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Effect of lime and sulphur on rapeseed (*Brassica campestris* subsp. *oleifera* var. *toria*) – soybean (*Glycine max*) cropping sequence

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ABSTRACT

A field experiment was conducted during 1989–90 and 1990–91 to evaluate the effect of lime and sulphur on yield and nutrient uptake of rapeseed [*Brassica campestris* ssp. *oleifera* (Metzger) Sinsk. var. toria] – soybean [*Glycine max* (L.) Merr.] cropping sequence. The levels of lime and sulphur tried were 0 and 1.25 tonnes/ha and 0, 10,20,30 and 40 kg S/ha respectively. Application of lime (1.25 tonnes/ha) and sulphur (30 kg/ha) to rapeseed significantly increased the seed yield as well as NPK uptake by the crop. The residual effects of lime (1.25 tonnes/ha) and S (30 kg/ha) on soybean were found superior to no lime andno sulphur application in increasing the seed yield and nutrient uptake.

Key words: Lime, S, Rapeseed, Soybean, Yield, NPK uptake

One of the ways to increase oilseed production is to adopt oilseed-based intensive cropping system. Among the various factors affecting the yield in intensive cropping, the preceding rotation crops and fertilizer used play an important role. For adoption of double cropping and maintenance of soil fertility, leguminous crops are needed to be introduced in the cropping system (Singh, 1981). The importance of NPK fertilizer in rapeseed as well as in soybean is well recognized. But a very little attention has been paid on application of lime and sulphur to these crops, more particularly when grown in sequence in acid soils; although these are needed by the oilseed crops in large quantities. The present study was therefore undertaken to evaluate the effect of lime and S on rapeseed–soybean cropping sequence in acidic red soils of Eastern Ghat Highland Zone of Orissa.

MATERIALS AND METHODS

The experiment was conducted with rapeseed in the winter season of 1989, followed by soybean in the rainy season at Semiliguda. Two cycles of the system were completed in fixed plots in1991. The soil was sandy loam, having pH 5.8, organic carbon 0.56%, total N 0.054%, available P_2O_5 14.8 kg/ha and available K_2O 184.2 kg/ha. The treatments consisted of 2 levels of lime (no lime and lime at 1.25 tonnes/ha) and 5 levels of S (0, 10, 20, 30 and 40 kg/ha) to rapeseed. Thus 10 treatment combinations were tested in facto-

rial randomized block design with 4 replications. Treatments allotted to plots were fixed for 2 years on same site. Both the crops were studied with recommended doses of NPK fertilizers. Lime was mixed with soil 15 days before sowing of rapeseed. Full dose of P, K and S and half dose of N were applied basal to rapeseed and remaining N was top-dressed at 20–25 days after sowing. The entire dose of NPK to soybean was applied at sowing. 'M 27' rapeseed was sown in the second fortnight of October and the crop was provided with 3 irrigations. 'Gaurav' soybean was sown in the second fortnight of June in each year as a rainfed crop. Soybean equivalent was calculated by converting the seed yield of rapeseed in soybean yield on price basis and then by adding it with respective soybean seed yield obtained due to different treatments. Seed and plant samples of both the crops were collected at harvest and analysed for N (modified micro-kjeldhal's method), P (vanado-molybdo phosphoric acid yellow colour method) and K uptake (flame photometer). Pooled analysis of 2 years mean data was done and reported in the tables.

RESULTS AND DISCUSSION

Yield

The overall seed yield during 1990–91 was higher than that during 1980–90 for both the crops (Table 1). Lime (1.25 tonnes/ha) application to rapeseed did not give any significant result in increasing the yield in the first year. But in subsequent seasons, its effect was significantly superior to no lime application. The pooled values of seed yield revealed that lime application resulted in the maximum rapeseed yield. The residual effect of lime on soybean indicated 25.5% higher seed yield than no lime application. Further, lime application also resulted in 15.9% increase in soybean-equivalent yield in rapeseed–soybean cropping system. The increase in seed yield could be attributed to supply of nutrients particularly of NPK in acid soils due to liming (Table 2). The similar response to lime was reported by Prasad *et al.* (1976).

