The Pharma Innovation Journal 2021; 10(1): 786-790

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(1): 786-790

www.thepharmajournal.com
Received: 09-11-2020
Accepted: 19-12-2020

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Studies on evaluation of mango (*Mangifera indica* L.) genotypes for year round production

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Abstract
Mango (*Mangifera indica.* L) assumes greater importance in the tropics and subtropics owing to its high economic value contributing substantially to the agricultural exports at global and national levels. India accounts to about 50% of the world's mango production. In crop improvement programme, high heritability generally enables the breeder to select plants on the basis of the phenotypic expression. However, the heritability estimates are often subjected to genotype-environment interaction. Hence, estimation of genetic advance is required for expected genotypic progress of a particular character. Evaluation of open pollinated mango seedling progenies was carried out from 2019-2020 in farmer's field, Annur, Coimbatore. Variability present among the twenty five genotypes was studied through morphological markers, yield parameters, quality attributes and by molecular markers. The assessment was carried out during three consecutive seasons (2019-2020). The study revealed that all the genotypes registered polyembryonic traits which were confirmed through morphological traits. All the genotypes flowered throughout the year and fruit matured at March - May, August - November and December – February. Among the genotypes, Annur 3, Annur 5 and Annur 8 recorded uniformity in flowering throughout the year with increased yield and fruit quality attributes. The study revealed that, among twenty five genotypes, Annur 5 was found to be most promising genotype with maximum number of panicles (548 Nos/ tree), number of fruits (453 Nos/ per tree), fruit weight (110.5 g), fruit length (8.35 cm), fruit width (16.80 cm), TSS (14.2°Brix) and total sugars (14.35 per cent). This genotype can be recommended for culinary purpose.

Keywords: Mango, heritability, polyembryony, variability and production

Introduction
The genetic diversity in mango offers greater opportunity to utilize these genomic resources and technologies to manipulate desirable traits. India has the richest germplasm collection for cultivated mango. Assessment of genetic variation within natural population and among breeding lines is crucial for effective conservation and exploitation of genetic resources for crop improvement programs. In India, mango occupies an area of 22.62 lakh ha with a production of about 196.86 lakh tonnes and the productivity is 8.7 MT/ ha (Anonymous, 2017) [2]. In Tamil Nadu, mango is cultivated in an area of 1.61 lakh ha, with an average productivity of 7.2 MT/ha (Indian Horticulture Database, 2017). Proper identification of genetic resources is the basic need for carrying out successful improvement work. Continuous studies on performance and evaluation help us to select an ideal cultivar for the specific region, which can help us to promote its cultivation and also help to fetch good price in the market on the basis of its quality characters.

Development of mango hybrids that are efficient in nutrient utilization, provide better return and endure adverse environmental conditions, forms the major objective of modern fruit breeding (Khan, 2004) [5]. An ideal mango cultivar should have characters like precocious, dwarf, regular and prolific bearing, early flowering and fruit setting, attractive fruit color and size, resistance to major diseases and other biotic and abiotic stresses (Litz, 2009) [7]. Flowering in mango is preceded by the differentiation of the flower bud in the shoots. Apart from the inherent character of the variety, the time of flowering in different regions is mainly governed by the local climatic conditions. In Northern India the duration of flowering in mango is about 20-25 days. The time and intensity of flowering greatly determines the fruit set. (Davenport 2007) [3]. Fruit set is a varietal character, depending upon several factors such as time of flowering, sex ratio, efficient cross pollination and intensity of drop. Evaluation forms an important aspect for studying the constant performance of genotypes in a particular environment.

In this study, the open pollinated progenies which produced flowers throughout the year were observed and qualitative and quantitative characters were recorded in different seasons.

Materials and Methods

Plant material

Evaluation of open pollinated mango seedling progenies was carried out from 2019-2020 in farmer's field, Annur, Coimbatore. Variability present among the twenty five genotypes was studied through morphological markers, fruit parameters and yield attributes. Ten genotypes were selected for biochemical analysis.

Morphological characterization

The fruit morphology was examined over 25 genotypes, the observation on fruit characters were taken from ten fruits per cluster selected at random and mean value was recorded. Fruit clustering habit was recorded at the time of harvesting and classified into solitary and clusters.

