

Response of Indian mustard (*Brassica juncea*) to nitrogen and sulphur fertilization under rainfed condition of Diara land

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ABSTRACT

An experiment was carried out during the winter season of 2000-01 and 2001-02 with NDR 8501 Indian mustard (*Brassica juncea* L. Czernj & Cosson) under diara land rainfed condition to evaluate the response of Indian mustard to nitrogen and sulphur application. Plant height, branches/plant and leaf area index increased with increasing N level. Nitrogen application up to 80 kg/ha significantly increased the yield attributes and seed yield while stover yield increased upto 120 kg N/ha. Oil content decreased as N level increased. However the difference between two consecutive levels were not significant in oil content. Oil yield and protein yield also registered higher with application of 80 kg N/ha over 0 and 40 kg N/ha. Similarly application of 30 kg sulphur/ha significantly improved the yield attributes, seed and stover yields. Sulphur application increased oil content and oil yield both.

Key words : Mustard, Nitrogen, and Sulphur.

INTRODUCTION

Diara land is the land which is subjected to the diluvion or alluvion as well as a result of flooding or an account of any change in the course of river. Generally in these areas amount of water starts to collect from the end of July and continues up to end of September. These lands are available for cultivation after September. A large of these lands can produce a good quantity of mustard seed but much effort has not been made to develop a proper recommendation of fertilizer for newly developed high yielding genotypes of mustard grow on diara lands. Availability of soil moisture in diara lands during crop period is sufficient upto February. In diara lands crop yield varies according to the silt deposition among different layers, input application and precipitation during crop period. Mustard [*Brassica juncea* (L) Czernj & Cosson] owing to its hardy nature and capacity to thrive well under poor conditions of moisture and fertility is generally raised as rainfed, without fertilizer resulting in low average yield. It has however been established that this crop responds well to sulphur also (Kachroo & Kumar 1997). Often inadequate application of N and Sulphur at diara land reduces the yield of Indian mustard but the fertilizer N recovery reported 23-35% by Pramanik (1992). Information pertaining to the synergistic effect of N and Sulphur fertilization yield attributes and seed yield is lacking in diara lands of Uttar Pradesh. Therefore the present investigation was undertaken to find out the effect of N and sulphur fertilization on the yield attributes and

seed yield of mustard under rainfed condition of diara land.

MATERIALS AND METHODS

A field experiment was conducted during winter *rabi* seasons of 2000-01 and 2001-02 at Raunahi site of Saryu diara 15 km. from Faizabad city. The soil of the experimental site was sandy loam having pH 7.8 & 7.5, organic carbon 0.19% and .20, available P 5.6 and 5.5 kg/ha, available K 185 and 188 kg/ha and sulphur 6.1 and 6.4 ppm. The treatments were arranged in split plot design keeping 4 nitrogen levels (0,40,80 and 120 kg/ha) in main plot and 4 sulphur levels (0, 15,30 and 45 kg/ha) in sub plots with 4 replication. The crop was sown in rows at 30 cm. apart using 5 kg. seed of variety NDR 8501 on 29 October and 25 October during 2000 and 2001, respectively. Plant to plant spacing of 15 cm. was maintained by thinning. Uniform basal application of 40 kg P₂O₅ through DAP, 20 kg K₂O through MOP full sulphur and 80 per cent of the N dose as per treatment was given basal. Rest of the N was top dressed after the winter showers. The other cultural practices were performed as per recommendation. The observation on various yield attributes were recorded at harvest on 5 random plants from the net plot area.

RESULTS AND DISCUSSION

Nitrogen :

Significantly taller plant, more branches/plant and leaf area index at flower initiation were recorded with

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Table 1: Effect of nitrogen and sulphur on growth and yield attributes of Indian mustard under diara land rainfed condition.

Treatment	Plant height (cm.)		Branches/plant		Leaf area index at flower initiation		Siliqua/plant		Seeds/Siliqua	
	2000-01	2001-02	2000-01	2001-02	2000-01	2001-02	2000-01	2001-02	2000-01	2001-02
Nitrogen (kg/ha)										
0	122.7	130.0	8.75	14.5	1.01	1.23	65	80	6.5	7.0
40	149.0	156.5	19.75	24.75	2.78	3.00	220	243	10.25	11.0
80	166.0	168.7	26.75	27.75	3.20	3.34	327	346	11.75	12.25
120	171.3	176.3	29.75	35.75	3.32	3.47	339	358	12.25	12.75
CD at 5%	3.2	5.7	2.40	3.14	-	-	15	21	.62	1.00
Sulphur (kg/ha)										
0	146.0	150.7	16.5	19.25	2.23	2.44	216	235	8.75	8.5
15	151.0	156.3	20.75	24.75	2.57	2.74	236	250	10.00	10.75
30	155.7	161.0	23.25	28.00	2.69	2.85	248	267	10.75	11.5
45	156.3	163.5	24.50	30.75	2.82	3.01	25.5	275	11.25	12.25
CD at 5%	2.5	3.4	1.60	2.53	0.09	0.05	7	12	.43	0.78

