



## Comparative performance of mango varieties grafted on Vellaikolamban and mixed rootstock

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### ABSTRACT

Research on rootstock in mango is very limited in our country. Kalapady was reported to be a dwarfing rootstock. Recent trend among mango growers is to high density orcharding with dwarfening nature of the varietie. Efforts were made at Agriculture Research Station, Mulde, to study comparative performance of Ratna, Alphonso and Kesar mango on Vellaikolamban and mixed rootstock i.e., heterozygous seedling stock and the effect of rootstock on a scion under high density of 5m x 5m spacing. Results indicated that use of Vellaikolamban rootstock reduced plant volume in scion cv. Alphonso by 39.1%, followed by 24.9% in Ratna and 26.5% in cv. Kesar. As volume of the canopy was reduced, it directly influenced fruit yield cvs. Alphonso and Ratna. However, reduction in canopy volume had a positive influence on yield in cv. Kesar. Net returns of Rs.38,629/- per ha were maximum for Kesar with the rootstock Vellaikolamban.

**Key words:** Mango, Ratna, Alphonso, Kesar, Vellaikolamban, Mixed rootstock, polyembryonic, dwarfing, volume, yield

### INTRODUCTION

Konkan region of Maharashtra is a traditional belt of mango cultivation particularly, cv. Alphonso which occupies an area of 1,64,000 ha. Though Alphonso is the chief commercial variety of the region, cultivars Kesar and Ratna are gaining popularity with the concept of high density orcharding. However, the weather of the region favours crop vigour. Wide variation in performance of the same variety within an orchard using grafts prepared out of heterozygous seedling stocks restricts establishment of high density orchards.

Rootstock research work in mango is still in its infancy. Good work was done on selection criteria for dwarfness, way back in 1985 at IARI (Bose, 1985). Studies conducted at various places indicated that the varieties Kalapady (Sen, 1939), Olur, Ambalavi (Jauhari *et al*, 1972), Vellaikolamban (Singh and Singh, 1976) and Belkhas and Parikhas (Mukherjee and Das, 1976) have the potential for imparting dwarfness. Avilan *et al* (1996) reported influence of rootstock on fruit size and shape of the grafted cultivars, showing strong scion/rootstock relationship. Singh and Singh (1976) recorded maximum reduction in height of Dashehari scion when grafted to Vellaikolamban rootstock. With this in view, the present study was carried out to study comparative performance of Ratna, Alphonso and Kesar

mango varieties on Vellaikolamban and mixed rootstock, i.e., heterozygous seedling stock, and, to study the effect of rootstock within a scion variety under a high density orchard with a spacing of 5m X 5m.

### MATERIAL AND METHODS

The present study on comparative performance of different, leading varieties namely Alphonso, Ratna and Kesar grafted onto Vellaikolamban and mixed rootstock under high density viz., 5m x 5m spacing was carried out at Agriculture Research Station, Mulde, from September, 1992 to May, 2007. The experimental station is located at 16°2' latitude, 73°42' longitude and at 17m above msl in Konkan region of Maharashtra, which is a coastal region with annual rainfall of 3000mm. Soils are well drained sandy loam with pH 6.01. Treatment combinations are detailed below:

- T<sub>1</sub> Ratna on Vellaikolamban
- T<sub>2</sub> Ratna on Mixed rootstock (heterozygous seedling stock)
- T<sub>3</sub> Alphonso on Vellaikolamban
- T<sub>4</sub> Alphonso on Mixed rootstock (heterozygous seedling stock)
- T<sub>5</sub> Kesar on Vellaikolamban
- T<sub>6</sub> Kesar on Mixed rootstock (heterozygous seedling stock)

T<sub>4</sub> trial was laid out in Randomized Block Design with five replications and two plants per replication as a unit. The experimental material was prepared by stone grafting and one year old grafts were planted at 5m x 5m

spacing during September, 1992. Annual growth (height and spread) was recorded in the month of May every year since 1994. However, data on growth and yield from year 2003 to 2006 only have been used here. Low spreading branches upto 60cm height above ground and overcrowded branches in the canopy of the tree were chopped by way of light pruning in the year 2004. Plant volume was calculated using the following formula:

$$\text{Plant Volume (m}^3\text{)} = \Pi r^2 \times h$$

$$\text{Where } h = \text{plant height and } r = \frac{\text{E} - \text{W} + \text{N} - \text{S spread}}{4}$$

Data on growth and yield attributes were subjected to statistical analysis (Panse and Sukhatme, 1989).