Sulphur did not result in any significant increase in seed yield of rapeseed during the first year. However, both the crops responded well to S in subsequent seasons. Pooled data indicated that increase in level of S from 0 to 40 kg S/ha increased the seed yield of rapeseed and significant increase in yield was obtained with application of 30 kg S/ha. The carry-over effect of S applied to rapeseed on yield of rainy-season soybean showed significant variation in seed yield. The average yield recorded under 30 kg S/ha was significantly

Table 1. Effect of lime and sulphur on seed yield of rapeseed–soybean cropping sequence

Treatment	Seed yield of rapeseed (q/ha)			Seed yield of soybean (q/ha)			Soybean equivalent yield (q/ha)		
	1989–90	1990–91	Pooled	1989–90	1990–91	Pooled	1989–90	1990–91	Pooled
Lime application									
No lime	13.1	14.3	13.7	15.3	16.1	15.7	30.4	32.6	31.5
Lime (1.25 tonnes/ha)	13.9	15.2	14.6	19.2	20.2	19.7	35.2	37.7	36.5
CD (P = 0.05)	NS	0.73	0.76	2.84	3.82	3.48	4.12	4.04	4.21
Sulphur (kg/ha)									
0	13.1	14.4	13.7	15.6	16.3	16.0	30.7	32.9	31.8
10	13.3	14.5	13.9	16.3	17.1	16.7	31.6	33.8	32.7
20	13.4	14.7	14.1	16.7	17.5	17.1	32.2	34.5	33.4
30	13.7	15.1	14.4	18.5	19.5	19.0	34.3	36.9	35.6
40	13.8	15.2	14.5	19.3	20.3	19.8	35.2	37.8	36.5
CD (P = 0.05)	NS	0.68	0.52	2.44	2.02	2.66	2.92	1.96	2.66

Table 2. Nutrient uptake (kg/ha) by rapeseed–soybean cropping sequence as influenced by lime and sulphur (pooled data of 2 years)

Treatment	Uptake by rapeseed			Uptake by soybean			Total uptake in sequence		
	N	P	K	N	P	K	N	P	K
Lime application									
No lime	59.43	14.72	48.23	98.40	8.64	21.60	157.83	23.36	69.83
Lime (1.25 tonnes/ha)	78.56	16.36	52.44	144.20	14.24	29.60	222.76	30.60	82.04
CD (P = 0.05)	10.02	1.12	8.41	16.72	1.22	4.30	10.92	1.18	7.72
Sulphur (kg/ha)									
0	44.00	9.52	30.78	117.20	10.72	23.20	161.20	20.24	53.98
10	56.56	11.43	39.84	129.20	12.96	27.20	185.76	24.39	67.04
20	68.24	12.93	50.25	132.40	13.68	30.40	200.64	26.61	80.65
30	75.23	13.82	52.16	136.72	13.96	32.16	211.95	27.78	84.32
40	77.93	14.16	53.08	138.36	14.14	32.84	216.30	28.30	85.92
CD (P = 0.05)	8.42	2.36	8.76	6.12	1.06	3.52	8.12	2.02	6.96

higher. Similar results were also reported by Tripathi and Sharma (1994) in Indian mustard–rice cropping sequence. The soybean-equivalent yield of rapeseed–soybean cropping sequence was significantly more at 30 kg S/ha.

Nutrient uptake

Lime application significantly increased the N, P and K uptake by rapeseed as well as residual crop of soybean. The increase in N uptake due to liming of acid soils could be attributed to the probability in increasing the bacterial activity in mineralization and nitrification processes in the reclaimed soils. The improvement in P uptake might be due to dissociation of Fe and Al phosphate complexes present in acid soils and to some extent increased mineralization of organic P. Liming of acid soils also increased the K uptake by both the crops. The residual effect on soybean could be due to increased rhizobial population in the soil.

Application of S increased the N, P and K uptake by rapeseed up to 40 kg S/ha. The carry-over effect of S on soybean was also significant for nutrient uptake. Similar response of S on nutrient uptake was also reported by Tripathi and Sharma (1994) for Indian mustard–rice cropping sequence.

The results indicate that in rapeseed–soybean cropping sequence, application of lime (1.25 tonnes/ha) and sulphur (30 kg/ha) to rapeseed significantly increased the seed yield and N, P and K uptake by both the crops in the system. Thus the crops should also get their recommended dose of fertilizer directly in the system to achieve higher yield.

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