two were waxless (No. 612, 622).

The estimates for nitrogen fixation varied from 6.6-54.8 mkg N/hr/plant in the mutants induced in Torsdag, the value for Torsdag itself being 19.5 mkg N/hr/plant (Table 2). Five mutants surpassing the original variety in nitrogen fixation were identified. Mutant No. 14, with a maximum nitrogen fixation of 54.8 mkg N/hr/plant, was noteworthy.

Nitrogen fixation was re-estimated in the most outstanding mutants. There was a good agreement between these and the previous estimates.

Table 1. Nodule number and estimates for nitrogen fixation in mutants induced in the 'Parvus' variety.

Mutant number	Stem length (cm)	Per plant			
		Fresh biomass	Dry biomass g	Nodule number	Nitrogen fixation mkgN/hr
Parvus	127	22g2	4.1	564	1.86
676	124	10.4*	1.6*	4*	0.05*
629	94*	12.4*	1.5*	388*	0.46*
646	133	18.9*	2.5*	203*	1.03*
6 30	106*	22.0	3.1*	138*	1.12*
65 3	129	12.8*	1.7*	72*	2.31
1073	113*	21.1	4.0	514	2.40
662	136*	16.4*	2.4*	104*	2.49
1070	114*	17.5*	3.3*	561	2.90
681	27*	8.4*	1 .4*	29*	3.08
614	131*	17.3*	2.8*	397*	3.14
620	124	17.3*	3.5*	617	6.15*
625	122	16.5*	2.6*	208*	6.29*
613	134*	19.8	3.7	459*	13.94*
622	128	17.0*	3.2*	651	17.00*
1087	70*	26.9*	4.1	271*	26.76*
612	123	19.5*	3.8	364*	27.02*
679	46*	18.8*	3.1*	227*	43.45*

* - The difference from the original variety is significant by Student's t test.

Tab 2. The estimates for ninrogene fixation in mutants induced in the 'Torsdag' variety.

Mutant number	Stem length cm	Per plant		
		Fresh biomass g	Dry biomass g	Nitrogene fixation mkgN/hr
Torsdag	67	4.3	1.1	19.5
3	31*'	4.6	1.1	6.6*
754	72*	10.7*	1.3*	7.7*
1256	76*	10.0	1.3*	11.5*
7	67	9.5	1.3*	12.6*
54	63*	7.8*	0.9	12.8*
1291	71*	10.1	1.5*	14.1*
1310	68	10.2	1.4*	14.6*
955	61	10.2	1.3*	16.5
32	70*	7.9*	1.1	23.3*
1342	75*	9.9	1.4*	23.9*
15	70*	9.4	1.3*	24 .4*
34	54*	7.9*	1.2	27.3*
14	70*	9.6	1.4*	54.8*

* - The difference from the original variety is significant by Student's t test.

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