EVALUATION OF SOME BANANA CULTIVARS UNDER SOUTH EGYPT CONDITIONS.

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Keywords:
Evaluation Banana Vegetative characteristics, Fruit quality, tissue culture

Abstract

This study was carried out during three successive seasons of 2013/2014, 2014/2015 and 2015/2016 on parent and first two ratoon crops of three banana cultivars namely 'Williams Zeaf ', 'Grand Naine' and 'Hindi' grown in new orchard situated at Bardees region, El- Baliana city, Sohag Governorate, Egypt. The considered banana plants were raised by tissue culture.maximum Assimilation area (m^2) was in 'Williams Zeaf' (38.24) in second ratoon. The highest values Bunch weight (Kg) was (34.86) in 'Williams Zeaf' in second ratoon. The highest values of Number of hands/bunch were in 'Williams Zeaf' (14.00) followed by 'Grand Naine' (13.20). The highest finger weight (g) was (132.02) in second ratoon followed by (123.20) and (104.60), in 'Williams Zeaf', 'Grand Naine' and 'Hindi' respectively, The highest pulp (%) was (74.17%) followed by (72.46% and 67.63%), in 'Williams Zeaf', 'Grand Naine' and 'Hindi' respectively, The highest total soluble solids (tss) percentage was in 'Williams Zeaf' (21.50%) followed by 'Grand Naine' (20.88%), The highest total sugar percentage was in 'Williams Zeaf' (18.45%) followed by 'Grand Naine' and 'Hindi' (16.60 %and 14.86%) respectively. It can be recommended that Williams Zeaf banana cultivar must be planted to obtain the high yield with good fruit quality under this area condition.

INTRODUCTION

Banana is an important crop in Egypt. Lack of improved varieties one of the primary sources of lower banana production in the Egypt Governorates. There had no trend of using improved of banana varieties in the existing production system. Hence; there is need to introduce improving banana cvs. to the target Governorates is crucial for banana production and productivity. Efforts to improve banana production in Egypt were started in 1987 by introducing

new banana germplasm; that consisted of cvs Grand Nain (*Musa cavendishii*), 'Williams Hybrid' (*Musa acuminate*). The "Grand Naine" bananas (also spelled Grande Naine) literally translates from French meaning "Large Dwarf". It is a cultivar of the well-known Cavendish bananas. This group of bananas is distinguished from other groups by it AAA genotype. The AAA genotype refers to the fact that this group is a triploid variant of the species (*Musa acuminate*). There are 33 chromosomes present in the AAA cultivar and all produce seedless fruits through parthenocarpy. The Grand Naine has become one of the most popular varieties for commercial plantations. It is characterized by high productivity and desired fruit quality (**Singh and Chundawat, 2002**). 'Williams Hybrid' is a cultivar of the Giant Cavendish type in the Cavendish subgroup. It is one of the most widely grown cultivars in commercial plantations. Genome group AAA. The plant grows to 6 to 8 feet. They produce very large heads of fruit that are sweet and delicious. They are wind resistant and cold hardy. In 2010 Private sector introduce banana cultivar 'Williams Zeaf' characterized by high yield production and high fruit quality.

Therefore, this study aimed to evaluate the vegetative growth behavior and productivity of three banana cultivars deriving from tissue culture such as introduced "Grand Naine" and newly introduced "Williams Zeaf" cultivars compared with local cultivar "Hindi" under field conditions of Sohag Governorate. The study was carried out three crop cycles in an experimental plot on a banana plantation in Egypt. The specific objective of the experiment was to identify the most promising ones which could be recommended for Sohag conditions in order to local banana production and gain a foothold in international banana markets.

MATERIALS AND METHODS

This study was carried out during three successive seasons of 2013/2014, 2014/2015 and 2015/2016 on parent and first two ratoon crops of three banana cultivars namely 'Williams Zeaf ', 'Grand Naine' and 'Hindi' grown in new orchard situated at Bardees region, El- Baliana city, Sohag Governorate, Egypt. The considered banana plants were raised by tissue culture. Mother

banana plants of minimum height and psedostem girth of 50 cm and 15 cm respectively, having 8-10 leaves when this study started on 21th March (2013), planting in a sandy clay loam (rich in organic matter and potash, having good water holding capacity with good drainage), spacing at 3.5 x 3.5m between and within respectively. Three ratoons were selected and left per each stool on the first week of July each year from plants emerging in May (2014 and 2015) with plant density (Planting of three suckers per pit spaced at 3.5m x 3.5m = (342 pits x 3 = 1026 plants) per feddan and the others were removed.

