



ROOT YIELD OF RADISH AS AFFECTED BY SOWING DATES AND SPACING

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Abstract

The study was conducted at College of Horticulture, Venkataramannagudem, West Godavari (Dist.), A. P., India; during the period from October, 2010 to January, 2011 to study the effect of sowing dates and spacing on root yield of radish cv. Pusa Chetki. 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. Results indicated that maximum root yield (13.88 t/ha) was recorded with early sowing on 1st October -D₁ with the closer plant spacing of 45 × 10 cm -S₁. Delayed sowing on 15th November -D₄ and closer spacing of 45 × 10 cm -S₁ recorded minimum number of days to maturity. Yield contributing characters like root girth and root weight were maximum with early sowing on 1st October -D₁ and wider plant spacing of 45 × 30 cm -S₃. Root length was found maximum with 1st October -D₁ sowing and closer plant spacing of 45 × 10 cm -S₁. Regarding root quality, percentage of root forking, splitting and cracking disorders were maximum with delayed sowing on 15th November -D₄ and closer spacing of 45 × 10 cm -S₁.

Key words : Tropical and temperate region, sowing, plant spacing, radish.

Introduction

Radish is fast-maturing, easy-to-grow root vegetable in both tropical and temperate regions. There are many agronomic factors influencing radish root production. However, the important ones are proper time of sowing and optimum plant density, but these aspects are very much neglected by the farmers resulting in inferior quality roots and ultimately the poor yields. Though, the suitable time of sowing varies with the locality (Thompson and Kelly, 1957), early planting helped in producing of higher yields and quality than late planting (Shoemaker, 1947 and Hawthorn, 1938). Effect of plant density on yield parameters may be due to competition of plants for available nutrients, light and water.

It is very difficult to raise the good quality radish roots because of excessive forking, splitting, cracking and pithiness, which is highly influenced by spacing and time of sowing. Hence, selection of optimum sowing time and spacing are key factors for successful radish production. But there is no satisfactory information available on the production aspects. Therefore, the present investigation was carried out to study the effect of sowing dates and plant spacing on root yield and quality of radish.

Materials and Methods

A field experiment was conducted at College of Horticulture, Venkataramannagudem during the *rabi* season. The experimental site had red sandy loam with pH 6.9, EC 0.01 dS/m, 0.34 % organic carbon and 712, 32.5, 217.5 kg of N, P₂O₅ and K₂O per ha, respectively. The experiment was laid out in a factorial randomized block design with three replications having twelve treatments. The treatments comprised of the combination of four dates of sowing (1st Oct., 15th Oct., 1st Nov., and 15th Nov) and three plant spacings (45 × 10 cm, 45 × 20 cm and 45 × 30 cm). The seeds are sown on ridges at a depth of 1.5 cm. Thinning was done at 25-30 DAS by retaining one seedling per hill. The crop was nourished with 80 kg/ha of nitrogen and 50 kg/ha each of P₂O₅ and K₂O. Full P₂O₅, K₂O and half nitrogen were applied as a basal and remaining half dose of nitrogen was applied at early root formation stage. The other cultural and plant protection operations were carried out as and when required.

Five plants were taken randomly from each experimental plot at different intervals. The yield parameters like days to maturity, root length (cm), root girth (cm), root weight (g) and root yield (t/ha) were

Table 1: Effect of sowing time and plant spacing on days to maturity and root length (cm) in radish cv. Pusa Chetki.

Sowing dates	Days to maturity				Root length (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 (1 st October)	65.33	66.33	67.67	66.44	22.95	19.85	19.29	20.69
D ₂ (15 th October)	64.67	64.33	64.00	64.33	21.91	17.18	15.13	18.07
D ₃ (1 st November)	61.00	61.67	63.00	61.88	20.03	17.17	16.47	17.88
D ₄ (15 th November)	58.00	60.00	61.00	59.66	16.15	15.10	14.17	15.13
Mean	62.25	63.08	63.91		20.25	17.32	16.26	
Interaction effect								
Source	D	S	D x S		D	S	D x S	
S.Em±	0.37	0.32	0.64		0.82	0.71	1.42	
CD at 5%	1.09	0.94	NS		2.41	2.09	NS	

Table 2 : Effect of sowing time and plant spacing on root girth (cm) and root weight (g) at harvest (60 DAS) in radish cv. Pusa Chetki.