120 kg N/ha than rest of the N levels and the control. Tomar *et al.* (1997) also observed higher value of growth attributes with 120 kg N/ha. The increase in growth might be due to increased availability of N causing accelerated photosynthetic rate and thus leading to the production of more carbohydrates (Dubey and Khan 1993). Application of nitrogen up to 120 kg/ha progressively improved all

the growth characters but difference in most of the yield attributes was not significant between 80 and 120 kg/ha (Table.2). Ultimately higher yield attributes with 80 kg N/ha resulted in significant increase in seed yield only up to 80 kg/ha but stover yield increased up to 120 kg N/ha. The application of 80 kg N/ha registered 24.1 and 383.0 per cent higher seed yield over 40 and 0 kg N/ha during

Table 2 : Effect of nitrogen and sulphur on yield and yield attributing characters of Indian mustard under diara land rainfed condition.

Treatment	1000 Seed weight (g)		Seed yield (q/ha)		Stover yield (q/ha)		Agronomic efficiency (%)		Physiologic efficiency (%)	
	2000-01	2001-02	2000-01	2001-02	2000-01	2001-02	2000-01	2001-02	2000-01	2001-02
Nitrogen (kg/ha)										
0	3.20	3.23	2.89	4.69	14.07	21.66	-	-	-	-
40	3.46	3.55	11.25	12.31	51.97	53.42	20.9	19.05	31.04	41.59
80	3.67	3.69	13.96	15.64	58.63	60.37	13.83	13.68	27.93	33.71
120	3.69	3.71	14.78	16.12	64.44	70.70	9.90	9.52	26.72	30.43
CD at 5%	0.14	0.12	1.51	1.24	5.16	6.15	-	-	-	-
Sulphur (kg/ha)										
0	3.20	3.31	8.75	9.77	40.68	43.35	-	-	-	-
15	3.49	3.52	10.59	12.09	47.86	51.51	12.26	15.46	27.58	19.86
30	3.66	3.66	11.61	13.32	51.15	56.21	9.53	11.83	26.16	20.74
45	3.69	3.68	11.93	13.57	53.40	59.85	7.06	8.44	25.31	20.46
CD at 5%	0.10	0.08	1.00	1.06	3.24	4.20	-	-	-	-

2000-01, while during 2001-02 it was 27.1 and 233.5 per cent, respectively.

Application of N reduced the oil content in seed of Indian mustard. Highest oil content was recorded in no nitrogen treatment followed by 40, 80 & 120 kg N/ha, but the difference between two consecutive levels were not preceptible. This might be attributed to higher fatty acid synthesis utilizing acetyl-carrying proteins at low supply of nitrogen, whereas a greater proportion of photosynthates was diverted to protein synthesis in seed thereby reducing the availability of carbohydrate for oil synthesis at adequate N supply (Shukla & Kumar 1994). Oil yield increased significantly up to 80 kg N/ha in commensurate with the seed yield (Table-2). The results are in agreement with those of Garnayak *et.al.* 2000.

The application of N up to 120 kg/ha significantly increased the protein content in seed but increase in protein yield marked up to 80 kg N/ha commensurate with seed yield (Table-3). Application of 120, 80 and 40

of urea N which increased initial growth and more photosynthetic rate. Nitrogen application is known to increase the root cation exchange capacity which enhances nitrogen absorption by plant (Rana *et.al.* 1991). N uptake by grain increased only upto application of 80 kg N/ha consonance with the seed yields. The crop fertilized with 40, 80 and 120 kg N/ha removed on an average 340, 468, 552 per cent higher nitrogen over control during 2000-01 while during 2001-02 it was 200, 300, 376 per cent higher respectively.

The application of nitrogen significantly influenced the concentration of sulphur in seed and stover (Table-4). Increase in dose of nitrogen from 0 to 120 kg/ha increased the concentration of sulphur in seed and stover but the difference in successive dose was not significant in respect to sulphur content in seed. Sulphur uptake in seed, stover and in total increased significantly up to 80 kg/ha. Agronomic efficiency and physiologic efficiency decreased at higher level of N.

Table 3 : Effect of nitrogen and sulphur on yield and yield attributing characters of Indian mustard under diara land rainfed condition.

