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Effect of nitrogen and sulphur on growth and yield of mustard (*Brassica juncea*)

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ABSTRACT

A field experiment was conducted during the winter seasons of 1987–88 and 1988–89 on clay-loam soils at Udaipur, to study the effect of nitrogen and sulphur on growth and yield of mustard [*Brassica juncea* (L.) Czernj. & Cosson]. Dry-matter production/plant and leaf-area index at 50% flowering stage were significantly increased with an increase in N levels during both the years. N @ 60 kg/ha was significantly superior to the other the levels of N for plant height, primary and secondary branches/plant. This level of N was also significantly superior to the other levels for seed yield. A significant improvement in growth characters was also noticed due to S application over no S. Dry-matter production/plant was significantly increased up to 150 and 100 kg S/ha during 1987–88 and 1988–89 respectively. A significant increase in leaf-area index, plant height, primary and secondary branches/plant was observed only up to 100 kg S/ha during both the years. The seed yield of mustard was significantly increased only up to 100 kg S/ha. The modes of S application did not attain the level of significance for all the growth characters and seed yield of mustard.

Of the major elements, nitrogen is found insufficient in most of the Indian soils. Samui *et al.* (1986) reported beneficial effect of N in increasing the growth parameters and seed yield of mustard [*Brassica juncea* (L.) Czernj. & Cosson]. During the past few years S has received increasing attention. Global reports of sulphur deficiency and consequent crop responses are quite ostensible (Tandon, 1989). Since very little information is available on the effect of N and S on growth parameters and seed yield of mustard, particularly in Udaipur district of Rajasthan, an experiment was carried out on these aspects.

MATERIALS AND METHODS

A field experiment was conducted during the winter seasons of 1987–88 and 1988–89 on clay-loam soil at Udaipur. The soil contained organic carbon 0.667 and 0.691%, available N 274.4 and 282.2 kg/ha, available P 67.30 and 65.65 kg/ha and available S 17 and 18 ppm during 1987—88 and 1988–89 respectively. The soil was moderately alkaline. The treatments comprising 4 levels of N (0, 20, 40 and 60 kg/ha) in main plot and combination of 4 levels of S (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

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gypsum + remaining dose through elemental S at sowing) along with an obsolute control in subplot, was laid out in split-plot design with 4 replications. The mustard variety 'Kranti' was sown in rows 30 cm apart using 5 kg seeds/ha. In all the crop received 4 irrigations.

RESULTS AND DISCUSSION

Response to nitrogen

Dry matter/plant and leaf-area index recorded at 50% flowering were significantly increased with an increase in level of N from 0 to 60 kg/ha during both the years (Table 1). This obviously appears to be a direct consequence of increased N availability for growth and development of plant. The increased N supply expended the leaf area which might have accelerated the photosynthetic rate, thereby increasing the supply of carbohydrates to the plant. Thus, N fertilization increased the leaf-area index and dry-matter production. The results confirm the findings of Rathore and Menohar (1989) for dry matter and of Shrimali (1987) and Reddy and Sinha (1988) for leaf-erea index.

Nitrogen fertilization significantly increased the plant height, primary branches/ plant and secondary branches/plant at harvest during both the years, being maximum at 60 kg N/ha (Table 1). This may be attributed to better availability of N at active growth of the crop, as the soil had medium N status. Similar effects of N in increasing the plant height, number of primary and secondary branches/plant were also reported by Rathore and Manohar (1989).

Nitrogen @ 60 kg/ha gave significantly higher seed yield of mustrad by 53.53, 46.43 and 20.43 compared with those of the control, 20 and 40 kg N/ha respectively during 1987–88. The respective figures were 31.52, 22.17 and 10.89% during 1987–88 (Table 1). Pooled data indicated that the application of 60 kg N/ha gave significantly higher seed yield compared with the other N levels. Application of N increased growth parameters of mustard, which in turn might have increased seed yield of mustard at 60 kg N/ha.