Sowing dates	Root girth (At 60 DAS)				Root weight (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 (1 st October)	4.07	4.87	4.80	4.57	137.81	139.53	237.98	171.77
D ₂ (15 th October)	3.63	4.40	4.07	4.03	100.40	108.29	187.27	131.98
D ₃ (1 st November)	3.50	3.23	4.73	3.82	99.60	139.97	148.87	129.47
D ₄ (15 th November)	3.67	3.30	4.10	3.68	98.60	144.53	161.47	124.86
Mean	3.71	3.95	4.42		109.10	125.58	183.89	
Interaction effect								
Source	D	S	D x S		D	S	D x S	
S.Em±	0.15	0.13	0.26		2.25	1.95	3.90	
CD at 5%	0.44	0.38	0.76		6.60	5.72	11.44	

recorded. Similarly, the root quality in terms of physiological disorders like root forking, splitting and cracking were recorded as percentage of disorders per plot. The analysis of data was done by the method of variance outlined by Panse and Sukhatme (1985).

Results and Discussion

The results pertaining to root yield and quality of radish as influenced by sowing dates and plant spacing. Number of days taken to maturity was maximum in D₁ -1st October and in S₃ -45 × 30 cm spacing but the interaction was found to be non-significant (table 1). The results depicted that sowing dates and days to maturity were negatively correlated. Seeds sown earlier took more time period for maturity of radish roots. Higher photosynthesis and higher dry matter assimilation in vegetative growth for longer period led to delayed reproductive phase. The findings are in line with the results of Maurya *et al.* (1990), Bhamburkar *et al.* (1993) and Aziz-Ur-Rehman and Nawab Ali (2000).

Among yield attributes, root length was found significantly maximum in early sowing on 1st October - D₁ followed by D₂ (table 1) and it was suggested that early sowing of radish variety gave a longest root length (Alam *et al.*, 2010). Significantly maximum root length was observed in closer spacing of 45 × 10 cm -S₁, while the minimum was in S₃, which was found to be on par with S₂. Pervez *et al.* (2004) recorded increased root length with increased plant population. Similar results were obtained by El-Desuki *et al.* (2005). The root length was not affected significantly due to interaction. However, the longest root was obtained in the treatment combination D₁S₁.

While the other yield parameters like root girth and root weight were maximum in D₁ -1st October (table 2). The rapid increase in root girth and weight was due to more vigorous vegetative growth in the earlier planting, resulting in more photosynthates translocation from leaves to roots. Similar results were reported by Ahmed and

Table 3 : Effect of sowing time and plant spacing on root forking and splitting and cracking at harvest (60 DAS) in radish cv. Pusa Chetki.

Sowing dates	Root forking at harvest				Splitting and cracking at harvest			
	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 (1 st October)	2.00	2.00	0.66	1.55	9.00	7.33	5.33	7.22
D ₂ (15 th October)	3.00	1.00	4.00	2.66	12.00	7.33	5.33	8.22
D ₃ (1 st November)	5.66	2.00	0.66	2.77	10.00	15.33	11.67	9.77
D ₄ (15 th November)	8.00	4.00	1.33	4.44	18.00	11.00	8.33	15.00
Mean	4.66	2.25	1.66		12.25	10.25	7.66	
Interaction effect								
Source	D	S	D x S		D	S	D x S	
S.Em±	0.30	0.26	0.52		0.80	0.69	1.39	
CD at 5%	0.89	0.77	1.55		2.35	2.04	NS	

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

Treatments	Plant spacing			
	S ₁ (45 x 10 cm)	S ₂ (45 x 20 cm)	S ₃ (45 x 30 cm)	Mean
D ₁ (1 st October)	13.88	10.41	9.64	11.31
D ₂ (15 th October)	12.34	8.48	7.13	9.31
D ₃ (1 st November)	10.60	7.89	3.46	7.32
D ₄ (15 th November)	5.13	3.47	2.42	3.67
Mean	10.49	7.56	5.66	
Interaction effect				
D	S	D x S		
SE.m±	0.39	0.34	0.68	
CD at 5%	1.15	0.99	1.99	

Siddique (2004) and Maurya *et al.* (1990). However, there was a parity between D₂, D₃ and D₄ with respect to root girth and root weight. Among the spacings, wider spacing of S₃ -45 × 30 cm showed significantly higher values for root girth and root weight. Root girth and root weight was decreased as the plant density increased, which might be due to competition for light, moisture and nutrients. The wider spacing provides more space for development of root by proper utilization of accumulates which resulted in a maximum root girth and weight. These results are well supported by Sirkar *et al.* (1998) and Rahman *et al.* (2007). Among the interaction, D₁S₃ recorded significantly maximum values for root girth and root weight.

