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Response of Nitrogen and Sulphur for maximizing the production of Mustard (*Brassica juncea*) in Rainfed condition of Sub Agro Climatic zone – VI

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ABSTRACT

The field experiment was conducted during *rabi* season of 2018-19 and 2019-20 at Zonal Research Station, Darisai, East Singhbhum, Jharkhand to study the Response of nitrogen and Sulphur for maximizing the production of mustard (*Brassica juncea*) in medium land underrainfed condition of sub agro climatic zone – VI to find out the maximum production of mustard in response of nitrogen and sulphur. All the treatments were tested in randomized bock design with ten treatments i.e., N_0S_0 (Control) (T_1), 20 kg N/ha +10 S/ha (T_2), 20kg N/ha+20 S/ha (T_3), 20 kg N/ha+30 S/ha (T_4), 40 kg N/ha+10 S/ha (T_5), 40 kg N/ha+20 S/ha (T_6), 40 kg N/ha+30 S/ha (T_7), 60 kg N/ha+10 S/ha (T_8), 60 kg N/ha+20 S/ha (T_9), 60 kg N/ha+30 S/ha (T_{10}). The treatments were replicated thrice resulted that the combination of 60 kg N/ha+30 S/ha (T_{10}) recorded highest plant height (165.8cm), yield attributes, viz. silique/plant (181.3), seed/silique (11.9), 1000 seed weight (5.1 g) owing to highest Seed yield (10.35q/ha). Also highest net returns (₹29152/ha) and benefit : cost ratio (1.84) was recorded by 60 kg N/ha+30 S/ha (T_{10}).

Key words: *Production, Mustard, Nitrogen, Sulphur, Yield attributes, Seed yield*

Introduction

The mustard crop belongs to genera *Brassica* in the family Brassicaceae. India is one of the four major players in the global oil seed/vegetable oils scenario, being one of the important oilseed grower, producer and exporter (De and Sinha, 2011). This crop account for nearly one- third of the oil produced in India, making it the country's key edible oilseed crop (Kumar and Chauhan, 2005). India accounts for about 15-20 per cent of global oilseeds area, 6-7 per cent of vegetable oil production and 9-10 per cent of the total edible oils consumption. In terms of acreage production and economic value, oilseeds are second only to food grain. As per the fourth advance estimates for 2018-19.Mustard group of crop account for area, production and productivity was 36.59 million hectare, 72.37 million tonnesand 1980 kg/ha, respectively, during 2018-19. However, productivity is low compared with other country due to several reason non availability of Sulphur and nitrogen is the most important one. Kanwar, 1984 also proved that the importance of NPK for improving production is well recognized but Sulphur is the mineral composition of plant and is essential for the synthesis of proteins, amino acid like cysteine, cysteine, and methionine and is essential for chlorophyll formation. It is also play a major role in protein, vitamins and oil synthesis in brassica species. Nitrogen is the most important source of all essential nutrients in its effect on plant growth and yield of this crop. Nitrogen increase the vegetative

growth and delayed maturity of plants. Moreover, nitrogen and Sulphur are closely related with one other Therefore, the present study was conducted to study the response of nitrogen and Sulphur for maximizing the production of mustard (*Brassica juncea*).

Materials and Methods

A field experiment was conducted during 2018-19 to 2019-20 at Zonal Research Station, Darisai, East Singhbhum, Jharkhand which is situated at 22°24′ north latitude, 86°23′ east longitude and altitude of 521 meter above mean sea level. Humid and sub tropical type of climate found in this zone with annual rainfall approx. 1200 to 1400 mm. The soil was sandy loam soil with pH 5.2, moderately fertile being low in organic carbon (0.36%), medium in available nitrogen (290 kg/ha), available phosphorous (19 kg/ha) and available potassium (136 kg/ha). The experiment was laid out in randomized block design with three replication. The experiment consisting of ten treatments, viz. N_0S_0 (Control) (T_1), 20 kg N/ha +10 S/ha (T_2), 20 kg N/ha+20 S/ha (T_3), 20 kg N/ha+30 S/ha (T_4), 40 kg N/ha+10 S/ha (T_5), 40 kg N/ha+20 S/ha (T_6), 40 kg N/ha+30 S/ha (T_7), 60 kg N/ha+10 S/ha (T_8), 60 kg N/ha+20 S/ha (T_9), 60 kg N/ha+30 S/ha (T_{10}). The full dose of fertilizer 40 kg phosphorus/ha and 20 kg potassium/ha were applied uniformally in all plots in mustard crop. Shivani variety of mustard was taken for experiment with spacing 30 cm row to row distance and 5 kg/ha seed rate. All the observations of each character were subjected to statistical analysis according to the standard method. The calculated values of the treatments and error variance ratio were compared with Fisher and Yates F table at 5% level of significance. The difference between significance treatments means were tested against CD at 5% probability.

