Performance of some Strawberry Cultivars Grown under Assiut Climatic Conditions

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Abstract

This experiment was carried out throughout two successive seasons of 2014 and 2015 at a private farm located at El-Kossia district, Assiut Governorate. The study included five (5) strawberry cultivars namely, Florida, Sweet Charlie, Americana, Gafiota and Festival. Transplants of the tested cultivars were obtained from local nurseries as cold stored plants (Frigo). This work aimed to evaluate such strawberry cultivars and assess their ability to grow and produce under the warm climatic conditions of Assiut governorate. Americana and Sweet Charlie was found to be the best performing cultivars in respect of vegetative growth vigor. They also produced reasonable yield with the best berryquality comparing with the other cultivars.

Keywords: Strawberries, Sweet Charlie, Festival, vegetative growth, berry quality.

Introduction

The wild strawberries (*Fragariavesca* and *Fragariaelatior*) grow in woods and hedgerows in Europe (Turner and Muir, 1985).

The commercial strawberry cultivars belong to (*Fragariaananassa*Duch). It is one of the most fruit crops in the world, not only for fresh consumption, but also for processing. The berries have a more attractive color than any other important fruit, are sweet and well flavored, enabling them to be eaten when picked direct from the bush or consuming by other means.

The suitable climate and weather conditions for growing strawberry plants included cold requirements, temperature and photoperiod. The growers should be also aware about spring frost and wind harms.

The endodormancy of strawberry is caused by a short day and low temperature and is broken to a degree in some cultivars by additional daily light exposures and in all cultivars by temperatures around freezing (Shoemaker, 1955 and Antunes*et al.*, 2010).

The weather and environmental conditions greatly affect the growth, development and fruiting of strawberry plants. Photoperiod, light, temperature and nutrient status of soil greatly affected the growth of strawberry (Tanaka and Muznta, 1974 and Strik, 1988). Day length also affected the vegetative growth of strawberry (Smeets, 1955 and Rao and Lal, 2010). Also, very low temperature may lead to flower frost damage leading to lower yield or poor pollination. However, high temperature in late spring might be a problem in tools and need to be cooled off (Neocleous

and Vasilakakis, 2008). The optimum temperature for growth and development of strawberry is 73°F (Shoemaker, 1955).

During the last decades, in Egypt,strawberries is increasingly recognized as attractive fruit plant that produce valued and health beneficial ingredients. According to the ministry of agriculture statistics (2015) the total area devoted for strawberry in (2015) was 13858 feddans producing about 259077 tons with an average of 18.695 tons/feddan

According to such statistics (2015), the Upper Egypt provinces including Assiut governorate do not contribute by any area for growing strawberry. On the other hand, Noubaria is the leader province for area and production followed by Ismailia where both districts contribute by about 57% of total area devoted for strawberry.

The local strawberry cultivar (Balady) has deteriorated during the past years although it has got some desirable characteristics such as high sugar content and good flavor and aroma of the fruits. Such cultivar is characterized by a low productivity. Accordingly, many cultivars have been introduced to Egypt from Europe and California. These cultivars are planting now in a large scale instead of the local traditional cultivar (Balady).

The objective of this work was to evaluate five strawberry cultivars namely, Florida, Sweet Charlie, Americana, Gafiota and Festival and assess their ability to grow and produce under the warm climatic conditions of Assiut governorate.

Materials and Methods

The experiment was carried out throughout two successive seasons of 2014 and 2015 at a private farm located at El-Kossia district, Assiut Governorate. The study included five (5) strawberry cultivars namely, Florida, Sweet Charlie, Americana, Gafiota and Festival. Transplants of the tested cultivars were obtained from local nurseries as cold stored plants (Frigo).

The soil texture was sandy and it prepared by ploughing, harrowing and manuring. Two irrigation systems were used under this experiment, drip and sprinkler irrigation.

The purpose of this experiment was to evaluate the vegetative growth and fruiting of the tested cultivars under Assiut climatic conditions. Planting was carried out during the third week of September in both seasons. The transplants were dipped in 0.2% Rizolex solutionfor 20 minutes, as a fungicide, before transplanting.

