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Short communication

Studies on rejuvenation of old, unproductive 'Alphonso' mango trees in orchards

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ABSTRACT

A field trial on pruning was conducted from 2004 to 2009 to induce rejuvenation of twenty six year old, unproductive 'Alphonso' mango trees, at Indian Institute of Horticultural Research, Bangalore. In the study, three treatments imposed comprised of two pruning treatments, namely 30cm and 45cm pruning of third order branches from the point of origin, and a control (no pruning). Pruning increased the mean cumulative fruit yield for four years, which was almost double that of control, although the two pruning treatments were on par. Maximum mean cumulative fruit yield (86.3kg/plant) was obtained with 30cm pruning, whereas control treatment recorded a fruit yield of 47.2kg/plant. Fruit quality attributes such as average fruit-weight, TSS, acidity and shelf-life were not affected by the two pruning treatments, for rejuvenation of 'Alphonso' mango.

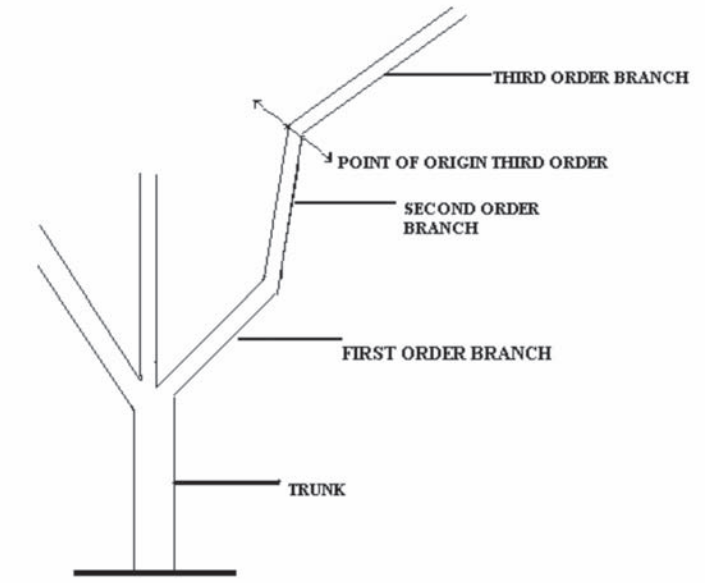
Key words: Pruning, rejuvenation, mango, fruit yield, fruit quality

Mango is an important fruit crop of India grown in an area of 12.22 million ha with production of 104.1 million tonnes (NHB, 2009). In mango, the average national productivity is around 6.42 t/ha, which is very low compared to countries like Israel, Mexico, Brazil and Philippines. One of the reasons for this low productivity is presence of several old, senile mango orchards. Improving the productivity of old, unproductive mango orchards plays an important role in augmenting production and productivity of mango in the country. In old and dense mango orchards, light interception and photosynthetic potential of trees is reduced. Thinning of overcrowded branches to facilitate air circulation improves photosynthetic efficiency, fruit yield and quality. Lakso (1980) reported a close relationship between light interception, photosynthesis and fruit yield in fruit tree orchards. Gross (1997) reported judicious pruning of mango trees for maintaining a good balance between vegetative growth and fruiting. Beneficial and favourable effects of pruning in mango have been reported on light interception and chlorophyll content of leaves (Schaffer and Gauye, 1989), growth parameters (Lal *et al,* 2001) and fruit yield (Lal and Mishra, 2007; Rao and Shanmugavelu, 1976; Burondakar *et al*, 1997; Shinde *et al*, 2003), fruit colour (Whitey, 1984) and regularity in bearing (Rao, 1971)

'Alphonso' is one of the commercial varieties of mango mainly grown in the states of Karnataka, Maharastra, Tamil Nadu, Gujarat and Andra Pradesh. It is a dual purpose variety used both for table purposes and processing. It is also exported to other countries. In Alphonso, productivity is around 4.5 t/ha, which is very low compared to other mango varieties, due to many reasons. With this in view, rejuvenation through pruning was applied in the existing, old Alphonso trees at Indian Institute of Horticultural Research, Bangalore.

A field trial was conducted from 2004 to 2009 on twenty six year old Alphonso mango trees where the fruit yield was around 40 to 50 kg/plant. The trees were under rainfed conditions on red loam soils, with available soil nitrogen 262 kg/ha, available soil phosphorus 9.62 kg/ha and available soil potash 141.1 kg/ha under pH 7.26. The plants were spaced at 10mx10m. Three pruning treatments were imposed, namely, 1. Pruning of third order branches 30cm from origin. 2. Pruning of third order branches 45cm from origin and 3. No Pruning (Control). The treatments are illustrated in the following figure:

The pruning treatments were decided and fine tuned based on earlier experience under an NATP trial where branches 5m and 4m from ground level were pruned for improving productivity of Alphonso mango orchards. Regular and uniform cultural practices were imposed on pruned and



control trees. The trial was laid out in Randomized Block Design with 10 replications and single tree as a unit/ treatment. Pruning treatments were imposed during September, 2004 and trees were pruned with a hand-saw. After pruning, the cut ends were applied with copper oxychloride paste. This was followed by three insecticidal sprays after emergence of sprouts, at intervals of 20 days, for control of shoot borer and other pests. Shoots were thinned to manageable levels thus avoiding overcrowding and only the healthy and vigorous ones were retained. No flowering was observed during December 2004/ January 2005 in any of the pruned trees. Fruit yield and quality parameters were recorded during the fruiting season (May-June) of 2006 to 2009, and data were statistically analyzed as per standard procedures (Panse and Sukhatme, 1985). Fruit quality parameters were estimated as per standard procedures (Ranganna, 1986).

