Middle East Journal of Agriculture Research
ISSN 2077-4605

Volume : 07 | Issue : 02 | April-June | 2018
Pages:559-568

Flowering and fruiting behavior of some introduced Mango cultivars grown in Giza Governorate conditions

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Received: 11 Mar. 2018 / Accepted: 14 May 2018 / Publication date: 28 May 2018

ABSTRACT

This investigation was carried out during 2016 and 2017 on 20 years old of mango cultivars namely Keitt, Heidi, R2E2, Sensation, Tommy atkins and Glenn were growing in clay soil at the experimental station of horticulture research institute, El – Giza Governorate. Date of terminal buds beginning of flowering(burst), number, length and color of panicle, percentage of malformation panicle, harvest date (seasonality), fruit number/tree, yield/tree as well as physical and chemical characteristics of fruits of each individual variety were determined as follow:-

All cultivars beginning to burst buds from first week of February to first week of March and arrived to full blooming from second week of March to first week of April, while beginning of commercial harvest extend from third week of July to first week of October and ending of harvest extend from second week of August to the second week of December. Tommy atkins and Heidi cultivars harvested in early and late intermediate season, respectively, while Keitt cultivar harvest at late season. Sensation cultivar gained the highest malformed average percentage 4.12% and the lowest value was recorded for Tommy atkins cultivar 2.08 %. The highest average yield of the two seasons was recorded for Keitt (52.48 g/tree) cultivar, while Tommy atkins cultivar produced the lowest average yield (43.89 g/tree). Keitt cultivar gained the highest average of length (13.5 cm), width (10.5 cm), total fruit weight (723.5 g) pulp weight (593.6g) and pulp percentage (82.05 %), whereas the lowest values length (8.6 cm), width (6.45 cm), total fruit weight (330.36 g) pulp weight (220.25g) and pulp percentage (66.65 %) in the average of two seasons were recorded by Sensation cultivar. Concerning total, reducing and non – reducing, it ranged between (10.0 and 12.2 %, 6.7 and 10.1 % and 1.9 and 3.3 %), respectively and the highest average of two seasons (12.0, 9.8 and 3.25%) were recorded for Glenn, Tommy and R2E2 cultivars, respectively.

Mango cultivars could be arranged descendingly based on total score (100) as follows: Keitt cultivar (94.36 units), Heidi cultivar (84.00 units), Tommy atkins cultivar (82.36 units), Glenn cultivar (81.97 units), R2E2 cultivar (81.09 units) and Sensation cultivar (73.50 units) in the average two tested seasons. Mango cultivars could be arranged descendingly based on total score (70) for fruit quality as follows: Keitt cultivar (64.36 units), Tommy atkins cultivar (57.27 units), Heidi cultivar (56.78 units), Glenn cultivar (56.18 units), R2E2 cultivar (54.45 units) and Sensation cultivar (46.87 units) in the average two tested seasons.

This investigation recommended with planted Keitt, Tommy atkins and Heidi cultivars in El Giza Governorate under condition of this study.

Key words: Introduced Mango cultivates – Flowering – Malformed percentage –Seasonality – Yield – Fruit physical and chemical properties.

Introduction

Mango [*Mangifera indica* L. (Anacardiaceae)] is a widely grown horticulture crop in many tropical and subtropical countries and is the fifth largest fruit industry in the world after citrus, banana, grape, and apple. It is popularly known as “the king of tropical fruits” for its succulence, different flavors and aromas, delicious taste, high caro- tenoid content, and high pro-vitamin A value (Tharanathan *et al.,* 2006).

Mango grows successfully throughout Egypt from the relatively cool coast of Mediterranean sea (lat. 31˚.30' N) up to the burning heat of Asswan Governorate (lat. 22˚N). Mango can play an

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important role in balancing human diet by providing about 64-86 calories of energy per 100 g (Rathore *et al* ., 2007) and, when consumed regularly, can be a valuable dietary source of many phytochemical compounds (Haard and Chism, 1996). In addition, among many other components, the ascorbic acid content makes the fruit an excellent source of vitamin C, its content varying from 32 to 200 mg per 100 g of edible pulp (Akinyele and Keshinro, 1980).