Fertilization with 40 kg balady manure (FYM) + 250 g superphosphate (15.5% P2 O5) added in december, about 500 g N (ammonium sulphate, 20.6% N) divided into fourteen equal doses from April to October intervals and 1200 g potassium sulphate (48-52% K2O) added in three equal doses in April, June and July per each plant (**Saleh, 2005**).

Experimental Design:

Selected mother Banana (5 plants) of each cultivar had one plant per replication, frits ratoons (15 plants) and second ratoons (15 plants) of each cultivar had five plants per replication were similar in growth, and the tested cultivars laid out as a randomized complete block design (RCBD) with five replicates.

The following variables were evaluated

Vegetative growth parameters:

Assimilation area (m2):

The assimilation area was worked out as the multiplication of the leaf area with number of functional leaves at flowering. The leaf area was worked out as the multiplication of the product of length and width of the leaf with leaf area factor (0.8) and recorded in (cm^2) as suggested by **Obiefuna and Ndubizy (1979)**.

Yield components:

Bunch weight (Kg):

Bunch stalk (peduncle) is cut above the first hand at the level of the last scar and immediately below the last hand and the bunch was weighted and recorded in (Kg/plants). The 2nd hand of the bunch was weighted and recorded in (Kg) as recommended by **Alvarez *et al*. (2001).** For recording average weight of hand in kg, the average number of fingers multiplied by average weight of fingers per bunch.

Number of hands/bunch:

Number of hands in the bunch were numerically counted

after complete opening of inflorescence and an average was recorded.

Fruit physical characteristics:

Finger weight (g):

Five individual middle fingers of the second hand were used to measure average finger weight (g).

Pulp percentage: Five individual middle fingers of the second hand were used to measure average pulp (%).

Fruit chemical content:

Total soluble solids (tss%) percentage:

Total soluble solids percentage (TSS %) was measured by a hand Refractometer at the ripe stage.

Total sugars percentage:

Total sugars percentage was determined according to the method described by **(Dubois et al 1956).** The amount of the estimated sugars in each sample was calculated in term of glucose.

Statistical Analysis:

All data collected were subjected to statistical analysis of variance (ANOVA) and significant difference among means were determined according to **(Snedecor and Cochran, 1972).** In addition significant difference among means were distinguished according to the Duncan's, multiple test range **(Duncan, 1955)** whereas, capital and small letters were used for differentiating the values of specific and interaction effects of investigated factors, respectively.

RESULTS AND DISCUSSION

Vegetative Growth Parameters:

Assimilation area (m2):

In regard to the assimilation area (m^2) data preformed that, there were significant differences between the cultivars with respect to the average assimilation area and superiority of Williams Zeaf cultivar (32.66) than in Grand Nain (23.95) and over Hindi figure (1). However, assimilation area was significantly greater in the second ratoon cycle (28.80) than in the first ratoon (26.45) and mother plant came the least.

Statistical analysis indicated significant differences for the interaction of growth cycles and cultivars. Second and the first ratoon were the best cycles for Williams Zeaf, Grand Naine and Hindi cultivars followed by mother plant and that Williams

Zeaf (38.24 and 35.37) followed by Grand Nain (28.56 and 24.87) cultivars are superior compared to Hindi. **Saleh (2005), Mostafa *et al.*, (2007)** and **El-khawage (2013)** found that variation in functional total leaf area (assimilation area) per plant of banana cvs.Williams and Grand Naine.

