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RESEARCH PAPER

Effect of nitrogen and sulphur levels on seed yield and some other characters in mustard [*Brassica juncea* (L.) Czern and Coss]

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Abstract : An experiment was conducted during *Rabi* 2009-10 at the research farm of Institute of Agricultural Science, Bundelkhand University, Jhansi to find out the effect of different levels of nitrogen and sulphur on seed yield and other characters on 'Varuna' variety of Indian mustard. Different levels, 40, 80 and 120 kg/ha nitrogen and 15, 30, and 45 kg / ha sulphur significantly out yielded the 0 kg/ha nitrogen and sulphur in seed and biological yield. Almost similar results were obtained in case of siliquae / plant, siliquae length, number of seed/siliquae, harvest index, oil and protein content in seed. The application of 120 kgN/ha and 45 kg S/ha was the best combination for getting higher seed yield with its better quality.

Key Words : Mustard, Nitrogen (N), Sulphur (S), Siliquae

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INTRODUCTION

Indian mustard [*Brassica juncea* (L.) Czern & Coss] is most important species grown almost all over India for oil as compared to all other species of family Brassiceae. It is generally cultivated on marginal and light texture soils having limited moisture. Amongst the various agronomic factors known to augment crop production, the application of nitrogen and sulphur have an important role in getting high yield of seed and oil in mustard Singh and Meena (2004) and Yasari and Patwardhan (2006). Keeping in view the above facts, the present study was under taken to find out the effect of application of nitrogen and sulphur on seed yield, biological yield and other characters including oil content and its quality in a national variety 'Varuna' of Indian mustard in the agro-climatic conditions of Bundelkhand region of U.P.

MATERIAL AND METHODS

The field experiment was conducted at the agricultural research farm of the Agricultural Institute of Bundelkhand University, Jhansi during *Rabi* season 2009-10. The fertilizer treatments comprised of four levels of nitrogen *viz*., 0, 40, 80 and 120 kg/ha and four levels of sulphur *viz*., 0, 15, 30 and 45 kg/ha and the experimental design used was Factorial Randomized Block with three replications. Urea was the source of nitrogen and the source of sulphur was gypsum while triple superphosphate was used as source of phosphorus. Observations were recorded on number of siliquae per plant, length of siliquae (cm), number of seeds per siliquae, biological yield (kg/ha), harvest index, oil and protein content. The data were subjected to statistical analysis as per method proposed by Cochran and Cox (1959).

RESULTS AND DISCUSSION

For the use of proper quantity of fertilizers is most essential for enhancing yield and quality in various crops. In case of mustard, the nitrogen and sulphur are most important

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inputs for increasing productivity of this crop. Therefore, these two fertilizers were tried to find their role in mustard crop and the results of present study are discussed character wise.

Seed yield:

It was observed that there was remarkable increase in seed yield with increase in the doses of nitrogen and sulphur against control. Highest seed yield was recorded with the application of 120 kg N and 45 kg sulphur per hectare followed by application of 80 kg and 40 kg N/ha and 30 kg and 15 kg sulphur/ha (Table 1). The increase in seed yield under all the three doses of the nitrogen was significantly higher as compared to 0 kg of N/ha. The results are in conformity with the finding of Seyedeh *et al.* (2012). However, application of sulphur showed marginal improvement in seed yield in mustard over control as the differences were non-significant. The highest seed yield of 1869 kg/ha was obtained with the application of 45 kg sulphur per hectare followed by use of 30 kg sulphur per hectare.

Biological yield:

The result presented in Table 1 showed that all the three levels of nitrogen *viz*., 40, 80 and 120 kg per hectare gave significantly higher biological yield over 0 kgN/ha. It was further clear from the data that 80 kg and 120 kg N/ha produced significantly higher biological yield over 40 kg N/ ha. Nevertheless, the differences in the biological yield with the use of 80 kg and 120 kg N/ha were found to be insignificant. The application of sulphur at the rate of 15, 30 and 45 kg per hectare produced significantly higher biological yield as compared to 0 kg/ha sulphur in mustard. The differences in biological yield between 15, 30 and 45 kg sulphur per hectare were significantly higher with each other. But the application of 45 kg sulphur per hectare gave higher biological yield as compared to other two doses of sulphur.

Harvest index:

The data given in Table 1 revealed that all the three levels of nitrogen gave significantly higher harvest index as compared to zero level of nitrogen. The use of 120 kg N/ha gave significantly higher harvest index over other two doses *i.e.* 40 and 80 kg N/ha. The difference in the harvest index between 40 kg and 80 kg N ha was non-significant. The value of harvest index in zero kilogram of sulphur was at per with the harvest index values of all the other three levels of sulphur. However, application of 15 kg sulphur/ha gave significantly higher harvest index in comparison to application of 30 and 45 kg sulphur per hectare.

