

Evaluation Study of Some Imported Mango Cultivars Grown under Aswan Governorate Conditions

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ABSTRACT

During 2012 and 2013 seasons, five imported mango cultivars (cvs) Kent, Keitt, Tommy Atkins, Heidi and Naomi were grown in Aswan region and namely evaluated for their growth, yield and fruit characteristics. Great variations were observed on growth and fruiting characteristics among the five mango cvs. Based on relatively better yield and fruit quality, mango cvs Keitt, Tommy Atkins and Kent are suggested to be cultivated successfully in descending order under Aswan conditions.

Keywords: mango cvs, growth, fruiting

INTRODUCTION

Most cultivated fruit species possess numerous recognized cultivars and their productivity largely depends on the successful performance of the most popularly established planted cultivars. Different cultivars of mango varied in their performance and these differences are governed by various genetic, cultural and environmental factors. Due to the variation in performance of different mango cultivars, the suitability of these cultivars from the consumers point of view are often evaluated from different angles. A study of growth, yield and pomologically important external and internal characteristics of the fruit in mango cultivars is required to provide the important criteria for the evaluation of such cultivars.

The results of Ahmed (2002), Tawfik (2003), Nilesh and Banik (2005), Abd El-Hadi (2006), Zaied *et al.* (2006), Rao and Rao (2007) and Swidan *et al.* (2007) confirmed the importance of evaluation studies on improving the productivity of different mango cvs grown under various climates. Previous studies emphasized the beneficial effects of evaluation studies for selecting the best mango cvs for the various locations for obtaining the highest yield (Sayed, 2009, Shaban, 2009; El-Sheikh and Burshaid, 2010; Jilani, *et al.*, 2010; Masoud – Amal, 2010; Pawan and Surendra, 2011; Reddy *et al.*, 2011; Pawan *et al.*, 2011; Abourayya *et al.*, 2011 and 2012 Wang *et al.*, 2013; Safuna *et al.*, 2014 and Fahmy, 2016).

This study was established as an attempt to know more information about growth, flowering, fruit setting, yield and fruit quality of some mango cultivars growing under Aswan region conditions. This assessment could provide valuable information to prescribe the prime mango cvs. having higher yield and fruit quality which

can be cultivated successfully under upper Egypt environmental conditions especially in Aswan region.

MATERIALS AND METHODS

This study was established during two consecutive seasons of 2012 and 2013 in a private orchard situated at Wady el-Nokra Aswan, Aswan governorate where the texture of the soil is sandy with a water table depth not less than two meters. Five mango cvs Kent, Keitt, Tommy Atkins, Heidi and Naomi were selected for achieving this evaluation study. Trees of all mango cvs were 10- years old at the start of this study. Trees were budded on mango seedling rootstocks. And were planted at 6x6 meters apart. Each cultivar was represented by six trees which were uniform in vigor.

Five treatments consisted of the five tested mango cultivars namely Kent, Keitte, Tommy Atkins, Heidi and Naomi were examined. This experiment was arranged in randomized complete block design (RCBD) with three replicates, two trees per each.

All mango cvs. received a basal recommended fertilizer in addition to the regular agricultural and horticultural practices which were already followed in the orchard including pruning, hoeing, irrigation with Nile water as well as pathogens, pests and weed control. The results of the orchard soil analysis according to Wilde *et al.* (1985) are shown in Table (1)

Monthly minimum and maximum temperatures as well as relative humidity percentages for Aswan governorate during 2012 and 2013 seasons were obtained and the data are shown in Table (2).

Generally, the following measurements for all the investigated mango cvs were recorded during the two seasons of the study.

Measurements of growth aspects in the growth cycles:

Ten secondary branches with 1.5 diameter were labeled in Feb. for each tree. Twenty new shoots in the growth flush were chosen from the ten labeled secondary branches per tree in all the investigated mango cvs. to measure their length (cm.) and to count the number of leaves on them. Twenty leaves per shoot below panicles were taken for calculating their area (cm²). Leaf area was measured using the following equation as reported by Ahmed and Morsy (1999).