Root yield was found significantly higher in D₁ -1st October sowing followed by D₂ -15th October and the lowest was noted with the delayed sowing D₄ -15th November. Among the plant spacing, S₁ -45 × 10 cm resulted significantly highest root yield. While, the

minimum root yield was recorded with wider spacing of S₃ -45 × 30 cm (table 4). Among the interaction, significantly higher yield was achieved in D₁S₁ (13.88 t/ha) followed by D₂S₁ (12.34 t/ha). The higher yield 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) and Aziz-Ur-Rehman and Nawab Ali (2000).

Among root quality parameters, root forking percentage (4.44 and 4.66%) and splitting and cracking percentage (15.00 and 12.25%) were maximum with delayed sowing D₄ -15th November and closer spacing of S₁ -45 × 10 cm, respectively (table 3). This might be due to fact that early sown crop escaped to a greater extend the ill of rains associated with diseases and disorders. As the sowing is delayed, environmental conditions went on becoming adverse and affects the plant growth, yield and quality coupled with more plant population in closer spacing. Similar results were reported by Mengistu and Yamoah (2010). The root spiltling and cracking disorders were not affected significantly due to interaction. While the root forking percentage was found significantly highest in D₄S₁ closely followed by D₃S₁ (table 3).

Though, the yield attributing characters like root girth and root weight were better in S₃ the root yield was recorded maximum in S₁ -45 × 10 cm due to the accommodation of more number of plants per unit area. Since, all the characters were recorded best under early sowing and as disorders percentage was also recorded minimum in the early sowing. Sowing early on 1st October and closer planting of 45 × 10 cm is recommended.

References

- Ahmed, M. J. and W. Siddique (2004). Effect of sowing dates on growth and yield of broccoli (*Brassica oleracea* L.). *Asian J. Plant Sci.*, **3(2)** : 167-169.
- Alam, M., A. M. Farooque, M. Nuruzzaman and A. F. M. Jamal Uddin (2010). Effect of sowing time on growth and yield of three radish (*Raphanus sativus* L.) varieties. *Bangladesh Res. Pub. J.*, **3(3)** : 998-1006.
- Aziz-Ur-Rehman and Nawab Ali (2000). Effect of plant spacing and sowing time on yield in turnip (*Brassica campestris* Cv. Purple Top) crop. *Sarhad J. Agri.*, **16(6)** : 575-579.
- Bhamburkar, A. S., C. M. Deshmukh, P. P. Deshmukh and L. V. Kulwal (1993). Effect of different dates of planting on growth and yield of some varieties of Onion under Akola conditions. *PKV Res. J.*, **17(2)** : 119-122.
- Bussell, W. T. (1976). Effect of time of sowing and spacing on baby carrots. *Newzealand Commercial Grower*, **31(8)** : 30-32.
- El-Desuki, M., S. R. Salman, El-Nemr and A. M. R. Mawgoud (2005). Effect of plant density and nitrogen application on growth, yield and quality of radish (*Raphanus sativus* L.). *J. Agron.*, **4(3)** : 225-229.
- Hawthron, L. R. (1938). Cultural experiments with yellow bermuda onions under irrigation. *Bull. Tex. Agric. Expt. Sta.*, **561** : 30.
- Maurya, A. N., M. P. Pathak and K. P. Singh (1990). A note on the effect of sowing dates, planting distances, seedling size on yield and quality of radish Cv. Pusa Chetki. *Acta Hort.*, **267** : 169-173.
- Mengistu, T. and C. Yamoah (2010). Effect of sowing date and planting density on seed production of carrot (*Daucus carota* var. sativa) in Ethiopia. *Afr. J. Plant Sci.*, **4(8)** : 270-279.
- Panse, V. G. and P. V. Sukhatame (1985). Statistical methods for agricultural workers. ICAR, New Delhi.
- Pervez, M. A., C. M. Ayub, B. A. Saleem, N. A. Virk and N. Mahmood (2004). Effect of nitrogen levels and spacing on growth and yield of radish (*Raphanus sativus* L.). *Int. J. Agri. Biol.*, **6(3)** : 504-506.
- Rahman, M., M. Iqbal, M. S. Jilani and K. Wasseem (2007). Effect of different plant spacing on the production of cauliflower (*Brassica oleracea* var. Botrytis). *Pakistan J. Biol. Sci.*, **10(24)** : 4531-4534.
- Shoemaker, J. S. (1947). *Vegetable growing*. John Wiley and Sons. Inc. pp. 181-223.
- Sirkar, B., Anitha Saha and T. K. Bose (1998). Effect of plant density on growth and yield of radish. *J. Interacade*, **2(6)** : 17-20.
- Thompson, H.C. and W.C. Kelly (1957). *Vegetable crops*. McGraw Hill Book Co., Inc. pp. 347-371.