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PHYSIOLOGICAL AND TAXONOMICAL STUDIES ON SOME PEACH CULTIVARS. B: EVALUATION OF FRUIT, VEGETATION CHARACTERISTICS AND NUTRITIONAL STATUS.

KARIM, M. FARAG[1]; AMR, M. HAIKAL[1] AND ATEF, M. IBRAHIM [2],
[1] Department of Horticuture, (Pomology), Faculty of Agriculture, Damanhour Branch, University of Alexandria,P.O.Box 22516, Damanhour, Egypt.
[2] Department of Pomology, Faculty of Agriculture, University of Alexandria, El-Shatby, Alexandria, Egypt.

ABSTRACT

This study was conducted during two successive seasons 2003 and 2004 by using twelve peach cultivars whether imported-low chill or originated as strains of local cultivar Meet Ghamr. Studied cultivars were either early-season ones (namely, Robin, Rubidoux, and Spring Time) or mid-season cultivars (namely, Florida Red, Fla 16/33, Fla 3/2, Desert Red, Bemto, and Hagazy) or late-season cultivars (namely, Shamy, Soltani and Tejon). All used cultivars were grafted on Nemaguerd rootstock and grown under similar cultural practices and climatic conditions in El-Noubaria Province, El-Behera governorate. This part of the research aimed at evaluating the fruit characteristics (physical and chemical), vegetative characteristics such as shoot length and trunk cross sectional area, and the nutritional status of some macro-nutrients (N, P, K, Ca, Mg) and some micro-nutrients (Fe, Zn, Mn, Cu) in order to identify their quality criteria needed to fulfill the requirements of export and local markets (such as fruit weight, diameter, flesh weight, fruit firmness, and color intensity). The results revealed that fruits of the cultivar Fla 16/32 was superior as compared with the other studied cultivars since it compromised the desired quality attributes. The local cultivars Hagazy and Sultani were superior in most physical characteristics but need further color enhancement (anthocyanin intensity). On the other hand,

well-colored fruits such as those of Spring Time, Desert Red, and Fla 3/2 need cultural practices that improve their weight, diameter, and hence size to meet the requirements for export especially after adopting them by peach producers in Egypt.

INTRODUCTION

During the past few years, there has been a considerable increase in the number of peach cultivars in Egypt. Growers and agricultural investors have been adopting low chilling cultivars that could be successful in warm winter climate in order to produce high quality fruits for national and export markets. Thus, the peach grown area has been expanding in Egypt to reach to 78646 feddans in 2004 (Annual Book of Statistics in Egypt in 2005). Cultivar selection is a very critical decision since adopted cultivars vary in their quality and suitability to prevailing environmental conditions. Even though genetic factors control the physical and chemical characteristics of fruit, the vegetative and floral characteristics, some adopted peach cultivars may suffer from some problems associated with mild winter such as the need to artificial defoliation, late and uneven flowering and foliating resulting from insufficient chilling accumulation, micronutrient deficiency of Fe and Zn due to the alkaline soil in the newly reclaimed areas which reflect on reduced fruit size. (Diaz *et al.*, 1986). Produce buyers have been demanding larger and redder peaches.

For many years, it was possible to sell peaches that were $2\ ^{1}/_{8}$" in diameter but now the minimum requested diameter in 2 ½" (Marini and Sowers, 2000). Studies on various peach cultivars reached to the conclusion that some varieties have greater potential to produce large fruits because they posses greater cell number especially during the first phase of the double sigmoid curve of fruit growth. Although most early-season cultivars produce small fruit, growers need to plant cultivars that produce the largest possible fruit (Marini, 2006). Thus, many researchers reached to the conclusion that early, mid-season, and late-season cultivars of peach may vary in their cultural practices to maximize the obtained

fruit quality (Corelli-Grappadelli and Coston, 1991, Johanson and Handley, 1989, Marini and Sowers, 2000, Marini and Sowers, 1991, Scorza *et al.*, 1991). Peach trees are usually treated similarly in the same orchard regardless their time of ripening. Aforementioned, this study aimed at evaluating fruit physical and chemical characteristics of twelve peach cultivars grown in the same orchard and their nutritional status in addition to some vegetative characteristics. Such evaluation would provide peach producers with necessary evidences to select the most profitable low chilling cultivars.

