

## Evaluation of Some Mango Strains Growing under Ismailia Conditions

Naglaa. K. H. Serry.

Horticulture Department, Faculty of Agriculture., Suez Canal University, Egypt.

---

**Abstract:** Fullbloom dates, susceptibility to floral malformation, alternate bearing habit, harvest date, proper maturity and shelf life, tree productivity and fruit quality of ten mango strains were studied. The ten strains seem to be promising, they were free from floral malformation, high productive and possessed good fruit quality attributes. The evaluation indicates that strains No. 6, 9 and 4 may be recommended as new superior mango cultivars to be grown commercially in Ismailia governorate and all over zones of Egypt. Besides, these three strains had some desired traits suited to the international quality standard.

**Key words:** Mango (*mangifera indica L.*) – evaluation – fruit quality – Fullbloom – maturity – shelf life – alternate bearing habit

---

### INTRODUCTION

Mango (*mangifera indica L.*) is a very popular fruit in many countries especially Egypt. It is truly called the 'King of fruits, it is a very high fruit consumption because it is delight all senses. There are many health benefits of mango fruit, and it can be used at all stages of development, raw fruit is used for the extraction of tannins and other astringents, curries, cold drink and pickles. They are rich in vitamins C & B complex, Beta carotene precursor of vitamin A, minerals and fatty acids.

In Egypt, mango industry has recently increased in area and production. Nowadays a total of 190 thousand feddans<sup>[8]</sup>. However, it is characterized by some problems which have been identified as being the most serious faced by producers today: malformation, alternate bearing, low yield and lack of postharvest technology. In addition, Increasing awareness of quality and enhanced perspicacity of consumer are leading a strong drive for improved quality of mango fruit in both the fresh market and the food industry. So, "selection" of some strains is considered the first step in improving mango production. Therefore, the main goal of this study is to describe the main characters of trees and fruits of promising strains.

### MATERIALS AND METHODS

This study was carried out during the period from 2007 to 2009 on 20- years old seedling trees of mango planted in sandy soil 7meters apart and subjected to regular orchard management<sup>[6]</sup> at El-Qssassene area - Ismailia Governorate. A preliminary study was carried

out on 2007 to select the high yield seedling trees, regular productivity and bearing, free from malformation and good fruit attributes.

Fullbloom dates, susceptibility to floral malformation, alternate bearing habit, harvest date, proper maturity and shelf life, Tree productivity and fruit quality of each individual tree were determined as follow :-

Fullbloom dates were recorded when about 75 % of the terminal buds reached the burst stage.

Maturity stage was assessed; also weeks from Fullbloom to maturity stage were counted for each strain in the three studied seasons.

Seasonality, the productive timing with the current ten seedling mango trees appears to be closely grouped the period of August (early mid season), September (mid season), and up to end- October (late season).

Survey and evaluation of mango malformation were done in complete differentiation by counted the number of healthy and malformed panicles during the flowering duration (March & April) for each tree, then calculated with respect to the total number of panicles as follow:-

$$\text{Floral malformation \%} = 100 \times \frac{\text{malformed panicles}}{\text{total number of panicles}}$$

The yield (weight of fruits Kg/ tree) was employed for estimate alternate bearing habit for each individual tree according to the equation suggested by Wilcox<sup>[12]</sup> on Apple and Singh<sup>[11]</sup> as follow:-

## RESULTS AND DISCUSION

$$\text{Biennial bearing index} = 100 \times \frac{\text{Differences between two yeilds}}{\text{sum of two yeilds}}$$

If the index is more than 50%, this means that the tree is in alternate bearing (off-year) while the tree is in regular bearing (on-year) if the index is less than 50%.

Fruit quality was estimated by (weight, fruit dimension, firmness, % pulp, % SSC, %acidity, vitamin C, total sugars, total phenols, color and type of embryo.

The shelf life of 50 fruits from each strain packed in carton boxes, then held at ambient temperature at (25 ± 1°C) and 65% RH was assessed. Consumer acceptance was judged at the ripe stage after shelf life, taste was scored from 1- dislike extremely to 9 – like extremely through sensorial panel of 20 tasters.

