

Evaluation of Some Mango Strains under Ismailia Governorate Condition

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THIS INVESTIGATION was carried out during the two successive seasons (2012 and 2013) on fourteen mango strains grown at Motreb Zahran orchard, Abu Sultan, Ismailia Governorate Egypt A.R.E. The studied trees were 16-year-old grown in sandy soil and irrigated with drip irrigation system. Flowering date, malformation percentage, date of fruit maturity, tree productivity and fruit quality were studied. Only three strains seem to be promising (S9, S10 and S11) which they gave highest values of (productivity per tree, fruit weight, percentage of pulp weight and values of T.S.S. and lowest percentage of malformed panicles, seed weight and acidity. The evaluation indicated that, the strains as superiority can be arranged in a descending order as follows: S9, S11 and S10 may be recommended as a new superior mango cultivars.

Keywords: Mongo, Evaluation, Flowering, Productivity, Fruit composition, Fruit quality, Set percentage.

Mango (*Mangifera indica* L.) belongs to family Anacardiaceae is regarded as the most desired fruit in tropical and sub-tropical regions of the world (Anonymous, 2007 and Shafqat *et al.*, 2012) Mango is consumed mainly as a fresh fruit or as a juice. Its nutritional value is great and is considered one of the richest sources of vitamins, mineral salts, enough amounts of carbohydrates, proteins (Abouraya *et al.*, 2011). There are many factors that influence yield, maturity and quality of fruits, the same cultivar can attain different characteristics in different growing condition. Even in the same region, different environmental conditions at different years can affect quality and maturity of the fruit (Devilliers, 1998). Mango world wide are generally poor, ranging from 4 to 9 ton/ha. in the major production countries (Oosthuysen, 1993). This is attributable to wide tree spacing malformation, alternate bearing, environmental factors and fruit drop (Jana and Sharangi, 1998). In Egypt, the area of mango orchards reached 130000 fed. in 2009 year producing about 534434 metric tons of fruit. Many cultivars are grown in Egypt facing many problems in productivity, Improving yield and quality of mango cvs. can be enhanced through breeding, selection and better cultural practices (Said and El-Masry 1992, Mou *et al.*, 2009, Sayed *et al.*, 2009, El-Agmei 2010 and El-Kosary *et al.*, 2011). There is present the seedling tree however, to make some of them more desirable than others must be propagated by budding or grafting to become a true to type horticultural variety (Nafees *et al.*, 2010). Moreover, mango fruit is increasingly becoming well established as an

item of international trade (Singh & Chadha, 1981, Mitra *et al.*, 2001 and Mauca *et al.*, 2009).

This investigation aimed to evaluate some seedling tree to assess some attributes and fruit physical, chemical properties of fourteen mango strains grown under Ismailia Governorate conditions to select the promising ones.

Materials and Methods

This investigation was carried out during two successive seasons (2012 and 2013) on fourteen mango seedling trees grown at Motreb Zahren orchard in Abu Sultan, Ismailia Governorate, Egypt. The observed trees were 16-year-old grown in sandy soil at 6 meters apart and subjected to the normal horticultural practices.

Data were recorded during the two seasons of investigation as follow

Flowering behaviour:

In both studied seasons date of flower bud burst and total number of panicles, also malformed inflorescences per tree was counted after full bloom and the percentage of malformed panicles was estimated as follow:

$$\text{Malformation (\%)} = \frac{\text{number of malformed panicles} \times 100}{\text{Total number of panicles}}$$

Maturity date and tree yield

Days required to fruit maturity, also number of fruit per tree was recorded, and then yield per tree was calculated as Kg.

$$\text{Yield tree} = \frac{\text{Average fruit weight (g)} \times \text{number of fruit/tree}}{1000}$$

Fruit physical characteristics

At harvest date, samples of nine mango fruits (divided in 3 replicates) from each strain were collected randomly and the following properties were examined:

- Peel and pulp colour by using colour chart.
- Peel thickness.
- Pulp content of fiber
- Embryo types (mono or polyembryonic)

Fruit weight, dimensions and shape index

- Fruit weight (g.)
- Fruit length (cm.)
- Fruit diameter (cm.)
- Fruit width (cm.)
- Fruit shape index (fruit length/fruit diameter).

