

Performance of Neelum variety of mango (*Mangifera indica* L.)
on polyembryonic rootstocks as compared to that
on monoembryonic rootstock

by

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Introduction: In our country mango occupies an important place in horticulture and covers maximum acreage under any single fruit crop (around two million acres). The acreage under grafted mango trees of commercial varieties has been gradually increasing in recent years and enlightened growers are increasingly alive to the research findings. In spite of various problems, there has always been good scope of mango export to foreign countries and hence the mango planting is to be viewed from the commercial angle and to give it an industrial orientation. Successful mango cultivation is beset with many intricate problems which have to be properly investigated and tackled in order to put the mango industry on a sound footing. Among the various problems rootstock selection is a vitally important subject for successful orcharding.

In mango propagation, the rootstock materials commonly used are the seedlings often raised from the stones collected in streets, shandies, orchard sites *etc.* These seedlings being the result of sexual union exhibit variations. On the other hand propagation through poly-embryonic seeds is of great advantage as seedlings thus raised behave exactly like their parents and are comparable to vegetatively propagated plants, which are uniform. The uniformity of such rootstocks would help in standardizing the performance of the scion trees and eliminate the variability inherent in monoembryonic rootstocks of unknown origin. Some experiments revealed that certain poly-embryonic varieties impart greater vigour to the scion and influence the yield also. A preliminary trial carried out in Andhra Pradesh showed that of all the different types of polyembryonic rootstocks tested, trees of variety Baneshan on Pahutan and those of Neelum on Goa showed striking uniformity in growth (Madhava Rao, 1967). Unfortunately all the important mango varieties seem to be largely monoembryonic in India. In South India however ten cultivars have been found on the west coast to be polyembryonic.

Studies on the influence of polyembryonic rootstocks on growth and production of different scion varieties are under progress in Regional Fruit Research Station, Anantharajupet (Andhra Pradesh) and Government Fruit Research Station, Basti, Uttar Pradesh (Anon, 1963, 1966). This paper deals

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with the progress of the Studies for the first ten years of a rootstock trial at the Fruit Research Station, Periyakulam.

Materials and Methods: Rootstocks: The following stocks were included in the trial.

1. Olour : Polyembryonic variety
2. Bapakkai : Polyembryonic variety
3. Seedlings of a selected monoembryonic tree

Scion variety: Neelum

Neelum is an important commercial variety in South India. The fruit quality is good. It is a variety of moderate vigour and therefore it gives an early indication of differences in rootstock influence on vigour and yield. This variety is generally a regular and heavy bearer. Occasionally it bears two crops in a year.

The trial was laid out at Fruit Research Station, Periyakulam, Madurai district in an area of 5.00 acres of red loamy soil. The trees were planted 50' apart on the square system on 11-7-1959.

Layout: The trial was laid out in randomised block with six replications. Each block consisted of three tree plots of each of the three rootstocks. An external guard row was planted all round.

General management: The ground was clean cultivated. Sunnhemp was grown during the first 4 years as intercrop. Thereafter groundnut (TMV 2) was raised as intercrop in the alley spaces. Regular spraying programme and fertilizer schedule were adopted throughout each season to keep the trees healthy and vigorous. Fertilizers and manures were applied for bearing tree at the following schedule: 75 kg of farm yard manure+N:0.910 kg (as ammonium sulphate) P_2O_5 :0.680 kg (as super phosphate) and K_2O :0.910 kg (as muriate of potash). Although some flowering was noted in the early years, deblossoming was done until 1964. Thereafter all fruits were allowed to mature.

Tree growth was recorded annually from the time of planting by measuring trunk girth at a fixed point 6" above the graft joint. Tree height and spread were also measured.

The yield was recorded annually both in terms of number and weight of fruits.

Results: Tree size: Rootstock influence on tree growth after 10 years is shown in Table 1. Out of the three stionic combinations, trees on Bapakkai were slightly more vigorous. The growth measurements indicated that

TABLE 1. Growth of 10 year Old Neelum mango trees showing the effect of three different rootstocks: (averages of eighteen three tree replications in 1969)

Sl. No.	Rootstock	Girth (cm)		Tree height (cm)	Spread (cm)		Circumference (cm)
		Stock	Scion		N.S.	E.W.	
1	Olour	71.61	61.67	399.17	594.17	596.33	1733.28
2	Bapakkai	80.70	77.30	446.18	789.12	797.65	2262.24
3	Monoembryonic	76.44	71.22	389.72	677.20	653.89	1900.00

Bapakkai has influenced the scion in obtaining uniformity in growth. Further the spread of those trees on Bapakkai rootstock was observed to be more than those on the other rootstocks.