Productivity of most mango cultivars in Egypt tend to be lower. Fruit characteristics (especially size, external color and flavor) do not usually satisfy local and export market requirements. 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. Therefore, the main goal of this study is to describe the main characters of trees and fruits of promising cultivars.

The quality of mango greatly depends on fruit physical properties, such as shape, vertical diameter, cross section, weight, stone weight, pulp recovery, pulp fibrosis, and fruit color, and on chemical properties such as total soluble solids, treatable acidity, total sugars, vitamin C, taste.

The aim of this present study was to comparative study of sex introduced mango cultivars namely: "Keitt", "Heidi", "Zill", "R2E2", "Sensation", "Tommy atkins ", and Glenn " grown in Horticulture research institute orchard , Giza Governorate, Egypt. The study involved the dates of beginning of flowering, full blooming and maturity and, fruit set% and fruit drop%, leaf area, number, length and color of panicle, average yield per tree as well as physical and chemical properties of fruits. The final evaluation of any tested cultivars was calculated on the basis of 100 units which were shared between tree yield (30 units) and fruit quality (70 units) (El Agamy 2016).

Materials and Methods

The present study was carried out during 2016 to 2017 on 20 years old of mango cultivars namely Keitt, Heidi, R2E2, Sensation, Tommy atkins and Glenn were growing in clay soil at the experimental station of horticulture research institute, El – Giza Governorate. The chosen trees were grafted on mango seedling rootstocks, planted at 4.5×2.5 apart irrigated with drip irrigation system. Trees of all the studied cvs. were in full production stage and received the same horticultural practices.

1 - Flowering characteristics

The following parameters were used to evaluate the tested cultivars: -

- Date of terminal buds was recorded when the first one flowered burst for each cultivar in the two studied seasons.
- Full bloom dates were recorded when about 75% of the terminal buds reach the burst stage.
- Beginning and ending harvest date were recorded. Seasonality, the productive timing with the current sex mango cultivars appears to be closely grouped the period of August (early mid-season) September (mid-season) and October (late season) according to Serry (2010)
- Growth period determined with counted the weeks from full blooming to beginning harvest
- Total and malformed panicles was counted and the percentage of malformation was calculate as follow:-

$$\text{Malformed percentage (\%)} = \frac{\text{Malformed panicles}}{\text{Total panicles}} \times 100$$

- Panicles length were meager by (cm)
- Color of panicles by using color chart.

2 - Fruit number and yield:

- Number of fruits on each cultivar was counted.
- The yield of each cultivar was calculated as follow:-

$$\text{Yield / tree (kg)} = \frac{\text{Numbers of fruit X average fruit weight (gm)}}{1000}$$

- Alternate bearing habit for each individual cultivar according to the equation suggested by Singh(1948) and Serry (2010) as follow:

$$\text{Biennial bearing index} = \frac{\text{difference between two yields}}{\text{Sum of two yields}} \times 100$$

3 - Fruit quality:-

Samples of 10 ripe fruits were taken randomly from each cultivar at harvest stage to determine.

***a. Fruit physical parameters**:*

- Fruit, pulp, peel and seed weight (g).
- Fruit length and width (cm.) by using .
- Percentage of pulp (%): A/ B × 100.
  - A: Pulp weight
  - B: Total fruit weight
- Fruit, Pulp and peel color by using color chart.
- Examination of seed (monoembryonic or polyembryonic) .

b. Fruit chemical parameters:

- Percentage of total, reducing, and non – reducing sugars according to Lans & Eynon volumetric method that outlined in A.O.A.C (2000).
- Total soluble solids (TSS) of fruit juice were determined directly from each sample by using refractometer at room temperature.
- Total acidity in fruit pulp was determined as citric acid % (g / 100 g) by titrating 10 g of fresh pulp sample against 0.1 N NaOH solution by following the (A.O.A.C, 2000) method.