A complete randomized block design with five replicates was adapted. The experiment consisted of five experimental plots, each one consisted of five rows and each raw represented one cultivar. Thus, each plot contains all tested cultivars and repeated five times. Each row was 10 meters long and 70 cm wide and the plants were set at 30 cm apart. All experimental plots received similar treatments as regards to manuring, fertilization, irrigation and pest and disease control as recommended. Measurements were recorded as follows:

1- Vegetative growth characteristics:

A random sample of ten plants for each plot and cultivar was chosen at the end of the growing season. The average reading of the ten plants was represented as a replicate. Thus, each cultivar comprised of 50 plants. The following characteristics were recorded on each plant:

1.1. Plant height (cm).
1.2. Average number of leaves per plant.
1.3. Number of runners per plant.
1.4. Number of stolons per runner.

2- Yield components:

2.1. Number of fruits per plant.

2.2. Total yield weight (g): All harvested fruits at the ripe stage (full red color) all over the growing season were weighed and total yield per plant was then calculated.

2.3. Average fruit weight (g): was calculated by dividing the total yield weight (g) on number of fruits per plant.

3- Physical characteristics:

A random sample of twenty fruits for each replicate was taken at harvest time to determine the following traits:

3.1. Fruit length (L) (cm):
3.2. Fruit diameter (D) (cm):

They were estimated by using varnier caliper and then the fruit L/D ratio was calculated.

3.3. Fruit firmness (kg/cm^2):

It was estimated by using penetrometer as kg/cm^2.

4- Chemical fruit characteristics:

Same samples that using for physical characteristics were used to determine the following traits:

4.1- Total soluble solids % (TSS):

It was determined by using a hand refractometer.

4.2- Total titratable acidity:

It was estimated by titrating pure fruit juice against NaOH 0.1 N and phenolphthalein as an indicator, (AOAC, 1984). Acid content was expressed as g citric acid/100 ml fruit juice.

4.3- TSS/acid ratio:

It was calculated by dividing the percentage of TSS on the total acidity.

4.4- Vitamin C content %:

It was analyzed according to the standard method described in AOAC (1984) and expressed as mg/100g.

4.5- Total sugars %:

They were determined according to Lane and Eynon method as outlined in AOAC (1984).

All obtained data were statistically analyzed. The analysis of variance (ANOVA) was applied according to Snedecor and Cochran (1989). Means were compared using Duncan multiple range test.

Results and Discussion

1- Vegetative growth characteristics:

Differences between the tested strawberry cultivars are presented in Tables (1&2). The vegetative growth characteristics included plant height (cm), number of leaves per plant, number of runners per plant and number of stolons produced by each runner.

1.1- Plant height (cm):

Data presented in Table (1) indicated that there were significant differences between the studied cultivars concerning the plant height. Results showed that Americana cultivar had the longest plants (19.0 and 21.7 cm

in the two seasons, respectively). The differences between this cultivar and other cultivars were significant during the second season of study, however, in the first season, the significant differences were detected between it and Gafiota and Festival. Nevertheless, there were no significant differences between Sweet Charlie, Gafiota and Festival during the 1st season and between Sweet Charlie and Gafiota in the second season. On the other hand, Festival gave the lowest values in this respect with an average of 15.4 (cm) during the two studied seasons.

The results were accordant with that reported by Das *et al.* (2007). They reported that plant height of strawberry cultivars ranged between 11.8 and 24.6. Also, Rahman *et al.* (2013) found that it differed from 16.67 to 25.00 (cm). On the other hand, Ahsan (2014) noted that Festival strawberry cultivar recorded the highest value of plant height which it recorded 30.3 (cm). The later was not accordant with the results of the present study which it revealed that Festival cultivar recorded the lowest value (15.4 cm) of plant height. Also, Das *et al.* (2015) found that the plant height of Festival cultivar reached 21.34 (cm), however Sweet Charlie recorded 19.17 (cm). The later supported the data of the current study which it found that the plant height of Sweet Charlie cultivar reached 18.00 (cm).