Yield: Rootstock influence on yield is shown in Table 2. Annual crop yields both in terms of number as well as weight of fruits per tree are presented along with the accumulated yield from 1964 to 1969. There were striking differences in yield among the three rootstocks. The trees on

TABLE 2. Effect of three different rootstocks on the yield of Neelum mango trees

Sl. No.	Rootstock	Yield					
		1964		1965		1966	
		No. of fruits	Wt. (kg)	No. of fruits	Wt. (kg)	No. of fruits	Wt. (kg)
1	Olour	270	39.860	70	12.031	182	27.639
2	Bapakkai	315	60.547	138	23.594	345	50.765
3	Monoembryonic	281	47.808	126	21.477	242	35.765

Yield							
1967		1968		1969		Total 1964 - 69	
No. of fruits	Wt. (kg)	No. of fruits	Wt. (kg)	No. of fruits	Wt. (kg)	No. of fruits	Wt. (kg)
333	59.777	145	29.125	567	66.528	1567	234.960
557	102.344	215	48.091	1030	122.929	2600	408.270
392	68.166	184	38.041	647	74.444	1872	285.701

Bapakkai rootstock recorded the maximum yields consistently and the highest cumulative yield of 2600 fruits per tree weighing 408.270 kg whereas the other polyembryonic rootstock Olour recorded minimum yields. The statistical analysis of the cumulative yield data from 1964 to 1968 indicated that Bapakkai was the best rootstock for Neelum with regard to yield in terms of number as well as weight of fruits (Table 3).

TABLE 3. *Mango rootstock trial: Statistical analysis of the Cumulative yield data from 1964 to 1968*(1) *Number of fruits per tree. Analysis of variance*

Source	D.F.	S.S.	M.S.	'F'
Replications	5	1,598,915	319,783	
Rootstocks	2	4,655,247	2,327,624	12.09 **
Experimental Error	10	3,615,138	361,514	1.88 N.S.
Pure Error	35	6,738,679	192,533	
Total	52	16,607,979		

** Significant at P=0.01 level

Summary of results

(1) Rootstocks:

Sl. No.	Rootstocks	Mean No.	SED of Mean	C.D. (P=0.05)	Conclusion
1	Olour	795	(1) Vs (2) 146.2	297	2, 3, 1
2	Bapakkai	1524	(1) Vs (3) } 148.4	301	
3	Monocembryonic	1117	(2) Vs (3) }		

(2) *Weight of fruits in kg per tree. Analysis of variance*

Source	D.F.	S.S.	M.S.	'F'
Replications	5	80,542.1	16,108.4	
Rootstocks	2	164,921.8	82,460.9	15.00 **
Experimental Error	10	110,944.3	11,094.4	2.02 N.S.
Pure Error	35	192,447.8	5,498.5	=
Total	52	548,856.0	=	

** Significant at P = 0.01 level

Summary of results

Sl. No.	Rootstocks	Mean weight in kg per tree	SED of Means	C.D. (P=0.05)	Conclusion
1	Olour	138.636	(1) Vs (2) 24.72	50.182	2, 3, 1
2	Bapakkai	274.641	(2) Vs (3) } 25.7	50.893	
			(1) Vs (3) }		
3	Monocembryonic	188.283			

Total solids: Total solids were estimated by using Hand refractometer. Fruits harvested from the trees on Bapakkai rootstock recorded the maximum percentage of total solids 24.2 (in 1968) and 21.9 (in 1969). (Table 4).

TABLE 4. Effect of different rootstocks on the quality of fruits

Sl. No.	Rootstock	Total Solids in percentage	
		1968	1969
1	Olour	21.1	19.9
2	Bapakkai	24.2	21.9
3	Monoembryonic	22.3	19.2

Other observations: Fruits were drawn from different treatments and organoleptic test was conducted. The marks scored by the three different rootstocks are furnished in Table 5. The data indicated that fruits from the trees on Bapakkai rootstock scored the maximum marks.

