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Effect of dates of planting on growth, yield and quality of ginger (*Zingiber officinale* Roscoe)

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Abstract

The trial was carried out during 2008–09 to study the ideal date of planting and spacing to obtain better growth, yield and quality of ginger crop var. 'IISR Mahima'. The experiment was laid out in Split Plot Design with dates of planting as main plot treatment (15th April, 1st May, 15th May, 30th May and 15th June) and three treatments of spacing as sub plot treatment (35 cm × 25 cm, 25 cm × 25 cm and 15 cm × 25 cm) with three replications. The observations were recorded on dry recovery (%), harvest index, oil and crude fibre content. Dates of planting had significant effect on all the characters studied. April 15th planting showed better oil content. Among spacings, the spacing of 35 cm × 25 cm gave highest dry recovery. The closer spacing of 15 cm × 25 cm recorded higher harvest index. It was observed that spacing had no significant effect on quality attributes *viz.*, oil and crude fibre content. The treatment combination of 15th April planting and 35 cm × 25 cm spacing exhibited higher dry recovery. The treatment combination of 15th April planting and 15 cm × 25 cm spacing showed maximum harvest index. Economics of interactions revealed maximum net returns of Rs. 559,690.1 ha^{-1} with benefit cost (B:C) ratio of 2.67 for the treatment combination of 15th April planting and 15 cm × 25 cm spacing.

Keywords: crude fibre, economics, quality, spacing, yield

Introduction

Ginger (*Zingiber officinale* Roscoe.) is one of the major tropical spices of the world which is prized for its flavor, aroma and medicinal properties. Proper planting time is an important non-monetary input in crop production which affects crop growth, yield and quality to a greater extent. Delay or early planting results in reduced growth and yield. A small change in planting time leads to significant change in performance of crop. Another factor of importance is plant spacing which has been recognized as a factor determining the degree of competition between plants, yield per plant and number of plants per unit area. Finding the optimum plant spacing that produce the maximum yield per unit area under given environmental conditions is of major concern. Inadequate as well as high plant population leads to low productivity with poor quality. Past research efforts have shown that plant spacing has a dominant influence on growth, yield and yield components in ginger. Considering the fact that very little work has

been done on these factors, the experiment on effect of dates of planting on growth, yield and quality of ginger was undertaken.

Materials and methods

The present investigation was carried out during 2008–09 under Konkan agro-climatic conditions of Maharashtra state. The field trial was carried out with five main plot treatments i.e. Dates of planting D_1 (15th April), D_2 (1st May), D_3 (15th May), D_4 (30th May), D_5 (15th June) and three sub plot treatments of spacing S_1 (25 cm × 15 cm), S_2 (25 cm × 25 cm), S_3 (25 cm × 35 cm). Thus, there were 15 treatment combinations replicated thrice in a split plot design.

An area of 19.4 m × 14.8 m was demarcated into 45 plots. Raised beds having 3 m × 1 m size and 15 cm height were prepared. Fifteen beds were arranged in one replication. The treatments were randomized by standard procedure as per the design given by Panse and Sukhatme (1997). Healthy seed rhizomes of IISR Mahima variety (25 g) were treated with Mancozeb (0.3%) for 30 min and planted on the bed at 4 cm depth on the respective dates of planting. The spacing was 15 cm, 25 cm and 35 cm along the rows as per the treatment and 25 cm between the rows. The planted rhizome bits were covered with soil. Harvest index was calculated at 240 DAP by using following formula,

Harvest index (%) = (Economic yield/ Biological yield) × 100

The dry ginger was prepared by soaking known weight of ginger in water for 6 h. After cleaning, the rhizomes were removed from water and the outer skin was removed with bamboo splinters having pointed ends. The peeled rhizomes were washed and dried in sun uniformly for one week. The dry rhizomes were rubbed together to remove the last bit of skin or dirt. The observations on recovery of dry ginger were recorded for each treatment. This was used to calculate dry recovery percentage. Oil content was estimated from dry ginger sample (2 g powder) by using Socs infra SIS 06 apparatus and petroleum ether as a solvent. The oil content was determined by using formula,

Oil content (%) = [(Weight of fat – Soluble material)/ Weight of sample] × 100

Crude fibre content from fat free sample of dry ginger was estimated as per method suggested by Ranganna (1977). Fibre content was estimated by using following formula,

Crude fibre (%) = (Per cent loss in weight of sample/ Weight of sample) × 100

The gross monetary returns in Rs ha^{-1} were worked out on the basis of green ginger yield. The prevailing market price of ginger was considered. Similarly, the cost of cultivation of the crop under individual treatment was worked out by taking into account the cost of all the operations from tillage to harvest. The net returns per hectare were calculated by deducting the cost of cultivation per hectare from the gross returns per hectare. Cost : benefit ratio for each treatment was calculated by dividing gross returns with cost of cultivation.