The variation in plant size might be due to the genetic makeup of strawberry plants (Asrey*et al.* (2004) and Rahman (2011)). The plant height of different strawberry cultivars was significantly influenced by interaction effect of planting time and cultivar (Rahman, 2014). It also is a genetical characteristic and different cultivars produced different plant height on the basis of their characteristics (Ahsan *et al.*, 2014).

1.2- Leaf number per plant:
Results presented in Table (1) showed the differences between the studied cultivars in respect of the number of leaves per plant. High significant differences could be observed between cultivars during the two seasons of study. Results of the two seasons indicated that Festival cultivar surpassed the other cultivars in the number of leaves per plant. The differences between this cultivar and the other cultivars were significant (except with Sweet Charlie in the 1st season) during the two seasons of study. The values associated with such cultivar were 18.7 and 21.0 leaves/plant in the two seasons, respectively. The second cultivar was Sweet Charlie followed by Florida, while Gafiota and then Americana gave the lowest number of leaves per plant. The latter two cultivars gave 12.9 and 13.7 leaves per plant as an average of the two studied seasons.

Table 1. Plant height (cm) and leaf number/plant of studied strawberry cultivars during 2014 and 2015 seasons.

Cultivar	Plant height (cm)		Leaf number per plant	
	2014	2015	2014	2015
1- Florida	18.7 A	19.0 B	15.3 B	17.0 B
2- Sweet Charlie	18.0 AB	18.0 BC	17.7 A	18.3 B
3- Americana	19.0 A	21.7 A	13.3 C	14.0 C
4- Gafiota	16.0 B	17.0 C	11.7 D	14.0 C
5- Festival	15.7 B	15.0 D	18.7 A	21.0 A
F-test	*	**	**	**

Data were analyzed with Duncan's multiple range test and means with same letters in the same column were not significantly different at 5% level of the probability.

The results of present study are supported by the finding of Sharma *et al.* (2014). They noted that the average number of leaves ranged from 11.88 to 17.21. However, Rahman *et al.* (2013) on 15 strawberry cultivars found that the number of leaves/plant differed from 20.33 to 46.67. Rahman (2014) observed that Sweet Charlie and Festival cultivars recorded the highest number of leaves grown on different planting dates. The later came on line with the data of present study which it found that both cultivars gave the highest number of leaves/plant in both seasons of study. Singh *et al.* (2007) revealed that the maximum number of leaves in early planting time (September) may be due to the congenial climatic conditions which were favorable for growth and development of plants.

Variation with respect to the number of leaves/plant could be attributed to the fact that different cultivars may react differently to photoperiod, light, temperature, and nutrient status of soil, available metabolites and their allocation to the above ground plant parts (Tanaka and Muznta (1974) and Strik (1988)).

Das *et al.* (2007) also found that a great differences of leaf number grown on different mulching materials.

1.3- Number of runners per plant:

The recorded data concerning the number of runners per plant are found in Table (2). The obtained results showed that the highest number (6.0 and 5.7) was recorded for Americana with significant differences between it and the other cultivars (except of Gafiota) during the two seasons of study. There were no significant differences between Florida, Sweet Charlie and Festival during the two studied seasons, however, Festival cultivar gave the least number of runners per plant. The later produced 3.7 and 4.0 runners per plant for the two seasons, respectively. Some investigators found significant variations among various strawberry cultivars in respect of the number of runners/plant (Hancock *et al.*, 2001; Tessarioli *et al.*, 2003; Rahman *et al.*, 2013; Ahsan *et al.*, 2014 and Jami *et al.*, 2015). For instance Rahman *et al.* (2013) found that the number of runners ranged

from 68.67 to 6.33. Sharma *et al.* (2014) also counted the number of runners/plant and they found that it ranged from 7.85 to 22.27. Also, Jami *et al.* (2015) found that it ranged from 4.40 to 1.16. Ahsan *et al.* (2014) found that Festival cultivar recorded the lowest number of runners/plant. While, Jami *et al.* (2015) noted that Sweet Charlie gave a high number of runners/plant. The previous reports supported the results of the current study.