Fruit yield: Fruit yield as influenced by different pruning treatments during 2006 - 2009 are presented in Table 1. Fruit yield in terms of number of fruits plant^{-1} and fruit yield per plant were found to be significant during the years 2007 to 2009. During all the years of study, pruning treatments improved fruit yield and a pronounced effect was seen with pruning of third-order branches 30cm from their point of origin. Although difference in fruit yield among 30 and 45cm pruning treatment was not much and at par among the treatment. In case of pruning third order branches 30cm from origin the fruit yield was almost double compared to no pruning treatment (control). Mean cumulative fruit yield was higher for pruning treatments of 30 and 45cm. Similar result of increased fruit yield was reported by Lal and Mishra (2007, 2008) in mango cvs. Chausa and Dashehari, respectively. Rao and Shanmugavelu (1975, 1976), Rao and Khader (1979) and Shanmugavelu and Selvaraj (1985) also reported increased yield of mango growing to the redistribution of the endogenous normonal substances to favour flowering and fruiting in different varieties. Fruit yield in seven cultivars improved with pruning (Anon., 1979). It appears that the apparently quiescent fruit-bearing buds were activated by pruning treatment owing to redistribution of the endogenous hormonal substances, to favour flowering and fruiting. Pooled fruit yield data for four years showed increased fruit yield by pruning 30 and 45cm away third-order branches from point of origin.

Fruit quality attributes: Fruit quality attributes such as average fruit weight, TSS, acidity and shelf-life as influenced by different pruning treatments are presented in Table 2. The average fruit weight during 2007 and 2008, TSS during 2008 and acidity during 2009 were found to be vary significantly among different pruning treatments. In general, pruning treatments reduced the fruit size due to a higher number of fruits plant^{-1}. TSS, acidity and shelf-life were not affected by different treatments. Similar results were reported by Lal and Mishra (2008) in Dashehari mango.

Table 1. Fruit yield of Alphonso mango as influenced by pruning

Treatment	No of fruits plant^{-1}						Fruit yield plant^{-1} (kg plant^{-1})					
	2006	2007	2008	2009	Cumulative	Mean	2006	2007	2008	2009	Cumulative	Mean
T_1-Pruning third order branches 30 cm from origin	273.6	596.7	235.6	400.4	1506.3	376.6	65.7	145.2	51.8	82.4	345.2	86.3
T_2-Pruning third order branches 45 cm from origin	270.9	502.2	255.3	356.9	1385.3	346.3	67.7	121.5	54.1	72.5	315.8	78.9
T_3-Contro(No Pruning)	206.3	190.0	186.2	211.1	793.6	198.4	49.5	48.4	46.9	44.2	189.0	47.2
F. test	NS	**	*	**	*		NS	**	*	**	*	
S.Em±	33.5	41.3	20.1	34.7	49.3		8.4	10.5	2.7	6.37	15.6	
C.D. (P=*0.05*)	__	124.0	63.6	104.2	137.9		__	31.4	8.5	19.1	46.8	
C.D. (*P=0.01*)	__	170.9	__	140.8	__		__	48.3	__	26.4	__	

NS = Non-significant, ** = Significant at *P0.01* and * = Significant at *P0.05*

Table 2. Fruit quality of Alphonso mango as influenced by pruning

Treatment	Average fruit weight (g)					TSS (^{0}Brix)					Acidity (%)					Shelf life (Days)				
	2006	2007	2008	2009	Mean	2006	2007	2008	2009	Mean	2006	2007	2008	2009	Mean	2006	2007	2008	2009	Mean
T_1- Pruning third order branches 30 cm from origin	241.5	243.9	220.3	206.1	227.9	17.5	17.0	18.0	16.9	17.3	0.201	0.268	0.202	0.201	0.218	13.2	12.5	13.2	12.9	12.9
T_2- Pruning third order branches 45 cm from origin	250.2	242.3	213.7	205.9	228.0	17.0	17.9	18.2	16.8	17.5	0.268	0.268	0.201	0.268	0.251	13.5	13.0	13.5	13.5	13.3
T_3-Control (No Pruning)	245.7	256.1	253.3	210.4	241.4	16.5	17.2	17.1	17.0	16.9	0.268	0.201	0.268	0.201	0.234	13.0	13.0	13.0	13.2	13.0
F. test	NS	*	*	NS	NS	NS	*	NS	NS	NS	NS	*	NS	NS	NS	NS				
S.Em±	3.9	2.5	1.9	3.3	1.2	0.9	0.3	0.5	0.4	0.2	0.5	0.02	0.6	1.0	0.4	0.3				
C.D. (*P=0.05*)	—	7.5	5.7	—		—	—	0.9	—		—	—	—	0.06		—	—	—	—	

NS = Non-significant, ** = Significant at *P0.01* and * = Significant at *P0.05*

Fruit quality parameters of Alphonso mango, thus, were not influenced by different pruning treatments.

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