Acceptance percentage was calculated as the number of fruit in like extremely category in relation to the total number of fruit. The following equation was used:-

$$\text{Acceptance\%} = \frac{\text{No. of fruits per each degree of liking}}{\text{Total No. of fruits in each treatment}} \times 100$$

**General Evaluation of the Seedling Trees:** The seedling trees belonging to each strain were evaluated with each other on the basis of 100 units for each. The units were divided between tree yield (50 units) alternate bearing habit (20) and for each of total sugars, ascorbic acid and seasonality a score of 10 was assigned. When evaluating each property, the best grade had the maximum points while the worst grade equaled to zero. Other grades had values depending upon the range between the two extremes. In this respect, the highest values for each yield, total sugars and ascorbic acid percentage were considered the best properties. The contrary was true for values of biennial bearing index, malformation and total phenols. The final grade was calculated by summing the various points of the different characteristics for each tree. The following equation was used to determine these characters:-

$$\text{Characters} = \sum \frac{A}{B} \times \text{score units}$$

\*A: the highest value recorded for studied character among all treatments (lowest for biennial bearing index)

\*B: the value which recorded for the specific character for considered treatments.

Data illustrated in table (1) shows the dates of Fullbloom, maturity and weeks from Fullbloom to maturity of the ten evaluated mango seedlings, it is clear that s6 & s9 recorded the longest period(25 week) compared with the other strains, they were followed by s7 which recorded (24 week). While, the lowest period noticed with S2, S3, S5 and S10 (20 week). As for seasonality, strains of 2, 5, 6 and 10 are considered early mid season, while strains of 1, 3, 7 and 8 are mid season. In general, these strains cover a long period in the season extend from August to October (Table 1).

Floral malformation is most important than vegetative because it directly hits the yield of the plants leaving unproductive inflorescence. As an average of three years, data in (Table 2) indicate that, the percentage of malformed panicles ranged from 0 - 3%. The strains of 2, 3, 4, 8, 9 and 10 are free from malformation and did not show any symptoms all along the three seasons of study. Inspite of 1, 5, 6, 7 and 10 strains showed flowering malformation, there percentages are considered relatively low and did not affect the yield.

Fruit yield of the different strains was recorded every season (Table 2). Generally, all strains produced relatively high yield ranged from 210 – 330 Kg/tree. Strains 6, 8 and 9 showed the highest fruit yield. It can be concluded that all the studied strains are commercially ones and may achieve good benefits in mango industry either in fresh market or food processing.

Fruit quality parameters of the ten strains are shown in (Table 2). It seems that the different strains produce higher fruit weight ranging from 440 – 610 g/fruit. This means that the fruit are in the range of medium to bigger sized fruit. This parameter could be insured in terms of fruit dimensions in both length (10.1 – 13.2 cm) and width (7.6 – 9.2 cm).

Fruit firmness is one of the most important parameters, the greater the firmness, the greater the quality of the fruit. It was differed in the evaluated strains and ranged from 5.8 to 8.2 (lb/in<sup>2</sup>).

The highest pulp percentage was 78.5 for strain 6 in the second season, whereas the lowest pulp percentage was 64.5 for strain 7 in the first season. In general, the strains have pulp percentage more than 70% are desirable for fresh consumption and processing.

Titrate acidity ranged from 0.3 to 1.0 % and SSC of fruits were 15.1 to 17.7 %. The different strains contain high percentage of SSC and the highest value was 18% for strain 6 in the third season. SSC percentages reflect the richness of the studied strains in this regard and consequently excellent taste. It is worth

**Table 1:** Dates of fullbloom of seedling mango trees and maturity stage of fruits from 2007 to 2009 seasons

Strain No.	Date of Fullbloom			Date of maturity			weeks from Fullbloom to maturity			Seasonality
	first season	second season	third season	first season	second season	third season	first season	second season	third season	
S1	3 <sup>rd</sup> week March	4 <sup>th</sup> week March	3 <sup>rd</sup> week March	September	September	September	21	20	21	Mid season
S2	2 <sup>nd</sup> week March	3 <sup>rd</sup> week March	3 <sup>rd</sup> week March	August	August	August	21	20	20	Early mid season
S3	3 <sup>rd</sup> week March	4 <sup>th</sup> week March	4 <sup>th</sup> week March	September	September	September	21	20	20	Mid season
S4	1 <sup>st</sup> week April	2 <sup>nd</sup> week April	1 <sup>st</sup> week April	October	October	October	25	24	25	Late season
S5	2 <sup>nd</sup> week March	3 <sup>rd</sup> week March	3 <sup>rd</sup> week March	August	August	August	21	20	20	Early mid season
S6	3 <sup>rd</sup> week March	4 <sup>th</sup> week March	3 <sup>rd</sup> week March	August	August	August	21	20	21	Early mid season
S7	3 <sup>rd</sup> week March	4 <sup>th</sup> week March	4 <sup>th</sup> week March	September	September	September	24	23	23	Mid season
S8	4 <sup>th</sup> week March	1 <sup>st</sup> week April	1 <sup>st</sup> week April	September	September	September	22	21	21	Mid season
S9	1 <sup>st</sup> week April	2 <sup>nd</sup> week April	1 <sup>st</sup> week April	October	October	October	25	24	25	Late season
S10	3 <sup>rd</sup> week March	4 <sup>th</sup> week March	3 <sup>rd</sup> week March	August	August	August	21	20	20	Early mid season