Results and Discussion

Growth and yield attributes

The mean data of two years were given in Table 1 and Fig. 1. which showed that the maximum height (165.8 cm) was observed in treatment T_{10}- 60 kg N/ha+30 kg S/ha which significantly increased 46.07% compared to control was at par with T_6- 40 kg N/ha +20 kg S/ha,T_7- 40 kg N/ha +30 kg S/ha and T_9- 60 kg N/ha + 20 kg S/ha. The number of silliqua/plant, numbers of seed /silliqua and 1000 seed weight of treatment T_{10}- 60 kg N/ha+30 kg S/ha was 181.3, 11.9 and 5.1 g, respectively increased significantly with increasing dose of nitrogen and Sulphur in treatments were 67.87%, 51.51% and 59.37% respectively which was at par with treatments T_9- 60 kg N/ha + 20 kg S/ha and numbers of silliqua/plant and 1000 seed weight were also at par with T_7- 40 kg N/ha +30 kg S/ha. These results also similed with the result of Kumar *et al*., 2011. Yield attributes of shivani mustard increased significantly with increasing level of Sulphur up to30 kg/ha. The increase in yield attributes of mustard with increasing level of nitrogen and Sulphur may be ascribed to role of Sulphur in improving mineral nutrition of the crop. Chauhan *et al*. 2002, Singh *et al.,* 2000 and Rana *et al*., 2003 also proved that increase level of Sulphur improving mineral nutrition of the crop.

Table 1. Effect of Nitrogen and Sulphur on growth parameters and yield attributes of mustard (mean data of 2 years)

Treatment	Plant height (cm)	No. of silliqua/plant	No. of seeds/silliqua	1000 seed weight (g)
T_1- N_0S_0 (control)	113.50	108.65	5.77	3.20
T_2- 20 kg N/ha+ 10 kg S/ha	126.50	118.35	6.33	3.65
T_3- 20 kg N/ha +20 kg S/ha	134.00	128.80	6.42	3.75
T_4- 20 kg N/ha +30 kg /ha	130.00	133.30	7.76	3.90
T_5-40 kg N/ha + 10 kg S/ha	135.00	135.30	8.40	4.05
T_6- 40 kg N/ha +20 kg S/ha	159.65	164.30	8.75	4.40
T_7- 40 kg N/ha +30 kg S/ha	160.50	175.90	9.79	4.70
T_8- 60 kg N/ha + 10 kg S/ha	149.50	170.00	9.01	4.30
T_9- 60 kg N/ha + 20 kg S/ha	163.70	178.30	11.20	4.85
T10- 60 kg N/ha+30 kg S/ha	165.80	181.30	11.90	5.10
CD at (5%)	15.14	22.27	2.00	0.63

Table 2. Effect of Nitrogen and Sulphur on yield and economics of mustard

Treatment	Seed yield (q/ha)	Straw yield (q/ha)	Net returns (₹/ha)	B:C ratio
T_1- N_0S_0 (control)	2.82	9.39	3008	0.40
T_2- 20 kg N/ha+ 10 kg S/ha	5.49	17.57	9729	0.68
T_3- 20 kg N/ha +20 kg S/ha	6.99	19.03	15750	1.10
T_4- 20 kg N/ha +30 kg /ha	7.41	21.41	17178	1.13
T_5-40 kg N/ha + 10 kg S/ha	8.68	22.43	20322	1.61
T_6- 40 kg N/ha +20 kg S/ha	9.42	28.80	24941	1.73
T_7- 40 kg N/ha +30 kg S/ha	9.68	29.79	26750	1.74
T_8- 60 kg N/ha + 10 kg S/ha	9.17	28.03	25045	1.67
T_9- 60 kg N/ha + 20 kg S/ha	10.14	30.51	28615	1.82
T_{10}- 60 kg N/ha+30 kg S/ha	10.35	31.2	29152	1.84
CD at (5%)	1.63	4.11	-	-