General evaluation of the tested importing mango cultivars:

The final evaluation of any tested cultivars was calculated on the basis of 100 units which were shared between tree yield (30 units) and fruit quality (70 units) (El Agamy, 2016) the latter units were divided on the basis of 15 units for both of fruit weight, flesh %, and 10 units for T.S.S., total acidity beside 5 units for both of fruit length, fruit diameter and vitamin C content. Each tree that gave the best results in any property took the full mark specified for this property, while each of the other tested trees took lower units equal to their quality.

Statistical analysis:

Experimental design was complete randomized blocks and data were statistically tested according to (Snedecor and Cochran, 1980). Mean values were compared by using the method of New Least Significant Differences (New L.S.D) at 5% level described by Waller and Duncan (1969).

Results and Discussion

Beginning of flowering and full blooming:

Beginning of flowering, full blooming and harvest date as well as growth period during 2016 and 2017 seasons are presented in Table (1).

Regarding beginning of flowering and full blooming the data cleared that Glenn cultivar gave the first bud burst (1st week of February) in the two season and arrived to full blooming in second and third week of March in both seasons, respectively. Tommy atkins cultivar recorded the last bud burst (first week in March) in the two seasons, while the last full blooming was gained by Sensation cultivar (4th week in March and 1st in April) during the two seasons, respectively. As a general, the

buds of all cultivars beginning to burst from first week of February to first week of March and arrived to full blooming between second week of March to first week of April through 2016 and 2017 seasons. In agreement with the present result Boshra *et al* (2007); Hamed *et al.,* 2011; El-Agamy 2011; El-Agamy *et al.,* (2016).

Harvest date and growth period:

Concerning the harvest date, beginning of commercial harvest in sex cultivars of mango under this study extend from third week of July to first week of October and ending of harvest extend from second week of August to the second week of December in the first and second seasons. Harvest period in all cultivars under investigation ranged between three to five weeks expect Keitt how take from 10 to 12 weeks from beginning to end harvest in the two seasons. R2E2, Sensation and Glenn cultivars came in intermediate (mid) season. Tommy atkins and Heidi cultivars harvested in early and late intermediate season, respectively, while Keitt cultivar harvest data begin in second week of September and extend to second week of December (late season) through the two seasons. In general, the mango cultivars trees cover a long period in the season extends from August to September.
The data also cleared that, the period from full blooming to beginning harvest date in the sex mango cultivars under this study ranged between 16 and 25 weeks. Keitt cultivar recoded the longest period (24 and 25 weeks), followed by Heidi cultivar (20 and 19 weeks), while the shortest period was gained by Tommy atkins cultivar (16 and 18 weeks) during the two seasons, respectively.

This result agree with Boshra *et al* (2007); Diedhioul *et al.* (2007); Hamed *et al.,* 2011; El-Agamy 2011; El-Agamy *et al.,*(2016) reported that date of commercial harvest in mango would be great important from the standpoint of economic value. Early as well as late maturation of fruits would be advantageous in each return for growers. They also reported that mango fruit develops rapidly after fruit set and is ready for harvesting within 13-20 weeks, depending upon the variety and climate

Table 1: Beginning of flowering, full blooming, Harvest date, growth period and seasonality of six introduced Mango cultivars growing under El – Giza governorate condition during 2016 and 2017 seasons.

