

Short communication

Performance of mango varieties for growth, flowering and yield under agro climatic condition of Chhattisgarh plains

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Mango is one of the important fruit crops of Chattisgarh and is grown in an area of 8880 ha (excluding forest trees) with production of 79920 tonnes (Patil, 2002). The crop takes about three to four months from the time of fruit set to maturity and ripening. In northern India, mango is harvested during end of May to July-August, while in Chhattisgarh, mango fruits mature one month earlier than north India which offers immense scope for the local as well as for export market. Therefore, the study was conducted to find out appropriate varieties/hybrids suitable for the region to obtain maximum benefit from the mango orchards.

The investigation was carried out at Horticultural Research Farm of Department of Horticulture, Indira Gandhi Agricultural University, Raipur, during the year 2002-03. Thirteen year old mango plants laid out in randomized block design in three replications with eleven treatments (varieties/hybrids) were taken for study. The varieties/hybrids selected for study were Langra, Sunderja, Amrapali, Mallika, Pairi, Totapari Red Small, Krishnabhog, Amin, Neeleshwari, Kesar and Dashehari. Recommended package

of practices were followed during the experimental period. The canopy volume of the tree was calculated by the formula, $\text{Volume} = \frac{1}{2} \pi r^2 h$, where $p = 3.14159$, r = spread $(N-S + E-W) / 4$, h = canopy height. For complete information regarding fruiting behaviour of individual varieties, the date of first flower bud appearance, date of flower opening and date of full bloom were recorded.

Growth characters

The tree height of different varieties / hybrids showed significant differences. Maximum plant height were recorded in Amin (6.08 m), Langra (5.61 m) and Mallika (5.58 m), whereas, the varieties Neeleshwari (4.27 m), Pairi (4.40 m), Kesar (4.46 m) and Totapari Red Small (4.50 m) were found significantly shorter/dwarf. The canopy height was found to be maximum in Amin (4.98 m) followed by Mallika (4.57 m) and Langra (4.52 m), which were at par whereas, minimum canopy was observed in Amrapali (3.33 m) and Neeleshwari (3.33 m) which were at par with Pairi (3.37 m), Kesar (3.52 m), Totapari Red Small (3.56 m), Dashehari (3.67 m) and Krishnabhog (3.88 m). The trunk girth was maximum in Amin (112.33 cm) followed by Langra

Table 1. Vegetative growth characters of different mango varieties / hybrids

S.No.	Varieties	Tree height (m)	Tree canopy height (m)	Trunk girth of tree (cm)	Tree spread (m)		Tree canopy volume (m ³)
					(N-S)	(E-W)	
1.	Langra	5.61	4.52	108.67	5.41	5.45	104.78
2.	Sunderja	5.00	4.07	74.67	4.75	4.73	73.54
3.	Amrapali	4.54	3.33	88.66	4.27	4.19	46.96
4.	Mallika	5.58	4.57	78.33	5.11	5.03	92.83
5.	Pairi	4.40	3.37	73.67	4.27	4.33	48.86
6.	Totapari Red Small	4.50	3.56	72.33	4.55	4.59	58.46
7.	Krishnabhog	5.00	3.88	83.66	4.88	4.73	69.52
8.	Amin	6.08	4.98	112.33	5.57	5.57	121.64
9.	Neeleshwari	4.27	3.33	70.33	4.86	4.85	61.39
10.	Kesar	4.46	3.52	87.00	5.10	4.87	69.51
11.	Dashehari	4.53	3.67	68.67	4.68	4.73	63.51
	C D at 5%	0.73	0.72	18.73	0.56	0.63	23.14

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Table2. Flowering and fruiting behaviour of different mango varieties/hybrids