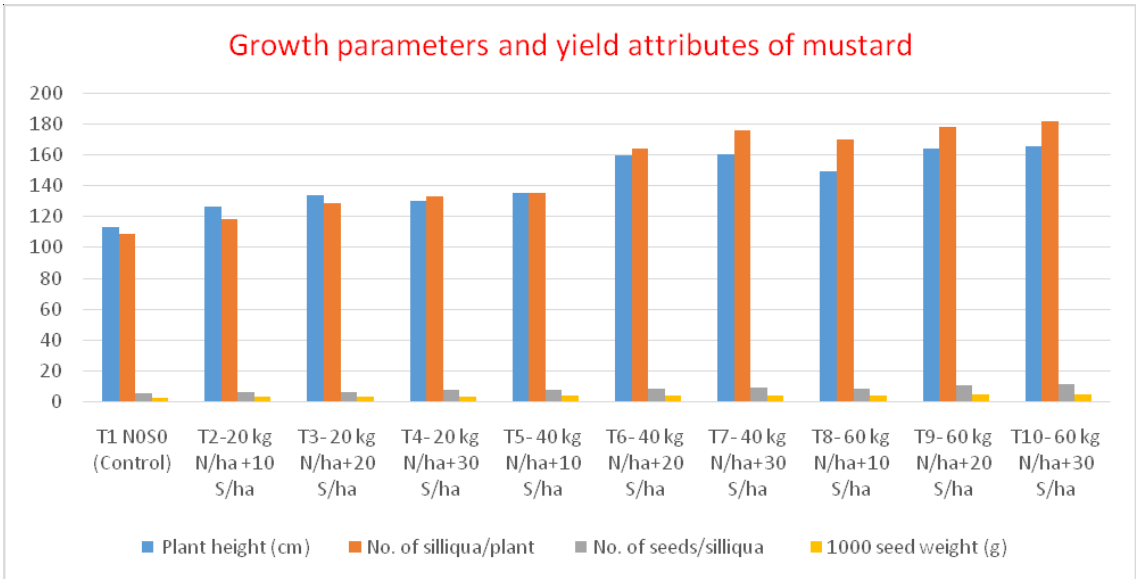

Fig. 1. Growth parameters and yield attributes of mustard

Yield

In the experiment seed yield increase significantly with successive increase in the level of application of nitrogen and Sulphur upto 60 kg/ha and 30 kg/ha. The seed yield and straw yield were 10.35 q/ha and 31.2 q/ha, respectively (Table 2) which were 72.75 % in seed yield and 69.90 % in straw yield compared with control which was at par with T_6- 40 kg N/ha +20 kg S/ha, T_7- 40 kg N/ha +30 kg S/ha, T_8- 60 kg N/ha + 10 kg S/ha and T_9- 60 kg N/ha + 20 kg S/ha. The increase in the yield due to increase level of nitrogen and Sulphur compared with initial status of nitrogen and Sulphur in the soil. Jat *et al.* (2003) and Jat and Mehra (2007) also reported an increase in the seed and straw yield of Indian mustard with increase level of Sulphur.

Economic

The result of this experiment indicated that increase the level of nitrogen and Sulphur i.e. 60 kg N/ha+30 S/ha was found to be practically significant and economically best strategy in response of nitrogen and Sulphur for maximize the production of mustard. 60 kg N/ha+30 S/ha recorded significantly higher net return (₹29152/ha) and B:C ratio (1.84) compared to other which was at par withT_6- 40 kg N/ha +20 kg S/ha, T_7- 40 kg N/ha +30 kg S/ha, T_8- 60 kg N/ha + 10 kg S/ha and T_9- 60 kg N/ha + 20 kg S/ha. The beneficial and effective response of nitrogen and Sulphur were also reported by Mohiuddin *et al.* 2011.

Conclusion

A field experiment was conducted during *rabi* sea-

son of 2018-19 and 2019-20 on sandy loam soil of Zonal Research Station, Darisai, East Singhbhum to assess the suitable N and S combination and increase the production and profitability of crop. On the basis of the finding of present investigation, it can be concluded that the treatment 60 kg N/ha+30 kg S/ha were found significantly increased the yield attributes, seed yield (10.35q/ha)and straw yields (31.2 q/ha) of the crop. Also highest net returns (₹29152/ha) and benefit : cost ratio (1.84) was recorded by 60 kg N/ha+30 S/ha (T_{10}). Thus the treatment 60 kg N/ha+30 S/hamay be considered as the best treatment for the maximize the production of mustard.

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