Fruit weight was recorded in ten fruits of variable size which were randomly selected to calculate the mean weight of fruits and expressed in gram (g). Volume of fruit was estimated by water displacement method and expressed as cubic centimetre (cc). Number of fruits per cluster was observed as average of ten randomly selected clusters from each tree. Length of the fruit was assessed by the distance between the base and the apex of ten randomly selected fruits was measured and the average was expressed as centimetre (cm). Width of the fruit was recorded by the Width of ten randomly selected fruits was measured around the midpoint of the fruit and the average was expressed as centimetre (cm). The pulp was separated in five fully ripened fruits by excluding the peel and stone and weighed and expressed in gram to record the pulp weight. The peel weight of fruit was taken after removing the pulp and stone in ten fruits and expressed in gram. The stone was taken out from the ripe fruits excluding peel and pulp in ten fruits and weighed and was expressed in gram. Then the pulp was weighed. Content of pulp was calculated by Pulp percent = weight of the pulp/ weight of whole fruit x 100. Stone percent was calculated by ten selected fruit samples were weighed. Then the stone was weighed separately. Content of stone was calculated by Weight of the seed (g) / Weight of the whole fruits (g) and it is expressed as percent. Pulp and stone weight were recorded for each sample and pulp/seed ratio was worked out by Weight of the pulp (g) / Weight of the seed. The yield of fruits from each plant was assessed by weighing the fruits harvested separately and expressed as kg per plant.

Biochemical analysis of the fruits

Total soluble solids was recorded directly by using a digital refractometer (range 0-32º brix) and expressed as degree brix (ºbrix). Anthocyanin content in the selected fruit sample was calculated by, 520 x Dilution factor x Final extract volume x 1000 / 500 x100 x Homogenate weight. The total sugars, reducing sugars, non-reducing sugars and ascorbic acid were estimated as per the method suggested by Somogyi (1952) and expressed as percentage (%). The titratable acidity was estimated by titrating a known weight/volume of the sample against 0.1N NaOH solution using phenolphthalein as an indicator for all the samples. The titratable acidity was calculated and expressed as per cent citric acid (Ranganna, 1997) [8].

Results and Discussions

Observation on fruit parameters

Mango flowered throughout the year with three consecutive seasons and fruits matured at October-November and January–February and April- May. Data related to fruit parameters were observed in three different seasons. According to variety and growth conditions, mango fruits varied in shape, size, weight and other parameters (Fig 1). Weight of a fruit is considered to be an important factor in judging its compactness, maturity, juice content and levels of chemical constituents. The weight of fruit also determines its acceptance to consumers and thereby the market price of it. Mean fruit weight of the selected genotypes was 111.33g, 113.32g and 113.02g (Table 1, 2 & 3) in three different seasons. Highest fruit weight was registered in Annur-10 (143.00g, 144.03g and 145.60g) in three seasons (Table 1, 2 &3). Mean fruit length of the selected genotypes were 8.61 cm, 8.61cm and 8.84 cm with the highest fruit length recorded in Annur -10(9.87 cm, 9.82 cm and 8.84 cm in three seasons(Table 1,2 &3). Lowest fruit weight was recorded in Annur-1 in all the season. The variation in length (11.50-6.86) and width (10.96-5.37) of fruit in mango was also observed by Kher and Sharma (2002) [6] and Abirami *et al.* (2008) [1].

In the market, the consumers have a preference to select the large sized fruits and accordingly the price of those fruits goes higher with size. Higher pulp percentage is a desirable character for table purpose and for breeding quality fruits. Annur 10 recorded the highest fruit breadth (19.55cm, 19.50 cm and 19.97cm), fruit volume (102.36cc, 105.32cc and 103.32cc), Pulp weight (92.25g,93.25g and 94.31g) and peel weight (32.21g, 32.21g and 32.21g) (Table 1, 2 & 3). In crop improvement, yield is one of the most important traits by which a genotype or variety will be evaluated. Wide variation in yield with different collections is due to the genetic makeup of plant and environmental factors such as location, maximum and minimum temperature, frequency of rainfall and relative humidity (Singh and Singh, 2012). Mean yield of selected genotypes were 38.55, 44.10 and 45.94 kg/tree. Among the genotypes Annur-5 observed the highest number of fruits and yield per tree. Annur 5 recorded 528, 506 and 528 number of fruits with comparatively higher yield of 58.69, 58.44 and 61.20 kg/tree (Table 1, 2 & 3). Annur -2 observed the lowest yield 26.47, 29.09 and 28.46 kg/tree (Table 1, 2 & 3).

