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Effect of sowing dates and plant spacing on growth and yield of Radish (*Raphanus sativus* L.)

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Abstract

This experiment was conducted during rabi season of 2016-17 at research farm of AKS University, Sherganj, Satna, to assess the effect of sowing dates and plant spacing on growth and root yield of radish (*Raphanus sativus* L.). The experiment consisting of nine treatment combination with three replications was laid out in randomized block design. Growth parameter differed significantly at all the stages of crop growth. Maximum plant height (32.26 cm.), number of leaves per plant (14.87cm), were recorded with sowing dates of 25 October. Maximum length of root (34.89 cm), diameter of root (16.04 cm), root yield (32.25 t/ha) were recorded with sowing dates of 25 October. Sowing dates of 25th October with plant spacing of 40x15cm increased the growth and yield of radish. Highest net return of Rs 79320 with B:C ratio of 2.59 was also found with sowing dates of 25th October. It was observed that plant spacing of 40x15 cm significantly improve growth and yield of radish.

Keywords: Sowing dates, Spacing, growth parameters and Yield

Introduction

Amongst the root vegetables, radish (*Raphanus sativus* L.) which belongs to family Brassicaceae is the most popular and widely grown vegetable in both tropical and temperate regions. Radish is grown for its tender fleshy edible roots. It is one of the most ancient vegetable. The present area under radish in India is 2.84 lakh ha with the production of 35.21 lakh tonnes and productivity of 12390 kg/ha. India is the second largest producer of radish in the world and occupies 183.26 area in ('000) ha, with a production in 2489.74 ('000) metric tonnes, and productivity of 12.77 metric tonnes/ha. (Anon 2007).

Radish is consumed raw as salad or cooked as vegetable. It is rich in calcium, potash, phosphorus and vitamin C containing 34-40 mg per 100 g of edible portion. It is very refreshing when eaten fresh. The leafy tops are rich in vitamins like A, B and C and possess little quantity of carbohydrates, iron and proteins (Nath *et al.*, 1987). The characteristics pungent flavour of radish is due to presence of volatile iso-thiocyanates which helps in digestion. The leaves of radish are also good source for extraction of proteins on a commercial scale (Kanwar, 1993). The radish seed is a potential source of non-drying fatty acid oil suitable for soap making and for edible purpose. It is normally grown commercially during winter season in the plains and during summer season in the hills. Keeping the above facts this experiment designed to study the effect of sowing dates and spacing on growth and yield of radish (*Raphanus sativus*).

Materials and Methods

The present investigation entitled, "Effect of sowing dates and spacing on growth and root yield of radish cv. Japanese White" was carried out on well developed field of the experimental farm, AKS University, Satna (M.P.). The field experiment was conducted during *rabi* (winter) season of 2016-17. A field experiment was conducted at, AKS University, Satna (M.P.). This experiment design with two factors, consisting of four sowing dates (D₁-15 October, D₂-25 October, D₃-05 November and three spacings (S₁-40 x 10 cm, S₂ -40 x 15 cm and S₃-40 x 20 cm) was laid out in Factorial Randomised Block Design (FRBD) With three replications. Whole experimental area was 164 m², which was divided into total 27 plots with 9 treatments and size of each plot was 3.0 m x 2.0 m.

Organic manures and fertilizer were applied as per the recommendations 80:50:50 NPK/ha. Seeds sown at the rate of 7 kg/ha in about 1.5 cm depths in lines continuously and covered by soil. 15-20 days after its emergence, seedlings were thinned out by retaining one at each hill. The other culture practices like irrigation, weeding, earthing up and plant protection operation were carried out as and when required. Crop was harvested after 60 days of each sowing date. Five representative individual plants were evaluated on each parameter at different intervals.

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The observations were recorded on growth parameters and yield and data was analyzed by the method of variance outlined by Panse and Sukhatme (1985).

Results and Discussion

The plant height enhanced by manifold with the enhancement of plant growth up to the harvest stage. The height at the initial stage of 20 DAS, in general, ranged from 13.28 to 17.62 cm under various treatments. The height went up to less than twice up to the harvest stage i.e. ranging from 27.42 to 32.26 cm under different treatments.

As regards with the applied treatments, plant densities exerted significant influence upon this parameter at every stage of observations. The increasing this parameter up to 40 x 15 cm increased the plant height almost significantly at every stage. Accordingly, at the harvest stage, the plant height went up to 31.24 cm due to 40 x 15 cm as against only 29.53 cm under 40 x 10 cm. Thus, 40 x 15 cm spacing proved significantly superior to rest of the spacing at every stage of observations.

The crop sown on 25 Oct. performed the best. The plant height was significantly higher at this sowing date. At harvest stage, the maximum height was 32.26 cm under 25 October against 27.42 cm under 15 Oct. sowing. Accordingly, the maximum height was recorded under 25 Oct. sowing with 40 x 15 cm spacing at every stage. On the other hand, the lowest height was noted from 15 Oct. sowing with 40 x 10 cm spacing. Similar findings were also reported by Ghormade *et al.*, (1993).