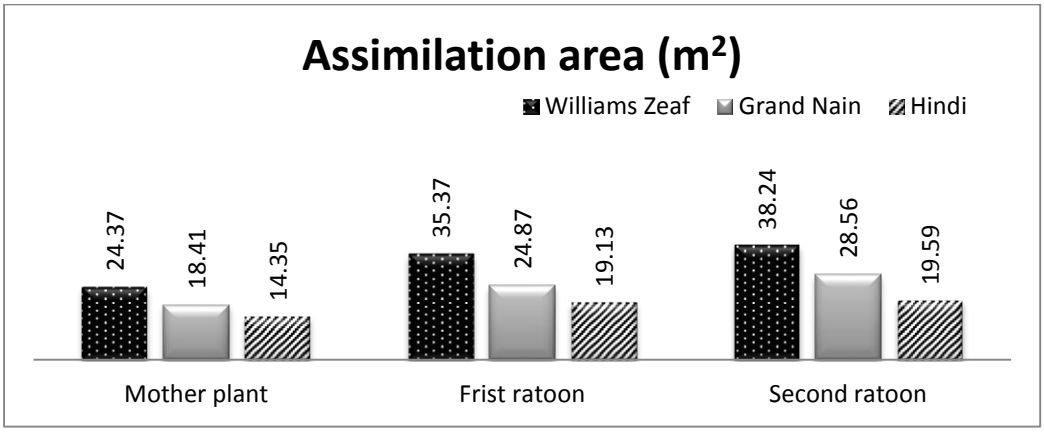

Figure (1): Assimilation area (m^2) of Williams Zeaf, Grand Naine and Hindi banana cultivars during three successive seasons (2014, 2015 and 2016).

Yield components:

Bunch weight (Kg):

In regard to the bunch weight (Kg) data revealed that, there were significant differences between the cultivars with respect to the average bunch weight and superiority of Williams Zeaf cultivar (31.19) than in Grand Naine (27.52) and over Hindi (18.39) figure (2). However, bunch weight was significantly greater in the second ratoon crop cycle (28.81) than in the first ratoon crop (27.42) and main crop came the least (20.88).

Statistical analysis indicated significant differences for the interaction of growth cycles and cultivars. Second and first ratoon crop were the best cycles for Williams Zeaf, Grand Nain and Hindi cultivars followed by main crop and that Williams Zeaf (34.86 and 32.83) followed by Grand Naine (31.47 and 30.66) cultivars are superior compared to Hindi (20.11 and 18.76).

These results are in accordance with those reported by **Abdalla and Mohamed (2004), Oliveirae *et al.*, (2006), Mahmoud *et al.*, (2010 and 2011)** and **Rayan *et al.*, (2016)** found that Williams plants gave significantly heaviest weight of bunches than Grand Naine and local banana cultivar. **Villalobos *et al.*, (2004)** added that there were differences in bunch weight in the first and third cycles.

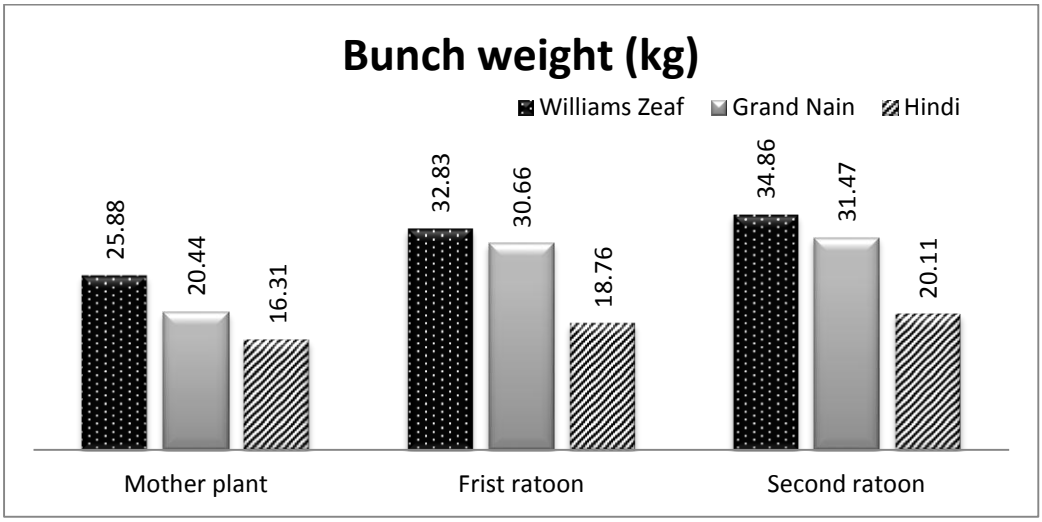

Figure (2): Bunch weight (Kg) of Williams Zeaf, Grand Naine and Hindi banana cultivars during three successive seasons (2014, 2015 and 2016).

