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Short Communication

Response of Soybean to Liquid Biofertizer

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The major N_2-fixing systems are the symbiotic systems, which can play a significant role in improving the fertility and productivity of low-N soils. The Rhizobium-legume symbiosis is suggested to be the ideal solution to the improvement of soil fertility. Phosphate solubilizing bacteria (PSB) are beneficial bacteria capable of solubilizing inorganic phosphorus from insoluble compounds. P-solubilization ability of rhizosphere microorganisms is considered to be one of the most important traits associated with plant phosphate nutrition[4]. Currently, the main purpose in managing soil phosphorus is to optimize crop production and minimize P loss from soils. PSB have attracted the attention of agriculturists as soil inoculums to improve the plant growth and yield.

The farmer field trials were conducted for consecinsive three years during 2015 to 207 on the farmers field of Dewas District of Madhya Pradesh. The experimental soil had pH 7.5, electrical conductivity 0.45 dS/m, Organic cabon 0.55 %, alkaline permangnate extractable N 200 kg/ha, olsen's P 22 kg/ha, 1 N ammonium acetate extractable N 380 g/ha and mongans S 18 kg/ha. The treatments were T_1: Farmers practices (18 kg N and 46 kg P/ha), T_2: recommended practices (25 kg N, 60 kg P, 40 kg K and 20 kg S/ha) and T_3: improved practices (25 kg N, 60 kg P, 40 kg K and 20 kg S/ha + seed treatment with I l/ha rhizobium + 1 l/ha liquid PSB in soil treatment. The observations were recorded at the critical stages of plant growth. After harvest of crop soil samples were collected and analyzed for pH, EC, OC, available N, P, K and S as per common followed methods. Qualities of seeds were estimated as per standard[1]. Grain ant plant samples were separately analyzed for N, P, K and S as per standard procedure and uptake values were calculated.

Table 1 Growth, yield and quality of soybean as influenced by liquid biofertilizers

Treatment	Pods/ plant	Branches /plant	Seed yield (q/ha)	Stover yield (q/ha)	Protein content	Oil content
Farmers practices	51.5	4.45	13.9	32.1	37.8	18.2
Recommended practices	61.8	6.02	15.5	36.2	383	18.9
Improved practices	65.7	6.6	16.9	38.7	39.0	19.2
CD (*P=0.05*)	4.2	1.2	1.4	2.7	0.41	0.21

Number of pods/plant and branches are an important character which ultimately affects the yield potential of the crop. Application of 25 kg N, 60 kg P, 40 kg K and

20 kg S/ha + seed treatment with 1 l/ha rhizobium + 1 l/ha liquid PSB in soil treatment recorded highest pods/plant and branches but it was at par with recommended practices. Lowest pods/plants and branches were recorded under farmer practices. The higher number of pods/plant branches in respect of sulphur application may be due to the fact that applied sulphur enhanced metabolic activities promoting chlorophyll formation and photosynthesis at one hand and root development coupled with accelerated *rhizobial* activities leading to continuous food material supply at adequate level on the other. Application of 25 kg N, 60 kg P_5, 40 kg K and 20 kg S/ha + seed treatment with 1 l/ha rhizobium + 1 l/ha liquid PSB in soil treatment significantly recorded highest yield (16.9 and 38.7 q/ha) followed by recommended practices (25 kg N, 60 kg P, 40 kg K and 20 kg S/ha) (15.5 and 36.2 q/ha). The lowest yield was observed in farmer practices. The availability of sulphur increased with its application which accelerated root development of the plant. The *rhizobial* activities also increased inducing more nodule formation leading to higher number of effective nodules of bigger size[2]. Sulphur application had favourable influence on these parameters. The highest oil and protein content were recorded under 25 kg N, 60 kg P, 40 kg K and 20 kg S/ha + seed treatment with 1 l/ha rhizobium + 1 l/ha liquid PSB in soil treatment. Sulphur a very essential element for oilseed crops, due to its direct involvement in the synthesis of oil, is expected to increase oil content and oil yield of the soybean[3,5].

Table 2 Nutrient uptake and economic viability of soybean as influenced by liquid biofertilizers

Treatment	Uptake of nutrient (kg/ha)				Economic viability			
	N	P	K	S	Cost of cultivation (₹)	Gross return (₹)	Net return (₹)	B:C ratio
Farmers practices	51.5	4.45	13.9	-	30068	43410	13343	1.4
Recommended practices	61.8	6.02	15.5	11.5	31600	48185	16586	1.5
Improved practices	65.7	6.6	16.9	21.4	32290	52815	20525	1.6

Table 3 Available soil nutrient status of soybean as influenced by liquid biofertilizers

Treatment	Before sowing of soybean				After harvest of soybean			
	N	P	K	S	N	P	K	S
Farmers practices	198	18.0	379	17.9	195	17.6	375	172
Recommended practices	201	18.2	381	18.3	205	18.3	385	18.4
Improved practices	201	17.8	380	17.8	209	18.8	391	18.9

A positive response of sulphur application was observed on nutrient uptake (N, P, K and S) by soybean crop. The highest oil and protein content were recorded under 25 kg N, 60 kg P, 40 kg K and 20 kg S/ha + seed treatment with 1 l/ha rhizobium + 1 l/ha liquid PSB in soil treatment The application of N, P, K and S increased the uptake of N, P, K and S. The uptake of N, P, K and S also reported by Gokhale *et al.* (2005). Before sowing and at harvest, soil samples were analyzed for available N, P, K and S status (kg/ha). Different treatments significantly influenced the available nutrients. Highest N, P, K and S were recorded under treatment under 25 kg N, 60 kg P, 40 kg K and 20 kg S/ha + seed treatment with 1 l/ha rhizobium + 1 l/ha liquid PSB in soil treatment followed by recommended practices (25 kg N, 60 kg P, 40 kg K and 20 kg S/ha). Lowest N, P, K and S status of soil were observed under farmer practices. Economic viability was also influenced by the different treatments. The highest cost of cultivation (₹32290/ha) gross

return (₹52815/ha), net return (₹20525/ha and B:C ratio (1.6) were recorded under improved practices. However, lowest cost of cultivation (₹30068/ha) gross return (₹ 43410/ha), net return (₹13343/ha) and B:C ratio (1.4) were recorded under farmers practices.

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