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Effect of dates of planting and spacing on growth and yield of broccoli

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Abstract : An experiment entitled effect of dates of planting and spacing on growth and yield of broccoli (*Brassica oleracea* var. italica) was carried out during *Rabi* season of 2009-10 at the field of Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The treatment combinations comprised of three dates of planting *viz.,* 15th September, 30th September and 15th October and three spacings *viz.,* 60 x 30 cm, 60 x 45 cm and 60 x 60 cm in a Factorial Randomized Block Design (FRBD) with three replications. The broccoli transplanted on the 1st date of planting *i.e.* 15th September reported significantly maximum yield (122.14 q ha^{-1}) over the other dates of planting, while spacing 60 x 60 cm showed significantly maximum growth for height, number of leaves, stem diameter and leaf area. Interaction between dates of planting and spacing was significant in respect of curd yield/ hectare. Maximum curd yield /hectare (134.05 q ha^{-1}) was obtained in D_1S_1 – 15th September and S_1 – 60 x 30 cm combination

Key words : Broccoli, Date of planting, Spacing, Yield

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Broccoli [*Brassica oleracea* (L.) var. *italica*] belongs to the family Brassicaceae is an exotic vegetable crop. It is native to the Mediterranean region and cultivated in Italy. Broccoli like other cole crops prefer cool moist climatic conditions which helps in the developing quality heads. In recent years cultivation of broccoli has gained momentum in India and has become increasingly popular with Indian growers for last couple of years. Broccoli contains Indole-3-carbinol which helps to fight breast and lung cancer. Broccoli soup is a delicacy in big hotels and resorts which is more nutritious than other coles, such as cabbage, cauliflower. Time of sowing and transplanting are important factor influencing vegetable production to pin point. The exact time of sowing of seed in nursery and transplanted in field is essential for obtaining maximum yield along with quality of vegetable (Csizinszky, 1996).

Spacing of plant affects both total yield and the size of broccoli head. According to recent field tests, wider spacing contributes towards larger and heavier heads while, yield per hectare can be increased by close spacing. Hence, it is necessary to optimize proper plant spacing for obtaining higher yield with better quality.

RESEARCH METHODS

The experiment was carried out at Horticulture farm, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *Rabi* season 2009-10. Treatment comprised of three planting dates (D_1- 15th September, 30th D_2 - September and D_3 - 15th October) and three spacing (S_1 - 60 x 30 cm, S_2 - 60 x 45 cm and S_3 - 60 x 60 cm). The experiment was laid out in Factorial Randomized Block Design with three replications. Seedlings were transplanted in 3.6 x 3.6 m plots at different spacing and different dates of planting. Observations were recorded on plant height, number of leaves, stem diameter and curd yield from randomly selected plants in each treatment.

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarised under following heads:

Date of planting:

Plant height, number of leaves and stem diameter

were influenced significantly due to different dates of planting (Table 1). Highest plant height (54.92 cm) was recorded at 60th DAT in 1st date of planting *i.e.* D_1 – 15th September may be due to the favorable condition for plant growth due to early planting. Maximum number of leaves was recorded at 60th DAT in 1st date of planting *i.e.* D_1 – 15th September.

The maximum stem diameter was recorded at 60th DAT in 1st date of planting D_1 – 15th September. Curd yield per hectare (122.14 q ha^{-1}) was significantly higher in 1st date of planting D_1 15th September as compared to other dates of planting. Similar results obtained by MacGillivray (1953), in broccoli, Vaidya and Patil (1965) in cabbage.

Plant spacing:

The plant height (56.23 cm) was recorded maximum at 60th DAT with the increased spacing *i.e.* S_3 – 60 x 60 cm and minimum plant height (51.55 cm) at 60th DAT in closer spacing *i.e.* S_1 – 60 x 30 cm. (Table 1). Similar results were obtained by MacGillivray (1953) and in broccoli and Gonzalez (1980) and Bobade (2001) in cabbage.