S.No.	Varieties	Flowering behaviour (Date)			Fruiting behaviour		
		Flower bud initiation	Flowering	Full bloom	Fruit setting	No. of fruits /tree	Yield /tree (kg)
						Fruit weight (g)	
1.	Langra	27 Jan.	24 Feb.	6 Mar.	14 Mar.	182.67	24.89
2.	Sunderja	30 Jan.	20 Feb.	2 Mar.	12 Mar.	267.33	45.55
3.	Amrapali	3 Jan.	28 Jan.	12 Feb.	18 Feb.	583.33	48.76
4.	Mallika	28 Jan.	20 Feb.	4 Mar.	10 Mar.	261.33	42.90
5.	Pairi	7 Jan.	2 Feb.	12 Feb.	19 Feb.	107.66	17.03
6.	Totapari Red Small	15 Jan.	12 Feb.	24 Feb.	4 Mar.	498.00	37.92
7.	Krishnabhog	28 Jan.	24 Feb.	4 Mar.	12 Mar.	127.33	21.13
8.	Amin	17 Jan.	10 Feb.	22 Feb.	3 Mar.	359.33	49.15
9.	Neeleshwari	5 Jan.	21 Jan.	16 Feb.	22 Feb.	219.00	29.25
10.	Kesar	21 Jan.	15 Feb.	28 Feb.	5 Mar.	173.33	25.20
11.	Dashehari	20 Jan.	5 Feb.	22 Feb.	1 Mar.	386.00	52.88
	C D at 5%	-	-	-	-	82.78	8.00

(108.67 cm). The spread of tree (N-S and E-W) was also noted maximum in Amin (5.57 m and 5.57 m) followed by Langra and Mallika. The variety Amin showed maximum tree canopy volume (121.64 m³), which was at par with Langra (104.78 m³) followed by Mallika (92.83 m³) and significantly superior to other varieties. The minimum canopy volume was noted under Amrapali (46.96 m³). Krishnamurthi *et al.* (1961) also reported high variability within the varieties for vegetative growth. Based on vegetative growth parameters, Amin, Langra, and Mallika appeared to be vegetatively vigorous after 13 years of plantation under Raipur plains.

Flowering

In mango, time of full bloom is demarcated as early, mid and late. The early blooming cultivars were Amrapali, Pairi and Neeleshwari, mid-bloomed cultivars were Amin, Dashehari and Totapari Red Small and late-blooming cultivars were Langra, Mallika, Sunderja, Krishnabhog and Kesar (Table-2). The varietal difference in flowering behaviour might be due to the different genetic make up of the varieties.

Fruiting behaviour

Early fruit setting was observed in Amrapali closely followed by Pairi and Neeleshwari while, late fruit set was observed in Langra, Sunderja and Krishnabhog. Fruit setting in all the varieties were observed between 18th February to 14th March. Similarly, Gangwar and Moti (1974) found stretched fruit setting in late mango varieties during last two weeks of March in north India. Maximum number of fruits per tree were noted in Amrapali followed by Totapari Red Small and Dashehari, whereas minimum number of fruits were observed in Pairi, Krishnabhog and Kesar. The maximum fruit weight was recorded with Sunderja

followed by Krishnabhog while lowest fruit weight was noted in Totapari Red Small which was at par with Amrapali.

The high-yielding varieties were Dashehari followed by Amin and Amrapali. Poor-yield in cv. Pairi was due to the lesser number of fruits per tree while in Langra it may be due to the sudden upsurge in temperature, low R.H. (<30%) and hot air during the year under observation. However cv. Dasehari was not much affected. Hoda and Yadav (1987) also reported significant variation in fruit yield/tree.

The varieties Amin, Langra and Hybrid Mallika were found vigorous. On the basis of flowering behaviour hybrids Neeleshwari and Amrapali appeared to be earlier, whereas, Mallika, Langra and Krishnabhog appeared late. The varieties Dashehari, Amin and hybrid Amrapali were found to be high-yielding.

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Short communication

Value added products in aonla

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Aonla (*Emblica officinalis* Gaertn.) known as Indian gooseberry is one of the important non-traditional fruit of Indian origin having immense potentiality of cultivation on marginal lands. The fruit is good source of Ascorbic acid. It contains chemical substances called leucoanthocyanin and polyphenols which retard the oxidation of Ascorbic acid. However, the fruit cannot be consumed afresh due to its highly acidic and astringent taste. Value addition through processing may be a suitable alternative for its economic utilization. Thus the present investigation was carried out to develop processing techniques for making different value added aonla products which can be used at home scale as well as commercial level.

Fresh aonla fruit (cv. NA. 6) was procured from the Central Institute for Arid Horticulture (CIAH), Bikaner in the month of December 2004. Seven value added aonla based products viz., aonla candy, chutney, jam, squashes,

ranking scale), ascorbic acid retention and microbial load (total viable count) during the recorded storage period of 60 days at the interval of each 15 days. The total cost of each developed product was estimated on the basis of food cost (60%) which included the raw material cost.