The number of leaves/plant of radish was counted periodically from the different treatments and thereafter the data were statistically computed. The number of leaves was enhanced by more than thrice with the enhancement of plant growth up to harvest stage. The increase of this growth parameter was very fast between 40 DAS to harvest stage. At 20 DAS stage, the leaves were ranged from 2.71 to 3.29/plant, whereas at harvest stage, these ranged from 10.20 to 14.87/plant under different treatments. Our findings are in line with the results of Gill and Singh (1979).

The crop sown on 25 October or 5 November resulted in equal root length (34.47 to 34.89 cm), but proved significantly superior to 15 October sowing (31.38 cm). In case of plant densities, 40 x 15 cm resulted in significantly higher root length upto 34.92 cm as compared to 40 x 10 cm spacing (32.57 cm). The difference between 40 x 15 and 40 x 20 cm spacing was identical. The maximum root length (38.02 cm) was observed in 25 October sowing with 40 x 15 cm spacing interaction. On the other hand, the minimum root length (30.04 cm) was noted in case of 15 October sowing with 40 x 10 cm interaction. Similar results were reported by Alam *et al.*, (2010); Parvez *et al.*, (2004).

The crop sown on 25 October brought about significantly higher root diameter (16.04 cm) in comparison to 15 October and 5 November sowing (13.97 to 14.43 cm). The different plant densities did not deviate this parameter upto significant extent. The root diameter ranged from 14.49 to 15.35 cm. Amongst the treatment interactions, the maximum root diameter (17.40 cm) was recorded from 25 October sowing with 40 x 15 cm spacing. On the other hand, the lowest root diameter (13.38 cm) was noted from 15 October sowing with 40 x 10 cm spacing. These results are in agreement with Sirkar *et al.*, (1998).

The significantly maximum root-yield (32.2 t/ha) was recorded under 25 October sowing which was significantly superior to both the other sowing dates. The root yield under 15 October or 5 November sowing was statistically the same (31.68 to 31.91 t/ha). The plant spacing 40 x 15 cm resulted in significant higher root yield (32.53 t/ha) over 40 x 10 and 40 x 20 cm spacing (31.61 to 31.70 t/ha yield).

The treatment interactions were found to be significant. Thus the 25 October sowing with 40 x 15 cm spacing resulted in the maximum root yield up to 34.05 t/ha, whereas the lowest root yield only 31.32 to 31.47 t/ha was obtained from 25 October sowing with other two dates. The second best interaction was 15 October with 40 x 20 cm (32.20 t/ha). Similar results were reported by Malik *et al.*, (1999), Rao and Manohar (1990).

Table 1: Plant height and number leaves/plant of radish at different growth intervals under different treatments

Treatments	Plant height (cm)			Number of leaves/plant		
	20 DAS	40 DAS	At harvest	20 DAS	40 DAS	At harvest
Plant spacing (cm)						
40 x 10	15.17	20.35	29.53	2.91	4.78	11.84
40 x 15	17.03	22.90	31.24	3.29	5.62	14.29
40 x 20	16.17	21.67	30.47	2.87	5.00	13.18
S.Em±	0.21	0.08	0.17	0.115	0.14	0.25
C.D. (P=0.05)	0.62	0.25	0.50	0.346	0.42	0.76
Sowing dates						
15 October	13.28	18.28	27.42	2.71	3.98	10.20
25 October	17.47	23.75	32.26	3.08	5.55	14.87
5 November	17.62	22.90	31.56	3.27	5.87	14.24
S.Em±	0.21	0.08	0.17	0.115	0.14	0.25
C.D. (P=0.05)	0.62	0.25	0.50	0.346	0.42	0.76

Table 2: Length of root (cm), diameter of root (cm), root yield (t/ha) (gm), of radish as influenced by dates of sowing and plant spacing.

Dates of sowing	Length of root(cm)				Diameter of root(cm)				Root yield (t/ha)			
	40 x 10	40 x 15	40 x 20	Mean	40 x 10	40 x 15	40 x 20	Mean	40 x 10	40 x 15	40 x 20	Mean
15 October	30.40	31.49	32.62	31.38	23.38	14.10	14.43	13.97	31.61	31.91	32.20	31.91
25 October	32.92	38.02	33.75	34.89	15.00	17.40	15.72	16.04	31.47	34.05	31.32	32.25
5 November	34.75	35.25	33.41	34.47	15.41	14.55	13.33	14.43	31.83	31.64	31.67	31.68
Mean	32.57	34.62	33.26		14.60	15.35	14.19		31.61	32.53	31.70	
Intracation effect												
Source	S	D	D×S		0.32	0.32	0.56		S	D	S×D	
S.Em. ±	0.64	0.64	1.11		NS	0.96	1.67		0.28	0.28	0.31	
CD at 5%	1.92	1.92	NS		0.32	0.32	0.56		0.54	0.58	0.93	

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