Seed, peel and pulp percentage

At ripening (seed, peel and pulp percentage) weight were recorded then there percentage of fruit were estimated as follow:-

- Seed (%) = $\frac{\text{Seed weight}}{\text{Fruit weight}} \times 100$
- Peel (%) = $\frac{\text{Peel weight}}{\text{Fruit weight}} \times 100$
- Pulp (%) = $\frac{\text{Pulp weight}}{\text{Fruit weight}} \times 100$

Chemical fruit characteristics:

Total soluble solids (T.S.S) of mango fruit juice were examined by using hand refractometer.

Titratable acidity was determined (as citric acid) according to (A.O.A.C. 1985).

(T.S.S/acid ratio) was also calculated.

Statistical analysis and comparison among means were made by using L.S.D test at 5% level according to Steel and Torrie (1985).

Results and Discussion

Date of flowering, number panicles and malformation (%)

The obtained data in Table 1 revealed that , flowering of four strains (S6, S3, S4 and S1) were earlier started at the period from 22nd to 28th of February and only two strains (S2 and S7) started flowering at 7th and 8th March, while S5 form 4th to 7th April , other strains (S8 to S14) flowering at the period from 20th to 28th April during the two study seasons.

Average number of panicles per tree for (S8) recorded lowest values (86&87) while, the highest (231&237) for (S2) ones during first and second seasons respectively, the other strains achieved values between them.

Number of malformed panicles per tree was fluctuant from 4 to 13 in both seasons. Concerning, malformation percentage the proportion ranged around 2.04 to 12.90 % where highest ratio for S5, the other strains that malformed panicles percentages among them.

These results are agreement with finding of Said and El-Masry (1992), Boshra *et al.* (2007), Serry (2010), El-Agmei (2010) and Nafees *et al.* (2010) who reported that, all mango strains differed in date of full bloom and malformation is considered to be the most fatal disorders which not only negatively affect plant health but reduces yield.

Harvest date and yield

The harvest date (as average) during two study seasons as shown in Table 2 where five strains fruits were harvest during July, *i.e.*, S6, S4, S1, S3 and S5

respectively while, S2 and S7 at first August, the other strains were harvest in period from 16 to 30 September gradually as follows S14, S9, S13, S12, S11, S10 and S8. Regarding the period from full bloom to maturity stage, through study to find out all fruits of strains required about 145 to 156 days.

As for number of fruits per tree differed significantly between the strains where S2 attained the highest fruit numbers (254&263) while, the lowest numbers (74&71) attributed S8 in the first and second seasons respectively, the other strains among them. On the other hand, yield as Kg per tree reached highest quantum for strains 9, 10 and 11 those (138.67 &143.31), (93.29 &109.06) and (91.94&100.98) while, the lowest (20.33 &18.47) with S4 in the first and second seasons respectively, producing of the other strains trees between them. These results were not due to the number of fruits per tree, but due to the fruit weight as shown in Table 4.

TABLE 1. Flowering behavior of the investigated mango strains during (2012 and 2013 seasons).

Strains	2012 season				2013 season			
	Date of flowering	Average number of		Malformation (%)	Date of flowering	Average number of		Malformation (%)
		Panicles /tree	Malformed panicles /tree			Panicles /tree	Malformed panicles /tree	
S1	28 th Feb.	196	4	2.04	26 th Feb.	203	6	2.96
S2	7 th March	231	8	3.46	7 th March	237	11	4.64
S3	24 th Feb.	107	10	7.35	26 th Feb.	112	8	7.14
S4	26 th Feb.	165	11	6.67	26 th Feb.	164	13	7.93
S5	4 th April	91	10	10.98	7 th April	93	12	12.90
S6	25 th Feb.	102	8	7.84	22 nd Feb.	101	9	8.91
S7	8 th March	118	11	9.32	8 th March	124	7	5.65
S8	25 th April	86	4	4.65	24 th April	87	4	4.59
S9	22 nd April	134	7	2.22	26 th April	141	7	4.96
S10	27 th April	116	8	6.89	28 th April	113	8	7.08
S11	24 th April	154	5	3.24	25 th April	146	5	3.42
S12	20 th April	126	6	4.76	23 rd April	130	4	2.07
S13	23 rd April	98	4	4.08	23 rd April	87	4	4.59
S14	21 st April	153	9	2.88	25 th April	156	11	7.05
L.S.D at 5%		10.17	4.01	4.16		10.81	4.34	3.96

The obtained results are in agreement with the finding of Saleh and Abd El Monem (2003), Hassan *et al.*, (2004), Lu Ping (2005), Shinde *et al.*, (2006), Boshra *et al.*, (2007) and El-Agmei (2010) who found that, period from start

blooming to harvest date in some mango strains ranged between 23 and 26 weeks and total fruit yield per tree ranged between 186.73 to 378.51 kg.