The runner production in strawberry cultivars may be correlated with day length (Smeets, 1955 and Rao and Lal, 2010).

1.4- Number of stolons per runner:

Results presented in Table (2) indicated that the highest number of stolons was recorded for Americana cultivar (2.7 stolons in the two seasons) with significant differences between it and the other cultivars with an exception of Florida cultivar in the 1st season. On the other hand, Festival exhibited the lowest value comparing with all tested cultivars which it gave only 1 stolon per runner during the two seasons of study.

Ahsan *et al.* (2014) found that the number of stolons per runner of strawberry cultivars showed a significant variations and Festival cultivar recorded the lowest number of stolon per runner. This finding came on line with the current study.

Table 2. Number of runners and stolons per runner of studied strawberry cultivars during 2014 and 2015 seasons.

Cultivar	Number of runners		Number of stolons per runner	
	2014	**2015**	**2014**	**2015**
1- Florida	4.3 B	4.3 BC	2.0 AB	1.7 B
2- Sweet Charlie	4.3 B	4.7 BC	1.7 BC	1.7 B
3- Americana	6.0 A	5.7 A	2.7 A	2.7 A
4- Gafiota	5.3 A	5.3 AB	1.3 BC	1.3 B
5- Festival	3.7 B	4.0 C	1.0 C	1.0 B
F-test	**	*	**	*

Data were analyzed with Duncan's multiple range test and means with same letters in the same column were not significantly different at 5% level of the probability.

2-Yield components:

Data presented in Tables 3&4 showing various traits associated with yield of the studied strawberry cultivars. Yield components included number of fruits per plant, yield weight (g) per plant and the average fruit weight (g).

2.1- Number of fruits per plant:

Data presented in Table (3) indicated that Florida cultivar produced the highest number of fruits per plant, followed by Festival and Sweet Charlie and then Americana. The number of fruits per plant associated with these cultivars was 16.8, 15.3, 14.9 and 14.5 fruits as an average of the two seasons, respectively. On the other hand, Gafiota recorded the low-

est number of fruits per plant (10.0 and 9.3 fruits in the two seasons, respectively).

2.2- Total yield weight (g) per plant:

Results in Table (3) revealed that there were high significant differences between the tested cultivars respecting the total yield weight per plant. In details, Florida cultivar produced the highest yield comparing with the other cultivars. The differences between this cultivar and the other tested cultivars were significant except of Americana cultivar in the 2nd season of study. The total yield weight of Florida reached 542.5 (g) followed by Americana which it gave 474.6 (g) and then Sweet Charlie gave 413.4 (g). Festival cultivar produced the lowest yield weight (309.8 g as an average of the two seasons).

2.3- Average fruit weight (g):

Significant differences in fruit weight were observed between various cultivars (Table 3). In this respect, Gafiota showed the highest values followed by Americana. Average fruit weight of such cultivar reached 36.3 (g) in the two seasons.

Table 3. Number of fruits per plant, total yield weight (g) per plant and average fruit weight of studied strawberry cultivars during 2014 and 2015 seasons.

Cultivar	No. fruits per plant		Total yield weight (g) per plant		Average fruit weight (g)	
	2014	2015	2014	2015	2014	2015
1- Florida	16.7 A	16.9 A	589.0 A	496.0 A	29.9 C	29.7 C
2- Sweet Charlie	14.8 A	15.7 A	401.3 C	425.5 B	27.3 C	27.1 C
3- Americana	15.0 A	14.0 A	483.0 B	466.2 A	32.2 B	33.3 B
4- Gafiota	10.0 B	9.3 B	363.0CD	337.6 C	36.3 A	36.3 A
5- Festival	15.7 A	14.9 A	332.8 D	286.7 D	21.2 D	19.5 D
F-test	**	**	**	**	*	**

Data were analyzed with Duncan's multiple range test and means with same letters in the same column were not significantly different at 5% level of the probability.