TABLE 5. Organoleptic evaluation of the fruits from the different stionic combination

Sl. No.	Rootstock	Marks scored in Organoleptic test		
		1967	1968	1969
1	Olour	64	48	60
2	Bapakkai	69	49	62
3	Monoembryonic	62	45	61

Pests and diseases resistance: In the later part of the year 1960 an unknown leaf disease made its appearance affecting some of the young trees in this trial. The affected trees showed crinkling of leaves, yellowing and rosetting in the advanced stages. They exhibited a stunted appearance and the trees slowly died. The mortality due to this disease is given in Table 6. It is found from the figures that the intensity of the disease had been severe in instances where Olour was employed as rootstock. With regard to incidence of other pests and diseases no pronounced differences were observed.

TABLE 6. Effect of different rootstocks on the mortality due to the leaf disease

Sl. No.	Rootstock	No. of grafts planted	No. of grafts died	Percentage of mortality
1	Olour	24	16	66.67
2	Bapakkai	29	6	20.69
3	Monoembryonic	29	6	20.69

Discussion: The need for the exploration of clonal rootstocks to eliminate the great variation occurring in mango varieties has been felt for long. The use of polyembryonic stocks known for their uniformity of growth has

been long suggested by Baksi (1963). Two polyembryonic rootstocks (Olour and Bapakkai) were compared with one monoembryonic seedling in this study.

Rootstock influence: 1. *Olour:* It is clear from this trial that this polyembryonic rootstock was inferior to the other two with regard to cropping. The susceptibility to a leaf disease, when the trees were young was more severe in the trees on Olour stock than those on the other stocks. The trees on this rootstock were lacking even the desired advantages of imparting uniformity to the scion trees and the early bearing tendencies of this variety. Based on these defects Olour does not prove to be a desirable rootstock for Neelum.

2. *Bapakkai:* Neelum trees on this rootstock produced consistently maximum yields. From the Agricultural Research Station, Taliparamba (Kerala State), the Bapakkai had been reported to be a vigorous rootstock. The results in this trial are in agreement with the above. It is interesting to note that the spreading habit of the tree is more commonly associated with heavy cropping in apple (Mckenzie, 1964). The results corroborate with the above finding and it is seen that more spreading habit of the trees on Bapakkai rootstock was found to be associated with heavy cropping. It is reported that some of the polyembryonic rootstocks have imparted greater vigour and uniformity to the scion (Madhava Rao, 1967). The results tally with the above findings. Grafts of Neelum on Bapakkai were used in mango manurial trial of this station were also observed to be remarkably uniform in growth. The fruit quality and the total solids were also found to be better in this rootstock than those on the other two rootstocks tried. Neelum trees on Bapakkai has recorded 30 to 35% increased yields over those on monoembryonic seedling and 50 to 60% increased yields over those on Olour stock. It can be recommended as the most promising rootstock for Neelum.

3. *Seedlings of a selected monoembryonic tree:* Variations with regard to growth, yield and fruit quality were observed in the performance of Neelum trees on monoembryonic seedling stock. However, with regard to cropping the trees on monoembryonic seedling stock were superior to those on Olour stock but inferior to those on Bapakkai rootstock. In view of the influence of the stock bringing in variations to the scion variety, this has to be discarded.

Summary: A rootstock trial with the mango variety Neelum on two polyembryonic rootstocks (Olour and Bapakkai) and one monoembryonic rootstock was laid out in July 1959 and the following results were obtained. Bapakkai was found to be the best rootstock for Neelum scion. The polyembryonic rootstock Bapakkai had a striking effect on growth, uniformity and yield on Neelum scion. The other polyembryonic stock Olour was inferior to the other two rootstocks.

REFERENCES

- Anon. 1963. Fourth Annual Progress report of the Scheme for establishment of Regional Fruit Research Station at Anantharajupet (A.P.)
- 1966. Annual report of the schemes-Intensification of research on mango and gauva in Government Fruit Research Station, Basti (U.P.).
- Baksi, J. C. 1963. Propagation studies with monoembryonic and polyembryonic varieties of mango. *Punjab Hort. J.*, 3: 135-93.
- Madhavarao, V N. 1967. Propagation practices. The Mango - A Hand book. First Edition. Indian Council of Agricultural Research, New Delhi.
- Mckenzie, D. W. 1964. Apple Rootstock trials Jonathan on East Malting, Merton and Malting - Merton rootstocks. *J. hort. Science*, 39: 69-77.

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