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Influence of crop geometry and nitrogen on seed yield and yield attributes of Ethiopian mustard (*Brassica carinata*)

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ABSTRACT

An experiment was conducted during the winter season of 1997–98, 1998–99 and 1999–2000 to study the effect of crop geometry and nitrogen levels on the seed yield and yield-attributing characters of Ethiopian mustard [*Brassica carinata* (A) Braun]. Plant height and siliquae/plant were significantly higher when Ethiopian mustard was planted at a spacing of 60 cm × 10 cm, but seed yield was highest under 30 cm × 10 cm spacing with a population of 222, 222 plants/ha. Significant response to nitrogen on seed yield, plant height and siliquae/plant was observed at successive level up to 90 kg/ha. Oil content (%) decreased significantly with each successive increase in N dose up to 90 kg/ha.

Key words : Ethiopian mustard, Spacing, Nitrogen, Oil content

Newly introduced non-traditional brassica species *Brassica carinata* (L.) Braun, known as karan rye or Ethiopian mustard has an edge over domestic species under rainfed conditions. Yield of Ethiopian mustard up to 40 q/ha under irrigated conditions and 36 q/ha under rainfed conditions have been observed (Anand and Rawat, 1984). Besides high-yielding, Ethiopian mustard is resistant to alternaria blight, white rust and tolerant to aphid attack, drought, shattering and birds attack which enable it to be successful in area where such problems are limiting brassica production. Moreover, it performs better than other species even under problematic areas like late sowing, rainfed and saline conditions (Malik, 1990). Available information on crop management of Ethiopian mustard is meagre. Hence the present investigation was planned to study the optimum plant density and nitrogen requirement of Ethiopian mustard under semi-arid, tropical conditions of Haryana.

MATERIALS AND METHODS

A field experiment was conducted during winter (*rabi*) season 1997–98, 1998–99 and 1999–2000 at Oilseeds Research Area of Chaudhary Charan Singh Haryana Agricultural University, Hisar (75°46'E, 22°10'N, with mean sea-level

215 m). The soil was sandy loam (typic ustochrepts) in texture, low in available nitrogen (102 kg/ha), medium in available phosphorus (10.5 kg/ha), high in available potassium (350 kg/ha), and slightly alkaline in pH (8.2). The experiment was laid out in split-plot design with 3 replications consisting of 4 crop geometries, viz. 30 cm × 15 cm and 4.5 cm × 10 cm (222, 222 plants/ha), 45 × 15 cm (148, 131 plants/ha) and 60 cm × 10 cm (166,666 plants/ha) as main treatments and 4 nitrogen levels (0, 30, 60 and 90 kg/ha) as sub treatments. Half dose of N through urea was applied before sowing and remaining half after the first irrigation 40 days after sowing. Only 1 irrigation was applied during the growing period. Required plant population was maintained by thinning out extra plants at 20 days after sowing. Cultivar 'PC 5' was planted on 5 November, 22 October and 28 October during 1997, 1998 and 1999 respectively. Rest of the package of practices was same as for Indian mustard.

RESULTS AND DISCUSSION

The lower population of 166,666 plants/ha (crop geometry 60 cm × 10 cm) registered significantly higher plant height and siliquae/plant than other plant population levels. Although the test weight did not vary significantly among different crop geometries, maximum test weight (3.09 g) was recorded at the lowest plant population level of 166,666 plants/ha. Higher test weight, plant height and siliquae/plant were recorded in wider row spacing (50 cm × 10 cm), might be due to more availability of resources for development of individual plant. As a result of better partitioning of photosynthates from source to sink and less competition for resources, development of yield attributes was better under wider row spacing.

Although favourable effect of lower plant population on growth and yield attributes of individual plants was observed, the seed yield did not improve mainly because of lower number of plants/ha. Seed yield with higher plant population of 222, 222 plants/ha at a crop geometry of 30 cm × 15 cm, was significantly higher than that of other crop geometries. The results clearly indicate that for *B. carinata*, wider spacing of 60 cm × 10 cm adversely affected the seed yield. Similar results were reported from studies conducted at Ludhiana, Bhatinda and Kangra (AICRP–RM, 2000). Oil content (%) did not vary significantly due to plant population levels. During 1998–99 the seed yield was better than that during 1997–98 and 1999–2000, due to receipt of 135.0 mm rainfall in September which helped in better establishment of crop sown under rainfed condition, whereas foggy and cloudy weather persisted up to 20 January during 1997–98 adversely affected the vegetative growth of crop and ultimately the seed yield.

