

Effect of fertilizers, manure and lime on soybean (*Glycine max*) grown in mid-hills of Sikkim

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ABSTRACT

An experiment was conducted during rainy season (*kharif*) of 1990 and 1991 to study the effect of graded doses of nitrogen, phosphorus, potassium, farmyard manure (FYM) and lime and their combinations on the yield and yield-attributing characters of soybean [*Glycine max* (L.) Merr.]. Application of lime 1 tonne/ha + FYM 15 tonnes/ha + full dose of NPK gave significantly higher seed and straw yields of 15.9 and 45.9 q/ha of soybean respectively over the control.

Soybean [*Glycine max* (L.) Merr.] can meet its nitrogen requirement by symbiotic nitrogen fixation of atmospheric nitrogen. The largest oilseed-growing country India imports still large quantities of edible oils. This is because the productivity of oilseeds is largely determined by the monsoon, as bulk of their areas are rainfed. Response to fertilizers, manures and lime were seen in high-rainfall area. As the soil is highly permeable, water does not stay for longer period in the field. Soybean responds favourably to lime + farmyard manure + full dose of NPK combinations (Singh *et al.*, 1990; Singh *et al.*, 1991; Patiram, 1991).

Since information on these aspect is scanty for acid soils of Sikkim, the present study was initiated to find out the effect of graded doses of NPK in combination with lime and FYM on yield and yield attributes of soybean.

MATERIALS AND METHODS

A field experiment was conducted at

ICAR Research Farm, Tadong, in mid-hills (881–500 m mean sea-level) of Gangtok during rainy (*kharif*) season of 1990 and 1991. The experiment was conducted in randomized block design with 3 replications. Eleven treatments, viz. T₁, control; T₂, N 25 kg/ha; T₃, N 25 kg/ha + P 21 kg/ha; T₄, N 25 kg/ha + K 50 kg/ha; T₅, N 25 kg/ha + P 21 kg/ha + K 50 kg/ha; T₆, farmyard manure (FYM) 15 tonnes/ha; T₇, FYM 15 tonnes/ha + N 25 kg/ha + P 21 kg/ha + K 50 kg/ha; T₈, lime 1 tonne/ha + N 25 kg/ha + P 21 kg/ha + K 50 kg/ha; T₉, lime 2 tonnes/ha + N 25 kg/ha + P 21 kg/ha + K 50 kg/ha; T₁₀, lime 1 tonne/ha + FYM 15 tonnes/ha and T₁₁, lime 1 tonne/ha + FYM 15 tonnes/ha + N 25 kg/ha + P 21 kg/ha + K 50 kg/ha. The experimental soil was silty clay-loam, pH (less than 5.5), medium organic carbon (0.69%), low in available P (3.2–4.0 kg/ha) and medium in available K (174.5 to 186.8 kg/ha). The test cultivar of soybean was 'Bragg'. The crop was sown at 50 cm x 20 cm spacing on 23 and 10 May and was har-

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Table 1. Effect of fertilizers, manure and lime on yield attributes, seed and straw yields of soybean

Treatment	Plant height (cm)		Branches/ plant		Filled pods/plant		Seed yield (q/ha)		Straw yield (q/ha)	
	1990	1991	1990	1991	1990	1991	1990	1991	1990	1991
Control	62.9	55.2	4.6	2.7	72.6	25.2	11.3	6.6	38.8	24.0
N 25 kg/ha	61.5	49.4	4.4	1.3	50.3	26.3	13.9	7.3	34.7	21.1
N 25 kg/ha + P 21 kg/ha	67.2	65.1	4.9	2.3	72.1	28.3	13.2	10.8	26.7	28.4
N 25 kg/ha + K 50 kg/ha	63.7	64.5	4.4	1.8	59.6	33.5	15.8	10.7	38.0	32.0
N 25 kg/ha + P 21 kg/ha + K 50 kg/ha	64.4	57.3	4.9	1.5	56.6	29.1	16.1	10.7	40.0	26.2
FYM 15 tonnes/ha	69.3	64.3	5.1	2.7	62.6	27.9	15.3	9.2	35.9	43.0
FYM 15 tonnes/ha + full dose NPK	74.6	76.0	4.6	2.9	64.1	40.7	15.2	13.3	44.2	43.3
Lime 1 tonne/ha + full dose NPK	62.3	62.8	5.1	1.6	73.7	26.7	16.1	12.7	33.5	35.0
Lime 2 tonnes/ha + Full dose NPK	67.9	67.1	4.4	2.5	61.0	37.3	15.9	9.3	34.6	38.4
Lime 1 tonne/ha + FYM 15 tonnes/ha	71.4	68.0	4.7	2.2	66.8	34.3	18.8	10.4	38.9	38.5
Lime 1 tonne/ha + FYM 15 tonnes/ha + full dose NPK	72.8	73.1	4.7	1.6	68.7	17.7	19.3	12.5	44.4	47.5
CD (P = 0.05)	5.4	6.6	NS	NS	NS	NS	2.5	3.2	NS	9.1

vested on 3 and 8 October 1990 and 1991 respectively. The observations were recorded on 5 plant basis and per plant average was worked out. The plant height (cm) at harvest, number of branches and number of filled pods/plant were recorded. The seed and straw yields (q/ha) were also calculated. The total rainfall received from (June to September) was 2,445.7 mm in 1989 rainy days and 2,262.9 mm in 115 rainy days in 1990 and 1991 respectively. The average sunshine hours were 3.55 and 3.12. The average evaporation was 0.9 and 0.6 mm/day.

RESULTS AND DISCUSSION

Growth and yield attributes

The plant height was significantly higher in 1990 and 1991 with the application of 15 tonnes FYM + full dose of NPK than that with the control (Table 1). The number of branches and number of filled pods/plant did not differ significantly due to the inorganic fertilizers, lime and FYM application, but numerically higher number of branches were found with 15 tonnes FYM/ha and 1 tonne lime/ha + full dose of NPK in both the years. The maximum number of filled pods/plant was found with the application of lime 1 tonne/ha + full dose of NPK in 1990, whereas number of filled pods/plant was found maximum where FYM 15 tonnes/ha + full dose of NPK were applied in 1991. The higher values of growth character and yield attributes of soybean might be mitigated in the more uptake of nutrients with the use of organic manures and increase in soil pH in association of lime (Patiram, 1991).

Seed and straw yields

The soybean seed yield was significantly

more where lime 1 tonne/ha + FYM 15 tonnes/ha + full dose of NPK were applied in 1990. However, in 1991 the FYM 15 tonnes/ha + full dose of NPK gave significantly higher yield of soybean. The average data of seed yield reveal that full dose of NPK + 1 tonne lime/ha + 15 tonnes FYM/ha resulted in the maximum seed yield. The response to lime was noticed by Patiram (1991) on these land. The FYM + N increases the seed yield of soybean in wheat-soybean rotation by (Kundu *et al.*, 1991). However, the straw yields were 44.4 q/ha in 1990 and 47.5 q/ha in 1991 with the application of full dose of fertilizer (Table 1). These differences in yield might be due to variations in quantum of rainfall and its distribution during the crop-growth periods. The higher inorganic fertilizers and organic manures enhanced the vegetative growth and resulted in higher seed yield. Singh *et al.* (1990) and Singh *et al.* (1991) reported that application of FYM, lime and NPK gave significantly higher seed and straw yields of soybean.

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