The second cultivar in this respect was Americana which it gave 32.2 and 33.3 (g) in the two seasons, respectively. The lowest values of fruit weight were obtained from Festival cultivar (20.41 g as an average of the two seasons).

The results of the present study were partially accordant with the previous reports made by Hancock *et al.* (2001), Bussell *et al.* (2005), Sonsteby and Heide (2008), Autunes*et al.* (2010), Rahman *et al.* (2013), Kim *et al.* (2013), Rahman (2014), Ahsan *et al.* (2014), Das *et al.* (2015) and Belakud *et al.* (2015).

The yield was differed between various cultivars, locations and planting method and date. Alders and Craig (1966) found a significant differences between cultivars in yield components. They found a positive correlation of various characteristics and were highly variable from seedling to seedling within a given cultivar. Also, Ruan *et al.* (2011) noted that different planting dates resulted in significant differences in fruit productivity and vegetative growth regardless of cultivar or planting material.

Hancock *et al.* (2001) noted that there were significant differences among the cultivars for fruit weight and total yield. Also, Santos *et al.* (2007) found significant differences between the studied cultivars and/or the locations.

In order to reach the maximum yield from strawberry, it should be optimize environmental and cultural manipulations that aid in plant establishment and development, thus increasing the resources available for floral initiation in the fall and fruit development in the spring (Fernandez *et al.*, 2001). Low temperature may lead either to flower frost damage leading to lower yield or poor pollination. However, high temperature in late spring might be a problem in tools and need to be cooled off (Neocleous and Vasilakakis, 2008). The differences between cultivars can be attributed to the production potential of the studied cultivars and the differences with respect to requirements for cold during the period of production of the plants. This requirements for cold varies from cultivar to another one (Antunes *et al.*, 2010). It was also found that the yields of the strawberry cultivars varies depending on the cropping system, year and cultivar (Paszko*et al.*, 2014) or due to the inherent character of the cultivar (Rahman *et al.*, 2013).

3- Physical fruit characteristics:

Measurements of physical fruit characteristics included fruit dimensions (length and diameter cm), L/D ratio and fruit firmness. Such traits are found in Tables (4&5).

3.1- Fruit length (L) (cm):

It is obvious from Table (4) that fruits of Gafiota cultivar exhibited the highest value followed by Americana cultivar and then Florida. The differences between Gafiota and the rest of cultivars were significant except of Americana in the 1st season of study. The fruit length of these cultivars was 6.0, 5.3 and 5.2 cm as an average of the two seasons, respectively. Festival cultivar recorded the least value among all tested cultivars.

3.2- Fruit diameter (D) (cm):

Data of fruit diameter, took the same trend of fruit length where Gafiota, Americana and Florida cultivars recorded the highest values. While, Festival and then Sweet Charlie gave the lowest values (Table 4).

3.3- Fruit length/Diameter ratio (L/D ratio):

Data presented in Table (5) showed that Gafiota cultivar represented the highest ratio with significant differences between it and the other tested cultivars during the two seasons of study. The L/D ratio associated with this cultivar was 1.50 and 1.53 in the two seasons, respectively. However, Festival cultivar recorded the least ratio comparing with the other cultivars.

3.4- Fruit firmness (kg/cm^2):

The obtained results (Table 5) revealed that Gafiota and Americana cultivars exhibited the highest value with no significant differences between them. However, Florida cultivar was the least cultivar respecting this trait.

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Table 4. Fruit length (L) (cm) and fruit diameter (D) (cm) of studied strawberry cultivars during 2014 and 2015 seasons.

Cultivar	Fruit length (L) (cm)		Fruit diameter (D)(cm)	
	2014	2015	2014	2015
1- Florida	5.1 B	5.2 B	3.6 BC	3.7 B
2- Sweet Charlie	4.8 C	4.9 B	3.4 C	3.6 B
3- Americana	5.2 AB	5.3 B	3.7 AB	4.1 A
4- Gafiota	5.9 A	6.0 A	3.9 A	4.1 A
5- Festival	4.2 D	4.1 C	3.1 D	3.3 C
F-test	**	**	**	**

Table 5. Fruit Length / diameter ratio and fruit firmness (kg/cm^2) of studied strawberry cultivars during 2014 and 2015 seasons.