The number of leaves per plant (22.71) were significant with increased the spacing *i.e.* S_3 – 60 x 60 cm and minimum number of leaves in closer spacing (16.84) at 60th DAT in spacing S_1 – 60 x 30 cm.Similar results were obtained by Gonzalez (1980), Kumar *et al.* (1984) and Bobade (2001) in cabbage.

The stem diameter (2.84 cm) was significantly maximum with increased the spacing S_3 – 60 x 60 cm and minimum in closer spacing *i.e.* S_1 – 60 x 30 cm at 60th DAT (2.43 cm). Similar results were obtained by Gonzalez (1980) and Bobade (2001) in cabbage. Nieuwhof (1961) and Kelley (2007) in broccoli.

The curd yield (Table 2) per hectare (134.05 q ha^{-1}) was significantly higher under closer spacing *i.e.* S_1 – 60

Table 2 : Interaction effect on dates of planting and spacing on curd yield per hectare

Date of planting	Spacing			
	Curd yield (q ha^{-1})			
	S_1	S_2	S_3	Mean
D_1	134.05	125.35	107.02	122.14
D_2	131.85	123.15	104.8	119.93
D_3	129.7	121.05	102.7	117.81
Mean	131.86	123.18	104.84	
Interaction effect				
	D	S	D x S	
'F' test	Sig.	Sig.	Sig.	
S.E.(m) ±	0.10	0.10	0.18	
C.D. (P=0.05)	0.31	0.31	0.54	

Table 1 : Effect of dates of planting and spacing on growth and yield characters

Treatments	20th DAT			40th DAT			60th DAT		
	Plant height (cm)	No. of leaves/ plant	Stem dia meter (cm)	Plant height (cm)	No. of leaves/ plant	Stem dia meter (cm)	Plant height (cm)	No. of leaves/ plant	Stem dia meter (cm)
Date of planting									
D_1	20.51	9.77	0.833	38.00	13.21	1.491	54.92	21.03	2.792
D_2	20.13	8.33	0.783	36.75	12.01	1.340	53.91	19.11	2.625
D_3	19.97	8.33	0.743	35.53	11.47	1.200	52.55	18.16	2.504
`F' test	Sig.	NS	NS	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E.(m)±	0.11	0.085	0.058	0.13	0.914	0.019	0.24	0.138	0.0169
C.D. (P=0.05)	0.34	-	-	0.34	0.273	0.057	0.82	0.415	0.0506
Spacing									
S_1	19.13	8.33	0.767	34.40	11.13	1.207	51.55	16.84	2.438
S_2	20.23	8.78	0.790	36.78	12.11	1.345	53.40	18.75	2.638
S_3	21.25	9.83	0.815	39.10	13.45	1.561	56.23	22.71	2.844
`F' test	Sig.	NS	NS	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E.(m)±	0.11	0.085	0.058	0.13	0.91	0.019	0.24	0.13	0.0169
C.D. (P=0.05)	0.34	-	-	0.34	0.27	0.057	0.82	0.41	0.0506
Interaction (D x S)									
`F' test	NS	NS	NS	NS	NS	NS	NS	NS	NS
S.E.(m)±	0.19	0.14	0.010	0.23	0.15	0.032	0.14	0.24	0.029
C.D. (P=0.05)	-	-	-	-	-	-	-	-	-

NS=Non-significant

x 30 cm as compared to wider spacing (107.02 q ha^{-1}) *i.e.* S_3 – 60 x 60 cm which may be due to more plant heads which resulted higher aggregate yield per unit land area. Similar results obtained by Yoldas and Esiyok (2004), and Kelley (2007) in broccoli.

Interaction:

Interaction between dates of planting and spacing was significant in respect of curd yield/ hectare. Maximum curd yield /hectare (134.05 q ha^{-1}) was obtained in D_1S_1 – 15th September and S_1 – 60 x 30 cm. Spacing (Table 2). This may be due to suitable environmental condition during the September crop span. No other interaction was found significant in this study.

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