Effect of nitrogen

Each successive increase in N dose up to 90 kg/ha significantly increased the plant height, siliquae/plant and seed yield. Significant response to nitrogen up to 90 kg/ha in Ethiopian mustard was reported from Ludhiana and Kangra (AICRP-RM, 2000) and up to 80 kg N/ha at Hisar (Thakral *et al.*, 1996). On an average of 3

Table 1. Plant height, siliquae/plant and test weight of *B. carinata* as affected by crop geometry and nitrogen levels

Treatment	Plant height (cm)				Siliquae/plant				Test weight (g)			
	1997–98	1998–99	1999–2000	Mean	1997–98	1998–99	1999–2000	Mean	1997–98	1998–99	1999–2000	Mean
Crop geometry												
30 cm × 15 cm	234	239	241	238	250	435	372	352	2.74	3.29	3.08	3.03
45 cm × 10 cm	237	242	243	241	229	452	354	345	2.65	3.23	3.06	2.98
45 cm × 15 cm	248	246	246	247	325	638	481	481	2.78	3.24	3.06	3.02
60 cm × 10 cm	258	258	256	257	380	754	694	609	2.86	3.29	3.12	3.09
CD (P=0.05)	7.8	7.6	9.4	6.2	16.2	37.0	44.3	43.2	NS	NSN	NS	NS
N (kg/ha)												
0	210	229	227	222	165	387	231	271	3.48	3.20	3.08	3.24
30	232	242	239	238	214	430	361	345	3.50	3.25	3.16	3.30
60	247	352	248	249	234	472	393	365	3.68	3.27	3.28	3.41
90	256	268	262	262	262	478	432	390	3.69	3.32	3.35	3.45
CD (P=0.05)	8.2	3.3	4.6	9.1	19.0	39.0	31.0	17.3	0.16	0.11	0.09	0.15

Table 2. Seed yield (kg/ha) and oil content (%) of *B. carinata* as influenced by nitrogen and crop geometry

Treatment	Seed yield (kg/ha)				Oil content (%)			
	1997–98	1998–99	1999–2000	Mean	1997–98	1998–99	1999–2000	Mean
Crop geometry								
30 cm × 15 cm	1,009	2,291	1,619	1,639	35.7	38.7	39.6	37.9
45 cm × 10 cm	876	2,295	1,537	1,569	35.3	37.9	40.0	37.7
45 cm × 15 cm	841	2,364	1,542	1,582	35.0	38.4	39.9	37.7
60 cm × 10 cm	789	2,259	1,481	1,509	35.2	38.0	39.2	37.4
CD (P=0.05)	95	56	NS	54	NS	NS	NSN	NS
N (kg/ha)								
0	691	2,117	903	1,237	38.8	38.8	41.1	39.5
30	853	2,323	1,497	1,557	38.2	38.4	40.1	38.9
60	902	2,407	1,788	1,699	37.4	38.0	39.5	38.3
90	1,068	2,386	1,991	1,815	36.8	37.3	38.6	37.5
CD (P=0.05)	92	74	149	98	0.57	0.56	0.40	0.52

years, maximum seed yield (1,815 kg/ha) was recorded with 90 kg N/ha, which was 46.7% higher over the control. Test weight and oil content (%) differed significantly due to N doses. In all the 3 years, maximum test weight was observed with 90 kg N/ha. Oil content (%) decreased significantly with each successive increase in N dose up to 90 kg/ha. The decrease in oil content with increase in nitrogen dose might be due to degradation of carbohydrates in tricarboxylic acid (TCA) cycle to Acetyl CoA, which by reductive amination and transamination processes, form more aminoacids than fatty acids. On an average maximum oil content (39.5%) was found at 0 kg N/ha, whereas minimum (37.5%) at 90 kg N/ha.

From the present finding, it can be concluded that Ethiopian mustard can be successfully grown in Haryana at a crop geometry of 30 cm × 15 cm with a nitrogen dose of 90 kg N/ha. Half dose of N should be applied at sowing and remaining at the first irrigation 40 days after sowing.

REFERENCES

AICRP-RM, 2000. *Annual Report of All-India Coordinated Research Project on Rapeseed Mustard*, Udaipur, pp. 43–45.

Anand, I.J. and Rawat, D.S. 1984. Recent plant breeding efforts towards productivity breakthrough in rapeseed–mustard. *Proceedings of the Symposium on Oilseeds Production and Utilization. Constraints and Opportunity*, held in September 1984 at New Delhi, pp. 45–50.

Malik, R.S. 1990. Prospects of *Brassica carinata* as an oilseed crop in India. *Experimental Agriculture* **26** : 125–129.

Thakral, S.K., Singh, B.P. and Faroda, A.S. 1996. Effect of irrigation and fertility levels on seed yield and yield attributes of *Brassica* species. *Indian Journal of Agricultural Sciences* **66** (4) : 212–216.