**Table 2:** Some characteristics of ten seedling mango trees and their fruit quality from 2007 to 2009 seasons.

Strain No.	% malformed panicles	Yield weight (Kg)/tree	Fruit weight (g)	Length (cm)	width (cm)	firmness (lb/in <sup>2</sup> )	% pulp	% acidity	% SSC	Vitamin C*	T. Sugars*	T. Phenols*
season 2007												
S1	3	260	550	11.6	7.6	7.5	71.7	14.8	0.45	55	12.2	66
S2	0	255	520	11.0	8.1	6.2	66.9	16.4	0.40	48	13.8	63
S3	0	221	580	10.7	8.0	6.0	67.1	16.8	0.50	36	14	77
S4	0	267	520	11.1	8.0	6.5	65.9	17.2	0.34	58	14.2	84
S5	2.5	268	480	10.1	8.0	7.8	71.7	16.8	0.25	48	14.2	70
S6	3	330	605	14.5	8.9	5.8	77.9	17.6	0.30	56	14.6	68
S7	1.5	218	515	11.9	8.0	7.3	65.8	17.0	0.28	48	13.6	65
S8	0	310	465	12.3	8.9	7.4	64.5	16.8	0.85	44	12.8	80
S9	0	311	510	11.6	8.6	6.1	70.6	17.2	1.00	38	13.8	74
S10	0	265	440	12.5	9.1	6.6	66.9	16.8	0.60	54	13.2	77
season 2008												
S1	2.5	254	540	11.5	7.8	8.2	72.0	15.2	0.38	60	12	64
S2	0	248	533	11.2	8.2	6.3	71.2	16.8	0.45	46	13.2	60
S3	0	212	574	10.8	8.3	6.6	66.5	17.2	0.55	38	14	82
S4	0	254	515	11.3	8.1	6.4	70.0	17.4	0.35	66	13.8	88
S5	2	251	488	10.2	8.0	8.5	73.2	17	0.28	54	12.5	75
S6	2.1	319	610	14.6	9.1	6.2	78.5	17.6	0.35	62	14.2	72
S7	0	210	520	12.2	8.2	7.7	66.2	16.4	0.36	44	12.6	66
S8	0	300	465	12.6	8.8	7.6	64.8	16.8	0.80	46	13.5	84
S9	0	286	520	11.8	8.5	6.5	74.3	17.2	0.90	42	13.2	77
S10	0	254	465	13.1	9.0	6.4	71.0	17.4	0.65	55	13.5	80

**Table 2:** Continue

season 2009												
S1	2.2	242	565	12.1	8.1	7.7	70.6	15.4	0.42	58	12.8	66
S2	0	237	544	11.6	8.3	6.6	73.1	17.2	0.50	48	13.2	64
S3	0	206	585	11.1	8.1	6.8	67.8	16.8	0.50	42	13	83
S4	0	244	524	11.6	8.0	7.0	72.1	17.2	0.44	64	14.2	86
S5	2.5	244	490	10.5	9.2	8.4	74.2	16.6	0.34	55	13.4	77
S6	2	308	622	14.5	8.4	6.7	77.6	18	0.40	64	14.5	76
S7	0	201	522	12.6	8.6	8.2	69.3	16.6	0.38	48	13.2	64
S8	0	286	477	12.7	8.5	7.4	65.8	16.8	0.90	48	12.6	82
S9	0	275	530	11.6	9.1	6.8	74.6	17.4	1.10	44	13.8	80
S10	0	243	477	13.2	8.6	7.0	72.6	17.6	0.70	60.0	13.4	82

\* mg/100 ml juice

to mention that total sugars took the same trend of SSC. Similarly, strain 6 recorded the highest total sugars percentage in the third season. With respect to vitamin C, it ranged from 38.7 to 62.7 mg/100 ml juice (Table 3). As fruit coloration, it could be safely concluded that strains 1, 3, 7 and 10 had attractive fruit color ranging from yellow to yellowish orange with red blush. The rest of strains ranged from light green to orange, (Table 4). So, in mango, peel color plays an important role in the perception of an overall quality, it is considered the first category could get special advantage in fresh fruit market specially in the export market.