Cost of cultivation was calculated using standard cost concepts applied by Gorivale *et al* (1997) and Nikam *et al* (2004).

## RESULTS AND DISCUSSION

Growth and yield observations for the years 2003 to 2006 are presented in Table 1.

It is evident from the data (Table 1) that significant difference between treatments was observed for pooled data on plant height, plant volume and yield. Grafts of Ratna variety on Vellaikolamban showed significantly lower plant height (3.6 m) compared to Kesar on Vellaikolamban and mixed rootstock (4.6 m), Alphonso on mixed rootstock (4.7 m) and was on par with Alphonso on Vellaikolamban, and Ratna, on mixed rootstock. Effect of rootstock on plant height within a scion variety was significant only in Alphonso variety. Alphonso grafts on Vellaikolamban showed marked reduction

in plant height (3.8 m) over the mixed rootstock (4.7 m). Singh and Singh (1976) recorded maximum reduction in plant height in Dashehari grafted on Vellaikolamban rootstock. However, rootstock did not show any effect on plant height in Kesar variety.

Data on average plant volume from 2003 to 2006 and pooled data over the years revealed that Ratna grafts on Vellaikolamban had reduced plant volume compared to that in other treatments. Similarly, grafts of all varieties on Vellaikolamban rootstock showed reduction in plant volume over the mixed rootstock.

Data on average plant volume pooled over the years revealed that Ratna variety on Vellaikolamban had recorded the lowest plant volume (285.9 m<sup>3</sup>) compared to the grafts on mixed rootstock and other scion varieties, irrespective of the rootstock. Maximum plant volume (651.5 m<sup>3</sup>) was recorded in 'Kesar' on mixed rootstock.

In the present study, reduction in plant volume was observed in cv. Alphonso (39.1%), followed by 'Kesar' (26.5%) and 'Ratna' (24.9%) when grafted onto Vellaikolamban rootstock. These results are in line with earlier results reported by Avilan *et al* (1996), Singh and Singh (1976) and Reddy *et al* (2003). Vellaikolamban rootstock not only important reduced plant volume to the scion variety, but four year pooled yield data revealed that it also reduced the yield by 24.4% in 'Ratna' and 21.6% in 'Alphonso' scions. Similar effect of Vellaikolamban rootstock on yield of Dashehari plants was reported by Singh and Singh (1976), whereas, Reddy *et al* (2003) reported higher yields with the dwarfing Vellaikolamban rootstock. However,

**Table 1. Growth and yield of 'Alphonso', 'Kesar' and 'Ratna' mango varieties grafted onto Vellaikolamban and mixed rootstock during 2003 - 2006 and data pooled over the years**

