Journal of Oilseed Brassica, 7 (2) : 169-173, July 2016

Effect of planting geometry and fertilizer levels on Yellow Sarson (*Brassica rapa* var. *trilocularis*) under rainfed condition

K Daulagupu and K Thakuria*

Department of Agronomy, Assam Agricultural University, Jorhat-785013, Assam, India
**Corresponding author: thakuria_k@yahoo.com*
(*Received: 2 May 2016: Revised: 12 May 2016; Accepted: 13 June 2016*)

Abstract

A field experiment on different planting geometries viz., uniform row at 20, and 30 cm apart (G_1 and G_2), border row (3:1) at 20, and 30 cm apart (G_3 and G_4), and border row at 20 and 30 cm, and replacement with coriander in skipped row (G_5 and G_6) along with two levels of fertilizers (60-30-30 (F_1), and 90-45-45 (F_2) N, P_2O_5, and K_2O kg/ha) carried out during *Rabi*, 2011-2012 at Assam Agricultural University, Jorhat, India revealed that different growth, and yield attributes except for 1000 seed weight, border row spaced at 20 cm, and replacement with coriander in the skipped row (G_5) proved to be superior in comparison to other planting geometries. In case of seed yield, the highest value was recorded for border method spaced at 20 cm rows (G_3). However, the stover yield was highest with uniform row spaced at 20 cm (G_1). Highest oil content and oil yield was recorded in case of G_3. The two levels of fertilizer did not influence plant characters. Though, the lower level of fertilizers (F_1) recorded higher oil content but the oil yield was recorded higher with the higher level (F_2). Higher uptake values of N, P, and K were recorded with planting geometry, G_5, and with higher level of fertilizers (F_2). In terms of benefit; cost ratio, border method spaced at 20 cm (G_3) with lower level of fertilizers (F_1) was found to be better than other treatments.

Key words: *Fertilizer level, planting geometry, Yellow Sarson*

Introduction

Oilseed crops claim highest share in the world's economy next to food grain crops. Although, India occupies a prominent position both in acreage, and production on oilseed map of the world, yet still there is a gap between production potential, and actual realization. Rapeseed-mustard contributed 25.9, and 22.0 per cent to the total oilseeds production, and acreage, respectively (Anonymous, 2011). In Assam, the oilseed productivity is low which may be due to the fact that 72 per cent of the total oilseed area is rainfed, subjected to uncertainties of moisture availability, low plant population, and application of proper dose of fertilizer. Planting geometry is another important non-monetary input in increasing the productivity per unit area. Research carried out at many places on border method of sowing of wheat indicated that yields were not reduced by reducing seed rate, and fertilizers to 75 per cent of the recommended dose (AICARP, 1986). Nitrogen, phosphorus, and potassium are the major nutrients needed in adequate quantity in available form for the growth, and reproduction of oilseeds. Thus, balanced, and efficient application of fertilizers with appropriate plant population per unit area is essential for better harvest. Hence, the present investigation was carried out.

Materials and Methods

A field experiment was conducted during *Rabi* season of 2011-12 in the Instructional-cum-Research Farm of Assam Agricultural University, Jorhat, India situated at 26°47^{1}N latitude, 94°12^{1}E longitude, and at an elevation of 86.6 m above the mean sea level. The seeds of Yellow Sarson, 'Binoy' were sown in a well prepared seed bed on 9 November, 2011 using randomized block design arrangement with 3 replications. The experiment included the possible combinations of six planting geometries *viz.*, uniform row at 20, and 30 cm apart (G_1 and G_2), border row (3:1 skip) at 20, and 30 cm apart (G_3 and G_4), and border row at 20 and 30 cm, and replacement with coriander in skip row (G_5 and G_6) along with two levels of fertilizers (60-30-30 (F_1), and 90-45-45 (F_2) kg N, P_2O_5, K_2O/ha). As per treatment, N, P_2O_5, and K_2O in the form of urea, single superphosphate, and muriate of potash were applied one day ahead of sowing into the soil. In the border row treatments *viz.*, G_3, and G_4, 75 per cent of the total requirement of fertilizers as per treatment was applied. The seeds of Yellow Sarson variety 'Binoy' were used @ 8, and 10 kg/ha in case of planting geometry G_2, and G_1, respectively. On the other hand, the seed rate of 6 and 7.5 kg/ha was used in case of G_4 and G_6 as well as G_3 and G_5, respectively. The seeds of coriander were sown @ 10 kg/ha as per row length basis in planting geometry G_5, and G_6 only. Interculture operations, and thinning of plants were done maintaining intra row spacing at 10-12 cm after 20 days of sowing. The crop Yellow Sarson, and coriander were harvested 95 and 120 days after sowing, respectively. Total rainfall received during the crop growth period was 65.8 mm distributed over 25 days.

