

Response of Indian mustard (*Brassica juncea*) varieties to nitrogen under varying sowing dates in eastern Uttar Pradesh

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ABSTRACT

A field experiment was conducted during winter seasons of 1997–98 and 1998–99 to study the response of Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson] varieties to nitrogen under varying sowing dates. Growth characters (plant height, leaves/plant, leaf-area index, dry-matter accumulation/plant, primary and secondary branches/plant), yield attributes (siliquae/plant, length of siliqua), yields (biological, seed and stover yields) and qualities (seed protein and oil yields) were found to be more with 14 October sowing compared to 20 October, 13 November and 28 November sowing dates. Variety 'Varuna' gave significantly higher growth characters, yield attributes, yields and quality than 'Vardan'. Growth characters, yield attributes, yields and qualities increased significantly with successive increase in nitrogen up to 120 kg N/ha. Integration of 160 kg N/ha with 14 October sowing, gave highest amount of seed yield than rest of the combinations of nitrogen levels and sowing dates during both the years.

Key words : Sowing date, Variety, Nitrogen and Indian mustard

Indian mustard is preferred due to its high yield potential and oil content. Yield potential of this crop can be explored by the use of agronomic techniques. Among them, time of sowing is an important non monetary input. Variation in the sowing date, day length and temperature interact to influence growth, yield and quality of a crop. Improved plant varieties play an important role in increasing the seed yield of crops.

Major plant nutrients also play a key role in increasing productivity. Among them, nitrogen is major essential nutrient required for obtaining good yields. Hence the present investigation was carried out and the results are reported in this paper.

MATERIALS AND METHODS

A field experiment was conducted during winter (*rabi*) seasons of 1997–98

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and 1998–99 at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad, Uttar Pradesh. Experiment was replicated 3 times in split-plot design with 4 dates of sowing (14 October, 29 October, 13 November and 28 November) in main plots and 2 varieties ('Varuna' and 'Vardan') in combination with 5 nitrogen levels (0, 40, 80, 120 and 160 kg/ha) in subplots. The soil of the experimental field was silty loam in texture with 0.42 and 0.48% of organic carbon and 180.40, 183.80, 15.46; and 1582, 258.10, 260.45 kg/ha of available N, P_2O_5 and K_2O during 1997–98 and 1998–99, respectively. Fertilizer, viz. phosphorus @ 40 kg/ha through single superphosphate, potassium @ 40 kg/ha through muriate of potash along with half dose of nitrogen as per treatment through urea were applied at the time of sowing. Remaining nitrogen was applied after the first irrigation. Two irrigations were given to the crop each at day 30 and siliqua-formation stage. All the recommended cultural practices were followed as per recommendation. Harvesting was done when more than 85% of siliquae turned brownish. Observations on growth (plant height, leaves/plant 60 DAS, leaf-area index 60 DAS, dry matter accumulation/plant and primary and secondary branches/plant), yield attributes (siliquae/plant, length of siliqua, seeds/siliqua, 1,000-seed weight and seed yield/plant), yields (biological, seed and stover yields/ha) and qualities (protein and oil yields/ha) were recorded.

RESULTS AND DISCUSSION

Sowing date

Sowing date significantly influenced the

growth characters, yield attributes, yield and qualities of Indian mustard (Tables 1,2,3). The crop sown on 14 and 29 October in both seasons produced significantly similar growth characters, viz. plant height, leaves/plant at 60 DAS, leaf-area index at 60 DAS, dry-matter accumulation/plant and primary and secondary branches/plant. But both the sowing dates were significantly superior to 13 and 28 November sowings. These findings corroborate the reports of Yadav *et al.* (1996) and Yadav and Yadav (1997).

The yield attributes siliquae/plant, seeds/siliqua, 1,000-seed weight and seed yield/plant decreased significantly with the crop sown after 29 October in both the years. However, 14 and 29 October sowings were at par. Length of siliqua could not cross the limit of significance. Decrease in yield attributes due to delayed sowing was also reported by Yadav *et al.* (1994) and Yadav *et al.* (1996).

Biological, seed as well as stover yields of Indian mustard were significantly affected due to its sowing dates (Table 3). Crop sown on 14 October recorded highest seed yield during 1998-99 which was statistically at par with seed yield obtained from 29 October sown crop but significantly more than 13 and 28 November sowings (Table 3). Similar trends were also observed in biological and stover yields. This is expected because, most of the growth and yield attributes that determine the biological, seed as well as stover yields of Indian mustard crop were adversely influenced in the present investigation when sowings were delayed beyond 29 October. These findings are in consonance with the reports of Yadav *et al.* (1996) and

Table 1. Growth characters of Indian mustard as influenced by sowing date, variety and nitrogen