MATERIALS AND METHODS

The present investigation was carried out during the two successive growing seasons 2003 and 2004 to evaluate twelve peach cultivars (*Pruns persica* L.) namely Hegazy , Shamy , Soltani , Desert Red , Robin , Tejon , Rubidoux , Spring time , Bemto , Florda Red , Fla 16/33 and Fla 3/2. The trees were three years old, grown in sandy soil budded on Nemaguard rootstock and spaced at 4 × 6 meters apart in a research center at Noubaria Province, El-Behera governorate The trees were annually irrigated with about 2500 cubic meters per feddan using drip irrigation system. During the winter time, a mixture of organic manure, ammonium sulfate, potassium sulfate and mono super phosphate at the rates of 22 m^3, 100-150 kg, 150 kg and 50 kg kg/feddan, respectively was annually ditched in the peach trees soil at a depth of 50 cm from the soil surface and 60 cm from the tree. During the growing season, 300 kg ammonium sulfate (21% nitrogen), 250 kg potassium sulfate (43..2% potassium) per feddan were also added to the irrigation water and 125 cm phosphoric acid each 1 m^3 irrigation water.

In both seasons, seventy two trees, as uniform as possible, were selected. from the experimental cultivars .Six trees, three replicates with two trees each, almost uniform in vigor were chosen at random from each cultivar and were utilized in this investigation (12 cultivars × 3 replicates × 2 trees = 72 trees). The studied trees were arranged in Randomized Complete Blocks Design (RCBD) .The ripening date was recorded according to the commercial harvesting date for each cultivar.

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In order to evaluate the effect of the different cultivars of peach trees on the leaves mineral composition, leaf samples of 25 leaves each were collected from each experimental tree at mid - May of both seasons. These leaf samples were taken from the middle portion of the outer current shoots. The leaves were processed and digested with sulphuric acid and hydrogen peroxide according to Evenhuis and Dewaard (1980). Nitrogen and phosphorus were colorimetrically determined according to Evenhuis (1976) and Murphy and Riley (1962), respectively. Potassium was determined by flame-photometer, calcium and magnesium by the Jenway PFP7 flame emission technique. Iron, manganese, zinc and copper were determined against a standard using Atomic Absorption Spectrophotometer. The yield of each tree was represented by number and weight of fruits per tree. From that yield, 15 fruits were taken at random, in each season, for the determination of fruit quality. In each fruit sample, firmness, fruit weight, flesh weight, stone weight, flesh to stone ratio, length and diameter. Fruit firmness was determined by Effegi pressure tester using a 5/16 inch plunger. Total soluble solids percentage in the fruit juice was determined by a hand refractometer. Juice acidity and vitamin C contents were also determined by titration with 0.1 N sodium hydroxide and 2, 6 dichlorophenol indo phenol blue dye, respectively while anthocyanin in the skin was determined colorimetrically (A.O.A.C., 1980). Flesh color and fruit stone freeness were recorded.. At the end of each season, shoot length was measured while trunk circumference was detected 20 cm above the soil surface and was converted to trunk cross sectional area (TCSA). The analysis of variance was obtained according to Snedecor and Cochran (1972) while comparing the means was done by using the least significant difference at 0.05 level.