Parameter	seasons	Cultivars					
		Keitt	Heidi	R2E2	Sensation	Tommy	Glenn
Beginning of flowering	2016	3rd week Feb	3rd week Feb	4th week Feb	2nd week Feb	1st week Mar	1st week Feb
	2017	3rd week Feb	3rd week Feb	4th week Feb	2nd week Feb	1st week Mar	1st week Feb
Full blooming	2016	2nd week Mar	3rd week Mar	3rd week Mar	4th week Mar	2nd week Mar	2nd week Mar
	2017	3rd week Mar	3rd week Mar	3rd week Mar	1st week Apr	3rd week Mar	3rd week Mar
Beginning of Harvest date	2016	2nd week Sep	3rdweek Aug	1stweek Aug	2ndweek Aug	4thweek Jul	1stweek Aug
	2017	1stweek Oct	2ndweek Aug	1stweek Aug	3rdweek Aug	3rdweek Jul	1stweek Aug
Ending of Harvest date	2016	2ndweek Des	4thweek Sep	4thweek Aug	2ndweek Sep	2ndweek Aug	4thweek Aug
	2017	2ndweek Des	2ndweek Sep	1stweek Sep	2ndweek Sep	3rdweek Aug	4thweek Aug
Seasonality		Late season	Late Mid-season	Mid-season	Mid-season	Early mid-season	Mid-season
Growth period	2016	24	20	18	18	18	19
	2017	25	19	18	19	16	19

Panicle characteristics:

The data in Table (2) showed significant differences between cultivars panicles number in both season. In this respect, the highest number of panicles was recorded for Glenn cultivar (359.13 and 401.10) followed by Keitt cultivar (340.70 and 349.50) in the first and second seasons, respectively. On the other hand, the lowest number was gained by Heidi cultivar (207.00) in the first season and for R2E2 cultivar (215.33) in the second one without significant difference between it and anther two cultivars Heidi and Sensation (219.00 and 217.33), respectively.

The date showed that significant differences between the studied cultivars in both number and percentage of malformed panicles. Comparing the number of malformed panicle, the highest number was recorded for Sensation cultivar (9.63 and 10.93) and followed by Glenn cultivar (9.23 and 10.17) without significant differences between them in the two seasons, respectively. On the other hand, Heidi cultivar gained the lowest number (5.65 and 6.33) in the first and second seasons, respectively. Other cultivars came in between.

Concerning malformed percentage, Sensation cultivar gained the highest percentage (3.23 and 5.02 %) and the lowest percentage was recorded for tommy atkins cultivar (2.18 and 1.98 %) during the two seasons, respectively. These differences between number of malformed and its percentage return to the total number of panicles.

Regarding panicle length, it ranged between (38.1 – 16.0 cm and 15.6 – 37.3 cm) in the first and second seasons, respectively and the highest number was recorded for Sensation cultivar (38.1 and 37.3 cm), while the lowest length gained by R2E2 cultivar (16.0 – 15.6 cm) in the two seasons, respectively.

Panicle of Keitt, Heidi and Glenn cultivars take a red color, while R2E2, Sensation and Tommy panicle take color red – green.

Generally, average of total and malformed panicles and its percentage as well as panicle length in the sex cultivars took a similar trend of its main date. These result were agree with this showed by Said and El-Masry (1992); Boshra *et al* (2007); Hamed *et al.,* 2011; El-Agamy 2011; El-Agamy *et al.,*(2016).

Table 2: Panicle characteristics of six introduced Mango cultivars growing under El – Giza governorate condition during 2016 and 2017 seasons.

Parameter	Seasons	Cultivars						New LSD at 5%
		Keitt	Heidi	R2E2	Sensation	Tommy	Glenn	
Total Number of panicles	**2016**	340.70	207.00	233.66	297.33	290.66	359.33	7.85
	2017	349.50	219.00	215.33	217.33	309.33	401.10	8.92
	Av.	345.10	213.00	224.50	257.33	300.00	380.22	
Malformed panicles Number	**2016**	8.52	5.65	7.37	9.63	6.35	9.23	1.37
	2017	9.27	6.33	6.29	10.93	6.11	10.17	1.57
	Av.	8.89	5.99	6.83	10.28	6.23	9.70	
Malformed percentage	**2016**	2.50	2.73	3.15	3.23	2.18	2.56	0.89
	2017	2.65	2.89	2.92	5.02	1.98	2.53	0.73
	Av.	2.58	2.81	3.04	4.12	2.08	2.55	
Panicle length	**2016**	33.0	33.1	16.0	38.1	19	31.0	2.39
	2017	32.8	32.2	15.6	37.3	18.0	30.4	3.27
	Av.	72.5	93.0	104.5	141.0	93.5	93.0	
Panicle color		Red	Red	Red – green	Red – green	Red – green	Red	