Table 1. Mechanical, physical and chemical analysis of the tests orchard soil

Characters	Values
Particle size distribution	
Sand %	72.22
Silt %	17.78
Clay %	10.0
Texture	sandy
pH (1: 2.5 extract)	8.11
E.C. (1:2.5 extract (mmh ^o s/1 cm / 25-°C)	0.97
Organic matter %	0.30
CaCO ₃ %	1.29
Macronutrients values	
Total N %	0.09
P (ppm, Olsen method)	5.1
K (ppm, ammonium acetate)	69.9
Mg (ppm)	10.9
EDTA extractable micronutrients (ppm)	
Zn	0.31
Fe	0.60
Mn	0.41
Cu	0.22

Table 2. Monthly average temperature and relative humidity % for the two seasons of 2012 & 2013

Month	2012				2013			
	Temperature e °C		R.H. %		Temperature e °C		R.H. %	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Jan.	7.0	24.2	31.0	87.0	6.0	23.2	29.0	89.0
Feb.	10.1	28.4	22.0	69.0	8.1	23.9	25.0	84.0
March	10.0	31.3	16.0	63.0	10.0	29.6	16.0	69.0
April	15.0	35.1	14.0	48.0	16.0	37.3	13.0	43.0
May	21.0	39.9	17.0	47.0	20.0	39.0	14.0	38.0
June	19.0	39.7	18.0	61.0	20.1	40.9	16.0	53.0
July	19.0	41.1	18.0	80.0	21.8	43.2	17.0	62.0
August	20.0	41.3	21.0	81.0	20.0	39.8	22.0	72.0
Sept.	19.8	40.0	21.0	73.0	18.8	40.1	21.0	71.0
Oct.	18.2	36.4	25.0	73.0	13.7	33.7	23.0	89.0
Nov.	11.3	31.0	29.0	93.0	10.2	29.3	28.0	91.0
Dec.	7.4	26.3	30.0	94.0	7.5	25.1	28.0	92.0

RH % = relative humidity %

Source: Meteorological station

L.A. = 0.70 (L x W) – 1.06

Where L.A = leaf area (cm²), L and W= maximum leaf length and width (cm), respectively. Dates of first flowering and start of fruit setting were recorded.

Yield and fruit quality

Harvesting was achieved and yield expressed in weight (kg.) was recorded. Twenty fruits from each tree were taken randomly from each tree for determining the

following physical and chemical characteristics of pulp (A.O.A.C.,2000)

Physical characteristics

- 1- Average fruit weight (g.).
- 2- Average fruit length (cm)
- 3- Average fruit diameter (cm)
- 4- Average fruit thickness(cm)
- 5- Percentage of pulp weight
- 6- Percentage of seed weight.

Chemical characteristics:

- 1- T.S.S. % using hand Refractometer.
- 2- Total, reducing and non reducing sugars.
- 3- Total acidity % as g. citric acid/ 100 ml./ juice.
- 4- Vitamin C content as mg. / 100 g. pulp.

Statistical analysis:

All the obtained data were tabulated and statistically analyzed according to the procedure of Snedecor and Cochran, 1980. The individual comparisons among the studied parameters in the mango cvs were compared by using new L.S.D. test.

RESULTS AND DISCUSSION**1- Shoot length in the three growth cycles:**

Data in Table (3) clearly show that significant differences of the shoot length in the three growth cycles were observed among the five mango cvs. It was significantly maximized in mango cv. Tommy Atkins followed by Kent and was minimized in mango cv Naomi.

2- Number of leaves/shoot in the three growth cycles:

Data in table (3) obviously indicate that number of leaves/ shoot in the three growth flushes were significantly differed among the five mango cvs. The maximum values were recorded in mango cv. Tommy Atkins (12.0 & 11.0 in the spring growth cycle), (10.56 & 9.83 in the summer) and (14.20 & 14.16 in the autumn) during both seasons, respectively. The minimum values were recorded in mango cv. Naomi. These results were true during both seasons.

3- Leaf area in the three growth cycles:

It was significantly varied among the five mango cvs. The highest values were recorded in mango cvs Tommy Atkins followed by Keitt, Kent, Naomi and Heidi, in descending order. The leaf area in the spring growth cycle of Tommy Atkins reached 89.67 and 87.00 cm² during both seasons, respectively. The highest values were recorded in the spring growth cycle followed by those in the autumn growth cycle. The minimum values were recorded for those leaves picked on summer growth cycle. Similar trend was noticed during both seasons (Table 4).

