INFLUENCE OF SOIL PREPARATION ON N_2 FIXATION OF SIX BEAN LINES (*Phaseolus vulgaris* L.) IN BRAZIL

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Improvement of N_2 fixation in common bean (*Phaseolus vulgaris* L.) has been achieved under experimental conditions (Attewell and Bliss, 1985; St. Clair, 1986; Pereira and Bliss, 1987), but increased N_2 fixation by beans in farmers fields requires a crop management strategy which considers symbiosis as the principle source of N. In the "cerrado" region of central Brazil, where drought periods are common during the bean growing season, deep soil preparation facilitates development of a larger root system, which can enhance escape from water stress. The objective of this study was to evaluate the influence of type of soil preparation on N_2 fixation-related parameters and yield of six bean lines.

Three types of soil preparation were used: conventional (one disk plowing with 3 multiple string tillate), deep plowing (one multiple string tillage with arrow plow), and no tillage preparation. The experiment was planted at EMBRAPA/CNPAF, Goiânia, Goiás, Brazil, in a randomized complete block design with a split-split plot layout and four replications. The sources of variation were distributed as follows: main plots were type of soil preparation, subplots were source of nitrogen (N_2 fixation or N fertilizer), and sub-subplots were six bean lines: WBR 22-03, WBR 22-08, WBR 22-34, WBR 22-50, and 22-55, selected for N_2 fixation (Bliss et al., 1989), and EMGOPA 201-Ouro, a recently released cultivar. Half the plots received 20 kg N fertilizer/ha at planting and 40 kg N/ha at the V_6 growth stage. In the remaining plots, *Rhizobium leguminosarum* biovar *phaseoli* strain CIAT 899, resistant to 500 ppm spectinomycin, was applied to the seeds at planting as dust inoculum in a peat carrier.

The type of soil preparation greatly affected shoot and nodule dry weight during early growth (Table 1). The greater nodule mass was associated with more dry matter accumulation, suggesting that the bean plants were relying on the symbiosis to obtain nitrogen (Table 1). Two breeding lines, WBR 22-34 and WBR 22-55, produced more dry matter during early growth than EMGOPA 201-Ouro (Table 1), but this greater dry matter accumulation was not correlated with higher yield (Table 2).

Yield was affected by the type of soil preparation. Across N sources, almost all bean lines produced higher yields with deep soil preparation. In this treatment, yields of plants inoculated with rhizobia were similar to those of plants that received 60 kg N/ha. With conventional soil preparation, four lines increased yield with N fertilization, but WBR 22-34 and WBR 22-08 had higher yields with rhizobial inoculation. In contrast, yield of all bean lines increased with the application of N in the no till system.

The percentage of nodules formed by the inoculated strain did not vary significantly with the type of soil preparation. The two bean lines evaluated for nodule occupancy presented different preference for the inoculated strain, regardless of the type of soil preparation. EMGOPA 201-Ouro and WBR 22-34 had 32 and 13%, respectively, of nodules formed by the inoculated strain. This different preference of bean lines for rhizobial strain or of strain for bean lines suggests the possibility of breeding for a more specific host x rhizobia interaction, thus reducing problems of competition among inoculated and indigenous strains. For farmers to realize increased benefits from N_2 fixation, agronomic studies are necessary to define the best field techniques to optimize the symbiosis.

References

Bliss, F.A., P.A.A. Pereira, R.S. Araujo, R.A. Henson, K.A. Kmiecik, J.R. McFerson, M.G. Teixeira, and C.C. da Silva. 1989. Registration of five high nitrogen fixing common bean lines. Crop Sci.: In Press.

Table 1. Effect of soil preparation on shoot and nodule dry weights at V_6 growth stage in three bean lines grown in the field. Goiânia, Goiás, Brazil.

Bean lines	Soil preparation					
	Standard		Deep		No tillage	
	S* (g)	N (mg)	S (g)	N (mg)	S (g)	N (mg)
WBR 22-34	0.57a	58a	1.02a	89a	0.91a	73a
WBR 22-55	0.56a	57a	1.01a	71a	0.84b	61a
EMGOPA 201-Ouro	0.52b	40b	0.87b	63b	0.80b	46b
$\bar{X}$	0.55	52	0.97	74	0.85	60

LSD 0.05 used for mean separation.
S = shoot dry weight: N = nodule dry weight.

Table 2. Effect of soil preparation and the source of nitrogen on the grain yield of six common bean lines grown in field. Goiânia, Goiás, Brazil.

Bean lines	Soil preparation					
	Standard		Deep		No tillage	
	R	N	R	N	R	N
WBR 22-34	1179	603	1586	1629	849	1518
WBR 22-55	727	867	1645	1671	1128	1224
WBR 22-50	1216	865	1845	1837	852	1445
WBR 22-03	776	1025	1739	1642	1302	1449
WBR 22-08	787	853	1777	1303	890	1461
EMGOPA 201-Ouro	1094	1262	1566	1432	1002	1319
$\bar{X}$	963	906	1693	1586	1004	1403
LSD 0.05**			43.8			

* R = inoculated with rhizobia; N = with nitrogen fertilizer.
** LSD = to separate means within columns.