Fruit characteristics:

Data in Table (3) indicated that all cultivars were free from fiber in the pulp and intermediate from thickens of peel. The data also, cleared that fruits peel color in Heidi and Tommy atkins cultivars were red, whereas the color of fruit peel in R2E2 and Glenn cultivars were green yellow also, the peel color of Keitt and Sensation cultivars were yellowish red and yellow orange, respectively. However, fruit pulp color in Keitt, Sensation and Glenn cultivars were yellow, while cultivars Heidi, R2E2 and Tommy were yellow orange and orange except fifth strain it was yellow.

Data in Table (3) mentioned that pulp texture of all cultivars had soft except Keitt and Tommy atkins had firm. Type of embryo of all cultivars had monoembryonic seeds.

Table 3: Fruit characteristics of six introduced Mango cultivars growing under El – Giza governorate condition during 2016 and 2017 seasons.

Parameters	Cultivars					
	Keitt	Heidi	R2E2	Sensation	Tommy	Glenn
Peel thickens	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate
Peel color	Yellowish red	Red	Green yellowish	Yellow orange	Red	Green yellow
Pulp color	yellow	Yellow orange	Orange	yellow	Orange	yellow
Pulp texture	Firm	Soft	Soft	Soft	Firm	Soft
Type of embryo	Mono	Mono	Mono	Mono	Mono	Mono

Total fruit number and yield / tree

The data in Table (4) showed significant differences between the studied cultivars for total fruit number / tree and total yield / tree in the two seasons. However, total fruit number / tree ranged between71.0 and 147.0 fruit / tree in the two seasons. The highest average total fruit number / tree was recorded for Sensation cultivar (141.0 fruit / tree), while Keitt cultivar gave the lowest average total fruit number / tree (72.5 fruit / tree).

Concerning total yield / tree, the date clarified that it ranged from 41.38 to 53.31 kg / tree and gained higher total yield / tree with Keitt cultivar (51.65 and 53.31 kg / tree) in both seasons, respectively with average (52.48 kg / tree). Glenn and Tommy atkins cultivars produced the lowest total yield (43.64 and 41.38 kg / tree) in the two seasons, respectively. The lowest average total yield (43.89 kg / tree) was gained by tommy atkins cultivar. Another four cultivars came intermediate between them.

Similar results were obtained by Leghari *et al.*, 2013; Ara *et al.*, 2014; Chovatiya *et al.*, 2015; Abdelrahman & Dawaud, 2015 and Fahmy, 2016 who's stated that there was a wide and great variation on yield and fruit quality of most mango cultivars. On the other hand, it smaller then these reported by Boshra *et al* (2007); Hamed *et al.,* (2011); El-Agamy (2011); El-Agamy *et al.,*(2016).

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%. The data clarified that biennial bearing index ranged between 1.58 and 5.72 % under this study. Keitt and Heidi varieties gave the lowest percentage (1.58 and 1.81 %), respectively, while Tommy atkins and Sensation cultivars gained the highest percentage (5.72 and 5.16 %) in the average both tested seasons. These results are in agreement with Serry (2010) and El-Agamy *et al.,*(2016).

Table 4: Total fruit number, total yield and biennial bearing index of six introduced Mango cultivars growing under El – Giza governorate condition during 2016 and 2017 seasons.

