Performance of mango under high density planting

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Abstract : In an effort to evolve a high density planting system suitable for Tamil Nadu condition, an experiment was conducted at Agricultural College and Research Institute, Killikulam during 1996 to 2010 using the variety Kalepad, as it is one of the leading and popular cultivar of Tamil Nadu. The treatments included square system, hedge row system, double hedge row system, paired planting and cluster planting with a population of 100, 167, 222, 133 and 177 plants per 900 square meters, respectively. The experimental design used was randomized block design with five replicates. The results revealed that the number of fruits and yield were significantly higher (1112.24 and 2402 kg/ha kg/tree, respectively) in double hedge row. The fruit characteristics such as fruit weight (206 g), fruit length (11.84 cm), fruit circumference (20.64 cm) and pulp content (156.64 g) were more in double hedge row system of planting however, there was no significant difference between the treatments for TSS of fruits. Hence the double hedge row system of planting with a spacing of 10 m between double hedges, 5m within double hedge and 5m between plants in double hedge is the best planting system for obtaining maximum number of fruits and the highest yield / unit area, especially for the variety "Kalepad'.

Key words : Mango, High density planting system

How to cite this article : Jasmine, A. Jaya (2011). Performance of mango under high density planting, *Asian J. Hort.*, **6** (2) : 468-470.

Mango is one of the most important fruits in India accounting for 37.60% of area (1.3 million hectares) and for 22.21% of total fruit production (14.0 million metric tonnes) in the country. India's share in the world production of mango is 54.2% (APEDA, 2009). In Tamil Nadu it is generally grown under rain-fed condition in a total area of 125104 ha with a production of 5.4 lakh tonnes. Of late, additional area under mango is coming up in Tamil Nadu under the National Horticultural Mission and new hybrids and varieties are gaining popularity. There is also an increasing demand for fresh and processed mango products which augments improved technologies to get high yields. But, majority of mango orchards in Tamil Nadu is rainfed with conventional spacing of 10x10 m. The square system of planting is the most popular in mango and the planting distance varies with the vigour of the cultivar and the location, ranging between 10 and 12 m. However, the yield obtained from these planting systems are generally low. Medium density plantation and high density plantation in mango can help shorten the gestation period of the crop, while also improving its yield

and hence, adoption of high density planting for new planting with use of drip irrigation and fertigation would aid in maximizing the yield. Further there is a good scope for establishing dwarf mango varieties in hedge rows for optimal light utilization and easy cultural operations. The terminal-shoots, inflorescences and fruits on such trees will be within easy reach of farm workers and the fruits can be specifically targeted for fungicide or pesticide application. Hence, experiments were conducted in an effort to evolve a high density planting system with high yield for Tamil Nadu condition.

RESEARCH METHODS

The trial was carried out over fourteen years at Agricultural College and Research Institute, Killikulam, Thoothukudi district, Tamil Nadu during 1996 to 2010 in an area of 11 acres under rainfed condition. The variety Kalepad was used as it is a leading and popular cultivar of Tamil Nadu which is also known for dwarf habit and superior quality fruits. This zone is characterized by a mean maximum temperature of 35^0C, a mean minimum

temperature of 24^0C and annual precipitation of 640 mm. The treatments included square system, hedge row system, double hedge row system, paired planting and cluster planting with a population of 100, 167, 222,133 and 177 plants per 900 square meter plot. The following spacing was adopted: 10x10 m for square system, 5 m x 10 m for hedge row system, 5 m x 5 m in one hedge row and 10 m between 2 hedges for double hedge system, 5 m x10 m in one of the pairs and 10 m between the pairs for paired row planting, 5x5 m in one of the 4 clusters and 10 m between each cluster for cluster planting. The experimental design used was randomized block design with five replicates. Observations were recorded on plant height, number of branches, canopy spread, number of fruits per plot, yield per plot, average fruit weight, fruit length, fruit circumference, peel weight, stone weight, pulp weight and total soluble solids.

RESEARCH FINDINGS AND DISCUSSION

The data on pooled mean for five years (2006-2010)

on growth of variety Kalepad in various planting systems are presented in Table 1.

Data on growth parameters like tree height, number of branches and tree spread revealed no significant differences in the initial years which is normally expected since growth may not differ much with crop density during the initial periods and thereafter, growth varied linearly. The pooled mean for three years (2006-2008) revealed that the plant height was maximum in T_1 (square system of planting) i.e., 3 m followed by T_4 (2.87 m) , T_3 and T_2 which were all at par while T_5 recorded the minimum height of 2.34 m. The number of branches and plant spread also followed a similar trend with highest in the treatment T_1 (5.41 number of branches ; 2.95 m EW spread and 3.00 m NS spread) while the treatments T_4, T_3 and T_2 were at par while the least values were recorded in T_5.