Treatment	Oil Content (%)		Oil yield (kg/ha)		Protein content (%)		Protein yield (kg/ha)	
	2000-01	2001-02	2000-01	2001-02	2000-01	2001-02	2000-01	2001-02
Nitrogen (kg/ha)								
0	39.84	39.22	115.1	183.9	18.07	18.43	52.2	86.4
40	39.61	38.96	445.6	479.6	19.55	19.71	221.1	242.6
80	39.44	38.74	550.6	605.9	20.37	20.42	284.4	319.4
120	39.14	38.43	578.5	619.5	20.55	20.59	302.3	331.9
CD at 5%	0.32	0.38	57.1	53.3	0.12	0.13	27.4	23.2
Sulphur (kg/ha)								
0	38.66	37.92	338.3	370.5	19.45	19.56	170.2	191.1
15	39.58	38.80	419.2	469.0	19.58	19.74	207.4	238.6
30	39.83	39.25	462.4	522.8	19.73	19.86	229.1	264.5
45	39.97	39.38	476.8	534.4	19.82	19.99	236.5	271.3
CD at 5%	0.20	0.24	22.5	31.3	0.10	0.09	15.7	17.4

kg N/ha resulted higher protein yield by 479.1, 444.8 and 323.5 per cent over control during 2000-01 while during 2001-02, it was 284.1, 269.6 and 180.8, respectively.

Nitrogen content in seed and stover marked upto 120 kg N/ha which increased the total uptake of nitrogen. Increased dry matter production in the crop including seed and stover compared with higher N content seems to be responsible for higher uptake of N by the crop. Sepat *et.al.* (2004) also reported higher uptake of N due to application of N. It might be due to the rapid availability Internat. J. agric. Sci. (2007) 3 (2)

Sulphur :

Sulphur application significantly increased the plant height, branches/plant and upto 30 kg/ha. While leaf area index increased up to 45 kg /ha. Sulphur application also increased siliqua/plant, seed/siliqua and test weight up to 30 kg/ha which ultimately resulted in increase the seed and stover yield. Higher application of sulphur (45 kg/ha) did not influence the yield. Application of 30 kg S/ha resulted in 32.7, and 9.6 percent higher seed yield over 0 and 15 kg/ha during first year, while in second year it

Table 4 : Effect of nitrogen and sulphur on N and S content and uptake in Indian mustard under diara land rainfed condition.

Treatment	N content (%)				S content (%)				N uptake (kg/ha)				S uptake (kg/ha)			
	Seed		Stover		Seed		Stover		Seed		Stover		Seed		Stover	
	00-01	01-02	00-01	01-02	00-01	01-02	00-01	01-02	00-01	01-02	00-01	01-02	00-01	01-02	00-01	01-02
Nitrogen (kg/ha)																
0	2.71	2.40	1.13	1.17	1.16	1.21	0.213	0.210	7.83	17.25	23.72	36.59	3.35	5.67	6.34	10.21
40	3.09	2.89	1.34	1.39	1.19	1.30	0.218	0.214	34.76	35.57	104.39	109.82	13.38	16.00	24.7	27.43
80	3.40	3.18	1.49	1.55	1.23	1.33	0.222	0.219	47.46	49.73	134.81	146.4	17.17	20.80	30.18	34.45
120	3.54	3.40	1.59	1.69	1.25	1.37	0.227	0.225	52.32	54.80	154.77	174.28	18.47	22.08	33.09	37.98
CD at5%	0.09	0.14	0.08	0.10	0.05	0.06	0.004	0.003	8.21	8.67	15.67	18.23	2.84	3.12	4.57	5.25
Sulphur (kg/ha)																
0	3.05	2.53	1.21	1.31	1.13	1.22	0.158	0.171	26.68	24.71	75.9	81.06	9.88	11.91	16.33	19.32
40	3.15	3.01	1.39	1.42	1.18	1.29	0.201	0.204	33.35	36.39	99.87	102.91	12.49	15.59	22.10	26.09
80	3.24	3.14	1.46	1.57	1.24	1.34	0.246	0.238	37.61	41.82	112.28	126.69	14.39	17.84	26.97	31.25
120	3.29	3.19	1.50	1.57	1.27	1.36	0.275	0.264	39.24	43.28	119.34	137.24	15.15	18.45	29.83	34.25
CD at5%	0.06	0.08	0.07	0.5	0.04	0.05	0.011	0.012	3.05	3.67	11.21	14.64	2.10	1.80	3.22	3.58

was 36.3 and 10.17 per cent higher, respectively. Increased in these parameters could be ascribed to the overall improvement in plant vigour due to increased assimilation of photosynthates. Similar findings were also reported by Kachroo and Kumar (1997).

Oil content and oil yield increased progressively with the increasing levels of sulphur application to 30 kg S/ha. The oil yield with 15 and 30 kg/ha being 23.9 and 36.7 per cent higher in 2000-01 and 26.6 and 41.1 per cent in 2001-02 of that without sulphur application. The increase in oil yield with increasing levels of sulphur is in consonance with the high oil content in seed and higher seed yield. Application of sulphur increased the N content, N uptake, sulphur content and sulphur uptake up to 30 kg/ha (Table-4.) Agronomic efficiency and physiologic efficiency gets decreased at higher levels of sulphur (Table-2).

It was concluded that under rainfed conditions of Sarju diara application of 80 kg N/ha and 30 kg S/ha was optimum for mustard.

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