Parameter	Seasons	Cultivars						New LSD at 5%
		Keitt	Heidi	R2E2	Sensation	Tommy	Glenn	
Total Fruit number	2016	71.0	89.0	101.0	135.0	98.0	89.0	3.47
	2017	74.0	97.0	108.0	147.0	89.0	97.0	4.23
	Av.	72.5	93.0	104.5	141.0	93.5	93.0	
Total yield / tree (kg)	2016	51.65	46.75	45.28	44.19	46.40	43.64	2.93
	2017	53.31	48.47	48.66	49.00	41.38	46.58	3.09
	Av.	52.48	47.61	46.97	46.60	43.89	45.11	
Biennial bearing index (%)		1.58	1.81	3.60	5.16	5.72	3.26	

Physical fruit properties:-

Fruit dimensions:

In Table (5) the data showed significant differences between the cultivars concerning all parameters of fruit dimensions during the two seasons. In this respect, fruit length and diameter ranged between (14.0 – 8.7 cm and 10.0 – 6.5 cm, respectively) in the first season and between (13.0 – 8.5 cm and 11.0 – 6.4 cm, respectively) in the second one. Keitt cultivar gained the highest average fruit length and width (13.50 and 10.5 cm), while the lowest average was recorded for Sensation cultivar (8.60 and 6.45 cm), respectively.

Fruit weight parameter:-

Total fruit, pulp and peel weight as well as seed weight differed significantly in the two seasons (Table 5).

Total fruit weight and fruit pulp weight ranged from 727.0 to 327.37 g and 594.2 to 211.48 g, respectively in 2016 season and from 720.0 to 333.35 g and 593.0 to 229.01 g, respectively in 2017 season. However, the highest average weight (723.50 and 593.60 g) was recorded for Keitt cultivar, whereas the lowest average (330.36 and 220.25 g) was gained by Sensation cultivar for both total fruit

weight and fruit pulp weight, respectively. The results concerning fruit characteristics are in harmony with the finding of Serry (2010) who recorded that it seems that the different strains grown under Ismailia conditions produce higher fruit weight ranging from 440 – 610 g/fruit.

The data also clarified that fruit peel weight ranged between (65.69 – 90.40 and 63.84 – 84.50 g), while seed weight ranged between (42.10 – 76.40 and 40.10 – 76.00 g) in the first and second seasons, respectively.

Regarding percentage of the fruit pulp, the data cleared significant differences between cultivars under study during the two seasons. Anyhow, the highest percentage (81.73 and 82.36 %) was recorded for Keitt cultivar, whereas Tommy atkins cultivar (66.8 and 66.2 %) and Sensation cultivar (64.6 and 68.7 %) without significant differences between them gained the lowest percentage in the first and the second seasons, respectively.

These results were in line with those found by Benjwan *et al.,* 2006; Boshra *et al.,* 2007; Hamed *et al.,* 2011; El-Agamey, 2011; Kobra *et al.,* 2012; Ara *et al.,* 2014; Abdelrahman &Dawaud, 2015; Fahmy, 2016; El-Agamy *et al.,* 2016).

Table 5: Physical fruit parameter of six introduced Mango cultivars at harvest stage growing under El – Giza governorate condition during 2016 and 2017 seasons.

