Plant Archives Vol. 14 No. 1, 2014 pp. 619-623 *ISSN 0972-5210*

EFFECT OF SOWING DATES AND SPACING ON GROWTH AND ROOT YIELD OF RADISH CV. PUSA CHETKI

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Abstract

An experiment was conducted at College of Horticulture, Venkataramannagudem, West Godavari (Dist.), Andhra Pradesh, India; during the period from October, 2010 to January, 2011 to study the effect of sowing dates and spacing on growth and yield of radish. The seeds sown on four different dates *viz.*, 1st October, 15th October, 1st November and 15th November at different plant spacings of 45 × 10 cm, 45 × 20 cm and 45 × 30 cm. All the growth parameters like days to germination, germination percentage, plant height, number of leaves, leaf area, root-shoot ratio and plant weight were found maximum with 1st October sowing. All parameters showed a decreasing trend as sowing date was delayed. In the present experiment, October 1st sowing gave highest yields of (11.31 t/ha) compared to the lowest yields of (3.67 t/ha) by 15th November sowing. Regarding the plant spacing, the closer spacing (45 × 10 cm) resulted in maximum plant height, whereas all other vegetative parameters like number of leaves, leaf area, root-shoot ratio and plant weight were found maximum with wider spacing (45 × 30 cm). Decreasing plant density significantly reduced the total yield (5.66 t/ha). Interaction effects of sowing dates and spacing showed that early sowing on 1st October with the closer spacing of 45 × 10 cm performed well in respect of yield. Except plant height, all the growth parameters were better with early sowing on 1st October with a plant spacing of 45 × 30 cm.

Key words : Sowing dates, growth parameters, plant height, root-shoot ratio.

Introduction

Amongst the root vegetables, radish (*Raphanus sativus* L.), which belongs to family Brassicacae 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 (Anon, 2007).

One of the factors responsible for reduced growth and lower yield of vegetables is cultural practices like time of sowing and spacing. The scientific vegetable production reveals the significance and importance of sowing dates and plant population to be used for raising vegetable crops in order to get higher production of good quality vegetables.

For good quality and better root production, radish requires optimum sowing date and plant density. There are few recommendations that sowing date and plant density have brought classical changes in growth and root yield of radish crop with economical returns. Early sowing on 1st November recorded maximum vegetative growth and higher yield than late planting (Alam *et al*., 2010). El-Desuki *et al*. (2005) conducted an experiment in radish cv. White Icicle with inter-row spacing of 10 and 20 cm and intra-row spacing of 5 and 10 cm. Maximum plant height and yield was observed with spacing of 20 cm between row and 10 cm between plants.

The present investigation was therefore taken up at College of Horticulture, Venkataramannagudem, West Godavari (Dist.) during the period from October, 2010 to January, 2011 to determine the suitable sowing time and optimum spacing in order to have maximum vegetative growth and higher yields.

Materials and Methods

A field experiment was conducted at College of Horticulture, Venkatarammanagudem, Tadepalligudem, West Godavari Dist. during the period from October, 2010 to January, 2011. Soil of the experiment plot was red sandy loam with good drainage and moderate water holding capacity. The experiment was designed to study the effect of sowing dates and spacing on growth and yield of radish in cv. Pusa Chetki.

Table 1: Effect of sowing time and plant spacing on days to germination and germination percentage (%) of radish cv. Pusa Chetki.

Sowing dates	Days to germination				Germination percentage (%)			
	Plant spacing							
	S_1 (45x10 cm)	S_2 (45x20 cm)	S_3 (45x30 cm)	Mean	S_1 (45x10 cm)	S_2 (45x20 cm)	S_3 (45x30 cm)	Mean
D_1 (1st October)	5.00	5.67	5.00	5.22	99.33	99.00	97.00	98.44
D_2 (15th October)	8.33	7.00	6.00	7.11	99.00	98.33	98.33	98.55
D_3 (1st November)	7.33	7.00	7.33	7.22	92.00	96.67	98.67	95.77
D_4 (15th November)	8.00	8.00	8.67	8.22	95.67	95.00	97.00	95.88
Mean	7.16	6.91	6.75		96.50	97.25	97.75	
Interaction effect								
Source	D	S	D x S		D	S	D x S	
S.Em±	0.20	0.17	0.35		0.60	0.52	1.04	
CD at 5%	0.60	NS	1.04		1.76	NS	3.04	

Table 2: Effect of sowing time and plant spacing on plant height (cm) and number of leaves per plant in radish cv. Pusa Chetki.

