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EFFECT OF PLANTING TIME AND PLANT DENSITIES ON MATURITY AND YIELD OF GARLIC (*ALLIUM SATIVUM* L.) Cv. JAMNAGAR

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Abstract

Field investigation were carried out to study the effect of planting time and plant densities on maturity and yield of garlic cultivar Jamnagar during late *rabi* of 2011-2012 at Model Orchard, College of Horticulture, Rajendranagar, Hyderabad (Andhra Pradesh), India. Maximum bulb yield (88.75 q/ha) was recorded when planting was done 1st November. The minimum was obtained from 15th December (62.71 q/ha) planting. Higher plant density with 900 plants/plot spaced with 10 × 5 cm yielded (109.51 q/ha). The lowest yield (57.41 q/ha) was obtained with 300 plants/plot spaced with 20 × 7.5 cm.

Key words : Garlic, planting time, plant densities, maturity, yield.

Introduction

Garlic (*Allium sativum* L.) is one of the important bulb crops grown widely as a spice or condiment throughout India. Among different factors influencing production of the crop, date of planting and plant densities are considered important, which can be manipulated to boost up the productivity. Therefore, the present study was under taken to find out suitable planting time and plant density on maturity and yield of garlic.

Materials and Methods

A field experiment was conducted during late *rabi* season of 2011-2012 in Model Orchard, College of Horticulture, Rajendranagar, Hyderabad (Andhra Pradesh), India. There were four different dates of planting 1st November, 15th November, 1st December and 15th December and six plant densities of 10 × 5 cm (900 plants/plot), 15 × 5 cm (600 plants/plot), 20 × 5 cm (450 plants/plot), 10 × 7.5 cm (600 plants/plot), 15 × 7.5 cm (400 plants/plot) and 20 × 7.5 cm (300 plants/plot) were used as the experimental treatments. The experiment was laid out in split plot design with three replications. The size of each unit plot was 3m × 1.5m. The experimental plot was ploughed, well prepared and used recommended dose of fertilizers. Irrigation and weeding were done whenever necessary. The experimental plot was regularly observed and the data were recorded on number of days taken to reach maturity, shoot to bulb ratio and yield/ha.

Collection of data

Number of days taken to reach maturity : The date of 50 per cent neck fall in each experimental plot was noted. The days required for maturity from transplanting were calculated and recorded accordingly.

Yield per hectare (q/ha)

On the basis of bulb yield of net plot, the total bulb yield per hectare was calculated and expressed in quintals.

Shoot to bulb ratio

This is calculated as the ratio of shoot weight to bulb weight.

The data recorded were subjected to statistical analysis using split-plot design and ANOVA technique suggested by Panse and Sukhatme (1985).

Results and Discussion

Number of days taken to reach maturity

When garlic was planted on 1st November recorded highest number of days taken to reach maturity (124.94) (table 1), while minimum number of number of days (99.55) taken to reach maturity was recorded in 15th December planting. The plants might have received favourable climatic conditions include temperature, humidity and day length, which resulted (33.0ºC maximum and 15.4ºC minimum temperature, 73% humidity) in optimum time to reach maturity in early planting, while the maturity period was reduced in late sowings because

of unfavorable conditions like very high temperatures. The plants are exposed to increasing high temperatures before bulb initiation and during growth and development in the period from February to April as a result the maturity period was reduced in later plantings. Similar trend was observed by Jamroz *et al*. (2001).

The days taken to reach maturity was significantly influenced by different plant densities. At final harvest maximum days taken to reach maturity (121.82) (table 1) was recorded with the plant density 300 plants/plot with spacing of 20 × 7.5 cm. But days taken to reach maturity was minimum (110.72) in the crop with higher density 900 plants/plot with spacing of 10 × 5 cm. This could be due to reduction in competition amongst seedlings which attributed better environmental condition enabling availability of more moisture, nutrients and light for crop growth in reduced plant density. While all above conditions are not available in higher density, hence require less number of days to reach maturity.

The interaction of dates of planting and plant densities significantly influenced the days taken to reach maturity (table 2).

Shoot to bulb ratio

The shoot to bulb ratio differed significantly by different planting dates. Plants, which were planted on November 1st recorded maximum shoot to bulb ratio (0.51) (table 1) while minimum shoot to bulb ratio (0.27) was obtained from the plants, which were planted on 15th December. The results are mainly based on weight of shoot and bulb, as the shoot and bulb weights differed with planting dates.

Plant density also showed significant effect in shoot to bulb ratio. Shoot to bulb ratio recorded to be maximum (0.46) (table 1) in closer spacing with higher density 900 plants/plot with spacing of 10 × 5 cm. Minimum shoot to bulb ratio was recorded (0.27) in wider spacing with lower density 300 plants/plot with spacing of 20 × 7.5 cm. This might be depending on shoot weight and bulb weight.

The interaction of dates of planting and plant densities significantly influenced the shoot to bulb ratio. However, the maximum value (0.59) (table 2) was recorded in 1st November planting with 900 plants/plot spaced 10 × 5 cm. Minimum value (0.17) was recorded with 15th December planting with 300 plants/plot spaced 20 × 7.5 cm. This could be attributed to the enhanced availability of nutrients at the appropriate time which encouraged good vegetative growth. The growth ultimately enhances the production of bulbs resulting in decrease of shoot to bulb ratio.

Table 1 : Effect of planting date and plant densities on maturity and yield of garlic.