Table 3. Shoot length and number of leaves in the three cycles of some mango cvs grown under Aswan governorate conditions during 2012 & 2013 seasons

Mango cvs	Shoot length						No. of leaves/ shoot					
	Spring		Summer		Autumn		Spring		Summer		Autumn	
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Kent	10.65	11.45	11.37	10.20	13.63	12.83	10.43	11.60	8.70	9.16	12.76	12.70
Keitt	10.52	10.16	10.91	9.47	12.60	11.96	9.40	9.70	8.46	8.95	11.40	11.56
Tommy atkins	10.68	12.13	13.10	11.20	16.10	15.03	12.00	11.00	10.56	9.83	14.20	14.16
Heidi	9.67	9.55	10.34	9.30	11.34	11.58	9.34	9.40	8.43	8.80	11.00	11.46
Naomi	8.32	7.06	8.77	8.26	9.00	7.36	9.00	8.67	8.16	7.77	9.20	9.30
New L.S.D.at 5%	0.11	0.10	0.12	0.12	0.11	0.10	1.0	1.0	1.0	1.0	1.0	1.0

Table 4. Leaf area in the three growth cycles, date of first bloom and date of fruit setting of some mango cvs grown under Aswan governorate conditions during 2012 & 2013 seasons

Mango cvs	Leaf area (cm) ²						Date of first bloom		Date of fruit setting	
	Spring		Summer		Autumn		bloom			
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Kent	80.67	77.33	17.65	19.11	55.00	54.76	4 th week of Jan.	1 st week of Feb.	2 nd week of Feb.	3 rd week of Feb.
Keitt	85.33	85.00	32.67	29.87	60.53	60.03	1 st week of Feb.	1 st week of Feb.	3 rd week of Feb.	3 rd week of Feb.
Tommy atkins	89.67	87.00	36.75	30.65	63.80	64.23	4 th week of Jan.	1 st week of Feb.	2 nd week of Feb.	2 nd week of Feb.
Heidi	68.63	62.00	16.11	16.01	38.88	38.50	1 st week of Mar.	1 st week of Mar.	2 nd week of Mar.	3 rd week of Mar.
Naomi	74.33	75.00	20.00	18.15	42.63	42.90	2 nd week of Feb.	1 st week of Feb.	4 th week of Feb.	3 rd week of Feb.
New L.S.D. at 5%	1.92	2.00	1.88	1.94	1.80	1.82	-	-	-	-

4- Date of first bloom:

It was considerably varied among the five mango cvs. The early blooming mango cvs were Kent and Tommy Atkins. They bloomed at the last week of Jan. in the first season of study and the first week of Feb. in the second season. Heidi mango cv bloomed lately at the first week of Mar. during both seasons. At the first and second weeks of Feb. mango cvs Keitt and Naomi bloomed. Similar trend was noticed during both seasons. (Table 4).

5- Date of start of fruit setting:

Data in Table(4) clearly show that majority of mango cvs began fruit setting at the periods from the second to fourth week of Feb. except mango cv Heidi which reached fruit setting stage at the second week of Mar. in the first season of study and the third week of Mar. in the second season. These results were true during both seasons.

6-Panicle length:

It is clear from the obtained data in Table (5) that panicle length was maximized in mango cv Keitt (34.97 & 34.07 cm) during both seasons, respectively. Mango cv. Tommy Atkins occupied the second position in this respect, since the values reached (33.34 & 33.52 cm) during 2012 and 2013 seasons, respectively. Heidi mango cv recorded the minimum values (26.25 & 31.21 cm) during both seasons, respectively.

7- Yield / tree:

Data in Table(5) reveal that varying mango cvs significantly altered the yield per tree. Yield/ tree ranged from 55 to 79 kg in the first season and from 59 to 77 kg in the second season. Mango cv Keitt recorded the highest values (79 & 77 kg) during both seasons, followed by Tommy Atkins (74 & 70 kg) during 2012 and 2013 seasons, respectively. The lowest values were recorded on the mango cv. Heidi (55 & 59 kg) during 2012 and 2013 seasons, respectively. The best four

mango cvs with regard to yield were Keitt; Tommy Atkins, Kent and Naomi during both seasons.

8- Fruit weight and dimensions:

Data in Tables (5&6) clearly show that weight, width, length and thickness of fruit were significantly varied for the five mango cvs. They were maximized in mango cvs Kent followed by Naomi, Keitt, Tommy Atkins and Heidi, in descending order. Weight, width, length and thickness of fruit were maximized in mango cv Kent. Values of weight of fruit in such mango cv. reached (554.0 & 526.66 g.) during 2012 and 2013 seasons, respectively.