Results and Discussion

Growth and development

The growth characters viz., plant height at harvest, and number of leaf per plant at 60 days after planting (DAS) were not influenced significantly due to adoption of different planting geometries in Yellow Sarson (Table 1). However, in case of border method (20 cm) when the skip row was replaced by coriander (G_5), tallest plants were recorded while, number of leaves per plant were higher for border methods of sowing spaced at 20 cm, and 30 cm apart (G_3 and G_4). Non-significant effect of planting geometry on plant height has also been reported by Thakur (1999).

Similar to planting geometry, plant height, and number of leaves per plant were not influenced significantly due to application of two levels of fertilizers. Plant height at harvest was, however, recorded higher value with application of lower level of fertilizers @ 60-30-30 kg N, P_2O_5, and K_2O/ha, while number of leaves/plant were higher with the higher level of fertilizers. The findings are in agreement with that of Antil *et al.* (1986).

Yield attributes and yield

All the yield attributing characters of yellow sarson viz., number of branches per plant, siliquae/plant, seeds/siliqua, and 1000-seed weight were not influenced significantly due to different planting geometries (Table 1). Border row method of sowing spaced at 20 cm (G_3) produced the highest seed yield whereas, highest value of stover yield was obtained from uniform row method of sowing spaced at 20 cm (G_1) (Table 2). The higher value of seed yield in case of G_3 (border row method spaced at 20 cm) in comparison to other planting geometries may be due to higher values of growth, and yield attributing characters recorded for this treatment. Another reason may be that plants in border line gets more light resulting in more healthy, and vigorous growth, and more number of branches per plant which ultimately reflected on yield. Similar findings were also reported by Rathi and Verma (1974), Sharma and Singh (1989), Singh and Uttam (1993) and Sharma *et al.* (2008).

All the yield attributing characters except for number of siliquae/plant were found to be higher with the application of higher level of fertilizers. Similar increase in yield attributes due to application of fertilizer' was reported by Tomer *et al.* (1996). Higher level of fertilizers resulted in higher seed, and stover yields of Yellow Sarson, but failed to differ significantly with the lower level. Similar increase in seed, and stover yields due to increase in levels of fertilizers have been reported by Tomar and Namdeo (1989).

Oil content and oil yield

The border row method spaced at 20 cm (G_3) recorded the highest oil content, and oil yield without differing with the same method of sowing spaced at 20 cm and sowing of coriander in the skipped row (G_5) (Table-2). The increase in oil yield in G_3 over G_5, and G_1 was 2.53, and 6.30 per cent, respectively. The increase in oil content in border method of sowing has also been reported by Sharma *et al.* (2008).