Shelf life (days after harvest at  $(25 \pm 1^\circ\text{C})$  and 65% RH, ranged from 5 – 8 days. In addition, weight loss percentages ranged from 5.6 – 7.9%, fruit firmness, ranged from 2.4 – 4.2 (lb/in<sup>2</sup>). Concerning the effect of shelf life on consumer acceptance percentage of mango fruits at  $(25 \pm 1^\circ\text{C})$  and 65% RH, it was observed that the best percentages were in strains No 5, 6 scored (95.7%) . The other percentages ranged from 86 – 93.3 % (Table 5). Thus, the fruits had a very good taste, texture flavor and overall acceptance.

It is quite evident from (Table 6), general evaluation of the ten studied strains, that strain No. 6 attained the highest score (97.7 %) and ranked first,

**Table 3:** Some characteristics of ten seedling mango trees and their fruit quality (average of three seasons).

Strain No.	% malformed panicles	Yield weight (Kg)/tree	Fruit weight (g)	Length (cm)	width (cm)	firmness (lb/in <sup>2</sup> )	% pulp	% acidity	% SSC	Vitamin C*	T. Sugars*	T. Phenols*
S1	2.6	252.0	551.7	11.7	7.8	7.8	71.4	15.1	0.4	57.7	12.3	65.3
S2	0.0	246.7	532.3	11.3	8.2	6.4	70.4	16.8	0.5	47.3	13.4	62.3
S3	0.0	213.0	579.7	10.9	8.1	6.5	67.1	16.9	0.5	38.7	13.7	80.7
S4	0.0	255.0	519.7	11.3	8.0	6.6	69.3	17.3	0.4	62.7	14.1	86.0
S5	2.3	254.3	486.0	10.3	8.4	8.2	73.0	16.8	0.3	52.3	13.4	74.0
S6	2.4	319.0	612.3	14.5	8.8	6.2	78.0	17.7	0.4	60.7	14.4	72.0
S7	0.5	209.7	519.0	12.2	8.3	7.7	67.1	16.7	0.3	46.7	13.1	65.0
S8	0.0	298.7	469.0	12.5	8.7	7.5	65.0	16.8	0.9	46.0	13.0	82.0
S9	0.0	290.7	520.0	11.7	8.7	6.5	73.2	17.3	1.0	41.3	13.6	77.0
S10	0.0	254.0	460.7	12.9	8.9	6.7	70.2	17.3	0.7	56.3	13.4	79.7

\* mg/100 ml juice

**Table 4:** Type of embryo and peel color of ten evaluated seedling mango trees

Strain No.	Type of embryo	color
S1	Poly	yellow with red blush
S2	mono	yellow orange
S3	Poly	orange yellow with a bright red blush
S4	Poly	light green with a yellow spots
S5	mono	yellow
S6	Poly	light green
S7	mono	yellow with a red cheek
S8	Poly	yellowish green
S9	mono	orange with yellow spots
S10	Poly	orange with red cheek

**Table 5:** Changes in mature mango fruit characteristics after held at (25°C&RH 65%) average of three years

Strain No.	Shelf life(days after harvest* at 25°C&RH 65%)	% weight loss	firmness (lb/in <sup>2</sup> )	% Consumer acceptance
S1	7	7.9	2.4	86.0
S2	8	6.4	3.3	89.7
S3	7	7.2	3.6	86.0
S4	6	7.9	3.3	89.7
S5	5	6.6	3.0	95.7
S6	5	5.6	3.5	95.7
S7	5	5.8	3.7	90.0
S8	7	6.4	3.7	88.0
S9	5	6.1	4.2	92.0
S10	8	7.8	3.7	93.3

\*harvest at maturity stage

closely followed by strain No. 9 (89.3 %) occupied the second rank, and strain No. 4 occupied the third rank (81.4 %).