The observation recorded on fruit and yield characters are presented in Table 2.

The number of fruits was the highest (1112.24) in

Table 1 : Effect of high density planting on growth of mango variety Kalepad				
Sr. No	Treatments	Plant height (m)	No. of branches	Plant spread (m)
				E→W	N→S
1.	T_1 Square system	3.00	5.41	2.95	3.00
2.	T_2 Hedge row system	2.73	5.48	2.92	2.82
3.	T_3 Double hedge row	2.80	5.31	2.90	2.92
4.	T_4 Paired row planting	2.87	5.17	2.87	2.70
5.	T_5 Cluster planting	2.34	4.78	2.75	2.60
	C.D. (P=0.05)	0.46	0.87	0.48	0.47

Table 2 : Effect of high density planting on fruit characters and quality of mango variety Kalepad							
Treatments	No. of fruits / 900 m^2	Average fruit weight (g)	Fruit length (cm)	Fruit circumference (cm)	Peel weight (g)	Stone weight (g)	Pulp weight (g)	TSS (^{0} Brix)
T_1 Square system	380.12	204.0	11.44	20.06	27.65	26.64	149.71	22.67
T_2 Hedge row system	674.64	194.0	11.36	19.96	28.66	28.66	136.68	23.65
T_3 Double hedge row	1112.24	206.60	11.84	20.64	24.32	25.64	156.64	23.56
T_4 Paired row planting	520.84	190.0	11.24	19.88	30.98	30.32	128.80	24.46
T_5 Cluster planting	658.36	182.8	11.04	18.96	31.33	31.99	119.48	23.72
C.D. (P=0.05)	23.74	NS	1.93	3.34	4.65	4.77	22.87	NS

NS=Non-significant

Table 3 : Pooled data on yield of Kalepad in high density planting 2005-2010							
Sr. No.	Treatments	Yield / 900 m^2					Mean
		2005- 06	2006– 07	2007– 08	2008-09	2009-10	2005-10
1.	T_1 Square system	77.54	66.10	58.58	67.40	61.28	66.18
2.	T_2 Hedge row system	130.88	116.60	109.25	118.91	110.00	117.13
3.	T_3 Double hedge row	230.23	212.18	201.00	214.47	224.50	216.48
4.	T_4 Paired row planting	98.96	85.61	78.96	87.84	69.20	84.12
5.	T_5 Cluster planting	120.47	106.90	100.80	109.39	104.54	108.42
	C.D. (P=0.05)						21.36**

Table 4 : Yield and B:C ratio in different systems of planting

Treatments	Yield /900 sq.m	Yield (kg/ha)	B:C ratio
T_1 (Square system)	66.18	735.3	1.10
T_2 (Hedge row system)	117.13	1304.0	1.95
T_3 (Double hedge row)	216.48	2402.9	2.60
T_4 (Paired row planting)	84.12	934.6	1.40
T_5 (Cluster planting)	108.42	1199.3	1.79

the double hedge row followed by hedge row system (674.64). The least (380.12) was recorded in square system of planting. The maximum yield (2402.9 kg/ha) was also recorded in double hedge system which was followed by hedge row system (1304kg/ha) while the lowest yield (735.3 kg/ha) was observed in square system of planting (Table 4). Similarly the double hedge row system had given highest yields in Amrapali as reported by Sanjay *et al.* (2001) and in variety Neelum by Anbu *et al.* (2001). There has been an increase in yield due to the increase in density which corroborates with the findings of Singh and Shukla (2001) in variety Dashehari wherein after year 7, the fruit yield per hectare increased with the increase in density.

There was no significant difference between the treatments for average fruit weight. However, maximum (206g) was also in double hedge row planting while the other treatments recorded an average fruit weight between 144 g to 180 g. The fruit characteristics such as fruit length (11.84 cm), fruit circumference (20.64 cm) and pulp content (156.64 g) also registered higher values in double hedge row system of planting while there was no significant difference between the treatments for TSS.

Summary:

It is concluded that highest yield of 2402 kg/ha was obtained in the double hedge row system of planting with benefit cost ratio 2.60 and 45.7 per cent increased yield over the hedge row system of planting in mango variety Kalepad. Hence, the double hedge row system of planting with a spacing of 10 m between double hedges, 5 m within double hedge 5 m between plants in double hedge is the best planting system in Tamil Nadu for obtaining highest number of fruits and the highest yield/ unit area.

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