Treatment	Plant height (cm)		Leaves/plant at 60 DAS		Leaf-area index at 60 DAS		Dry matter/ plant		Primary branches/plant		Secondary branches/plant	
	1997- 98	1998- 99	1997- 98	1998- 99	1997- 98	1998- 99	1997- 98	1998- 99	1997- 98	1998- 99	1997- 98	1998- 99
<i>Sowing date</i>												
14 October	178.10	184.01	74.54	79.04	5.48	5.65	104.98	112.99	6.88	7.91	12.83	13.93
29 October	175.86	182.98	71.58	76.65	5.44	5.63	103.02	110.57	6.45	7.51	11.90	13.10
13 November	171.43	177.30	60.15	64.43	4.08	4.29	97.67	104.56	4.65	5.60	8.44	9.46
28 November	158.22	165.11	43.01	47.37	2.74	2.87	92.52	98.55	3.14	4.03	6.55	7.39
CD (P=0.05)	6.57	6.65	4.98	5.31	0.27	0.31	6.37	5.99	0.40	0.41	0.68	0.87
<i>Variety</i>												
'Varuna'	176.35	185.24	64.99	69.77	4.61	4.79	102.41	108.91	5.80	6.78	10.91	11.96
'Vardan'	165.46	169.46	59.65	63.98	4.26	4.43	96.69	104.43	4.75	5.70	8.95	9.97
CD (P=0.05)	3.62	3.47	1.97	1.70	0.11	0.13	2.67	2.73	0.20	0.19	0.38	0.38
<i>Nitrogen (kg/ha)</i>												
0	138.43	143.65	35.48	40.12	2.79	2.91	56.71	61.86	3.04	3.87	5.75	6.80
40	158.94	164.94	53.00	56.84	3.94	4.11	84.62	90.67	4.49	5.24	8.44	9.21
80	174.32	182.67	67.84	72.89	4.74	4.94	108.51	116.27	5.55	6.49	10.43	11.41
120	189.70	196.86	76.07	80.92	5.35	5.54	122.45	130.13	6.58	7.74	12.38	13.60
160	193.12	198.63	79.17	83.59	5.36	5.55	125.44	134.40	6.73	7.86	12.65	13.82
CD (P=0.05)	5.73	5.48	3.12	2.69	0.17	0.20	4.23	4.31	0.31	0.30	0.59	0.61

DAS, Days after sowing

Treatment	Siliquae/plant		Length of siliqua (cm)		Seeds/siliqua		1,000-seed weight (g)		Seed yield/plant (g)	
	1997–98	1998–99	1997–98	1998–99	1997–98	1998–99	1997–98	1998–99	1997–98	1998–99
	<i>Sowing date</i>									
14 October	309.6	359.42	5.60	5.66	14.11	14.81	5.10	5.26	16.20	17.46
29 October	291.32	347.54	5.58	5.63	14.09	14.78	5.09	5.24	15.25	17.01
13 November	229.65	315.11	5.50	5.59	13.91	14.05	4.77	4.96	12.06	14.09
28 November	109.65	199.02	5.45	5.49	12.15	13.02	4.61	4.81	9.43	11.60
CD (P=0.05)	19.00	22.80	NS	NS	0.75	0.70	0.28	0.28	0.98	0.91
<i>Variety</i>										
'Varuna'	240.22	309.22	5.93	5.97	14.49	14.95	5.32	5.54	14.53	16.46
'Vardan'	224.62	301.32	5.14	5.21	12.64	13.38	4.47	4.59	11.95	13.62
CD (P=0.05)	6.17	7.29	0.10	0.11	0.20	0.19	0.10	0.10	0.36	0.38
<i>Nitrogen (kg/ha)</i>										
0	160.57	216.74	5.20	5.26	12.75	13.31	4.60	4.76	9.13	10.53
40	211.77	274.74	5.12	5.48	13.29	13.88	4.79	4.96	11.78	13.23
80	244.76	323.59	5.59	5.65	13.70	14.31	4.94	5.11	13.77	15.64
120	269.94	354.12	5.70	5.76	13.97	14.62	5.04	5.22	15.62	17.75
160	275.06	357.17	5.75	5.82	14.11	14.70	5.09	5.27	18.88	18.04
CD (P=0.05)	9.76	11.53	0.15	0.18	0.32	0.30	0.17	0.15	0.58	0.60
DAS, Days after sowing										

DAS, Days after sowing

Yadav and Yadav (1997).

Oil yield as well as protein yield in case of 2 early sowings dates (14 and 29 October) were at par, which decreased significantly with the delayed sowing dates (13 November and 28 November).

Variety

All growth parameters, viz. plant height, leaves/plant at 60 DAS, leaf-area index at 60 DAS, dry-matter accumulation/plant and primary and secondary branches/plant were found significantly higher to that of 'Vardan' (Table 1). Similar results were also reported by Bora (1997).