Response to sulphur

Application of sulphur significantly increased dry matter/plant and leaf-area index at 50% flowering compared with the control during both the years. The dry-matter production was significantly increased up to 150 and 100 kg S/ha during 1987–88 and 1988–89 respectively, whereas significant increase in case of the leaf-area index was observed up to 100 kg S/ha during both the years (Table 1). The increase in these characters could partly be attributed to the beneficial effect of S fertilization as a nutrient which plays an important role in various metabilic processes in plant (Tandon, 1986). Improvement in leaf chlorophyll content coupled with significant increase in leaf-area index under the influence of S fertilization might have also contributed to significant increase in the dry-matter production/plant. The results confirm the findings of Rathore and Manohar (1989).

Plant height, number of primary and secondary branches/plant recorded at harvest were singificantly increased due to S fertilization compared with no S application during both the years (Table 1). Significant increase in the case of plant height and primary branches/plant was noticed up to the application of 100 kg S/ha during both the

Table 1. Effect of nitrogen and sulphur and modes of S application on dry-matter production, leaf-area index (at 50% flowering), yield and its contributing characters in mustard

Treatment	Dry matter/ plant (g)		Leaf-area index		Plant height (cm)		Primary branches/plant		Secondary branches/plant		Seed yield (q/ha)	
	1987–88	1988–89	1987–88	1988–89	1987–88	1988–89	1987–88	1988–89	1987–88	1988–89	1987–88	1988–89
N (kg/ha)												
0	17.94	16.94	2.76	2.56	148.60	147.47	4.65	4.53	5.54	5.39	11.75	11.23
20	19.64	18.57	2.97	2.79	151.22	150.25	4.97	4.73	5.92	5.53	12.32	12.09
40	21.41	20.29	3.33	3.31	155.93	193.43	5.39	5.06	6.53	6.27	14.98	13.32
60	22.87	21.78	3.79	3.54	162.96	159.66	5.73	5.44	7.20	7.06	18.04	14.77
CD (P = 0.05)	0.45	0.67	0.08	0.14	6.24	5.05	0.37	0.32	0.21	0.26	1.03	0.70
Control vs S												
Control	17.33	16.37	2.94	2.75	149.49	147.06	4.55	4.43	5.39	5.16	11.82	11.31
S	20.86	19.77	3.25	3.03	155.33	153.41	5.27	5.01	6.41	6.18	14.58	13.04
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S (kg/ha)												
50	18.73	17.91	3.07	2.85	153.22	150.76	4.79	4.62	5.73	5.47	12.85	12.03
100	21.29	20.30	3.29	3.08	155.26	154.30	5.39	5.07	6.51	6.20	15.03	13.31
150	21.60	20.40	3.31	3.10	156.12	153.75	5.41	5.13	6.61	6.46	15.19	13.36
200	21.81	20.49	3.32	3.11	156.61	155.23	5.48	5.20	6.80	6.58	15.24	13.42
CD (P = 0.05)	0.22	0.25	0.06	0.11	2.11	2.72	0.15	0.17	0.20	0.17	0.37	0.25
Modes of S application												
Elemental S alone 21 DBS	20.29	19.78	3.25	3.04	155.42	153.90	5.28	5.02	6.43	6.23	14.60	13.06
Gypsum + elemental S at sowing	20.81	19.77	3.24	3.03	155.23	152.92	5.25	4.99	6.40	6.13	14.55	13.02
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Sig, Significant; DBS, days before sowing

years. However, number of secondary branches/plant were significantly increased up to 100 and 150 kg S/ha during 1987–88 and 1988–89 resectively. This increase in plant height, prikmary brances and secondary branches/plant might be attributed to better nutritional environment for plant growth at active vegetative grwoth. Similar findings were also resported by Rathore and Manohar (1989).

Fertilizing the crop with 100 kg S/ha was found beneficial as far as crop productivity is concerned. However, 100, 150 and 200 kg S/ha were largely comparable in both the years as well as in pooled results (Table 1). The increase in the growth parameters as a result of S application might have resulted in increased seed yield of mustard.

Response to mode of sulphur application

Sulphur applied either through elemental S alone 21 days before sowing or 50 kg S/ha through gypsum + remaining S through elemental S at sowing were found equally effective for all the growth characters and seed yield of mustard during both the years.

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