RESULTS AND DISCUSSION

I. Fruit characteristics:

A. Physical characteristics:

The data in Tables (1 and 2) indicated the variations in fruit

weight of twelve commercial peach cultivars. Fruit weight didn't show a consistent trend in relation to the time of fruit maturity (harvest timing). In other words, early maturing cultivars were not necessarily smaller than medium or late-maturing cultivars. The three early cultivars (Robin, Rubidoux, and Spring Time) significantly varied in their fruit weight. In a similar way, medium (Florida Red, Fla 16/33, Fla 3/2, Desert Red, Bemto, and Hagazy) and late maturing cultivars (Shamy, Soltani and Tejon) significantly varied in fruit weight. The above trends were consistent in the two seasons 2003, and 2004. The highest fruit weight in both seasons was obtained with Fla 16/33 followed by Soltani. They had significantly higher fruit weight than all other evaluated cultivars, while Bemto fruits had the smallest weight as compared with other cultivars in both seasons. It was also shown in the data that free-stone cultivars such as Fla 16/33 and Fla 3/2 had relatively higher fruit weight than that of semi cling and cling cultivars. This trend was consistent in both seasons with few exceptions where fruits weight of Fla 16/33 cultivar didn't significantly vary from Spring Time and Hegazy cultivars, the semi cling and cling cultivars, respectively in the first season only. Variations in fruit weight among various cultivars in this study are in agreement with other investigators such as Mansour and Stino (1987), Allam (1988), Roduguez and Sherman (1990), Valentini et al. (1993), Cardoni and Malpezzi (1994), Babu and Yadav (2002), Mahajan and Dhillon (2002) and Neelam and Muhammad (2002).

Furthermore, Scorza *et al.* (1991), showed that these variations in peach fruit weight were due to the difference in the cell number rather than cell size and this number of cells per fruit is determined during the first phase of the double sigmoid curve of growth pattern. It was also found that most late maturing cultivars had higher fruit weight when compared with mid-season and early peach cultivars. Moreover, variations in peach fruit weight within the same cultivar were not affected by the position on the shoot but influenced by crop density and fruiting shoot length (Marini and Sowers, 2000).

Assessment of fruit firmness data of various cultivars is shown in Tables (1 and 2). These were marked variations in fruit firmness of the

studied cultivars in both seasons. However, this was a general trend of higher fruit firmness of late season peaches than that of early and mid-season peaches. This trend was consistent in both seasons. The early season peaches of Robin, Rubidoux and Spring Time didn't significantly vary in fruit firmness at harvest in both seasons. In similar manner, mid-season cultivars tended to have similar fruit firmness especially in the first season, except the cultivar Bemto which had lower fruit firmness than other mid-season peaches. Furthermore, the late-season cultivars, namely Hegazy, had the highest fruit firmness in both seasons as compared with the other studied cultivars. Moreover, no late-maturing cultivar had similar fruit firmness to that obtained with Hegazy fruits at harvest, the selected local strain, which became cultivar, namely Shamy followed Hegazy in terms of fruit firmness as compared with other cultivars. It is worth mentioning that both Hegazy and Shamy peaches are cling-stone fruits. Lespinasse and Bakry (1998) pointed to fruit firmness as one of the main selection criteria in breeding programs that deal with fruit characteristics in addition to large size, attractive shape and color good quality and transportability. Variations in fruit firmness and other quality traits were attributed to genetic factors but very environmentally influenced (Smole, 1992).

With regard to flesh weight of various assessed cultivars, the data shown in Tables (1 and 2) revealed that peach cultivars differed in their flesh weight even within the same category of harvesting time. There was no relationship between flesh weight and the duration needed to reach maturity. Thus, this fruit trait seemed to be related to the genetic make up of the cultivar rather than to the harvesting time. These trends were consistent for flesh weight of evaluated cultivars in both seasons 2003 and 2004. However, as was the case with fruit weight, the highest flesh weight was found in Fla 16/33 when compared with other evaluated cultivars in both seasons. Soltani cultivar came second in terms of its flesh weight and in a similar way to what was found with fruit weight. On the other hand, Bemto peach fruits had the lowest values of flesh weight as compared with other studied cultivars. Furthermore, free stone cultivars tended to have greater flesh weight when compared with cling or

semi cling cultivars. In the general, trends of results obtained in flesh weight were similar to that obtained in fruit weight.

Variations in stone weight among the studied cultivars are shown in Tables (1 and 2). There was no consistent trend among cultivars in terms of their stone weight. However, in the early season peaches, Spring Time fruits had significantly higher stone weight than Robin and Rubidoux peaches in both seasons. In the mid-season peaches, fruits of Bemto cultivars had significantly lower stone weight as compared with other cultivars. In the late-maturing cultivars, Hegazy, Shamy, and Tejon didn't have significant differences in stone weight. Furthermore, the free stone cultivars, Fla 16/33 and Fla 3/2 had significantly heavier stone as compared with cling stone peaches of Shamy and Hegazy in the first season. Since the duration of stage I of the double sigmoid curve is similar for early, mid, and late seasons peaches and about 70-80 % of the mature size of the endocarp is attained in this stage I, there are not much expected differences in the stone weight. Moreover, seeds grow rapidly at the end of this phase I. Nucellus and integument reach nearly their maximum size. This might explain the small differences in stone weight (Zucconi, 1986) among studied cultivars.