Results and discussion

The data pertaining to harvest index of ginger is presented in Table 1. The treatment, 15th April planting showed significantly highest harvest index (55.73%), while lowest harvest index was observed in 15th June planting (52.28%). In case of spacing, the treatment 25 cm × 15 cm produced highest harvest index (54.77%) and it was significantly superior over rest of the treatments. The harvest index of all treatments ranged between 51.76% in 15 June planting at 25 cm × 35 cm spacing to 55.85% in 15th April planting at 25 cm × 15 cm spacing with a mean of 54.52%. Thus, 15th April planting recorded maximum harvest index. This might be due to more favorable environmental conditions resulting in higher growth and higher yield (Ishimine 2004). Regarding spacing, 15 cm × 25 cm spacing was found to be superior.

The dry recovery is presented in Table 1. 15th April planting recorded significantly higher dry recovery (21.31%), while lowest dry recovery was observed in 15th June planting (19.32%). Among spacings, 25 cm × 35 cm recorded highest dry recovery (20.36%), while lowest recovery percentage was observed in 25 cm ×

Table 1. Harvest index and dry recovery percentage of ginger as influenced by dates of planting and spacing

Treatment	Harvest index (%)				Dry recovery (%)			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
D_1	55.85	55.70	55.63	55.73	21.13	21.37	21.43	21.31
D_2	55.61	55.52	55.47	55.53	20.63	20.67	20.77	20.69
D_3	55.40	55.33	54.41	55.05	20.37	20.53	20.47	20.46
D_4	54.36	53.89	53.82	54.02	19.53	19.63	19.67	19.61
D_5	52.65	52.44	51.76	52.28	19.17	19.33	19.47	19.32
Mean	54.22	54.58	54.77		20.17	20.31	20.36	
	Ft	SEm	P<0.05	Mean	F	S.Em	P<0.05	Mean
D	S	0.01	0.05	—	S	0.01	0.03	—
S	S	0.01	0.03	—	S	0.00	0.01	—
D×S	S	0.08	0.23	54.52	S	0.03	0.10	20.28

S_1=25 cm × 15 cm; S_2=25 cm × 25 cm; S_3=25 cm × 35 cm; D_1=15 April; D_2=1 May; D_3=15 May; D_4=30 May; D_5=15 June

15 cm spacing (20.17%). The recovery varied from 19.17% in 15th June planting at 25 cm × 15 cm spacing to 21.43% in 15th April planting at 25 cm × 35 cm spacing. The significant effect of early sowing on growth, green ginger and dry ginger yield resulted in proportionate change in dry recovery.

Quality attributes

Table 2 shows oil content as affected by dates of planting. 15th April planting showed significantly higher oil content (1.80%) which decreased with advancement of planting dates and it was lowest in 15th June planting (1.47%). These observations are in accordance with the findings of Kandiannan & Chandaragiri (2006) in turmeric. Interaction effect was found to be non significant.

The crude fibre content is presented in Table 2. The lowest crude fibre content was observed in 15th June planting (3.27%). It was highest in 15th April planting (3.64%). No significant effect of spacing was seen on crude fibre content. However, the highest crude fibre content was observed in 25 cm × 35 cm (3.44%) and the lowest was observed in 25 cm × 15 cm spacing (3.40%). Interaction effect of dates of planting

Table 2. Oil content and crude fibre content of ginger as influenced by dates of planting and spacing