Number of hands/bunch:

In regard to the number of hands per bunch data preformed that, there were significant differences between both cultivars with respect to the average number of hands and superiority of Williams Zeaf cultivar (12.80) than in Grand Naine (12.13) and over Hindi (10.40) figure (3). However, number of hands was significantly greater in the second and first ratoon crop cycles (12.67 and 12.33), respectively than in main crop.

Statistical analysis indicated significant differences for the interaction of growth cycles and cultivars. Second and first ratoon crop were the best cycles for Williams Zeaf, Grand Naine and Hindi cultivars followed by main crop and that Williams Zeaf (14.00 and 13.60) followed by Grand Nain (13.20 and 12.80) cultivars are superior compared to Hindi (10.40 and 10.80).**Abdalla and Mohamed (2004), Oliveirae *et al.* (2006) and Rayan *et al.*, (2016)** found that Williams banana plants gave significantly more number of hands than Grand-Naine and local banana cultivar. **Villalobos *et al.*, (2004)** added that no differences in number of hands in the first and third cycles.

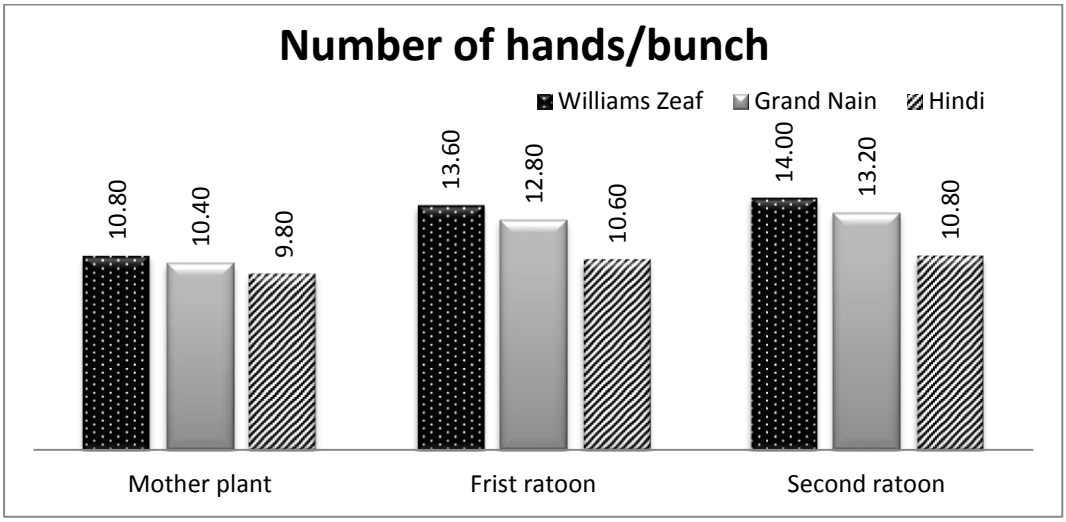

Figure (3): Number of hands per bunch of Williams Zeaf, Grand Naine and Hindi banana cultivars during three successive seasons (2014, 2015 and 2016).

Fruit1 physical characteristics:

Finger weight (g):

Mustered in figure (4), Data preformed that, there were significant differences between the cultivars with respect to the average finger weight and superiority of Williams Zeaf cultivar (121.75g) than in Grand Naine (113.33g) and over Hindi (97.49g). However, finger weight was significantly greater in the second ratoon crop cycle (119.95g) followed by first ratoon crop (114.19g) than in main crop. Statistical analysis indicated significant differences for the interaction of growth cycles and cultivars. Second ratoon crop was the best cycle for Williams Zeaf, Grand Naine and Hindi cultivars followed by first ratoon crop and main crop came the least and that Williams Zeaf (132.02 and 123.80g) followed by Grand Naine (123.20 and 116.60g) cultivars, respectively are superior compared to Hindi (104.60 and 102.10g).These results were coincide with those obtained by **Abd El Moniem *et al.*, (2008), Sarrwy *et al.*, (2012)** and **Rayan *et al.*, (2016)** found that Williams banana plants gave significantly more number of bigger fingers than Grand-Naine and local banana variety.