The oil content in seed was not influenced significantly by two levels of fertilizers. Oil yield was higher with the higher levels of fertilizers though it failed to differ significantly with the lower level. Increase in oil content in the lower level over the

Table1. Growth and yield attributes of Yellow Sarson as influenced by planting geometry and fertilizer levels

Treatment	Plant height (cm)	Number of leaves/plant at 60 DAS	Plant population (lakh/ha)	Number of branches/ plant	Number of siliquae/ plant	Number of seeds/siliqua	1000-seed weight (g)
Planting geometry (G)							
G_1-Uniform row (20 cm)	111.4	4.4	6.50	4.9	56.4	21.4	3.57
G_2-Uniform row (30 cm)	112.3	4.2	4.20	4.3	51.7	20.9	3.73
G_3-Border row 20 cm (3:1 skip)	113.3	4.9	5.29	4.9	67.7	22.0	3.68
G_4-Border row 30 cm (3:1 skip)	111.1	4.9	3.46	4.7	56.5	18.5	3.80
G_5-Border row 20 cm + One row of coriander in skip row	115.5	4.7	5.03	5.5	71.1	22.3	3.52
G_6-Border row 30 cm + One row of coriander in skip row	111.6	4.7	3.38	4.5	51.5	20.0	3.73
SEm±	1.99	0.25	0.16	0.34	6.29	0.90	0.08
CD (P=0.05)	NS	NS	0.40	NS	NS	NS	NS
Levels of fertilizer (N-P_2O_5-K_2O kg/ha) (F)							
F_1-60-30-30	112.7	4.7	4.75	4.7	61.6	20.5	3.66
F_2-90-45-45	112.5	4.0	4.53	4.9	56.8	21.2	3.69
SEm±	1.15	0.15	0.08	0.19	3.63	0.52	0.05
C.D (P=0.05)	NS	NS	NS	NS	NS	NS	NS

DAS- Days after sowing, NS- Non- significant

Table 2. Seed and stover yield, oil content and oil yield, total uptake of N, P, K and economics of Yellow Sarson as influenced by planting geometry and fertilizer levels

Treatment	Yield(kg/ha)		Yellow Sarson equivalent yield (kg/ha)	Oil content (%)	Oil yield (kg/ha)	Total uptake (kg/ha)			Net return (Rs/ha)	Benefit-Cost ratio
	seed	stover				N	P	K		
Planting geometry (G)										
G_1-Uniform row (20 cm)	822.7	2746.4	872.7	35.9	315.4	31.14	5.74	18.82	50,833	2.93
G_2-Uniform row (30 cm)	843.7	2365.4	843.7	36.6	303.4	28.42	5.20	16.54	48,716	2.88
G_3-Border row 20 cm (3:1 skip)	921.3	1977.2	921.3	36.7	338.9	30.94	5.44	15.28	55,606	3.59
G_4-Border row 30 cm (3:1 skip)	855.1	2594.2	855.1	35.7	305.6	29.85	5.49	18.02	51,404	3.36
G_5-Border row 20 cm + One row of coriander in skip row	900.6	2432.7	960.5 (59.9)	36.5	330.4	35.08 (3.71)	6.59 (0.90)	22.39 (5.01)	57,093	3.23
G_6-Border row 30 cm + One row of coriander in skip row	840.5	2161.5	897.3 (56.7)	35.7	300.4	31.11 (93.62)	5.79 (0.82)	20.09 (4.82)	52,284	3.00
SEm±	52.1	211.1	52.2	0.43	21.5	2.18	0.40	1.31	-	-
CD(P=0.05)	NS	NS	NS	NS	NS	NS	NS	3.86	-	-
Levels of fertilizer (N-P_2O_5-K_2O kg/ha) (F)										
F_1-60-30-30	829.9	2278.5	849.3	36.6 (58.2)	304.6	28.73 (3.54)	5.29 (0.82)	17.43 (4.84)	50,231	3.17
F_2-90-45-45	914.8	2480.7	934.3 (58.5)	35.6	326.7	33.54 (3.79)	6.13 (0.90)	19.62 (4.99)	55,084	3.14
SEm±	30.1	121.8	30.1	0.25	12.4	12.4	0.23	0.76	-	-
CD (P=0.05)	NS	NS	NS	0.74	NS	NS	0.68	NS	-	-

Figure in parentheses represents the seed yield of coriander, NS- Non- significant higher levels of fertilizers was 2.70 per cent. On the contrary, oil yield increase in higher levels of fertilizers over the lower level was 6.74 per cent which may be due to higher seed yield obtained in higher levels of fertilizers. Combined application of nitrogen, and phosphorus has also been reported by Khan *et al.* (1990) and Tomer *et al.* (1992).