Table 1: Fruit parameters of mango genotypes -Season 1 (Oct- Nov'2019)

Genotypes	Fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Fruit Volume (cc)	Pulp weight (g)	Peel weight (g)	Stone weight (cm)	Pulp to peel ratio	Pulp to stone ratio	Number of fruits per tree	Fruit yield per tree (kg/tree)
Annur-1	101.00	8.30	17.51	66.12	57.82	25.12	18.06	2.30	3.20	338	34.13
Annur-2	103.00	8.44	17.87	68.24	60.37	24.55	18.08	2.45	3.33	257	26.47
Annur-3	112.50	8.75	17.70	71.23	65.24	26.65	20.61	2.44	3.16	305	34.31
Annur-4	107.60	8.30	17.44	66.45	61.28	26.22	20.10	2.33	3.04	264	28.40
Annur-5	109.50	8.42	16.85	65.21	63.25	25.41	20.84	2.48	3.03	526	58.69

Annur-6	108.20	8.50	16.33	68.12	63.05	26.34	18.81	2.39	3.35	284	30.72
Annur-7	100.50	8.64	17.37	62.15	60.20	24.42	15.88	2.46	3.79	329	33.06
Annur-8	113.50	7.41	18.40	70.18	65.78	28.78	18.94	2.28	3.47	451	51.18
Annur-9	114.50	9.50	17.82	72.45	66.30	28.90	19.30	2.29	3.43	446	51.06
Annur-10	143.00	9.87	19.55	102.36	92.25	32.21	18.54	2.86	4.97	423	56.48
Mean	111.33	8.61	17.68	71.25	65.55	26.86	18.91	2.42	3.47	342.30	38.55
Std. Dev	12.201	0.675	0.867	11.342	9.767	2.440	1.450	0.169	0.571	72.831	11.465
Std. Error Mean	3.858	0.2136	0.2741	3.586	2.901	0.771	0.458	0.053	0.1818	23.031	3.624
CV	0.113	0.0382	0.049	0.159	0.149	0.9	0.076	0.069	0.164	0.021	0.297

Table 2: Fruit parameters of mango genotypes- Season 2 (Jan-Feb'2020)

Genotypes	Fruit weight(g)	Fruit length (cm)	Fruit breadth(cm)	Fruit Volume (cc)	Pulp weight (g)	Peel weight (g)	Stone weight (cm)	Pulp to peel ratio	Pulp to stone ratio	Number of fruits per tree	Fruit yield per tree (kg/tree)
Annur-1	102.05	8.61	17.52	68.77	58.80	25.12	18.06	2.34	3.25	353	33.67
Annur-2	103.55	8.44	17.86	68.28	60.37	25.10	18.08	2.40	3.33	281	29.09
Annur-3	115.65	8.38	17.70	74.23	68.24	29.05	23.71	2.34	2.87	489	56.55
Annur-4	109.67	8.35	17.44	66.88	62.28	27.20	20.12	2.28	3.09	275	30.15
Annur-5	115.54	8.47	16.82	65.85	66.25	21.45	22.84	3.08	2.90	506	58.44
Annur-6	109.20	8.52	16.35	68.23	63.15	26.36	18.84	2.39	3.35	295	32.21
Annur-7	101.52	8.60	17.35	62.45	60.21	25.42	15.88	2.36	3.79	339	34.41
Annur-8	116.50	7.45	18.46	70.26	66.78	29.78	19.94	2.24	3.34	458	53.35
Annur-9	115.57	9.53	17.84	72.21	67.30	28.90	19.30	2.32	3.48	452	52.23
Annur-10	144.03	9.82	19.50	105.32	93.25	32.21	18.54	2.89	5.02	423	56.92
Mean	113.32	8.61	17.684	72.248	66.663	27.059	19.531	2.464	3.442	387.1	44.102
Std. Dev	12.295	0.6525	0.8615	12.070	9.9138	3.046	2.310	0.282	0.616	88.713	13.162
Std. Error Mean	3.880	0.206	0.272	3.810	3.134	0.963	0.730	0.089	0.194	28.055	4.161
CV	0.108	0.075	0.048	0.167	0.148	0.112	0.118	0.114	0.178	0.229	0.298

