

Effect of sulphur and nitrogen on yield attributes and seed yield of Indian mustard (*Brassica juncea*) on Vertisol

V. D. KHANPARA¹, B. L. PORWAL², M. P. SAHU³ AND J. C. PATEL⁴

Rajasthan College of Agriculture, Rajasthan Agriculture University, Udaipur 313 001

Received: June 1992

ABSTRACT

A field experiment was conducted during the the winters of 1987-88 and 1988-89 to study the effect of sulphur and nitrogen on yield attributes and seed yield of Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson] on Vertisol of Udaipur. N @ 60 kg/ha significantly improved the yield parameters, viz. siliquae/plant and seed yield/plant and 1,000-seed weight during both the years and seeds/siliqua during 1987-88. This level of N was also significantly superior to the other levels for seed yield during both the years as well as in pooled results. All the yield characters and seed yield showed a significant increase up to 100 kg S/ha. However, mode of sulphur application did not show significant effect on yield attributes and seed yield.

Fertilizer management, especially of nitrogen and phosphorus, is one of the most important agronomic factors that affects the crop yield. Of late, sulphur has become an important nutrient. Rapeseed and Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson] crops respond to S remarkably depending upon soil type and source of S used (Singh and Sahu, 1986). Singh and Singh (1984) reported 31% increase in yield with S application (through elemental sulphur) @ 250 kg/ha, 21 days before sowing on clay-loam calcareous soils of south Rajasthan. It is very difficult for the farmers to have a period of 21 days prior to sowing of the Indian mustard. Hence it is necessary to find out the alternate way to apply elemental sulphur for increased efficiency under Indian mustard.

MATERIALS AND METHODS

The field experiment was conducted during the winter (*rabi*) season of 1987-88 and 1988-89 on clay-loam soil of Udaipur, with Indian mustard. The experiment comprised 36 treatment combinations of 4 levels of nitrogen (0, 20, 40 and 60 kg/ha) as main-plot treatment, and 4 levels of sulphur (50, 100, 150 and 200 kg/ha) and 2 modes of S application (application of full dose of S through elemental S 21 days before sowing and application of 50 kg S/ha through gypsum + remaining dose through elemental S at sowing) along with an absolute control (no S) in subplot treatments.

The treatments were laid in split-plot design with 4 replications. Experimental soil was clay loam in texture, with moderately

Present address: ¹Department of Agronomy, GAU, Junagadh 362 001; ²KVK, RAU, Sirohi 307 001; ³ARS, RAU, Bikaner 334 001; ⁴N.M. College, GAU, Navasari 396 450

Table 1. Effect of levels of nitrogen and sulphur and modes of sulphur application on yield attributes and yield of Indian mustard

Treatment	Siliquae/ plant		Seeds/ siliqua		Seed weight/ plant (g)		1,000-seed weight (g)		Seed yield (q/ha)		
	1987- 88	1988- 89	1987- 88	1988- 89	1987- 88	1988- 89	1987- 88	1988- 89	1987- 88	1988- 89	Pooled
<i>N (kg/ha)</i>											
0	104.3	101.1	11.0	11.4	3.78	3.62	3.43	3.44	11.8	11.2	11.5
20	112.4	105.4	11.4	11.4	3.94	3.87	3.46	3.45	12.3	12.1	12.2
40	120.6	117.4	11.6	11.5	4.81	4.30	3.56	3.54	15.0	13.3	14.2
60	131.8	131.4	12.2	11.7	5.81	4.75	3.71	3.68	18.0	14.8	16.4
CD (P = 0.05)	5.2	5.6	0.1	NS	0.44	0.29	0.20	0.16	1.0	0.7	0.8
<i>Control vs S</i>											
Control	105.9	101.2	10.8	11.4	3.79	2.68	3.24	3.34	11.8	11.3	11.6
S	118.7	115.4	11.6	11.5	4.68	4.19	3.58	3.55	14.6	13.0	13.8
F test	Sig.	Sig.	Sig.	NS	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
<i>S (kg/ha)</i>											
50	108.5	104.1	11.1	11.4	4.12	3.90	3.42	3.42	12.6	12.1	12.5
100	120.3	116.8	11.8	11.5	4.82	4.24	3.63	3.58	15.0	13.3	14.2
150	122.0	120.2	11.8	11.5	4.88	4.30	3.63	3.59	15.2	13.4	14.3
200	124.0	120.4	11.8	11.6	4.91	4.33	3.64	3.60	15.2	13.4	14.3
CD (P = 0.05)	4.4	3.1	0.1	NS	0.14	0.09	0.07	0.07	0.4	0.3	0.3
<i>Modes of S application</i>											
Elemental S alone 21 DBS	11.9	116.2	11.6	11.6	4.70	4.20	3.58	3.55	14.6	13.1	13.8
Gypsum + elemental S at sowing	117.8	114.6	11.6	11.5	4.67	4.18	3.57	3.55	14.6	13.0	13.8
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS, Not significant; DBS, Days before sowing

alkaline reaction. The soil was medium in available N and S. Indian mustard 'Kranti' was sown in rows 30 cm apart using 5 kg seed/ha.