Parameters	seasons	Cultivars						New LSD at 5%
		Keitt	Heidi	R2E2	Sensation	Tommy	Glenn	
Fruit length	2016	14.0	9.4	10.5	8.7	9.1	9.9	1.03
	2017	13.0	9.0	10.8	8.5	9.0	10.0	1.75
	Av.	13.50	9.20	10.65	8.60	9.05	9.95	
Fruit width	2016	10.0	7.9	7.6	6.5	7.2	6.7	0.97
	2017	11.0	7.5	7.5	6.4	7.1	6.5	1.05
	Av.	10.50	7.70	7.55	6.45	7.15	6.60	
Fruit weight	2016	727	525.33	448.35	327.37	473.5	490.29	11.39
	2017	720	499.71	450.55	333.35	465.0	480.23	15.57
	Av.	723.5	512.52	449.45	330.36	469.25	485.0	
Pulp weight	2016	594.2	362.47	331.7	211.48	316.3	369.5	8.93
	2017	593	360.23	336.7	229.01	308.1	358.6	11.21
	Av.	593.60	361.35	334.20	220.25	312.2	364.05	
Peel weight	2016	85.3	90.4	74.2	65.69	80.8	68.5	6.27
	2017	84.5	82.0	73.2	63.84	81.0	69.0	4.29
	Av.	84.90	86.20	73.70	64.77	80.9	38.75	
Seed weight	2016	47.7	72.46	42.1	50.20	76.4	52.0	3.25
	2017	42.5	57.48	40.1	40.5	76.0	52.4	2.89
	Av.	45.10	64.97	41.10	45.35	76.2	52.2	
Pulp %	2016	81.73	69.0	74.0	64.6	66.8	75.4	5.45
	2017	82.36	72.1	74.7	68.7	66.2	74.6	3.23
	Av.	82.05	70.55	74.35	66.65	66.50	75.05	

Chemical fruit properties:-

Fruit pulp sugar percentage:-

The data in Table (6) indicated that the total, reducing and non-reducing sugar percentage in the fruit pulp differed insignificantly in both seasons. However, total sugar percentage ranged between 10.3 – 12.2% and 10.0 – 12.0% for both seasons, respectively. Concerning reducing sugar percentage, it ranged between (7.0 – 9.6% and 6.7 – 10.1%) whereas, non-reducing sugar percentage ranged between (2.0 – 3.3 % and 1.9 – 3.2%) in the two seasons, respectively.

As a general, the highest average total, reducing and non-reducing sugar percentage in the fruit pulp (12.0%, 9.8% and 3.25 %) was recorded for Glenn, Tommy atkins and R2E2 cultivars, respectively. Sensation cultivar was gained the lowest percentage for total and reducing sugar (10.05 % and 7.05%), respectively, while Tommy atkins cultivar gained the lowest non reducing sugar percentage.

Total soluble solids (TSS):-

The data in Table (6) showed significant differences between the sex cultivars concerning total soluble solids through the two seasons. However, the highest average of TSS in the fruit juice (18.5%) was recorded for Keitt cultivar followed by Sensation cultivar (18 %), whereas Heidi cultivar gained the lowest TSS (16.5 %). Other three cultivars came in between them.

Total acidity (TA):-

In Table (6) the data indicated that total acidity percentage differed significantly in both seasons. In this respect, R2E2 and Sensation cultivars gained the highest (0.37%) and (0.40 %) total acidity percentage through the first and second seasons, respectively. The lowest percentage (0.22 and 0.19 %) was recorded for Tommy atkins cultivar in both seasons. Anyhow, Sensation cultivar gained the highest average of total acidity percentage (0.38 %), while the lowest average percentage (0.21 %) was recorded for Tommy atkins cultivar.

Ascorbic acid content:-

The data in Table (6) clarified that ascorbic acid content differed significantly in the two seasons. However, R2E2 cultivar gained the highest ascorbic acid content (53.0, 48.0 and 50.5 mg/100g) while, the lowest value (39.0, 0.39 and 39.0 mg/100g) was recorded for Glenn cultivar during the first and second seasons as well as the average of them, respectively.
These results are in agreement with Boshra *et al.,* 2007; Abdelrahnan *et al.,* 2009; Abourayya *et al.,* 2011; EL-Agamy, 2011; Hamed *et al.,* 2011; Sivakumar *et al.,* 2011; Leghari *et al.,* 2013; Ara *et al.,* 2014; Chovatiya *et al.,* 2015; Abdelrahman &Dawaud, 2015; El-Agamy *et al.,* 2016 and Fahmy, 2016 they reported that the great variation in chemical component content differed according to mango cultivars and mango seeded trees.

Table 6: Chemical parameters of six introduced Mango cultivars at harvest stage growing under El – Giza governorate condition during 2016 and 2017 seasons.