Table 3: Fruit parameters of mango genotypes (April-May'2020)

Genotypes	Fruit weight(g)	Fruit length(cm)	Fruit breadth(cm)	Fruit Volume (cc)	Pulp weight (g)	Peel weight (g)	Stone weight (cm)	Pulp to peel ratio	Pulp to stone ratio	Number of fruits per tree	Fruit yield per tree (kg/tree)
Annur-1	103.45	8.45	17.90	69.77	59.80	25.53	18.09	2.34	3.30	405	41.89
Annur-2	103.51	8.51	17.95	67.28	60.33	25.10	18.08	2.40	3.34	275	28.46
Annur-3	112.75	8.63	17.81	75.23	69.29	29.75	23.71	2.33	2.92	384	43.29
Annur-4	110.91	8.52	17.65	69.88	63.29	27.50	20.12	2.30	3.15	260	28.83
Annur-5	115.92	8.61	16.97	66.85	69.25	22.75	22.88	3.04	3.03	528	61.20
Annur-6	111.54	8.84	16.55	69.23	64.25	27.33	19.90	2.35	3.23	395	44.05
Annur-7	117.50	8.77	17.60	63.45	69.96	28.98	18.89	2.41	3.70	418	49.11
Annur-8	118.97	7.80	18.67	72.26	69.00	29.99	19.99	2.30	3.45	468	55.67
Annur-9	115.85	9.71	17.90	73.21	67.30	28.90	19.60	2.33	3.43	442	51.20
Annur-10	145.60	10.00	19.97	103.32	94.31	32.21	18.54	2.93	5.09	383	55.76
Mean	115.6	8.784	17.897	73.048	68.678	27.804	19.98	2.473	3.464	395.8	45.94
Std. Dev	11.813	0.634	0.926	11.160	9.766	2.766	1.913	0.273	0.6129	80.787	10.989
Std. Error Mean	3.73	0.212	0.292	3.529	2.906	0.877	0.604	0.086	0.193	25.54	3.47
CV	0.102	0.072	0.051	0.152	0.142	0.099	0.095	0.11	0.176	0.2	0.23

Table 4: Quality Parameters of mango genotypes-Season 1 (Oct- Nov'2019)

Genotypes	TSS (%)	Titratable Acidity (%)	Total sugars (%)	Reducing sugars (%)	Non Reducing sugars (%)	Ascorbic acid (mg $100g^{-1}$)
Annur-1	11.84	0.87	12.45	4.12	8.33	25.60
Annur-2	11.35	0.91	11.24	4.40	7.31	28.31
Annur-3	13.19	0.65	13.58	4.15	9.43	23.80
Annur-4	12.87	0.89	12.72	3.42	9.30	24.37
Annur-5	14.25	0.60	14.35	4.53	9.82	22.65
Annur-6	11.91	0.86	12.25	4.21	8.24	25.96
Annur-7	12.35	1.12	11.82	4.21	7.61	31.24
Annur-8	13.58	0.93	11.71	3.12	8.12	29.57
Annur-9	12.53	0.88	12.55	4.32	8.23	27.60
Annur-10	13.64	0.76	12.92	4.21	8.70	24.33
Mean	12.75	0.84	12.55	3.96	8.60	26.34
Std. Dev	0.921	0.147	0.914	0.441	1.018	2.760
Std. Error Mean	0.291	0.046	0.289	0.139	0.32	0.872
CV	0.072	0.174	0.072	0.111	0.118	0.104

Table 5: Quality Parameters of mango genotypes (Jan-Feb'2020)