There was significant difference in the seed quality of 'Varuna' and 'Vardan' (Table 3). Variety 'Varuna' gave more oil and protein yields than 'Vardan', which may be due to genetic characters of the variety. Bora (1997) also reported similar results.

Nitrogen

N application had significant effects on growth character, yield attributes, yield and seed qualities of Indian mustard (Tables 1, 2, 3). An application of N significantly increased the growth characters (plant height, leaves/plant at 60 DAS, leaf-area index at 60 DAS, dry matter/plant, and primary and secondary branches/plant) up to 120 kg N/ha which was at par with 160 kg N/ha. It might be due to the fact that nitrogen plays vital role both in cell division and cell enlargement. Similar results were reported by Kachroo and Kumar (1997) and Tomar *et al.* (1997).

Yield-attributing characters, viz. siliquae/plant, length of siliqua, seeds/

siliqua, 1,000-seed weight and seed yield/plant were significantly increased with increasing level of N up to 120 kg N/ha (Table 2), which remained at par with 160 kg N/ha. High level of N improving the fertility status of soil created congenial conditions for better growth and development of plants. Better development of plants resulted in high yield attributes. Similar results were also reported by Ali *et al.* (1996) and Kachroo and Kumar (1997).

Seed, stover and biological yields increased with increase in the doses of N, recording highest value at 160 kg N/ha which remained at par with 120 kg N/ha (Table 3). Application of 160 kg N/ha gave seed yield, showing an increase of 128.78, 47.91, 21.84 and 2.47% in 1997-98; and 83.18, 27.99, 12.24 and 1.68% in 1998-99 over those of 0, 40, 80 and 120 kg N/ha respectively. Nitrogen fertilization pushed up to removal of nutrients and water from soil by the crop which might have enhanced the photosynthesis, translocation of assimilates from sources (leaves and stems) to sink (siliqua and seed) vis-a-vis yield. These findings corroborate the report of Ali *et al.* (1996) and Tomar *et al.* (1997).

Protein as well as oil yield in case of 2 early sowing dates (14 October and 29 October) were at par and these decreased significantly with delaying of sowing dates (13 November and 28 November) (Table 3).

Interaction

The crop sown on 14 October and receiving 160 kg N/ha recorded the maximum yield. This was also at par with yield recorded in crops sown on 29 October

Table 3. Biological, seed, stover, protein and oil yields of Indian mustard as influenced by sowing date, variety and nitrogen

Treatment	Biological yield (q/ha)		Seed yield (q/ha)		Stover yield (q/ha)		Protein yield (q/ha)		Oil yield (q/ha)	
	1997- 98	1998- 99	1997- 98	1998- 99	1997- 98	1998- 99	1997- 98	1998- 99	1997- 98	1998- 99
<i>Sowing date</i>										
14 October	64.57	72.82	15.99	18.01	48.55	54.81	288.62	344.89	657.99	760.02
29 October	62.06	70.43	15.29	17.34	46.83	53.19	287.45	341.60	627.35	729.15
13 November	48.58	57.93	11.86	14.12	36.72	43.81	247.40	303.44	475.23	578.78
28 November	23.15	37.50	6.58	9.09	17.52	28.33	137.76	199.16	256.50	361.78
CD (P=0.05)	4.43	4.68	0.94	0.96	2.88	3.20	21.66	21.06	45.17	37.58
<i>Variety</i>										
'Varuna'	54.08	64.05	13.82	15.77	40.72	48.28	300.45	348.31	572.29	670.38
'Vardan'	45.10	55.29	11.04	13.51	34.09	41.83	197.17	251.96	433.43	540.67
CD (P=0.05)	1.74	1.83	0.40	0.45	1.08	1.44	11.09	8.91	20.62	19.83
<i>Nitrogen (kg/ha)</i>										
0	29.67	40.69	6.95	9.57	22.72	31.17	122.39	179.36	290.16	406.08
40	44.38	56.26	10.75	13.61	33.64	42.65	206.40	273.70	444.51	575.57
80	52.96	63.03	13.05	15.52	39.91	47.52	261.65	324.83	528.53	642.06
120	59.87	68.61	15.52	17.13	44.90	51.59	325.61	372.75	609.78	688.80
160	61.07	69.74	15.90	17.42	45.85	52.24	336.76	382.72	617.08	692.27
CD (P=0.05)	2.75	2.89	0.64	0.71	1.71	2.28	17.54	14.08	32.61	21.36

DAS, Days after sowing

receiving 160 kg N/ha, sown on 14 October receiving 120 kg N/ha and sown on 29 October receiving 120 kg N/ha. These treatment interactions resulted in highest amount of seed yield than rest of the combinations evaluated (Table 4).

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