



## Studies on morpho-physiological differences in regular and biennial bearing varieties of mango (*Mangifera indica* L.)

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**Abstract:** The present investigation was carried out during the year 2006-07 and 2007-08 with main objective to find out the morpho-physiological differences between 4 regular bearing and 5 biennial bearing varieties. The experiment was layout in Randomized Block Design with three replication. The experimental material consist of 9 cultivars of mango viz., Mallika, Amrapali, Totapuri, Neelum, Dashehari, Chausa, Bombay Green and Safeda. The maximum extended shoots were observed in regular bearing variety during 'on' year while it was observed maximum during 'off' year in biennial bearing variety and during 'off' year in regular bearing variety. Length and diameter of extended and unextended shoots were observed maximum in biennial bearing variety during both on and 'off' years. Thus, it can be said, that alternate bearing problems of mango varieties can be minimize by applying the morphological and Phenological measures viz. deblooming cultural practices.

**Key Words:** Mango, Regular bearing, Biennial bearing, Deblooming cultural practices

### Introduction

Mango (*Mangifera indica* L.) belong to family anacardiaceae and is on of the most important fruit crop in India. The Mango, because of its great utility occupies a pro-eminent place amongst the fruit crops grown in India acknowledged as the king of fruits of this country. Amir Khwsrau (1330AD) has stated (Popenoe, 1920). "The Mango is the pride of the garden the choicest fruit of Hindustan, other fruits we are content to eat when ripe but the mango is good in all stages of growth. Mango (*Mangifera indica* L.) is the fifth most important fruit crop of the world after Apple, Citrus, Banana and Grapes. It is cultivated in more than 100 countries spread over in five continents. Because of its delicious taste, excellent flavor, attractive, fragrance and excellent source of vitamin 'A' and 'C' Mango occupies about 70 per cent of the total area under fruits in India covering an area of 5.51 million hectares (Rahim *et al.*, 2011; Chacko and Reddy, 1982). The major mango productivity countries are India (12.538 Mt), China (3.676Mt). Mexico (1.679Mt.), Thailand (1.800Mt.), Pakistan (16.06 Mt), Indonesia (1.143 Mt.) and Philippines (1.003 Mt.). India share in world mango production share was 40.1% (N.H.B.Data base 2006) which has not increased since then substantially. The total annual production of mango in India is estimated to be 97.82 lakh tones with total coverage of 14.01 lakh hectares (2005-06). Although India has major area and production in the world producing states of India are Andhra Pradesh (2.379 MT), Uttar Pradesh (1.915 Mt), Bihar (1.872 Mt), Karnataka (1.180 Mt), Tamilnadu (0.70/ Mt), West Bengal (0.560 Mt) and Gujarat (0.382 Mt) (APEDA, database). The average fruit production in India is 8-10 tones/ ha. Which is quite lower than the world production of 14-16 tones/ha (Singh and Singh, 2003; Upretiet *al.*, 2014). The popular commercial varieties of different regions in India are:

Northern region: Dashehari, Langra, Chausa, Bombay Green.  
Eastern region: Himsagar, Langra, Fazli, Lakshman bhog, Krishana bhog, and Gulabkhas.

Western region: Alphanso, pairi, Kesar, Rajapuri, Mankurad and Jamadar.

Southern region: Bangalora, Neelum, Swarnrekha, Pairi (Peter), Banganpalli, Mulgoa and Badami (Alphonso).

Productivity of mango is low around 6.2 Mt/ha. There are ample opportunity to increase the productivity of mango. There are some major factors responsible in low productivity which is alternate bearing, fruit drop, disease and pest infestation.