Genotypes	TSS (%)	Titratable Acidity (%)	Total sugars (%)	Reducing sugars (%)	Non Reducing sugars (%)	Ascorbic acid (mg $100g^{-1}$)
Annur-1	11.95	0.88	12.80	4.41	8.39	23.61
Annur-2	11.45	0.88	11.20	4.45	7.33	28.35
Annur-3	13.80	0.65	14.35	4.15	9.40	22.85
Annur-4	12.85	0.77	12.75	3.43	9.32	23.32
Annur-5	14.57	0.54	14.51	4.50	10.01	21.60
Annur-6	11.90	0.86	12.24	4.22	8.02	23.95
Annur-7	11.82	1.04	11.87	4.21	7.66	30.20
Annur-8	12.95	0.93	11.74	3.10	8.10	26.50
Annur-9	12.51	0.71	12.38	4.35	8.03	25.62
Annur-10	11.65	0.76	12.91	4.20	8.71	22.31
Mean	12.54	0.80	12.67	3.99	8.57	24.83
Std. dev	1.012	0.145	1.066	0.471	1.027	2.786
Std. Error Mean	0.321	0.045	0.337	0.148	0.324	0.881
CV	0.081	0.18	0.084	0.117	0.119	0.112

Table 6: Quality Parameters of mango genotypes (April-May'2020)

Genotypes	TSS (%)	Titratable Acidity (%)	Total sugars (%)	Reducing sugars (%)	Non Reducing sugars (%)	Ascorbic acid (mg $100g^{-1}$)
Annur-1	12.84	0.81	12.86	4.33	8.53	24.12
Annur-2	12.15	0.86	11.54	4.45	7.50	27.85
Annur-3	14.27	0.77	13.72	4.32	9.40	22.20
Annur-4	13.15	0.89	12.91	3.40	9.51	23.91
Annur-5	14.88	0.59	14.88	4.51	10.37	22.18
Annur-6	12.30	0.85	12.54	4.32	8.22	25.52
Annur-7	11.95	1.15	11.95	4.23	7.72	30.01
Annur-8	13.55	0.92	11.94	3.32	8.22	29.17
Annur-9	13.16	0.86	12.49	4.35	8.14	27.40
Annur-10	11.97	0.75	12.92	4.22	8.70	24.80
Mean	13.02	0.84	12.77	4.08	8.68	25.71
Std. Dev	0.994	0.142	0.965	0.406	1.017	2.775
Std. Error Mean	0.314	0.044	0.305	0.128	0.321	0.876
CV	0.076	0.168	0.075	0.099	0.117	0.107