Treatment	Number of days taken for maturity	Shoot to bulb	Yield ratio/ ha (q)
Dates of planting			
1st November	124.94	0.51	88.75
15th November	121.47	0.39	84.35
1st December	119.69	0.31	69.62
15th December	99.55	0.27	64.21
S.Em. ±	4.553	0.046	1.575
C.D. at 5%	11.141	0.113	3.855
Plant densities			
10 × 5 cm (900 plants/plot)	110.75	0.46	109.51
15 × 5 cm (600 plants/plot)	113.89	0.44	79.34
20 × 5 cm (450 plants/plot)	116.84	0.39	60.19
10 × 7.5 cm (600 plants/plot)	116.42	0.36	86.60
15 × 7.5 cm (400 plants/plot)	118.76	0.31	67.36
20 × 7.5 cm (300 plants/plot)	121.82	0.27	57.41
S.Em. ±	2.437	0.034	2.580
C.D. at 5%	4.925	0.069	5.215

Yield per hectare (q/ha)

The bulb yield of garlic was significantly influenced by the different dates of planting. Crop planted on 1st November recorded maximum bulb yield (88.75 q/ha) (table 1), when compared to other dates of planting. Minimum bulb yield (64.21 q/ha) was recorded in 15th December planted crop. Maximum yield in early planting could be attributed to better growth of plants and large sized bulb and also the enhanced crop growth rate which might have resulted in efficient metabolism, there by increased the sink capacity. Higher metabolism, greater photosynthates mobilization and better source sink relationship helped to produce higher yield. Bulb volume, bulb diameter and bulb weight also might have influenced the bulb yield. Pratibha Singh *et al*. (2010), Adekpe *et al*. (2008), Chattopadhyay *et al*. (2006) in garlic also reported that the early planting results in higher yield compared to later plantings.

Plant densities showed marked effect in increasing the yield of garlic which was evident from the fact that the higher plant density with 900 plants/plot with spacing of 10 × 5 cm resulted in higher yield of garlic (109.51 q/ha) (table 1). Minimum yield/ha (57.41 q/ha) were recorded in crop with lower density of 300 plants/plot with spacing of 20 × 7.5 cm. The reduction in total yield could be due to decrease in plant population. However, it was observed to be partly compensated by an increase in yield of large sized cloves and a decrease in small

Table 2 : Combined effect of planting date and plant densities on maturity, shoot to bulb ratio and yield/ha in garlic.

Treatment		Number of days taken for maturity	Shoot to bulb ratio	Yield/ha(q)
1st November	10 × 5 cm (900 plants/plot)	119.25	0.59	134.30
	15 × 5 cm (600 plants/plot)	122.32	0.57	91.71
	20 × 5 cm (450 plants/plot)	125.38	0.54	69.11
	10 × 7.5 cm (600 plants/plot)	124.85	0.50	99.45
	15 × 7.5 cm (400 plants/plot)	127.37	0.46	74.46
	20 × 7.5 cm (300 plants/plot)	130.49	0.40	63.50
15th November	10 × 5 cm (900 plants/plot)	117.77	0.47	126.39
	15 × 5 cm (600 plants/plot)	120.49	0.45	87.10
	20 × 5 cm (450 plants/plot)	121.54	0.42	65.96
	10 × 7.5 cm (600 plants/plot)	121.25	0.39	93.42
	15 × 7.5 cm (400 plants/plot)	121.37	0.34	71.77
	20 × 7.5 cm (300 plants/plot)	126.38	0.28	61.48
1st December	10 × 5 cm (900 plants/plot)	115.66	0.43	97.93
	15 × 5 cm (600 plants/plot	118.77	0.38	71.09
	20 × 5 cm (450 plants/plot)	119.30	0.33	54.93
	10 × 7.5 cm (600 plants/plot)	120.32	0.29	78.14
	15 × 7.5 cm (400 plants/plot)	120.68	0.25	62.72
	20 × 7.5 cm (300 plants/plot)	123.40	0.21	52.93
15th December	10 × 5 cm (900 plants/plot)	90.32	0.38	79.42
	15 × 5 cm (600 plants/plot)	93.98	0.34	67.47
	20 × 5 cm (450 plants/plot)	101.15	0.29	50.75
	10 × 7.5 cm (600 plants/plot)	99.27	0.25	75.40
	15 × 7.5 cm (400 plants/plot)	105.61	0.20	60.51
	20 × 7.5 cm (300 plants/plot)	106.99	0.17	51.72
Interaction				
S × D	SEm±	4.874	0.068	5.160
	C.D at 5%	9.850	0.138	10.430
D × S	SEm±	6.366	0.078	4.967
	C.D at 5%	14.253	0.169	10.251

sized cloves. The highest yield at high plant density levels can be attributed to compensatory effect of number of plants per unit area. The difference between the highest and the lowest population could be due to higher net assimilate obtained at higher population density per unit area. Increased productivity at higher plant population resulting from efficient utilization of resources and closer planting enabled maximum interception of radiant energy and conversion to biomass than wider spaced plants.

The interaction of dates of planting and plant densities significantly influenced the yield of garlic. Maximum bulb yield (134.30 q/ha) was recorded in 1st November planting with 900 plants/plot spaced 10 × 5 cm (table 2), while minimum bulb yield (51.72 q/ha) in 15th December planting with 300 plants/plot spaced 20 × 7.5 cm. Similar results were reported by Jamroz *et al*. (2001) in garlic and Nagre *et al*. (1985) in onion.

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