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RESEARCH PAPER

Growth, yield, quality and nitrogen uptake of various genotypes of mustard (*Brassica juncea* L.) as influenced by varying nitrogen levels under late sown conditions in Eastern Uttar Pradesh

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Abstract : The field experiment conducted at Narendra Dev University of Agriculture and Technology Kumarganj, Faizabad, U.P. (26.5^{0}N, 82.12 ^{0} E and an altitude of 113 m above mean sea level), from 2004-05 to 2005-06 on silt loam soil revealed that the highest mean dry matter accumulation of 87.30 g/plant in mustard was recorded with 120 kg N/ha which was 36.1 and 26.0 % higher as compared to control and 30 kg N/ ha, respectively. The highest seed and oil yield of 19.78 and 7.57q/ha, respectively was obtained with 120 kg N/ha which was significantly higher as compared to all the lower doses including control. But the seed yield was only 1.6 q/ha more over 90 kg N/ha and the per cent increase over control with 90 kg and 120 kg/ha was 19.8 and 17.8, respectively. The highest total nitrogen uptake (106.32 kg/ha) was also reported with 120 kg N/ha which was significantly superior over rest of the treatments. Whereas, among the varieties Urvashi registered significantly more number of branches and dry matter accumulation/plant as compared to all other varieties. The next in the order was Maya. The plant height was highest in case of Maya (176.6cm) followed by Vardan and the smallest plants were noticed in Urvashi with highest (4.35) leaf area index. Urvashi registered the highest mean seed yield (14.50 q/ha) and maximum oil yield (5.68q/ha) which were significantly superior over Vardan and Narendra Rai but statistically at par with Maya (13.94 q/ha). All the yield attributing characters *viz.*, number of siliquae / plant, siliqua length, seeds /siliqua and 1000 seed weight were also statistically higher under Urvashi followed by Maya. Narendra Rai gave the lowest oil yield and next in order were Vardan and Maya. The per cent increase in oil yield of Urvashi over Narendra Rai, Vardan and Maya was to the tune of 21.1, 9.9 and 8.4, respectively. Urvashi also registered the highest nitrogen uptake (75.84 kg/ha) which was significantly superior over Vardan and Narendra Rai but statistically at par with Maya (73.12 kg/ha).

Key Words : Mustard, Seed yield, Oil yield, Nitrogen uptake

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INTRODUCTION

Brassica spp, commonly known as rapeseed mustard, play an important role in Indian economy by providing edible oils, vegetables, condiments and animal feed, It is the third most source of vegetable oil of the world, after soybean and palm. Rape seed and mustard is an important oil seed crop of Indian which stands next only to groundnut in terms of both area and production. In India is cultivated over an area of 6.49 million ha with the production of 7.41 mt (2011-2012). However, its productivity is low due to poor soils conditions and inadequate use of key inputs like fertilizers. Among plant nutrients, nitrogen is the most important and urea is the most widely used source of nitrogen by farmers all over the world. Efficiency of nitrogen use by most of the crops ranges from 20-60 per cent and commonly average

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around 50 per cent (Aulakh *et al*., 1992). Low recovery of applied nitrogen by crops raise questions on the fate of the nitrogen that loss from soil plant system through runoff, leaching, dinitrification and ammonia volatilization an made unavailable to the plant through biological immobilization. Besides, the soil of eastern and central Uttar Pradesh region is deficient in nitrogen, phosphorus and sulphur content. These aspects of unstained crop production have received very little attentions. The importance of nitrogen fertilization to achieve the higher production potential in mustard is well recognized. Nitrogen is an important metabolic element for growth and development of plant. It is considered essential for metabolism of protein and other biochemical products such as nucleic acid, chlorophyll and protoplasm. It is thus, the basic constituent of plant life and tends to encourage vegetative growth and gives to a considerable degree the utilization of other nutrients also.

The yield of rapeseed and mustard can be raised with the use of high yielding varieties. Besides the nitrogen levels, varieties has also influenced the growth of mustard especially in light textured soils and high temperature. Thereafter, the present investigation was undertaken to find out the effect of nitrogen levels on growth, yield and quality of various muastard (*Brassica juncea*) varieties under late sown condition