The results of flesh / stone ratio at Tables (1 and 2) indicated to considerable variations. Within the early-season peaches, Spring Time fruits had significantly higher flesh / stone ratio than Robin and Robidoux fruits in both seasons. This trend was consistent with what was found in flesh weight and stone weight. Similarly, mid-season peach cultivars varied in their flesh to stone ratio. The highest ratio was obtained with Fla 16/33 and Fla 3/2 as compared with other mid-season cultivars in both seasons. Moreover, late season peaches, except with Tejon, varied significantly in their flesh to stone ratio. These variations were more relevant to the differences in flesh weight in both seasons. There was an observable trend in flesh to stone ratio in relation to the time of harvest. Early-maturing cultivars tended to have smaller flesh to stone ratio than that of mid, and late-maturing cultivars in both seasons. The only deviation from that trend was Tejon cultivar which had the lowest flesh to stone ratio as compared with all other studied cultivars. Furthermore, no

consistent relationship could be concluded between stone freeness and flesh to stone ratio. The improvement in flesh to stone ratio is a desired quality attribute that is related to fruit size, weight and flesh weight. These characteristics could be improved by increasing the rate of cell division during stage I of fruit growth curve and by increasing cell size during stage III or the final swell stage of fruit growth Scorza *et al.* (1991).

The data in Tables (1 and 2) reported the variations in fruit length of different cultivars. Within the early-season peaches in this study, Spring Time fruits were significantly longer than Robin and Robidoux ones. In a similar way mid-season cultivars varied in their fruit length. Peaches of Bemto cultivar were significantly shorter as compared with other cultivars in this category, while Fla 16/33 and Fla 3/2 were more elongated than Florida Red and Desert Red. Moreover, Spring Time, Fla 16/33 and Fla 3/2 had the most elongated fruits in studied cultivars. Early maturing cultivars were not necessarily the shortest, while late-maturing cultivars were not necessarily the longest. Furthermore, late-maturing cultivars didn't vary in their fruit length except Shamy that had relatively shorter fruits. The above mentioned trend of results was applied to both seasons. It could be also observed that the two free-stone cultivars in this study, namely Fla16/33 and Fla3/2, had fruit length values greater than all other studied cultivars except Spring Time fruits. However, greater fruit length didn't mean that fruits had oblong shape since the final fruit shape depend on fruit dimensions (length, width, height). The mentioned above results agreed with those previously reported by many investigators such as Aly (1988), Yamaguchi *et al.* (1989), Babu and Yadav (2002), Mahajan and Dhillon (2002) and Neelam and Muhammed (2002).

Variations in fruit diameter of studied cultivars are shown in Tables (1 and 2). In both seasons, early-season peach cultivars had no significant difference in fruit diameter. However, mid-season cultivars varied significantly in their fruit diameter in both seasons. As in fruit length, both Fla 16/33 and Fla 3/2 had relatively larger fruit diameter but not significantly different from Bemto and Florda Red in the first season. Moreover, late-season cultivars, in this study, had similar fruit diameter.

This trend was consistent in both seasons. Results and trends of fruit diameter didn't necessarily coincide with those obtained with fruit length. Williams and Crocker (2000) indicated that an ideal commercial peach tree should produce firm fruit, 5cm or larger in diameter. Fruits within high blush color or less than 5cm in diameter for peach fruits have not been very acceptable in commercial markets. Moreover, Avila (1995) mentioned that distinct variety of peach such as Madonna Sun had an average diameter in the suture plane from 7.3 to 8.4 cm while the average diameter in the cheek plane ranged from 7.1 to 7.6 cm.