TABLE 2. Harvest date, maturity period and yield of the investigated mango strains during (2012 and 2013 seasons).

Strains	2012 season				2013 season			
	Harvest Date	Maturity Period (days)	Number of fruit/tree	Yield/tree (Kg.)	Harvest Date	Maturity Period (days)	Number of fruit/tree	Yield/tree (Kg.)
S1	22/7	148	221	27.47	27/7	152	230	29.72
S2	3/8	149	254	63.02	1/8	148	263	65.20
S3	26/7	153	133	22.14	28/7	151	138	23.61
S4	22/7	147	179	20.33	25/7	150	162	18.47
S5	25/7	145	82	22.82	31/7	146	101	28.39
S6	19/7	145	147	25.96	18/7	147	124	21.80
S7	4/8	150	149	23.66	2/8	148	150	23.72
S8	25/9	149	74	47.54	29/9	149	71	46.10
S9	16/9	150	155	138.67	28/9	156	165	143.31
S10	25/9	152	182	93.29	28/9	156	206	109.06
S11	22/9	152	171	91.94	30/9	153	187	100.98
S12	19/9	153	136	62.76	29/9	151	135	63.01
S13	23/9	154	101	33.89	21/9	152	112	37.85
S14	18/9	151	168	53.34	22/9	151	172	54.95
L.S.D at 5%	--	4.02	6.70	9.12	--	3.71	5.61	11.04

Fruit physical characteristics

Fruit physical characteristics, *i.e.*, peel and pulp color, peel thickness, pulp content of fiber and embryo type were shown in Table 3. Green color peel were showed with six strains (S1, S3, S5, S9, S10 and S12), while strains (S2, S8, S11 and S14) have green yellowish peel. Meanwhile strains (S6 and S13) have green with red side peel, only one strain (S4) has yellow peel and (S7) has a yellow with red side.

Regarding, peel thickness differed between thin, mediate and thick. Only strain (S3) has thin peel, but nine of strains have thick –peel (S1, 2, 5, 6, 7,8,9,10 and S11), while only four once (S4, 12,13 and S14) have mediate peel.

As for pulp fruit color, eight strains (S1, 2,3,4,7,9,13 and S14) have orange pulp while, yellow pulp were noticed in the other six strains (S5, 6,8,10,,11 and S12). Pulp content of fiber among high, low and free, pulp fruit of strains (5 and 10) gained the highest fiber content, while S2, 11,12,13 and S14 were low pulp fiber, on the other hand, S1, 3,4,6,7, 8 and S9 their pulp fruit fiber free.

Concerning embryo type, seed of three strains (S3, S4 and S10) were polyembryonic, whereas the other studied strains had monoembryonic seeds.

These results were according the finding of El Agmey, 2010 and Serry, (2010), on the other hand, Nafees (2010) mentioned that most of the seedling mango races are polyembryonic.

Fruit weight and dimensions

As shown in Table 4 fruit weight differed significantly between strains whereas the heaviest weight (894.70g) and least (124.30g). The fruit of strains can be arranged to three groups as follows: Above 500 g for S10, 11, 8 and S9 in an ascending order where S9 gained heaviest weight fruit. Above 200 to least of 500 g for S2, 5, 14, 13 and S12 in an ascending order. Least of 200 g for S6, 3, 7, 1 and S4 in a descending order where S4 the lowest weight.

Regarding length, diameter and width of fruit, the data show that measurement in most cases indicate the highest measure for S9 while, the least for S4 in the two study seasons.

As for fruit shape index the revealed that, values of all strains fruits take an elongate above 1.00 values. These results confirm those of both Dutta and Dhua (2002), Boshra *et al.*, (2007), Mamiro *et al.*, (2007), Saeed *et al.*, (2009) and El-Agmey (2010) who found that, the elongation of mango shape occur when fruit index was higher than 1.0.

TABLE 3. Average fruit physical characteristics of the investigated mango strains during (2012 and 2013 seasons).