MATERIAL AND METHODS

An experiment was conducted at Narendra Dev University of Agriculture and Technology Kumarganj, Faizabad, U.P. (26.5^{0}N, 82.12 ^{0} E and an altitude of 113 m above mean sea level), from 2004-05 to 2005-06 on silt loam (21.8 % sand, 58.6 % silt and 19.6% clay) soil. The climate of Faizabad is semiarid, subtropical with dry hot summers (Apr-June) and cold winters (Nov.- Jan.). The average annual precipitation is about 1194mm, of which nearly 80% received during monsoon period (June – September). The soil having 0.44% organic carbon, 186.0 kg available nitrogen, 18.8 kg available phosphorus, 240.0kg available potassium and 13.4 kg available sulpher per hectare with 8.15 pH and 0.35 dS/m electrical conductivity (1:2.5 soil water ratio). The treatment consisted of 5 nutrient doses (N_0 P K S, N_{30} P K S, N_{60} P K S, N_{90} P K S and N_{120} P K S) and 4 varieties of Indian mustard (Vardan, Maya, Urvashi and Narendra Rai (NDR-8501) were tested in Randomized Block Design with 3 replications. The crop was sown 30cm apart; by using a seed rate of 5 kg/ha on November 25, 2004 and November 26, 2005. The thinning was done in two phases (15 and 25 DAS) to ensure the plant to plant distance at 15 cm. Full amounts of P, K and S fertilizers and ½ N was applied as basal and remaining amount of the nitrogen was applied in two equal splits, 30 and 45 days after sowing, as per treatment. The sources for N, P, K and S were urea, SSP, MOP and gypsum, respectively. The crop was sprayed twice with thiodone @1.5 l/ha at 50 and 90 DAS for controlling the insects, particularly aphids. Two irrigations were also given to the crop at 30 DAS and at Pod filling stage during both the years. The total rainfall received during the crop season was 57.6 and 37.9 cm during first and second years, respectively. The data on growth and yield component were recorded by selecting 10 plants per plot and then represented on per plant basis where, yields, oil content and nitrogen uptake were recorded by drawing the sample plot wise and then presented on hectare basis. Soil and plant samples were taken and analyzed as per standard procedure. The oil and protein content in seeds was estimated from the oven dry samples following the standard methods of analysis.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Growth parameters:

The mean data presented in Table 1 revealed that the branches/ plant, leaf area index and dry matter accumulation/ plant varied significantly due to nitrogen fertilization and cultivars. Each successive increments in nitrogen level upto 120 kg/ha significantly increased the number of branches/ plant, leaf area index and dry matter accumulation/plant in mustard, though the pace of increment was highest between 60 and 90 kg of N/ha. The highest mean dry matter accumulation of 87.30 g/plant was recorded with 120 kg N/ ha which was 36.1 and 26.0 % higher as compared to control and 30 kg N/ha, respectively. The increasing trend was also observed in case of plant height up to 120kg N/ha although, the differences were statistically alike. Among varieties Urvashi registered the significantly more number of branches and dry matter accumulation/plant as compared to all other varieties. The next in the order was Maya. Narendra Rai and Vardan did not differ statistically, showed lowest values of these parameters. The plant height was highest in case of Maya (176.6cm) followed by Vardan and the smallest plants were noticed in Urvashi with highest (4.35) leaf area index.

Yield and yield attributes :

The mean seed yield responded up to 120 kg N/ha (Table 2). The highest seed yield of 19.78q/ha was obtained with 120 kg N/ha which was significantly higher as compared to all the lower doses including control but only 1.6 q/ha more over 90 kg N/ha. The per cent increase over control with 90 kg and 120 kg/ha was 19.8 and 17.8, respectively. The highest seed yield with higher doses of N was mainly due to more number of siliquae/plant, seeds /siliqua and 1000- seed weight under these treatments which directly influences the

seed yield. Similar findings were also reported by Singh *et al.* (2002) and Reager *et al.* (2011). The harvest index of mustard varied in between 22.58 to 24.00% with differential doses of nitrogen. Urvashi registered the highest mean seed yield/ha a (14.50 q) which was significantly superior over Vardan and Narendra Rai but statistically at par with Maya (13.94 q/ha). All the yield attributing characters *viz.*, number of siliquae / plant, siliqua length, seeds /siliqua and 1000 seed weight were also statistically higher under Urvashi followed by Maya. The increase in seed yield of Urvashi over Narendra Rai and Vardan was to the tune of 11.7 and 8.4 %, respectively. These results are in close conformity with those of Shukla *et al.* (2001), Chauhan *et al.* (2007) and Kumar *et al.* (2009).

Quality parameters:

The mean protein content responded upto 120 kg N/ha (Table 3). The highest protein content in grains (24.43%) was obtained with 120 kg N/ha which was significantly higher as compared to all the lower doses including control but at par with 90 kg N/ha. The highest protein content with higher doses of N was mainly due to more nitrogen percentage in grains (Reager *et al.*, 2011). Urvashi registered the highest protein content (23.00%) which was significantly superior over Vardan and Narendra Rai but statistically at par with Maya (22.64%). The highest oil yield of 7.57q/ha was reported

Table 1 : Plant height, number of branches/plant, leaf area index and dry matter accumulation/ plant as influenced by nitrogen levels and varieties (mean of 2 years)