Treatment	Crude fibre content (%)				Oil content (%)			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
D_1	3.60	3.65	3.68	3.64	1.78	1.80	1.82	1.80
D_2	3.40	3.42	3.53	3.45	1.60	1.62	1.67	1.63
D_3	3.42	3.43	3.47	3.44	1.58	1.63	1.67	1.63
D_4	3.27	3.30	3.32	3.29	1.48	1.50	1.52	1.50
D_5	3.25	3.27	3.30	3.27	1.45	1.47	1.50	1.47
Mean	3.40	3.41	3.44		1.58	1.60	1.63	
	F	SEm	P<0.05	Mean	F	SEm	P<0.05	Mean
D	S	0.01	0.02	—	S	0.01	0.03	—
S	NS	001	0.02	—	NS	0.01	0.02	—
D×S	NS	0.05	N.S.	3.42	NS	0.07	N.S.	1.61

S_1=25 cm × 15 cm; S_2=25 cm × 25 cm; S_3=25 cm × 35 cm; D_1=15 April; D_2=1 May; D_3=15 May; D_4=30 May; D_5=15 June

Table 3. Economics of ginger cultivation as influenced by dates of planting and spacing

Treatments	Green ginger yield (t ha^{-1})	Gross returns (Rs. ha^{-1}) (t ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio	Treatments	Green ginger yield (t ha^{-1})	Gross returns (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio
Dates of planting						$D_1 S_1$	40.67	894740	335049.9	559690.1	2.67
D_1	34.54	759953.3	290530.8	469422.6	2.61	$D_1 S_2$	34.58	76060	290893.6	4659866.4	2.61
D_2	31.61	695493.3	279787.4	415705.9	2.47	$D_1 S_3$	28.38	624360	245648.8	378711.2	2.54
D_3	27.37	602066.7	264216.3	337850.3	2.27	$D_2 S_1$	37.97	835340	325149.9	510190.1	2.57
D_4	23.93	526386.7	251603	274783.7	2.09	$D_2 S_2$	31.46	692120	279453.6	412666.4	2.48
D_5	17.32	381040	227378.5	159811.2	1.79	$D_2 S_3$	25.41	559020	234758.8	324261.2	2.38
Spacing						$D_3 S_1$	32.63	717860	305569.9	412290.1	2.35
S_1	31.57	694584	301690.6	392893.4	2.27	$D_3 S_1$	27.50	605000	264933.6	340066.4	2.28
S_2	26.74	588324	2621454.2	326169.8	2.21	$D_3 S_2$	21.97	483340	222145.5	261194.5	2.17
S_3	22.55	496056	224264.8	271791.2	2.19	$D_4 S_3$	27.46	604120	286613.3	317506.7	2.11
						$D_4 S_1$	23.78	52316	251293.6	271866.4	2.08
						$D_4 S_2$	20.54	451880	216902.1	234977.9	2.08
						$D_5 S_1$	19.13	420860	256069.9	164790.1	1.64
						$D_5 S_2$	16.39	420860	224196.9	136383.1	1.61
						$D_5 S_3$	16.44	361680	201868.8	159811.2	1.79

and spacing was non- significant. However, the highest crude fibre content was observed in 15th April planting with 25 cm × 35 cm spacing (3.68%) and the lowest was observed in 15th June planting at 25 cm × 15 cm spacing (3.25%).The mean crude fibre content was 3.42%.

Economics of ginger cultivation

Data regarding economics of ginger cultivation is presented in Table 3. The treatment 15th April planting gave highest net returns of Rs. 469,422.6 with B : C ratio of 2.61. Minimum net returns of Rs. 159,811.2 and B : C ratio of 1.79 was realized from the treatment with 15th June planting. The spacing 25 cm × 15 cm gave highest net returns of Rs. 392,893.4 with B : C ratio of 2.27. Minimum net returns of Rs. 271,791.2 and B : C ratio 2.19, respectively was obtained in 25 cm × 35 cm spacing. The data on economics of interactions presented in Table 3 revealed that the ginger crop gave maximum gross returns and net returns of Rs. 894,740 and Rs. 559,690.1, respectively in the treatment with 15th April planting at 25 cm × 15 cm spacing. Similar reports were reported by Ghosh & Hore (2011) in ginger when interplanted in coconut garden. The B : C ratio under this treatment was 2.67. Minimum net returns of Rs. 159,811.2 and B : C ratio of 1.79, respectively was obtained in the treatment with 15th June planting at 25 cm × 35 cm spacing.

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