Cultivar	Length / diameter ratio		Fruit firmness (kg/cm^2)	
	2014	2015	2014	2015
1- Florida	1.40 B	1.40 B	1.20 B	1.20C
2- Sweet Charlie	1.40 B	1.37 C	1.40 AB	1.30 C
3- Americana	1.40 B	1.43B	1.60AB	1.80A
4- Gafiota	1.50 A	1.53 A	1.70 A	1.80 A
5- Festival	1.34 C	1.24 D	1.40B	1.40B
F-test	*	**	*	**

The abovementioned results came on line with that reported by Kim *et al*. (2013). They found that at fruit ripening, the fruit length differed from 44.5 to 55.3 (mm), fruit width from 34.05 to 40.1 (mm) and the shape index ranged from 2.1 to 1.5. However, the fruit firmness of the studied cultivars greatly differed and ranged from 0.5 to 11.6 (N). Other report (Ahsan *et al*., 2014) mentioned that, Festival cultivar recorded the highest fruit length and diameter (30.1 and 19.3 mm). The later values are lower than that of the present study which it found that Festival cultivar recorded 4.1 and 3.2 (cm) for fruit length and diameter, respectively (2 season's average). Das *et al*. (2015) also found that fruit length was 3.28 and 4.19 for Sweet Charlie

and Festival cultivars while fruit diameter recorded 2.27 and 3.09 (cm) for both cultivars, respectively. The later came on line with the results of present study. Different mulches probably led to differences in canopy temperature, soil temperature, moisture content and quantity and quality of light. These differences in turn, may have affected plant growth and fruit quality in strawberry plants (Das *et al*., 2007).

Also, differences in the fruit size or weight of various strawberry cultivars may be due to their genotypic differences or adaptability to different climatic conditions.

4- Chemical fruit characteristics:

Chemical fruit characteristics for the studied strawberry cultivars are found in Tables (6 and 7).

4.1- Total soluble solids (TSS %):

Data presented in Table (6) demonstrated that Americana cultivar exhibited the highest percentage of TSS followed by Festival and then Gafiota. The differences between the three cultivars were not significant except of Gafiota in the 2nd season of study. The lowest TSS% was observed in Florida cultivar.

Antunes *et al.* (2010) concluded that the chemical characteristics of the strawberry cultivars did not differ statistically between them. They also found that Festival cultivar recorded 7.6% for the TSS%. This value was exactly as the obtained value of such cultivar under the present study. Also, Rahman (2014), found that TSS% of Sweet Charlie differed from 7.10 to 7.57 and in Festival from 7.60 to 8.33 depending on the planting date. The later supported the values of TSS obtained from such cultivars in the present study.

4.2- Total titratable acidity %:

Results of acidity percentage are presented in Table (6). It is clear from such table that Americana cultivar exhibited the lowest acidity percentage followed by Sweet Charlie and then Gafiota. However, winter down recorded the highest percentage of acidity among all the tested cultivars where it reached 0.92% during the two seasons.

Similar results were obtained by Antunes *et al.* (2010), Rahman (2014), Voća *et al.* (2008), Pineli*et al.* (2011) and Belkaud *et al.* (2015).

Table 6. Total soluble solids (TSS %) and acidity % of studied strawberry cultivars during 2014 and 2015 seasons.

Cultivar	TSS %		Acidity %	
	2014	**2015**	**2014**	**2015**
1- Florida	6.0 B	6.2 C	0.92 A	0.92 A
2- Sweet Charlie	6.9 B	7.4 B	0.76 C	0.72 C
3- Americana	7.6 A	7.8 A	0.65 C	0.62 D
4- Gafiota	7.2 A	7.1 B	0.80 B	0.78 C
5- Festival	7.6 A	7.6 AB	0.82 B	0.84 B
F-test	*	*	*	*

Data were analyzed with Duncan's multiple range test and means with same letters in the same column were not significantly different at 5% level of the probability.