Treatments	Plant height (cm)	Branches/plant	Leaf area index	Dry matter accumulation (g/plant)
Nitrogen levels				
N_0	172.00	13.25	2.78	64.13
N_{30}	173.30	15.13	3.92	69.30
N_{60}	175.60	16.75	4.55	75.83
N_{90}	178.03	18.75	4.92	82.13
N_{120}	180.50	19.75	5.32	87.30
S.E.±	3.92	0.36	0.07	1.19
C.D. (P=0.05)	NS	1.03	0.19	3.40
Varieties				
Vardan	175.32	16.40	4.27	74.70
Maya	176.60	16.90	4.31	76.68
Urvashi	170.18	17.40	4.35	78.48
Narendra Rai	174.44	15.80	4.25	73.08
S.E.±	3.51	0.32	0.06	1.06
C.D. (P=0.05)	NS	0.92	NS	3.04

NS=Non-significant

Table 2 : Yield attributes, seeds yield and harvest index of mustard as influenced by nitrogen levels and varieties (mean of 2 years)

Treatments	Siliquae/plant	Siliqua length (cm)	Seeds/siliqua	1000-Grains weight (g)	Seed yield (q/ha)	Harvest index (%)
Nitrogen levels						
N_0	72.29	4.55	10.80	3.75	6.10	22.58
N_{30}	81.18	4.86	11.58	4.13	10.20	23.61
N_{60}	91.81	5.33	12.10	4.55	14.25	23.66
N_{90}	126.70	5.83	12.63	4.84	18.18	23.80
N_{120}	129.53	6.20	13.13	5.28	19.78	24.00
S.E.±	1.49	0.09	0.21	0.07	0.22	-
C.D. (P=05)	4.25	0.26	0.61	0.19	0.64	-
Varieties						
Vardan	97.07	5.28	11.98	4.43	13.38	23.32
Maya	101.06	5.40	12.14	4.58	13.94	23.50
Urvashi	110.21	5.56	12.32	4.70	14.50	23.58
Narendra Rai	92.86	5.17	11.74	4.32	12.98	23.20
S.E.±	1.33	0.08	0.19	0.06	0.20	-
C.D. (P=05)	3.80	0.23	0.55	0.17	0.57	-

Table 3 : Nitrogen, protein and oil content in grains, oil yield and nitrogen uptake by mustard as influenced by nitrogen levels and varieties (mean of 2 years)

Treatments	Nitrogen content in grains (%)	Protein content in grains (%)	Oil content in grains (%)	Oil yield (q/ha)	Total nitrogen uptake (kg/ha)
Nitrogen levels					
N_0	3.04	19.00	38.80	2.43	38.08
N_{30}	3.44	21.00	39.30	3.98	59.78
N_{60}	3.69	23.24	39.00	5.56	69.23
N_{90}	3.90	24.33	38.55	7.01	85.14
N_{120}	3.91	24.43	38.25	7.57	106.32
S.E.±	0.03	0.14	0.34	0.08	0.98
C.D. (P=05)	0.09	0.41	0.98	0.23	2.80
Varieties					
Vardan	3.54	22.23	38.78	5.17	70.16
Maya	3.66	22.64	39.12	5.24	73.12
Urvashi	3.68	23.00	39.62	5.68	75.84
Narendra Rai	3.50	21.89	38.40	4.69	67.71
S.E.±	0.03	0.13	0.30	0.07	0.87
C.D. (P=05)	0.07	0.37	NS	0.21	2.51

NS=Non-significant

with 120 kg N/ha which was significantly superior over rest of the treatments. The highest oil yield with higher doses of N was mainly due to the more oil content in grains. Among varieties Urvashi produced the maximum oil yield (5.68q/ha) which was significantly higher than all other varieties. Narendra Rai gave the lowest oil yield and next in order were Vardan and Maya. The per cent increase in oil yield of Urvashi over Narendra Rai, Vardan and Maya was to the tune of 21.1, 9.9 and 8.4, respectively.

Nitrogen uptake:

The mean nitrogen content and uptake responded upto 120 kg N/ha (Table 3). The highest nitrogen content in grains (3.91%) was obtained with 120 kg N/ha which was significantly higher as compared to all the lower doses including control but at par with 90 kg N/ha. The highest nitrogen content with higher doses of nitrogen was mainly due to more nitrogen uptake by grains. Urvashi registered the highest nitrogen content in grains (3.68%) which was significantly superior over Vardan and Narendra Rai but statistically at par with Maya (3.66%). The highest total nitrogen uptake (106.32 kg/ha) was reported with 120 kg N/ha which was significantly superior over rest of the treatments. The highest total nitrogen uptake with highest nitrogen was mainly due to more nitrogen content in grains coupled with more seed yield and the maximum dry matter accumulation/plant. Similar results were also observed by Shukla *et al.* (2001) in Uttar Pradesh tarai. Among varieties, Urvashi registered the highest nitrogen uptake (75.84 kg/ha) which was significantly superior over Vardan and Narendra Rai but statistically at par with Maya (73.12 kg/ha).

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