Treatments	Pooled mean height (m)	Pooled over the years (m <sup>3</sup> )				Pooled over the year (m <sup>3</sup> )	% Reduction in volume	Yield (t/ha)				Pooled over the	% Decrease/ increased in yield over mixed rootstock
		2003	2004	2005	2006			2003	2004	2005	2006		
Ratna / Vellaikolamban	3.6	289.0	263.3	270.6	320.7	285.9	24.9	13.4	4.2	2.8	3.1	5.9	(-) 24.4
Ratna / Mixed rootstock	3.7	360.8	334.6	329.5	498.0	380.8		13.8	5.8	4.4	6.9	7.8	
Alphonso / Vellaikolamban	3.8	306.1	303.1	270.7	414.2	323.5	39.1	5.1	1.7	3.9	1.0	2.9	(-) 21.6
Alphonso / Mixed Rootstock	4.7	582.6	465.4	483.3	593.9	531.3		7.4	2.6	3.8	1.1	3.7	
Kesar / Vellaikolamban	4.6	512.4	397.2	406.1	599.5	478.8	26.5	17.8	8.0	4.5	3.9	8.6	(+) 10.3
Kesar/ Mixed rootstock	4.6	679.5	569.0	576.0	781.4	651.5		15.7	8.5	3.6	3.2	7.8	
C.V.	8.2	28.1	27.7	28.7	32.0			44.0	35.3	75.2	50.6		
SE ±	0.17	57.3	48.2	50.0	76.5	27.9		2.4	0.8	1.3	0.7	0.8	
CD (P=0.05)	0.5	169.0	142.2	147.4	225.7	78.4		7.1	2.4	N.S.	2.1	2.3	

**Table 2. Cost of cultivation (Rs./ha) of mango varieties on rootstocks**

Particulars	R x V	R x M	A x V	A x M	K x V	K x M
Hired labour	21,775	21,775	21,775	21,775	21,775	21,775
Manures and fertilizers	18,640	18,640	18,640	18,640	18,640	18,640
Plant protection	7,000	7,000	7,000	7,000	7,000	7,000
Input cost (Rs.)	47,415	47,415	47,415	47,415	47,415	47,415
Depreciation on implements and machinery	500	500	500	500	500	500
Land revenue & other cesses	50	50	50	50	50	50
Interest on working capital for 12 months @ 13%	7,682	7,682	7,682	7,682	7,682	7,682
Interest on fixed capital @ 10%	500	500	500	500	500	500
Rental value of land (1/6 <sup>th</sup> ) of the gross value. land revenue	14,700	19,400	9,733	12,400	21,400	19,400
Amortization value	7,482	7,332	7,482	7,332	7,482	7,332
Supervision charges @ 10% of input cost	4,742	4,742	4,742	4,742	4,742	4,742
Total cost (Cost C)	83,071	87,621	78,104	80,621	89,771	87,621
Yield (t/ ha) and Gross Returns	5.88	7.76	2.92	3.72	8.56	7.76
Sale price of 'Alphonso @ Rs.25/kg	88,200	1,16,400	73,000	93,000	1,28,400	1,16,400
Ratha and kesar @ Rs.15/kg						
Net returns at Total Cost	5,129	28,779	(-) 5,104	12,379	38,629	28,779
Benefit:Cost ratio	1.06	1.32	0.93	1.15	1.43	1.33

R= 'Ratra', V= 'Vellaikolumban', A= 'Alphonso', M= Mixed rootstock', K= Kesar

Vellaikolumban rootstock showed beneficial effect on 'Kesar' variety, where the yield increased by 10.3% over mixed rootstock.

Per hectare cost of cultivation of different mango varieties grown on Vellaikolumban and mixed rootstock is presented in Table 2. Data revealed that 'Ratna' variety on mixed rootstock exhibited 1.32 benefit to cost ratio as against 1.06 in 'Ratna' on Vellaikolumban rootstock. Cultivation of 'Alphonso' on Vellaikolumban suffered a loss by recording only 0.93 benefit to cost ratio compared to 'Alphonso' on mixed rootstock (1.15). Maximum net returns (Rs. 38,629/-) per hectare were recorded in 'Kesar' on Vellaikolumban, exhibiting B:C ratio of 1.43 as against that on mixed rootstock with, Rs. 28,779 and 1.33 B:C ratio.

The present study revealed that plant height, plant volume and yield decreased by use of Vellaikolumban rootstock in 'Alphonso' and 'Ratna' whereas, Vellaikolumban rootstock reduced the plant volume of 'Kesar' variety with increased per hectare yield under high density planting of 5m x 5m.

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