### Materials and Methods

The present experiment was carried out at main experimental station, Department of Horticulture and P.G. Laboratory NDUAT, Faizabad on 15 years old plants of 9 cultivars of mango. The experimental site falls under subtropical climate zone of Indio-gangetic plains, which is situated at 26.47°N latitude, 82.12°E longitude at an altitude of 113m from mean sea level. The weekly meteorological data recorded at the meteorological observatory of NDUAT, Faizabad. These cultivars are of two types:

(A) Regular bearing variety: Mallika, Amrapali, Totapuri, Neelum  
(B) Biennial bearing variety: Dashehari, Langra, Chausa, Bombay Green, Safeda

The all observation on important characteristics of shoot growth, leaf, flowers and biochemical characters have been recorded, methods used and genetic analysis made for determining traits in relation to variable genotypes have been described as: Number of extended shoot, Number of unextended shoot, Shoot Length, Shoot Diameter, Time of initiation of new leaf, Number of Leaves, Fresh weight of leaves and Dry weight of leaves. The statistical analysis were done following the standard methods.

### Results and Discussion

The present investigation involves a detailed evaluation of a variety of mango with regard to Marpho-physiological difference in regular and biennial bearing variety. Several criteria's were

considered for evaluation and discussion pertaining to each of the selected criterion has been presented under separate head. **Morpho-physiological character:** The major growth attributes taken in to account for comparing different cultivars are number of extended and unextended shoots, length of extended and unextended shoots, diameter of extended and unextended shoots, time of initiation of new leaf, number of leaves per shoot fresh and dry weight of leaves etc. During experimental study marked differences were observed in above parameters. The number of extended shoots was observed maximum in regular bearing variety. Variety Amrapali during 'on' year while, in 'off' year the variety Chausa and Safeda of biennial bearing variety showed maximum number of extended shoot. However, the maximum numbers of unextended shoots were recorded in variety Chausa and Safeda of biennial bearing variety during 'on' year. During 'off' year it was recorded maximum in regular bearing variety Amrapali. Kurian and Lyer (1997) studied the canopy size and vigour of 24, 9 year old mango cultivars, growing in India. The cultivars were determined as medium, vigorous (canopy volume 14.25m<sup>3</sup>) and most vigorous (canopy volume greater than 25m<sup>3</sup>) shoot which had fruited in 1986 were selected and growth parameters were measured from 1986 to 1988. The number of vegetative flushes produced in year and the number of nodes and internodal length of shoots did not have much influence on canopy size on bigger, which showed good positive association with leaf size, but not with stomatal density, productivity was inversely related to canopy size. New shoots emergence were recorded maximum in regular bearing variety because it flowed every alternate year therefore, new shoots were showed and fruiting during 'off' years.

Lengths of extended shoot were depend on the nature of the variety. Biennial bearing varieties were vigorous in nature. Therefore, variety Bombay Green showed the maximum length of shoot during 'on' and 'off' years. All variety showed significant differences with Bombay Green. Length of unextended shoot was observed maximum in variety Chausa biennial bearing variety during 'on' year. While, 'off' year it was

**Table-1:** Studies on morpho-physiological differences in regular and biennial bearing varieties of mango

Name of varieties	No. of shoot				Length of Shoot (cm)				Diameter of shoot (cm)			
	extended		unextended		extended		unextended		extended		unextended	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
<b>Regular bearing variety</b>												
Mallika	3.5	16.0	16.0	3.5	10.57	10.63	14.57	13.63	1.60	1.77	1.57	1.75
Amrapali	7.0	13.0	13.0	7.0	6.60	7.40	9.6	10.4	1.40	1.50	1.39	1.45
Totapuri	5.5	14.5	14.5	5.5	7.40	7.87	10.4	10.87	1.63	1.83	1.75	1.80
Neelum	6.0	14.0	14.0	6.0	4.97	5.47	7.97	8.47	1.33	1.43	1.62	1.41
<b>Biennial bearing variety</b>												
Dashehari	2.0	18.0	18.0	2.0	12.46	14.27	14.47	15.27	2.33	2.53	2.32	2.50
Langra	1.0	19.0	19.0	1.0	12.60	13.13	15.6	16.13	2.16	2.43	2.32	2.41
Chausa	0.0	20.0	20.0	0.0	0.0	17.23	20.0	0.0	0.0	2.50	2.16	0.0
Bombay green	1.0	19.0	19.0	1.0	16.43	18.80	19.43	20.8	2.36	2.47	2.35	2.45
Safeda	0.0	20.0	20.0	0.0	0.0	12.80	14.8	0.0	0.0	2.30	2.32	0.0
SEM ±	0.128	0.705	0.705	0.128	0.704	0.66	0.609	0.401	0.116	0.146	0.079	0.056
CD at 5%	0.386	2.116	2.116	0.386	2.110	1.99	1.828	1.203	0.349	0.439	0.237	0.170