The evaluation of mango cultivars was achieved by many researches such as Kakar *et al*<sup>[9]</sup> who studied some morphological characteristics of mango fruit cultivars, Chaikiattiyos *et al*<sup>[2]</sup> who assessed about 320 “Kaew” clones collected from different areas in Thailand and selected some clones with superior horticultural characteristics for further evaluation, Desai & Dhandar<sup>[4]</sup> studied the variation in physico-chemical and morphogenetic characters of some mango cvs of Goa, India. Mitra *et al*<sup>[10]</sup> determined the chemical composition of seven cvs and four hybrids of mature mango fruit grown in west Bengal, India and El-

Wakeel *et al*<sup>[7]</sup>, who estimated seven mango cvs under east coast conditions of “United Arab Emirates”

**Conclusion:** All mango strains differed in dates of Fullbloom, maturity stage, respect to bearing habit, floral malformation and fruit characteristics. Commonly, All strains have a commercially acceptable qualities and produced relatively high yield ranged from 210 – 330 Kg/tree. Generally, the results of this work have shown that the strain No. 6 recorded the highest value (97.7%) in the general evaluation, followed by Strains No. 9 and No. 4 scored (89.3 and 81.4%) respectively. In general, these three strains possessed most of the desired commercial attributes of international standard.

**Table 6:** General evaluation of ten mango strains according to yield (Kg/tree), Biennial bearing index and fruit quality (average of three seasons)

Strain No.	Yield Kg/ tree(50)	Biennial bearing index(20)	*Seasonality	Total sugars(10)	Vitamin C (10)	Total 100%
S1	39.5	3.2	9.0	8.5	9.2	69.4
S2	38.6	3.7	8.0	9.3	7.5	67.1
S3	33.4	17.6	9.0	9.5	6.2	75.6
S4	40.0	11.6	10.0	9.8	10.0	81.4
S5	39.9	14.7	8.0	9.3	8.3	80.2
S6	50.0	20.0	8.0	10.0	9.7	97.7
S7	32.9	3.5	9.0	9.1	7.4	61.9
S8	46.9	4.2	9.0	9.0	7.3	76.5
S9	45.6	17.6	10.0	9.4	6.6	89.3
S10	39.8	9.8	8.0	9.3	9.0	75.8

\*Seasonality, late season = 10 mid season =9, early mid = 8 and early season =10

#### REFERENCE

1. A.O.A.C., 1990. Official Methods Of Analysis. The Association of Official Analytical Chemists. Arlington, West Virginia, USA, 15th Edn Washington D.C.
2. Chaikiattiyos, S., R. Kurubunjerdjit and P. Anupunt, 2000. Improvement and evaluation of the selected, Kaew Sisaket. *Acta Hort.*, 509: 185-192.
3. Crisosto, C.H., G.M. Crisosto, P. Metheney, 2003. Consumer acceptance of 'Brooks' and 'Bing' cherries is mainly dependent on fruit SSC and visual skin color. *Postharvest Biol. Technol.*, 28: 159-167. Davies, B.H., 1976. Carotenoids. In: Goodwin, T.W. (Ed.), *Chemistry and Biochemistry*
4. Desai, A.R. and D.G. Dhandar, 2000. Variation in physico-chemical and morphogenetic characters of some mango varieties of Goa. *Proc. Sixth 1 mango Symp. Eds. S. Subhadrabandhu – A. Pichakum. Acta Hort.*, 509, ISHS 2000.
5. El-Khoreiby, A.M.K., 1997. Principal Egyptian mango cultivars. (Mango Sub- Sector Study. RONCO Consortium, Min of Agric. And Land Reclamation, Egypt. ATUT / RONCO publ. No. 9, USAID project.
6. El-Khoreiby, A.M.K., 1998. Mango growing in Egypt (in Arabic). ATUT. Egypt.
7. El- Wakeel, H.F., M.M. Rashid and R.K. Bo Reshid, 2006. Evaluation of some mango cultivars under eastern coast conditions of United Arab Emirates. 10<sup>th</sup> Conf. Agric. Dev. Res., Fac. Agric., Ain Shams Univ., Cairo, Egypt, 2006. *Annals Agric. Sci., Sp.*, 1: 179-190.
8. FAO Production Yearbook, 2007. Food and Agricultural Organization of United Nations. Rome.
9. Kakar, A.A., M.A. Sheekh, G.H. Jamro and M.I. Lango, 1999. Study of morphological characteristics of mango varieties. *Sarhad J. of Agri.* 15(4) 297-298. (c.f. *Hort. Abst.* 70 No. 2-1207).
10. Mitra, S., S. Kunda and S.K. Mitra, 2001. Chemical composition of some varieties and hybrids of mango. *Environment and Ecology*, 19(2): 487-488. (C.f. *Hort. Abst.*, 72: 5-4436).
11. Singh, L.B., 1948. Studies in biennial bearing. *J. Hort. Sci.*, 24: 45-65.
12. Wilcox, J.C., 1944. Some factors affecting apple yields in the Okanagan Valley. *Sci. Agric.*, 25: 189-213 (C.f. *J. Hort. Sci.*, 24(1): 45-65).