9- Percentages of seeds and pulp:

As shown in Table (6), varying mango cvs showed no significant differences on the percentages of seeds and pulp during both seasons.

10- Chemical characteristics of the fruits:

Data in Tables (6&7) show that significant differences on all chemical characteristics of the fruits were observed among the five mango cvs. Mango cv Tommy Atkins exhibited the highest values of T.S.S. (14.93 & 15%), total sugars (11.52 & 11.59%), reducing sugars (5.20 & 5.20 %), non reducing sugars (6.34 & 6.40%) and vitamin C (52.20 & 49.03 mg / 100 g. pulp) during both seasons, respectively. Mango cv Tommy Atkins recorded the lowest values of total acidity (0.205 & 0.215 %) during 2012 & 2013 seasons, respectively. The second mango cv in this respect was Keitt. Similar trend was observed during both seasons.

The different responses of the five mango cvs to various biotic and abiotic stresses, agricultural practices, genetical aspects, growth aspects, flowering, fruit setting, harvesting dates could explain the present results.

These results are in agreement with those obtained by Ahmed (2002), Tawfik (2003), Abd El- Hadi (2006), Sayed (2009); Shaban (2009), Abourayya *et al.*, (2011) & (2012) and Fahmy (2016).

Table 5. Panicle length, yield / tree as well as weight, width, length of fruit of some mango cvs grown under Aswan governorate conditions during 2012 & 2013 seasons

Mango cvs	Panicle length (cm)		Yield/ tree (kg.)		Av. fruit weight (g.)		Fruit width (cm)		Fruit length (cm)	
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Kent	31.65	31.54	68.00	64.67	554.00	526.66	9.20	9.07	12.40	12.43
Keitt	34.97	34.07	79.00	77.00	446.67	457.86	8.60	8.50	11.56	11.50
Tommy atkins	33.34	33.52	74.00	70.00	410.00	400.0	8.43	8.10	10.50	10.50
Heidi	26.25	31.21	55.00	59.00	353.00	345.00	7.97	8.00	10.31	10.27
Naomi	31.53	32.80	63.00	61.00	514.00	475.00	9.00	9.13	12.10	12.26
New L.S.D. at 5%	1.1	1.0	2.0	2.1	15.5	16.0	0.18	0.15	0.16	0.17

Table 6. Some physical and chemical characteristics of the some mango cvs grown under Aswan governorate conditions during 2012 & 2013 seasons

Mango cvs	Fruit thickness (cm)		Seed weight %		Pulp weight %		T.S.S. %		Total sugars %	
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Kent	7.83	7.83	7.50	7.79	92.50	92.21	13.80	14.00	10.65	10.80
Keitt	7.76	7.43	7.75	8.00	92.25	92.00	14.53	14.60	11.23	11.29
Tommy atkins	7.10	7.30	7.80	8.11	92.20	91.89	14.93	15.00	11.52	11.59
Heidi	6.73	6.70	7.85	8.15	92.15	91.85	13.34	13.73	10.34	10.60
Naomi	7.73	7.57	7.60	7.90	92.40	92.10	14.00	14.34	10.82	11.06
New L.S.D. at 5%	0.16	0.18	NS	NS	NS	NS	0.22	0.21	0.18	0.17

Table 7. Some chemical characteristics of the fruits of some mango cvs grown under Aswan governorate conditions during 2012 & 2013 seasons

Mango cvs	Reducing sugars %		Non reducing sugars %		Total acidity %		Vitamin C (mg/100 g pulp)	
	2012	2013	2012	2013	2012	2013	2012	2013
Kent	4.83	4.84	5.82	5.97	0.324	0.322	42.50	42.83
Keitt	5.10	5.06	6.13	6.24	0.228	0.234	50.10	46.00
Tommy atkins	5.20	5.20	6.34	6.40	0.205	0.215	52.20	49.03
Heidi	4.67	5.10	5.67	5.84	0.330	0.340	39.90	40.00
Naomi	4.87	4.97	5.94	6.08	0.301	0.295	44.97	43.00
New L.S.D. at 5%	0.09	0.08	0.10	0.11	0.018	0.016	1.10	1.08

From the obtained data it could be revealed that the five mango cvs Kent, Keitt, Tommy Atkins, Heidi and Naomi are widely varied toward their behaviour on growth and fruiting characteristics. Mango cvs Keitt, Tommy, Atkins and Kent are suggested to be cultivated successfully in descending order under Aswan conditions based on relatively better yield and fruit quality.

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