RESULTS AND DISCUSSION

Effect of nitrogen

Significant effect of N was observed on yield attributes, viz. siliquae/plant, seeds/silique (only during 1987–88), seed yield/plant and 1,000-seed weight during both the years (Table 1). These were increased with increasing levels of N up to 60 kg N/ha, due to the overall improvement in vegetative growth at higher level of N.

Pooled data of 2 years (Table 1) indicated that significantly highest seed yield was with 60 kg N/ha, which was higher by 42.8% than that of the control. Application of N increased the yield attributes, which in turn increased the seed yield @ 60 kg N/ha. The results are in close conformity with the findings of Reddy and Sinha (1988) and Rathore and Manohar (1989).

Effect of sulphur

Sulphur fertilization significantly improved the different yield attributes, viz. siliquae/plant, seeds/silique (1987–88), seed yield/plant and 1,000-seed weight during both the years (Table 1) compared with the control. The significant increase in all these characters was recorded up to 100 kg S/ha. Increase in these parameters could be ascribed to the overall improvement in plant growth, vigour and production of sufficient photosynthates through increased leaf-area index and chlorophyll content of leaves with S fertilization. A part of the beneficial effect of S on yield attributes seems to be due to better availability of N, K and S and their translocation which reflects in terms of increased yield attributes of the crop. Singh

and Bairathi (1980) and Rathore and Manohar (1989) also reported similar results.

Effect of mode of S application

Seed yield and productive parameters were largely comparable under the 2 modes of S application. The data indicate that for increasing efficiency of elemental S, combined application of elemental S and gypsum was more effective agro-technique than elemental S application 21 days before sowing. No such attempt for increasing sulphur-use efficiency in mustard production has, however, been made so far in the country and elsewhere.

Interaction effect of N and S

Combined application of 60 kg N/ha + 100 kg S/ha was significantly superior to the other treatment combinations for number of siliquae/plant during 1988–89. This treatment gave 45.7% more siliquae/plant (136.3) than 50 kg S/ha applied without N (Table 2).

Significant interaction of N $\times$ S for seed yield/plant was observed during 1987–88, indicating the superiority of proper combination of 60 kg N/ha + 100 kg S/ha. The seed yield/plant recorded under this combination was 6.13 g/plant, which was significantly higher by 73.7% than that obtained under 50 kg S/ha applied without N (Table 2).

Likewise, a significant increase in seed yield/ha was observed up to application of 60 kg N/ha supplied with 100 kg S/ha in pooled results (Table 2). It indicates the superiority of this treatment combination in producing seed yield. The seed yield recorded under this treatment combination was 17.3 q/ha, which was significantly higher by 58.1% than that obtained under 50 kg S/ha applied without N.

The interaction effect between N and S on

Table 2. Interaction effect of nitrogen and sulphur on siliquae/plant, seed yield/plant and seed yield of Indian mustard

S (kg/ha)	Siliquae/plant (1988-89)			Seed yield/plant (g) (1987-88)			Seed yield (q/ha)*		
	N ₀	N ₂₀	N ₄₀	N ₀	N ₂₀	N ₄₀	N ₀	N ₂₀	N ₄₀
50	93.6	99.2	107.1	116.8	3.53	3.58	4.24	5.13	5.13
100	103.9	107.9	120.3	136.3	3.94	4.12	5.10	6.13	6.13
150	104.8	109.2	124.7	142.1	3.96	4.10	5.12	6.36	6.36
200	105.3	109.1	124.4	142.9	3.93	4.21	5.21	6.26	6.26
CD									
Two S means at the same level of N			6.2				0.3		0.6
Two N means at the same level of S								0.4	0.8

N₀, N₂₀, N₄₀, N₆₀, 0, 20, 40 and 60 kg N/ha respectively

*Pooled data

these characters might be the result of the synergistic effects of both the nutrients.

REFERENCES

- Rathore, P. S. and Manohar, S. S. 1989. Response of mustard to nitrogen and sulphur. I. Effect of nitrogen and sulphur on ancillary characters and yield of mustard. *Indian Journal of Agronomy* 34 : 333-336.
- Reddy, B. N. and Sinha, M. N. 1988. Yield and phosphorus utilization of mustard as influenced by phosphorus at various levels of nitrogen and moisture regimes. *Fertiliser News* 33 (2) : 31-37.
- Singh, K. S. and Bairathi, R. C. 1980. A study in the sulphur fertilization of mustard in semi-arid tract of Rajasthan. *Annals of Arid Zone* 19 (3) : 197-202.
- Singh, H. G. and Sahu, M. P. 1986. Response of oilseeds to sulphur. *Fertiliser News* 31 (9) : 23-30.
- Singh, T. P. and Singh, H. P. 1984. Response of Indian rape to planting density, nitrogen and sulphur. *Indian Journal of Agronomy* 29 (4) : 539-543.