Sowing dates	Plant height (At 60 DAS)				No of leaves per plant (At 60 DAS)			
	Plant spacing							
	S_1 (45x10 cm)	S_2 (45x20 cm)	S_3 (45x30 cm)	Mean	S_1 (45x10 cm)	S_2 (45x20 cm)	S_3 (45x30 cm)	Mean
D_1 (1st October)	35.17	30.40	29.93	31.83	11.53	13.53	14.40	13.15
D_2 (15th October)	31.30	27.83	26.33	28.48	10.73	11.07	11.60	11.13
D_3 (1st November)	30.37	27.27	25.57	27.73	10.07	10.80	11.07	10.64
D_4 (15th November)	26.66	25.50	24.17	25.44	10.20	9.80	10.27	10.08
Mean	30.87	27.75	26.50		10.63	11.30	11.83	
Interaction effect								
Source	D	S	D x S		D	S	D x S	
S.Em±	0.94	0.81	1.63		0.22	0.19	0.39	
CD at 5%	2.76	2.39	NS		0.66	0.57	1.14	

The factorial experiment consisting of four sowing dates (D_1-1st October, D_2-15th October, D_3- 1st November and D_4-15th November) and three spacings (S_1- 45 × 10 cm, S_2- 45 × 20 cm and S_3- 45 × 30 cm) was laid out in Factorial Randomised Block Design (FRBD) with three replications. Whole experimental area was 311 m^2, which was divided into total 36 plots with 12 treatments. Size of each plot was 3.6 × 2.4 m.

Organic manures and fertilizers were applied as per the recommendations. Seeds sown at the rate of 9 kg/ha in about 1.5 cm depths in lines continuously and covered by loose soil. 20-20 days after its emergence, seedlings were thinned out by retaining one at each hill. The other cultural 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. 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

It would be clear from the data (table 1) that days to germination and germination percentage was significantly influenced by sowing dates. Minimum number of days to germination was noted with October 1st sowing (5.22 days) and maximum with 15th November sowing (8.22 days). In general, the gradual delay in sowing resulted in the reciprocal increase in the seed germination period which is a result of lowering down of the temperature (Singh and Yadhav, 1989; Hessayon, 1985; Sharma, 1997). In respect to germination percentage, highest was recorded with 15th October sowing (95.55%), which was found to be on par with 1st October sowing (98.44%). Similar findings were reported by Ghormade *et al*. (1989). Regarding spacing, there were non-significant results observed on days to germination and germination percentage (table 1). This might be due to the fact that

Table 3: Effect of sowing time and plant spacing on leaf area (cm^2) and root-shoot ratio in radish cv. Pusa Chetki.

Sowing dates	Leaf area (At 60 DAS)				Root-shoot ratio (60 DAS)			
	Plant spacing							
	S_1 (45x10 cm)	S_2 (45x20 cm)	S_3 (45x30 cm)	Mean	S_1 (45x10 cm)	S_2 (45x20 cm)	S_3 (45x30 cm)	Mean
D_1 (1st October)	104.74	108.60	122.68	112.00	1.13	1.08	1.31	1.17
D_2 (15th October)	91.50	107.48	112.22	103.73	0.79	1.11	1.14	1.01
D_3 (1st November)	94.97	101.35	106.50	100.93	0.9	0.98	1.12	1.00
D_4 (15th November)	81.00	87.27	100.97	89.74	0.86	1.06	1.05	0.99
Mean	93.05	101.17	110.59		0.92	1.06	1.15	
Interaction effect								
Source	D	S	D x S		D	S	D x S	
S.Em±	1.24	1.08	2.15		0.03	0.02	0.05	
CD at 5%	3.65	3.16	6.33		0.08	0.07	0.15	

Table 4 : Effect of sowing time and plant spacing on plant weight (g) and root yield (t/ha) in radish cv. Pusa Chetki.