Oil and protein content:

The oil and protein content are most important quality traits in mustard. It was interesting to note from the data given in Table 1 that both oil and protein content increased successively upto application of 120 kg N/ha. The differences in the mean values of both the quality traits with the use of various levels of nitrogen application were significantly higher in comparison to zero kilogram of nitrogen. The use of 80 and 120 kg N/ha and 45 kg/ha of sulphur gave significantly higher improvement in the oil content as compared to their all other doses. However, the differences in the oil content under 80 and 120 kg N/ha were non-significant. It was interesting to note from the data in Table 1 that the application of 80 and 120 kg N/ha also improved the protein content by a significant margin as compared to other levels of nitrogen. However, the application of sulphur did not show significant improvement in protein content of mustard seed.

Siliquae per plant:

The results presented in Table 2 indicated that all the three levels of nitrogen *i.e.* 40, 80 and 120 kg/ha gave significantly higher number of siliquae per plant in comparison to 0 kg / ha nitrogen. The differences in the number of siliquae per plant with the doses of 40, 80 and 120 kg nitrogen / ha were also significant. The highest number of siliquae per plant was recorded in 120 kg N/ha followed by 80 and 40 kg N per hectare. These findings are in consonance to result reported by El-Habbasha *et al.* (2010). In case of saulphur application, 45 kg/ha dose of sulphur produced highest number of siliquae followed by 30 kg and 15 kg of sulphur / per hectare. The differences in the number of siliquae per plant among all the doses of sulphur including control (0 kg S/ha) were significant. The successive increase in the number of siliquae per plant under varied doses of nitrogen and sulphur may be due to availability of more nutrients for proper growth of plants at different stages of mustard crop. These findings are in full agreement to the results reported earlier by El-Habbasha and Abd El-Salam (2010) and Yasari and Patwardhan (2006).

Siliquae (cm) :

It is revealed from the data given in Table 2 that different levels of nitrogen had considerable effect on length of siliquae. The highest length of siliquae (5.1cm) was recorded in 120 N/ha which was significantly higher than the length of siliquae in other levels of nitrogen including 0 kg N/ hectare. This could be due to the availability of more nutrients for proper development of vegetative parts of plant including siliquae under higher dose of nitrogen. These results are in full agreement with those observed by El-Kholy *et al.* (2007). However, in case of both 30 and 45 kg levels of sulphur, 4.8 cm length of siliquae was recorded which was significantly higher than the siliquae length observed in 0 and 15 kg doses of sulphur per hectare. These findings are in full agreement to those reported by Piri *et al.* (2011) who

Table 1 : Effect of nitrogen and sulphur on seed and biological yield, harvest index and some quality traits in mustard

Treatments	Seed yield (kg/ha)	Biological yield (kg/ha)	Harvest index	Oil content (%)	Protein content (%)
Nitrogen level (kg/ha)					
0	1194	5887	20.7	37.5	16.6
40	1733	7781	22.0	39.4	19.6
80	1945	8767	21.9	39.9	21.1
120	2104	8967	23.4	41.4	22.5
S.E.±	35	15	0.6	0.8	0.5
C.D. (P=0.05)	71	320	1.2	1.7	1.0
Sulphur level (kg/ha)					
0	1618	7206	22.3	36.5	19.5
15	1697	7347	23.4	38.5	19.9
30	1793	8163	21.6	40.2	20.2
45	1869	8724	21.3	43.0	20.2
S.E.±	35	156	0.6	0.8	0.5
C.D. (P=0.05)	320	71	1.2	1.7	NS

Table 2 : Effect of nitrogen and sulphur on some traits in mustard

Treatments	Siliquae / plant	Siluquae length (cm)	Number of seed / siliquae
Nitrogen level (kg/ha)			
0	258.6	4.0	8.4
40	322.9	4.6	8.9
80	403.3	4.8	10.5
120	485.4	5.1	10.7
S.E.±	6.3	0.1	0.1
C.D. (P=0.05)	12.7	0.2	0.2
Sulphur level (kg/ha)			
0	309.4	4.4	9.7
15	364.0	4.5	9.6
30	375.7	4.8	9.9
45	421.0	4.8	10.3
S.E.±	6.3	0.1	0.1
C.D. (P=0.05)	12.7	0.2	0.2

observed that the increasing level of sulphur not only increased the siliquae length but also gave higher yield of straw, more leaf area index, high growth rate and higher net assimilation rate at all the stages of crop growth.

Number of seeds per siliquae:

Numbers of seeds per siliquae recorded in mustard under four levels of nitrogen and sulphur application is given in Table-2 which revealed that there were significant differences in the mean values of seeds per siliqaue under four doses of nitrogenous and sulphur fertilizers. The highest number of seeds per siliquae (10.7) was recorded in 120 kg N / ha and lowest (8.4) in case of zero kilogram nitrogen per hectare. It was evident that increase in the number of seeds per siliqaue with the application of 40, 80 and 120 kg N/ha was successive and it amounted to 34.00, 67.31 and 109.42 per cent higher over zero kilogram of nitrogen per hectare, respectively. Similar result were reported by Fathy *et al.* (2009) who found that use of higher dose of nitrogen in mustard crop increased the number of siliqaue per plant. In case of application of sulphur at the rate of 45 kg/ha, it was observed that this dose was significantly better over control as well as other two doses (15 and 30 kg /ha) of sulphur in increasing the number of seed per siliquae in mustard. But the application of sulphur at the rates of 15 and 30 kg/ha was at par to each other in producing the number of seeds per siliquae.

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