**Table-2:** Studies on morpho-physiological differences in regular and biennial bearing varieties of mango

Name of varieties	Time Initiation of new leaf		No. of leaves /shoot 2006-07		Fresh weight of leaves		Dry weight of leaves	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
	<b>Regular bearing variety</b>							
Mallika	21-03-06	20-03-07	8.0	8.33	2.201	2.104	1.096	1.134
Amrapali	21-03-06	20-03-07	8.0	7.00	1.949	1.882	0.863	0.862
Totapuri	14-03-06	12-03-07	10.0	9.33	1.290	1.223	0.773	0.763
Neelum	30-03-06	29-03-07	7.0	8.33	3.549	3.548	1.077	1.268
<b>Biennial bearing variety</b>								
Dashehari	20-03-06	16-03-07	12.0	11.33	3.831	3.788	1.239	0.964
Langra	21-03-06	18-03-07	13.0	12.67	2.819	2.753	1.268	0.965
Chausa	00	27-03-07	8.33	9.00	3.040	3.037	1.384	1.234
Bombay green	12-03-06	14-03-07	14.33	13.33	2.153	2.120	1.090	0.956
Safeda	00	30-03-07	14.00	13.00	2.667	2.667	1.380	1.363
SEM ±			0.957	0.811	0.390	0.458	0.064	0.069
CD at 5%			2.868	2.43	1.168	1.373	0.191	0.206

recorded highest in variety Bombay Green revealed that the emergence of new shoots early in the season does not ensure flowering in such shoots in the following year. Besides climate, varietal differences do occur in the flushing habit of the tree. In most of the irregular bearing variety, generally early initiation and cessation of shoot growth is followed by definite period of shoot dormancy which is maturity and differentiation of flowered bud in biennial bearing variety of mango (Singh, 1971). However, there are also evidences to show that flushing habit in mango is greatly influenced by the variety (Singh, 1971) and some regular bearing cultivars flower irrespective of physiological maturity of the shoots. During 'on' year maximum diameter of shoot were observed in biennial bearing variety Bombay Green. However, in 'off' year it was observed in variety Dashehari (biennial bearing variety). New leaves were initiated earliest in var. Bombay Green biennial bearing variety during 'on' year while it was recorded earliest during 'off' year in variety. Totapuri *i.e.* regular bearing variety number of leaves/ shoots Primordia was recorded maximum in variety Bombay Green *i.e.* biennial bearing variety during 'on' and 'off' year (Gonzalez, and Blaikie, 2003; Gurunget *et al.*, 2014).

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water content (RWC) varied significantly with variety but not with time. A gradual decline in LDM was observed from November to January followed by an increase in February. The regular to show that the growth of mango shoot is purely a varietal feature and that flower bud differentiation in regular bearing varieties is an annual feature. But in biennial bearing varieties it is governed by 'on' and 'off' year phase of the tree rather than by the time of origin and cessation of growth of shoots. The potentiality of these shoot to form flower bud will depend on the floriferous condition of the tree, which turn will be determined by the amount of fruit load carried by the tree in the previous year. Flowering cultivars Maliviya Bhog and Amrapali had significantly higher RWC and lower water saturation deficit in September than in May leaves of Langra had higher mean RWC than other cultivars. Mean absolute water content and LDM showed significant fluctuation with time.

In biennial bearing variety flowering and fruiting occurs every alternate year. Therefore, in 'off' year it attains the physiological maturity. Even the regular bearing types, if they carry a heavy load of crop in one year, show a tendency towards reduced yield in flowering year. The pattern of growth flushes in mango and have reported different periods of primary and extension growth depending upon the variety and the environmental conditions under which they worked (Naik and Rao, 1942a, b). Singh and Khan *et al.* (1993) reported that early initiation and cessation of growth followed by a dormant period will help the shoots to attain proper physiological maturity which is essential for fruit bud initiation in them. However, there is now enough evidences.

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