Strains	Peel colour	Peel thickness	Pulp colour	Pulp content of fiber	Embryo type
S1	Green	thick	orange	fiber free	mono
S2	Green Yellowish	thick	orange	fiber low	mono
S3	Green	Thin	orange	fiber free	Poly
S4	Yellow	mediate	orange	fiber free	Poly
S5	Green	thick	Yellow	fiber high	Mono
S6	Green with red side	thick	Yellow	fiber free	Mono
S7	Yellow with red side	thick	orange	fiber free	Mono
S8	Green Yellowish	thick	Yellow	fiber free	Mono
S9	Green	thick	orange	fiber free	Mono
S10	Green	thick	Yellow	fiber high	poly
S11	Green Yellowish	thick	Yellow	fiber low	Mono
S12	Green	mediate	Yellow	fiber low	Mono
S13	Green with red side	mediate	orange	fiber low	Mono
S14	Green Yellowish	mediate	orange	fiber low	mono

TABLE 4. Fruit weight, dimensions and shape index of the investigated mango strains during (2012 and 2013 seasons).

Strains	2012 season					2013 season				
	Fruit weight (g)	Fruit Length (cm)	Fruit diameter (cm)	Fruit width (cm)	Fruit shape index	Fruit weight (g)	Fruit Length (cm)	Fruit diameter (cm)	Fruit width (cm)	Fruit shape index
S1	124.3	9.8	7.6	6.3	1.29	129.2	9.8	7.7	6.5	1.27
S2	248.1	11.4	10.1	9.2	1.13	247.9	11.5	9.9	9.4	1.16
S3	166.5	12.0	7.8	6.9	1.54	171.1	12.1	7.7	6.9	1.57
S4	113.6	11.3	6.4	5.7	1.76	114.0	11.3	6.5	5.6	1.74
S5	278.3	12.7	8.9	8.2	1.43	281.1	12.8	8.8	8.3	1.45
S6	176.6	12.1	7.4	6.5	1.64	175.8	12.0	7.4	6.6	1.62
S7	158.8	11.4	7.8	6.3	1.46	158.1	11.3	7.9	6.3	1.43
S8	642.4	14.3	9.7	8.9	1.47	649.3	14.5	9.6	9.0	1.51
S9	894.7	15.1	11.4	10.1	1.32	868.6	15.0	11.2	10.2	1.34
S10	512.6	12.8	9.3	8.2	1.38	529.4	12.7	9.4	8.4	1.35
S11	537.7	13.1	9.6	8.8	1.36	540.0	13.2	9.6	8.7	1.38
S12	461.5	17.4	8.9	6.5	1.96	466.7	16.9	9.1	6.4	1.86
S13	335.6	9.7	8.3	7.6	1.17	338.0	9.6	8.4	7.5	1.14
S14	317.5	9.1	8.0	7.2	1.14	319.5	9.2	8.0	7.1	1.15
L.S.D at 5%	6.9	1.98	1.03	0.65	0.18	8.3	1.71	1.40	0.84	0.16

Seed, peel and pulp percentage

Tabulated data in Table 5 clearly showed that, percentage of seed in relation to fruit weight of tested strains was significantly differed in the two seasons. In this concern, the lowest percentage of seed weight was in fruit of S9, 12, 8 and S11, respectively in both seasons. Where seed weight for S9 recorded (5.81 & 5.93%), while S11 (8.32& 8.59 %), however, the other strains their percentage seed to fruit weight ranged from 1.01 to 39.03 % during two studied seasons.

As for percentage of peel in relation to fruit weight, the least percentage of peel weight were in fruit of S8, 12, 9 and S10 respectively in both seasons, where, peel weight of S8 gained (10.89& 11.04 %), while S10 (15.21 & 15.34 %), on the other hand, the other strains their percentage peel to fruit weight ranged from 18.62 to 43.01 % during two study seasons.

Pulp percentage in fruit of tested strains significantly differed in two study seasons. the highest pulp percentage for (S8, 12, 9, 11 and S10) through first and second seasons in a descending order , meanwhile , S8 achieved (81.45 and 81.38 %) whereas, remained strains S1,2,3,4,5,6,7,13 and S14 recorded least values in this concern during two examined seasons.

These results are in line with the finding of Thakur *et al.* (2000), Hammam *et al.*, (2001), El-Wakeel *et al.*, (2006), Scholefield *et al.* (2006), Reddy and Reddy (2009), El-Agmei (2010) Hagage (2010) and Serry (2010) who noticed

that, percentage of seed, peel and pulp in relation to fruit weight, differed between varieties and strains.