Sowing dates	Plant weight (g)				Root yield (t/ha)			
	Plant spacing							
	S_1 (45x10 cm)	S_2 (45x20 cm)	S_3 (45x30 cm)	Mean	S_1 (45x10 cm)	S_2 (45x20 cm)	S_3 (45x30 cm)	Mean
D_1 (1st October)	189.65	273.12	292.67	251.81	13.88	10.41	9.64	11.31
D_2 (15th October)	207.14	207.76	240.67	210.82	12.34	8.48	7.13	9.31
D_3 (1st November)	178.07	199.85	224.83	200.91	10.60	7.89	3.46	7.32
D_4 (15th November)	160.44	190.23	244.10	198.25	5.13	3.47	2.42	3.67
Mean	183.82	217.74	244.79		10.49	7.56	5.66	
Interaction effect								
Source	D	S	D x S		D	S	D x S	
S.Em±	3.90	3.38	6.77		0.39	0.34	0.68	
CD at 5%	11.46	9.92	19.85		1.15	0.99	1.99	

different spacings took same number of days to germinate because of factors like soil moisture, temperature, seed vigour and dormancy of seed which usually influence the days to germinate and germination percentage. This is in agreement with the findings of Shrivastava *et al.* (1992) and Pervez *et al.* (2004). Interaction between the sowing dates and spacing on days to germination and germination percentage was found significant (table 1). Seeds sown on 1st October with the combination of 45 × 10 cm and 45 × 30 cm took minimum number of days to germinate (5.00 days). Whereas, treatmental combination D_1S_1 (1st October sowing with 45 × 10 cm spacing) was found superior in respect of germination percentage (99.33%).

The data reflected significant variations in plant height among all the dates and spacing as observed at 60 days after sowing with the highest value being in D_1 -1st October (31.84 cm), which was identical with the date of sowing on D_2 -15th October (30.46) and the minimum in D_4 (26.82 cm) (table 2). This might be due to favourable conditions prevailing during the growing period when planted earlier *i.e.*, 1st October and also due to longer growth experienced by plants resulted from the seeds sown eariler (1st October). Similar results were obtained under different climatic conditions as influenced sowing time by Ghormade *et al*. (1989), Kanwar (1993) and Gill and Gill (1995). Regarding spacing, significantly maximum plant height was observed in S_1 -45 × 10 cm and minimum in S_3 -45 × 30 cm. Increased plant density limits the availability of space for lateral growth, resulting in increased plant height (Khurana *et al*., 1990) and Pandita *et al*., 2005). While, the interaction was not affected significantly on plant height.

Other growth characters like no. of leaves per plant, leaf area, root-shoot ratio and plant weight were recorded highest in D_1 -1st October among the four dates of sowing (tables 2, 3 and 4). Such results are obtained on account of favourable conditions available during the growing period and also early sowing possibly attributed to maximum photosynthesis with longer growth period than the later plantings, which also faced severe winter months

after planting causing cessation of growth. Similar results were made by Joshi *et al.* (1975) and Gill and Singh (1979). Ahmed and Siddique (2004) also reported that highest leaf area is due to higher number of leaves per plant in early sowing. The wider spacing of 45x30 cm showed the significant superiority over other spacings for all these growth characters (tables 2, 3 and 4). This might be due to erect growing habit of radish crop and leaves are grown horizontally in later stages and hence in wider spacing due to the availability of more space, nutrients and light, the crop might have produced maximum leaf area and more number of leaves per plant (Islam and Hussain, 1992; El-Desuki *et al*., 2005). On the other hand, the larger intra-row spacing of 30 cm increased the root yield and decreased the shoot yield resulting in a higher root-shoot ratio, which was reported by Sirkar *et al*. (1998). While, all the vegetative characters were found significantly maximum in treatmental combination D_1S_3 (1st October sowing with 45x30 cm spacing) due to interaction (tables 2, 3 and 4).

The yield was found significantly higher in 1st October sowing - D_1 followed by D_2 and the lowest yield was noted in the delayed planting D_4 -15th November. Among the plant spacing, S_1-45 × 10 cm resulted in highest yield, outyielding the other spacings with highly significant margin. The S_3-45 × 30 cm resulted in the minimum yield which was significantly lower than S_2 and S_1 (table 4). The maximum yield of 13.88 t/ha was achieved in D_1S_1 due to the interaction, which was remained on par with treatment combination D_2S_1 (table 4). The higher yield in above treatments is due to better plant survival owing to the favourable environmental conditions for growth and development of roots and the closer spacing accommodates more number of plants per unit area. Similar results were reported by Busell (1976), Aziz-Ur-Rehman and Nawab Ali (2000).

The experiment results revealed that though some of the growth characters like number of leaves, leaf area, root-shoot ratio and plant weight were maximum in treatment combination D_1S_3, the other characters like days to germination, germination percentage and plant height were better in treatment combination D_1S_1, due to maximum plant survival and maximum plant population per unit area, the root yield was also recorded maximum in treatment combination D_1S_1. Therefore, the early sowing on 1st October with closer spacing of 45 × 10 cm is recommended.

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