4.3- Total soluble solids/acid ratio:

Data presented in Table (7) clearly indicated that varietal differences were detected between the tested cultivars. The highest ratio was obtained from Americana cultivar (11.7 and 12.6 for the two seasons, respectively) with significant differences between it and the other cultivars during the two studied seasons. The TSS/acid ratio of Florida cultivar was the least (6.5) among all tested cultivars. The other three cultivars recorded ratios ranged between 9.1 and 10.3.

4.4- Vitamin "C" content of fruit juice:

Data presented in Table (7) showed that Florida cultivar gave the highest percentage of V.C, where it reached 234.40 and 246.23 mg/100g in the two seasons, respectively. The differences between Florida and the other cultivars were significant during the two studied seasons. However, the rest of cultivars recorded values ranged between 178.0 and 195.8 and 192.80 to 213.60 in the two seasons, respectively with no significant differences between them during the two studied seasons. Rahman (2014) found that ascorbic acid (mg/100 g) of Festival strawberry cultivars ranged from 75.67 to 80.50 while in Sweet Charlie ranged from 77.33 to 85.00 depending on the planting dates. The later did not accordant with the results of current study which the V.C. % recorded for the studied cultivars was much higher than the previous report. It also higher than those reported by Pineli *et al.* (2011) and Kim *et al.* (2013).

4.5- Total sugars %:

The presented data (Table 7) revealed that there were no significant differences between the tested cultivars except of Florida which it gave the least values of total sugars. However, the other cultivars recorded percentages ranged from 5.2% for Sweet Charlie in the 1st season and 5.9% for Americana in the 2nd season.

The present work concluded that, Sweet Charlie and Americana was found to be the best performing cultivars in respect of vegetative growth vigor. They also produced reasonable yield with the best berry quality comparing with the other cultivars.

Table 7. TSS/acid ratio, V.C. (%) and total sugars (%)of studied strawberry cultivars during 2014 and 2015 seasons.

Cultivar	TSS/acid ratio		V.C. (%)		Total sugars (%)	
	2014	2015	2014	201○	2014	2015
1- Florida	6.5 C	6.5 D	231.4 A	246.23 A	4.7 B	4.6 B
2- Sweet Charlie	9.1 B	10.3 B	178.0 B	192.83 B	5.2 A	5.7 A
3- Americana	11.7 A	12.6 A	186.9 B	195.80 B	5.8 A	5.9 A
4- Gafiota	9.1 B	9.1 C	195.8 B	213.60 B	5.7 A	5.6 A
5- Festival	9.3 B	9.1 C	195.8 B	201.73 B	5.8 A	5.8 A
F-test	**	**	*	*	*	*

Data were analyzed with Duncan's multiple range test and means with same letters in the same column were not significantly different at 5% level of the probability.

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سلوك بعض أصناف الفراولة المزروعة تحت ظروف أسيوط المناخية

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الملخص

أجريت التجربة خلال موسمين متتالين ٢٠١٣/٢٠١٤ و ٢٠١٤/٢٠١٥ فـي مزرعـة خاصة تقع في منطقة القوصية، محافظة أسيوط. وشملت الدراسـة خمسـة (٥) أصـناف مـن الفراولة وهي فلوريدا، سويت تشارلي، أمريكانا، جافيوتا وفيستيفال. وقد تـم الحـصول علـى النباتات من المشاتل المحلية كشتلات مبردة (فريجو). تهدف الدراسة إلى تقييم الخمسة أصـناف من الفراولة وقدرتها على النمو والإنتاج في ظل الظروف المناخية الحـارة لمحافظـة أسـيوط واتضح مننتائج هذا العمل أن صنفي أمريكانا وسويت تشارلي هما أفضل الأصناف فيما يتعلـق بقوة النمو الخضري هذا بالأضافة الى أنهما أنتجا محصولا جيدا مع أفضل جودة للثمار مقارنـة مع الأصناف أخرى.