Fruit chemical constituents

Total soluble solid (T.S.S.) Brix in juice strains fruit during 2012 and 2013 seasons was showed in Table 5. In point of fact the total soluble solids of mango varieties fruits above 15 values, it is worthy there are some tested strains were recorded similar values in this respect through both seasons, can be mentioned in a descending order as follows: S13, 4, 10, 14, 8, 12, 9, 3, 11 and S1.

As for acidity ranged from 1.01 to 2.40 in all strains fruits during the two seasons, whereas, the least values (1.01 & 1.01) for S1 while, the highest (2.40 & 2.30) for S10 and S14. Concerning TSS/acidity ratio the highest values belonged strains S1,4, and S9 in two study seasons.

The obtained results are harmony with those of Mitra *et al.* (2001), Tawfik (2003), Chanana *et al.*, (2005), El-Wakeel *et al.*, (2006), Mauco *et al.*, (2009), Hagage (2010) and Serry (2010) who noticed that, total soluble solids and acidity varied among the different cultivars and races.

TABLE 5. Seed, peel, pulp weight percentage and T.S.S., acidity and TSS/acidity ratio of mango strains fruits during (2012 and 2013 seasons).

Strains	2012 season						2013 season					
	(%)			T.S.S.	Acidity	T.S.S./acidity ratio	(%)			T.S.S.	Acidity	T.S.S./acidity ratio
	Seed weight	Peel weight	Pulp weight				Seed weight	Peel weight	Pulp weight			
S1	39.03	26.42	34.55	16.00	1.01	15.84	38.91	26.83	34.86	16.20	1.01	16.04
S2	22.39	41.30	36.31	14.00	2.10	6.67	24.63	42.18	33.19	14.00	2.10	6.67
S3	21.70	35.20	43.01	17.20	1.31	13.23	21.84	37.10	41.06	17.40	1.40	12.14
S4	35.79	32.73	31.48	21.00	1.40	15.00	35.63	33.42	30.95	21.00	1.40	15.00
S5	34.81	42.63	22.56	10.20	1.50	6.80	34.77	43.01	22.22	10.30	1.60	6.43
S6	29.70	34.80	25.50	13.00	1.10	11.81	30.19	36.55	33.26	13.10	1.20	10.91
S7	27.99	34.41	37.60	14.00	1.30	10.76	27.86	36.02	36.12	14.20	1.40	10.14
S8	7.66	10.89	81.45	19.00	2.01	9.45	7.58	11.04	81.38	19.10	2.01	9.50
S9	5.81	15.01	79.18	18.00	1.20	15.00	5.93	15.22	77.85	18.00	1.30	13.84
S10	11.12	15.21	73.67	20.00	2.40	8.33	11.39	15.34	72.65	20.00	2.30	8.69
S11	8.32	18.04	73.64	17.00	1.40	12.14	8.59	18.62	72.84	17.10	1.40	12.21
S12	6.70	12.28	81.02	19.00	1.80	10.56	6.68	13.56	79.76	19.10	1.70	11.23
S13	11.01	31.28	51.71	23.00	2.10	10.95	11.37	31.76	56.87	23.00	2.10	10.95
S14	14.04	31.12	54.84	19.20	2.40	8.00	5.21	31.08	52.71	19.20	2.30	8.34
L.S.D at 5%	4.12	6.07	10.13	0.86	0.05	4.51	6.14	8.02	9.73	0.91	0.07	4.87

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تقييم بعض سلالات المانجو تحت ظروف محافظة الإسماعيلية

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أجريت هذه الدراسة خلال موسمي ٢٠١٢ ، ٢٠١٣ على ١٤ سلالة مانجو بذرية بمزرعة مطرب زهران بأبو سلطان- محافظة الإسماعيلية. الأشجار تحت الدراسة عمر ١٦ سنة منزرعة في أرض رملية وتروى بالتنقيط . تم دراسة تاريخ التزهير ونسبة الإصابة بالتشوه الزهري ، ميعاد إكمال نمو الثمار، الإنتاجية وجودة الثمار. وتبين من الدراسة تفوق ثلاث سلالات هي ٩ ، ١٠ ، ١١ والتي أعطت أعلى القيم لـ إنتاجية الشجرة ، وزن الثمرة، نسبة اللب والمواد الصلبة الذائبة - وأقل نسبه تشوه للشماريح الزهرية، وزن للبذرة والحموضة.

وقد أوضح التقييم أن السلالات حسب تفوقها يمكن ترتيبها تنازليا كالتالى :
٩ ، ١١ ، ١٠ وتعد سلالات مميزة وكأصناف جديدة للمانجو.