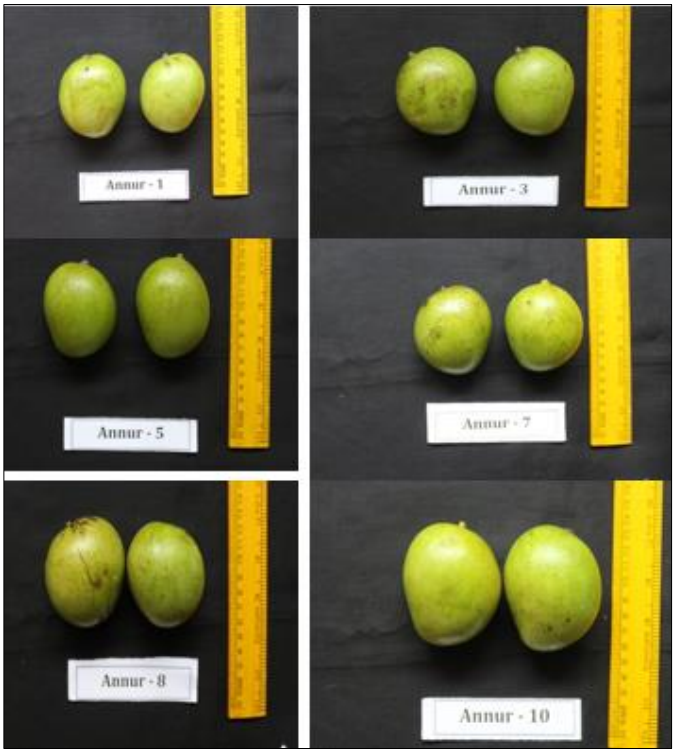

Fig 1: Open pollinated mango fruits

Observation on Quality parameters

Total soluble solids are measure of the amount of material dissolved in water. This material can include carbonate, bicarbonate, chloride, sulphate, phosphate, nitrate, calcium, magnesium, sodium, organic ions and other ions. Among the ten genotypes selected for biochemical analysis, the m, ean value of total soluble solids were 12.75, 12.54 and 13.02^{o}brix. highest TSS recorded in Annur-5 with the value of 14.25, 14.57 and14.88 ^{o}brix. Lowest TSS recorded in Annur-2 with the values of 11.35, 11.45 and 12.15 ^{o}brix in three seasons (Table 3, 4 & 5). Annur -5 recorded the highest Total sugars (14.35%, 14.51% and 14.88%), reducing sugars (4.53%, 4.50% and 4.51%) and Non reducing sugars (9.82%, 10.01% and 10.37%) (Table 3, 4 & 5). Annur-2 recorded the lowest total sugar content (Table 3, 4 & 5). The TSS and acidity content as re-ported in present study were similar to those of Palaniswamy *et al*. (1975). The similar findings have also been reported by Mitra *et al.* (2001) [9], Dhillon *et al*. (2004) [4], Sharma and Josan (1995) [10] and Kher and Sharma (2002) [6] while working on fruit quality characters of different mango varieties under different climatic conditions. Mean ascorbic acid content for selected genotypes were 26.34, 24.83 and 25.71 mg $100g^{-1}$ in three different seasons where Annur-7 recorded the highest ascorbic acid content 31.24, 30.20 and 30.01 mg $100g^{-1}$(Table 3, 4 & 5). Lowest ascorbic acid content was recorded in Annur-5 (22.65, 21.60 and 22.18 mg $100g^{-1}$) in three different season (Table 3, 4 & 5). The categorization of genotypes can help to short out the similarity in their traits observed based on quality parameters. However these quality traits may vary from time to time and region to region, as the performance and quality of fruit is favored depending upon the favorable environmental conditions, and expression of the genes responsible for the desired traits. Therefore constantly the evaluation studies need to be taken to short out the best genotype for a region.

Conclusion

On the basis of findings of the present study, it can be concluded that the significant variation exist within the genotypes based on physico-chemical characters. Annur-10 showed highest fruit weight, fruit length, fruit volume, fruit breadth, Pulp weight and peel weight but it showed greater variation among the genotypes and yield less compared to Annur-5. Where, Annur-5 registered increased no. of fruits, yield parameters and quality attributes among the genotypes. It showed better uniformity among the other genotypes and can highly used for culinary purpose. The cultivation of non-seasonal bearing genotype generates more revenue to the farmers and also makes revolutionize in mango improvement programme.

References

1. Abirami K, Nacheggowda V, Reddy YTN. Physico-chemical attributes of certain polyem-bryonic varieties of mango. South Indian Hort 2004;52(1/6):291-296
2. Anonymous. Horticultural Statistics at a Glance Na-tional Horticulture Board, Tamil Nadu, 2017.
3. Davonport. Braz. J Plant Physiol 2007;19(4):363-376.
4. Dhillon WS, Sharma RC, Kahlon GS. Evaluation of some mango varieties under Punjab con-ditions. Haryana J of Hort. Sci 2004;33(3-4):157-159
5. Khan MD. Advances in mango hybridization. In: Mangoes in Pakistan. (Ed.): S. Ahmed 2004.
6. Kher R, Sharma RM. Performance of some mango cultivars under sub-tropical rainfed regions of Jammu. Haryana J of Hort. Sci 2002;31(1/2):8-9.
7. Litz RE. The Mango Botany Production and Uses, 2nd edition, CABI International, 2009, 58-69.
8. Ranganna S. Handbook of analysis and quality control for fruit and vegetable products: Tata McGraw-Hill Education, 1977, 124-125.
9. Mitra S, Mitra SK. Studies on physico-chemical characteristics of 19 mango varieties grown in West Bengal. Indian Agriculturist 2001;45(3/4):215-219.
10. Sharma JN, Josan JS. Performance of mango cultivars under arid irrigated regions of Punjab. Indian J of Hort 1995;52(3):179-181.