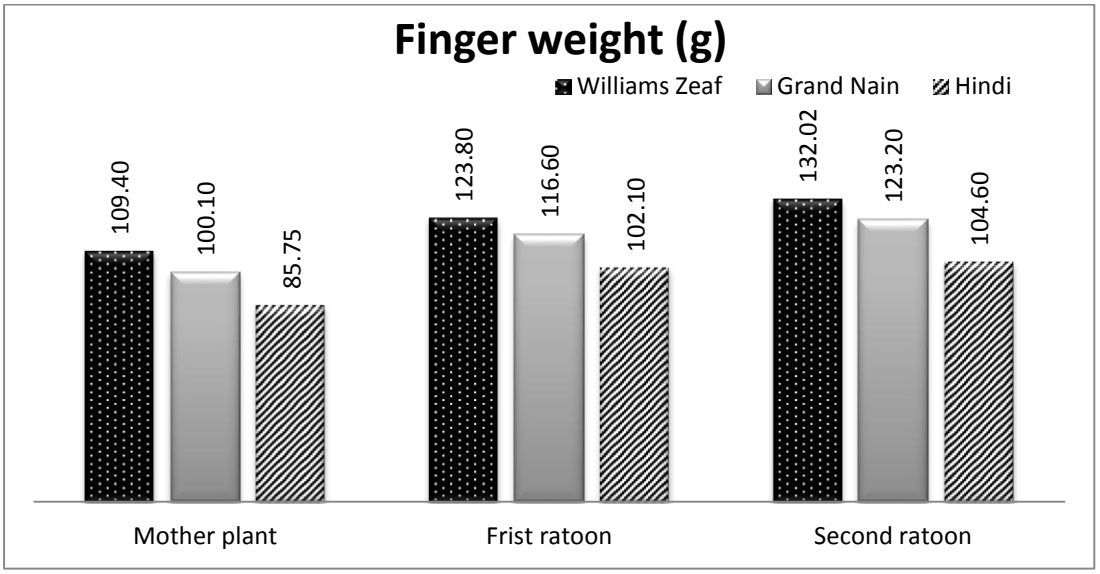

Figure (4): Finger weight (g) of Williams Zeaf, Grand Naine and Hindi banana cultivars during three successive seasons (2014, 2015 and 2016).

Pulp percentage:

As for the pulp percentage data revealed that, there were significant differences between both cultivars with respect to the average pulp and superiority of Williams Zeaf cultivar (72.70%) than in Grand Naine (71.07%) and over Hindi as shown in figure (5). However, pulp was significantly greater in the second ratoon crop cycle (71.42%) followed by first ratoon crop (70.78%) than in main crop.

Statistical analysis indicated significant differences for the interaction of growth cycles and cultivars. Second and first ratoon crop were the best cycle for Williams Zeaf, Grand Naine and Hindi cultivars and main crop came the least and that Williams Zeaf (74.17 and 73.47%) followed by Grand Naine (72.46 and 71.94%) cultivars are superior compared to Hindi. Similar results were reported by **Debnath *et al.*, (2001).** Whereas, **Abdalla and Mohamed (2004)** and **Rayan *et al.*, (2016)** found that Grand-Naine banana fruits, recorded significantly higher pulp percentage. While, Basrai fruits had the lowest significant values of pulp percentages and Williams fruits were intermediate in both seasons.