Parameters	Seasons	Cultivars						New LSD at 5%
		Keitt	Heidi	R2E2	Sensation	Tommy	Glenn	
Total sugar	2016	11.1	10.3	11.6	10.1	11.5	12.2	1.03
	2017	11.3	10.5	11.7	10.0	12.0	12.0	1.51
	Av.	11.2	10.4	11.65	10.05	11.75	12.1	
Reducing sugar	2016	8.5	7.0	8.3	7.4	9.5	9.6	0.97
	2017	8.4	7.5	8.5	6.7	10.1	9.1	0.75
	Av.	8.45	7.25	8.4	7.05	9.8	9.35	
Non reducing sugar	2016	2.4	3.3	3.3	2.7	2.0	2.6	0.23
	2017	2.9	3.0	3.2	3.3	1.9	2.9	0.29
	Av.	2.75	3.15	3.25	3.0	1.95	2.75	
Total soluble solid (TSS)	2016	17.0	17.0	17.0	20.0	18.0	16.0	1.89
	2017	20.0	16.0	17.0	16.0	17.0	19.0	1.35
	Av.	18.5	16.5	17.0	18.0	17.5	17.0	
Total acidity (TA)	2016	0.24	0.35	0.37	0.36	0.22	0.24	0.157
	2017	0.19	0.30	0.33	0.40	0.19	0.27	0.139
	Av.	0.21	0.33	0.35	0.38	0.21	0.26	
Vitamin (C)	2016	48.0	41.0	53.0	53.0	49.0	39.0	1.95
	2017	44.0	40.0	48.0	46.0	46.0	43.0	2.05
	Av.	46.0	40.5	50.5	49.5	52.0	41.0	

Numerical evaluation:

Total score for yield and fruit quality (100). Data pertaining the general evaluation of the Mango cultivars in Table (7) revealed that Keitt cultivar seemed to be the higher in the general evaluation score (94.36 unit) in the average of two seasons followed by Heidi and Tommy atkins

cultivars (84.00 and 82.36 unit) while, the lowest general evaluation total units (100) average two tested seasons (73.50 units) was recorded by Sensation cultivar.

Table (7) revealed the total score (70) for fruit quality (biennial bearing index, flowering malformation percentage, seasonality, total sugar, Vitamin c, pulp percentage and seed weight) was varied to Mango cultivars. Mango cultivars could be arranged descendingly based on total score (70) for fruit quality as follows: Keitt cultivar (64.36 units), Tommy atkins cultivar (57.27 units), Heidi cultivar (56.78 units), Glenn cultivar (56.18 units), R2E2 cultivar (54.45 units) and Sensation cultivar (46.87 units) in the average two tested seasons. In harmony with the present result those obtained by (Serry, 2010).

Tab1e 7: General evaluation (as average two seasons) of six introduced Mango cultivars growing under El – Giza governorate condition during 2016 and 2017 seasons.

Index	Units	Mango Cultivars					
		Keitt	Heidi	R2E2	Sensation	Tommy	Glenn
Yield/tree (kg)	30	30.00	27.22	26.64	26.63	25.09	25.79
Biennial bearing index	10	10.00	8.73	4.39	3.06	2.76	4.84
Flowering malformation	20	16.12	14.80	13.51	10.09	20.00	16.31
Seasonality	10	10.00	9.00	8.00	8.00	9.00	8.00
Total sugar	10	9.26	8.60	9.63	8.31	9.71	10.00
V.C (mg/100 g)	5	4.42	3.89	4.86	4.76	5.00	3.94
Pulp (%)	10	10.00	8.60	9.06	8.12	8.10	9.15
Seed weight	5	4.56	3.16	5.00	4.53	2.70	3.94
Fruit quality score	70	64.36	56.78	54.45	46.87	57.27	56.18
General evaluation score	100	94.36	84.00	81.09	73.50	82.36	81.97

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