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Response of soybean (*Glycine max*) to nitrogen and phosphorus

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Soybean [*Glycine max* (L.) Merr.] is recently introduced for cultivation in Orissa. Hence an experiment was conducted during the rainy season of 1991 at Bhubaneshwar, to study the effect of different levels of nitrogen and phosphorus on its grain yield and protein content under rainfed condition.

The soil belongs to the order Oxisol, and is loam in texture with pH 5.6. It was low in organic carbon (0.41%) and medium in available phosphorus (14.4 kg/ha) and available potassium (139.0 kg/ha). The treatments consisting of similar combinations of 3 levels of N and P_2O_5 (0, 40 and 80 kg/ha) arranged in randomized block design with 3 replications. Nitrogen in form of urea was applied as basal and 3 weeks after germination in 2 equal splits, whereas total phosphorus was applied as basal through single superphosphate. A uniform dose of K_2O @ 40 kg/ha was applied at sowing as muriate of potash. Soybean cv. 'BR 2' was sown on 7 July 1991 with the spacing 45 cm x 5 cm.

Nitrogen @ 40 kg/ha significantly increased the seed yield and yield-attributing parameters over the control (Table 1). The yield increase at 40 and 80 kg N/ha was 45 and 52% compared with the control respectively. The enhancement in grain yield could be attributed to cumulative effects of number of fertile pods/plant and 100-seed weight. This is in agreement with the observations of Jayapaul and Ganesaraja (1990). But increasing the dose of fertilizer N to 80 kg/ha did not record any significant re-

Table 1. Effect of nitrogen and phosphorus on growth, yield attributes, yield and protein content of soybean

Treatment	Plant height (cm)	Branches/ plant	Pods/plant		Sterility (%)	100-seed weight (g)	Seed yield (q/ha)	Protein content in grain (%)
			Fertile	Sterile				
N (kg/ha)								
0	39.3	3.4	36.3	2.8	7.7	10.4	6.07	36.38
40	44.3	3.9	57.8	3.4	5.9	10.6	8.79	37.97
80	55.2	5.2	63.0	4.8	7.6	11.1	9.21	39.00
CD (P = 0.05)	2.9	0.6	6.6	0.9		0.2	0.96	0.42
P_2O_5 (kg/ha)								
0	38.2	3.3	36.2	3.1	8.6	10.4	6.23	36.75
40	47.2	4.0	58.1	3.6	6.2	10.8	8.84	37.83
80	53.4	5.1	63.2	4.3	6.8	11.0	9.01	38.94
CD (P = 0.05)	2.9	0.6	6.6	0.9		0.2	0.96	0.42

sponse in seed yield, though the protein content increased significantly.

Phosphorus application @ 40 kg P_2O_5/ha increased the grain yield by 42% over the control. Further increase in P level to 80 kg P_2O_5/ha did not, however, show significant variation in grain yield, but there was a significant increase in the protein content of grain compared with the control and 40 kg P_2O_5/ha. Significant beneficial effects of P application on grain yield of soybean was reported by Singh and Bajpai (1990).

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Effect of irrigation and nitrogen on nodulation, N accumulation and seed yield of soybean (*Glycine max*)

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Nitrogen fixed by soybean [*Glycine max* (L.) Merr.] is capable of meeting the major part of its requirement (Clegg, 1982). However, a part of the N is needed particularly during early vegetative and seed-development stages. Nodule activity, a source to fulfil N demand of soybean, also gets reduced at seed-development stage, when requirement of N is maximum. The excess or limited soil-moisture supply adversely affects nodulation and thereby N fixation (Pahalwan and Tripathi, 1984).

The experiment was conducted on clay-loam soil during the summer season of 1991 at Raipur. The soil was low in available N (207 kg/ha), medium in available P (35 kg/ha) and high in exchangeable K (337 kg/ha), with pH 6.8. The moisture content at field capacity and wilting point were 27.5 and 18.3% respectively. Different possible combinations of 3 irrigation water (IW) : cumulative pan evaporation (CPE) ratios (0.3, 0.5 and 0.7) and 3 growth stages, viz. vegetative (germination to bloom, i.e. up to 38 days after sowing); flowering (blooming to pod-initiation stage, i.e. 39–58 days after sowing); and podding stage (pod initiation to maturity stage, i.e. 59–93 days after sowing); as well as 6 combinationss of irrigation schedules (main plot) were studied along with 3 nitrogen levels (subplot) in split-plot design with 3 replications. The irrigation treatments were: I_1, IW : CPE of 0.7 at all the stages; I_2, IW : CPE of 0.3 at vegetative