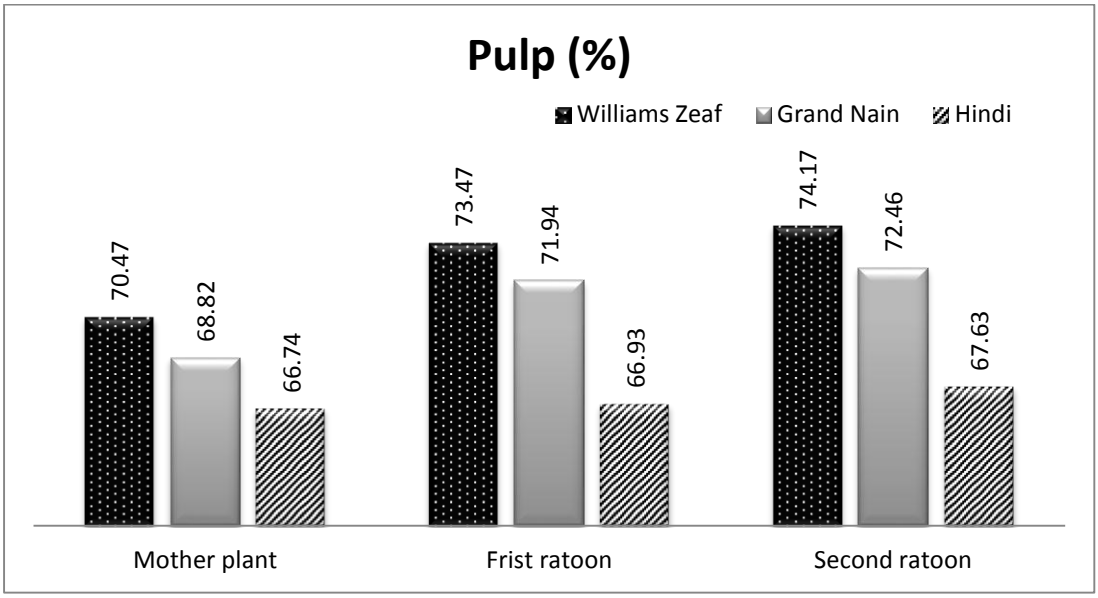

Figure (5): Pulp percentage of Williams Zeaf, Grand Naine and Hindi banana cultivars during three successive seasons (2014, 2015 and 2016).

Fruit chemical content:

Total soluble solids (TSS%) percentage:

Concerning the total soluble solids percentage (TSS%) data preformed that, there were significant differences between the cultivars with respect to the average TSS and superiority of Williams Zeaf cultivar (20.73) than in Grand Naine (20.15) and over Hindi, figure (6). However, TSS% was significantly greater in the second and first ratoon crop cycles (20.83 and 20.74) than in the mother crop.

Statistical analysis indicated significant differences for the interaction of growth cycles and cultivars. Second and first ratoon crop were the best cycles for Williams Zeaf, Grand Naine and Hindi cultivars followed by mother crop and that Williams Zeaf (21.50 and 21.36) followed by Grand Naine (20.88 and 20.86) cultivars are superior compared to Hindi. These results were in agreement with those obtained by **Ahmed *et al.*, (2012)** reported that introduced clones of Grand Nain and Williams Hybrid recorded the highest TSS content than the local clone Dwarf Cavendish. On the other hand, **Elkashif and Mahmoud (2005)** and **Mahmoud *et al.*, (2010 and 2011)** they found that irradiated clones of Grand Nain and Williams Hybrid had slightly lower total soluble solids content than the local clone Dwarf Cavendish.