The data recorded on nutritional analysis of developed aonla products ascertained that 100 gm of sample provides moderate amount of protein (0.2 to 0.3 g), crude fat (0.1 to 3.5 g), fiber (0.01 to 8.3 g), ash (0.1 to 1.2 g). The carbohydrate and energy content of the sample were recorded to be high after processing (Table 1). The moisture and ascorbic acid recorded as 3.3 to 70.8 g and 150 to 210 mg/100 g on fresh wt. basis is the indicator of moderate to low perishability of the products.

Gradual changes were recorded in ascorbic contents of aonla products during storage. After 60 days of storage ascorbic acid retention in different products varied between 40.7 to 68.9 mg of ascorbic acid per 100 g on the fresh wt.

Table 1. Nutritional composition of developed aonla products

Aonla Products	Moisture (g)	Crude protein (g)	Crude fat (g)	Crude fiber (g)	Total ash (g)	Carbohydrate (g)	Energy (Kcal)	Ascorbic acid (mg)
Candy	6.0	0.3	0.2	8.3	1.2	98.8	398	210.0
Chutney	25.3	0.3	0.1	1.2	0.9	99.0	399	186
Jam	3.3	0.2	0.3	0.8	0.1	99.8	403	150
Squash	70.8	0.2	0.1	0.1	0.2	99.7	400	211
Preserve	3.0	0.3	0.1	9.0	1.1	98.8	397	199
Mouth freshener	8.0	0.3	0.2	11.0	1.2	79.2	320	299
Pickle	26.0	0.5	3.5	11.1	5.4	23.5	397	180

preserve, mouth freshener and pickle were prepared and standardized in the laboratory of Dept. of Food and Nutrition, college of Home science, Rajasthan Agricultural University, Bikaner following standard procedure for preparation and sensory evaluation. Samples of aonla fruit and their products were chemically analyzed as the method described by AOAC (1990) for its moisture, protein, fat, fiber, total ash, carbohydrate, energy and ascorbic acid content. The shelf life of all the products was assessed on the basis of their sensory attributes (on nine point hedonic

basis (Table 2). The reduction in ascorbic acid may be due to oxidation by light and trapped oxygen in glass bottle resulting in the formation of dehydroascorbic acid. Similar, reduction in ascorbic acid content during storage has been reported by Mehta and Rahotre (1976). Minimum loss was observed in aonla mouth freshener which could be due to dry state of the product. Singh *et al.* (2001) stated that the greater stability of the ascorbic acid in dried products is assigned to the presence of polyphenols.

The effect of microbial quality on shelf life of the products 60 days after storage is presented in Table 2. The total viable count of all the developed products was found to be negligible. This could be due to compositional

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Table 2. Ascorbic acid retention, microbial load and over all acceptability at 60 days of storage.

Aonla Products	Ascorbic acid (mg/100g)	Microbial load	Over all acceptability
Candy	40.7	0.5×10^3	7.79
Chutney	42.6	0.9×10^3	8.23
Jam	51.9	0.8×10^3	8.29
Squash	68.9	Nil	8.32
Preserve	44.25	0.8×10^3	8.20
Mouth freshener	72.0	Nil	7.20
Pickle	44.9	Nil	7.90

components like presence of sugar and use of preservative in the products during preparations. The hygienic condition during storage was found effective in retaining the good quality of the products through out the period.

The acceptability of the products were assessed on the basis of maximum mean over all acceptability score obtained on nine point hedonic ranking scale. The observations (Table 2) reveled that aonla candy followed

by aonla chutney and aonla jam scored highest. The variation in the scores due to storage was tested statistically and the differences were found to be non significant, thus indicating good acceptability of the products during the storage of 60 days.

The developed aonla products under the study were found to be reasonable in cost (Rs 20 to 60) then other preserve products such as apple, tomato , mango, etc. available in the local market during the month of Feb.2005

Results of the present study clearly indicate that there is a greater scope of value added processed aonla products. Inclusion of these products in diet will definitely help in improving the nutritional value of Indian meal. Low cost of the products and good sensory, nutritional and shelf life qualities establish that the value added processed aonla products are appropriate for consumption and commercialization.

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