Nutrient uptake

Total uptake of potassium was significantly influenced by different planting geometries, G_5, and G_6 without differing with each other, recorded the highest uptake. Non-significant effects of planting geometry on nutrient content, and uptake of N and P have also been reported by Mishra and Kurchania (2001). The total uptake of nitrogen, phosphorus, and potassium by seed, and stover was found to be significant due to the application of two levels of fertilizers. The higher level of fertilizers significantly increased the contents, and uptake of nitrogen, phosphorus, and potassium.

Economics

The net return was recorded highest in the border row method spaced at 20 cm and replacement of skipped row with coriander (G_5) which was followed by the same method without coriander in the skipped row (G_3). However, reverse trend was recorded in respect of benefit – cost ratio. The lower level of fertilizer recorded higher benefit – cost ratio over the higher levels due to low cost involvement in the treatment. On the basis of findings, it can be concluded that sowing of yellow sarson var. 'Binoy' either in border row method at 20 cm row spacing or sowing of coriander in the skipped row of the same method, and application of fertilizers @ 60-30-30 kg N, P_2O_5, and K_2O/ha were found to be the best for higher production.

References

AICARP. 1986. Studies on border method of sowing of crops. All India Co-ordinated Agronomic Research Project, Annual Report, 1984-85: 91-101.

Anonymous. 2011. Vision 2030. ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur, Rajasthan, India, pp. 27.

Antil RS, Kumar V, Singh M. 1986. Effect of nitrogen on yield and its uptake of N at different growth stages of raya (*B. juncea*). *Indian J Agron* **31**: 37-44.

Khan NA, Samimullah, Afridi MMRK, Ansari SA. 1990. Response of six mustard varieties to different combinations of nitrogen and phosphorus. *Indian J Agron* **35**: 412-414.

Mishra JS, Kurchania SP. 2001. Weed dynamics, nutrient uptake and yield in Indian mustard (*B. juncea*)-weed ecosystem as influenced by N levels, planting geometry and herbicides. *Indian J Agron* **46**: 296-303.

Rathi KS, Verma VS. 1974. A note on skip row technique and border effect studies on Moti wheat. *Indian J Agron* **19**: 279-281.

Sharma HL, Singh CM. 1989. Assessment of border method in relation to regular sowing in wheat (*Triticum aestivum*) and rice (*Oryza sativa*). *Indian J Agril Sci* **59**: 63-65.

Sharma A, Gupta R, Kumar A. 2008. Effect of sowing methods, nitrogen and sulphur level on growth, yield and oil contents of mustard (*B. juncea*). *Plant Archives* **8**: 421-424.

Singh VPN, Uttam SK. 1993. Performance of wheat (*Triticum aestivum*) cultivars under different sowing methods and fertility levels in central Uttar Pradesh. *Indian J Agron* **38**: 285-287.

Thakur KS. 1999. Response of promising varieties of Indian mustard (*B. juncea*) to nitrogen and spacing under mid-hills, rainfed conditions of Himachal Pradesh. *Indian J Agron* **44**: 816-819.

Tomar SS, Namdeo KN. 1989. Response of mustard varieties to row spacing and nitrogen. *Indian J Agron* **34**: 472-473.

Tomer S, Tomer S, Singh S. 1992. Effect of irrigation and fertility levels on growth, yield and quality of mustard (*B. juncea*). *Indian J Agron* **37**: 76-78.

Tomer S, Tomer TVS, Kumar S, Tomer S, Singh M, Singh, S. 1996. Response of Indian mustard (*B. juncea*) varieties to nitrogen, phosphorus and potassium fertilizers. *Indian J Agron* **41**: 624-626.