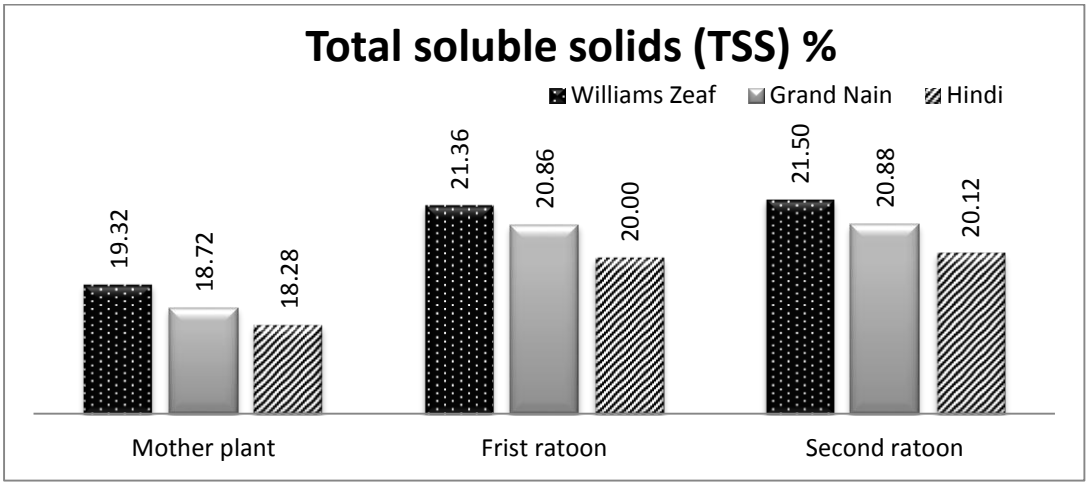

Figure (6): Total soluble solids (TSS) percentage of Williams Zeaf, Grand Naine and Hindi banana cultivars during three successive seasons (2014, 2015 and 2016).

Total sugars percentage:

In regard to the total sugars percentage data revealed that, there were significant differences between the cultivars with respect to the average total sugars and superiority of Williams Zeaf cultivar (17.42%) than in Grand Naine (15.82%) and over Hindi, figure (7). However, total sugars was significantly greater in the second and first ratoon crop cycles (16.94 and 16.43%) than in the mother crop.

Statistical analysis indicated significant differences for the interaction of growth cycles and cultivars. Second and first ratoon crop were the best cycles for Williams Zeaf, Grand Naine and Hindi cultivars followed by mother crop and that Williams Zeaf (18.45 and 18.36%) followed by Grand Naine (16.60 and 16.19%) cultivars are superior compared to Hindi. These results are in consistent with those reported by **Abdalla and Mohamed (2004)** and **Rayan *et al.*, (2016)** found that the highest significant values of total sugar percentage were obtained by Williams fruits while, the lowest significant values were obtained by the local banana cultivar.

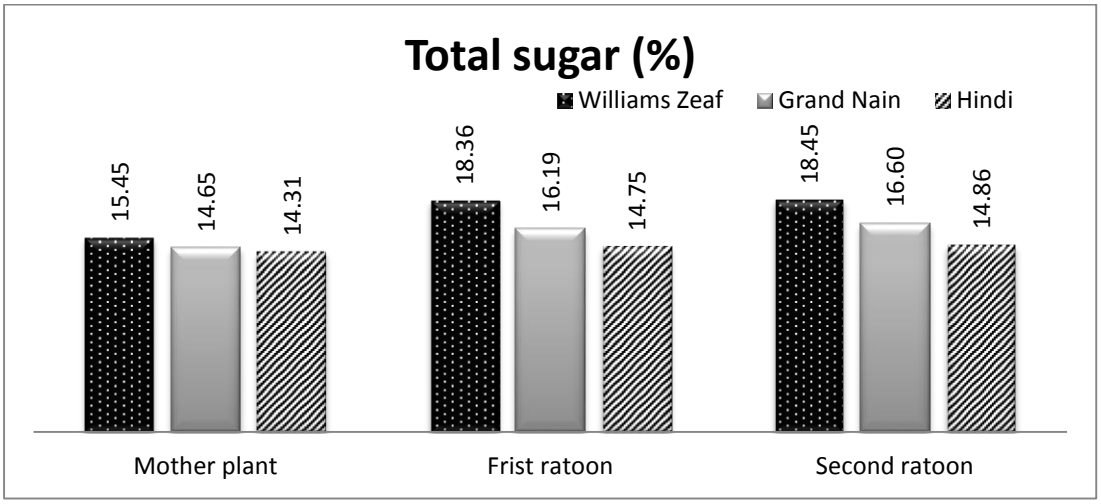

Figure (7): Total sugar percentage of Williams Zeaf, Grand Naine and Hindi banana cultivars during three successive seasons (2014, 2015 and 2016).

CONCLUSION

This study suggested that, both Williams Zeaf and Grand Naine must be planted to obtain the high yield with good fruit quality under south Egypt condition. Furthermore, the best one was Williams Zeaf plants since the highly production.

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