The data of length to diameter ratio is shown in Tables (1 and 2). It was clear that fruit shape, resulting from that ratio, was mostly round in early-maturing cultivars. However, length to diameter in the first season exceeded one in some cultivars such as Spring Time, Desert Red, Fla3/2, and Soltani. These four cultivars wouldn't be described as elongated fruit since the length to diameter ratio hardly exceeded the value one. Moreover, fruits of many cultivars seemed to be flatened especially Bemto and Shamy. In the second season, Spring Time and Soltani fruits were still elongated but Desert Red and Fla3/2 were almost round since their length to diameter ratios were 0.99 and 1.01, respectively. These ratios in the second season, for Bemto and Shamy tended to be similar to that obtained in the first season. Fruit shape as concluded from the above dimension didn't relate to the time of maturity. Within early-maturing cultivars, Spring Time fruits were more elongated than others in the same category, in both seasons. However, in midseason and late-season cultivars, in this study, the length to diameter didn't greatly exceed the value one for most cultivars variations in fruit shape among low chill peaches were also reported by Diaz *et al.* (1986).

To select the best cultivar in this study, based on physical characteristics, criteria must be well defined. Williams and Crocker (2000) stated that an ideal commercial peach tree should produce firm fruit, 5 cm or larger in diameter with yellow flesh, capable of week's marketing life and with more than 50% or more attractive red surface blush. It would preferably be free stone, and fruit weight should range from 90 to 150 gm.

On the other hand, Smole (1992) considered that while many plant characteristics are important in the successful acceptance of new cultivars, fruit quality must be considered the premier factor and field characteristics such as earliness, yield and disease resistance also play a primary role in selecting a new cultivar. To present a cultivar or two that represent some compromise of desirable physical traits, as shown in Tables (1&2), Fla 16/33 followed by Soltani had relatively much better fruit physical characteristics than that of the other studied cultivars. The superior firmness of Hegazy fruits at harvest put this cultivar in the list of the best as compared with others as well as its high percentage of Flesh / Stone ratio. The relatively low yield of Hegazy tree was the undesirable trait. However, two selected strains of the local cultivar Meet Ghamr seemed to have better fruit quality than most other cultivars with emphasis on physical characteristics, namely Soltani and Hegazy.

B. Chemical characters:

The data presented in Table (3) indicated that, in both seasons, Rubidoux had the highest juice total soluble solids, whereas Soltani, Hegazy and Spring Time had the lowest value and those of Shamy, Desert Red, Robin, Tejon, Bemto, Florda Red and Fla 16/33 were intermediate. In the first season, Fla 3/2 had significantly higher T.S.S content in fruit Juice than all other studied cultivars. Robin and Florda Red had significantly higher juice T.S.S content than those of the other experimental cultivars, except Shamy, Desert Red, Bemto and Florda Red. The data also revealed that Hegazy, Spring time and Soltani had significantly lower juice T.S.S than the all-experimental cultivars. No significant difference was found among Hegazy, Spring Time and Soltani in both seasons. In the second season, Fla 3/2 had significantly higher juice TSS than all other cultivars, except Fla 16/33 and Florda Red, which also had significantly higher juice TSS than Hegazy, Spring time and Soltani. Variations among peach cultivars in juice total soluble solids were previously reported by Kumar and Chitkara (1983), Stino and Mansour (1985), Allam (1988), Raseira *et al.* (1989), Chanana *et al.* (1992), Brooks *et al.* (1993), Babu and Yadav (2002).

The data concerning the average fruit juice acidity percentage of

the experimental peach cultivars during 2003 and 2004 growing seasons were presented in Table (3). In the first season, the present results showed that Soltani cultivar had significantly higher average fruit juice acidity than all other studied cultivars. The data also showed that Hegazy had significantly higher average fruit juice acidity than the rest cultivars. Fla 16/33 had significantly higher average fruit Juice acidity than the other studied cultivars. On the other hand, Tejon, Desert Red, and Spring Time cultivars had significantly lower fruit juice acidity than the other studied cultivars. No significant differences were found among Desert Red, Tejon and Spring Time. In the second season, Soltani and Hegazy cultivars had significantly higher fruit juice acidity than the other studied cultivars. The data also indicated that Shamy cultivar had significantly higher fruit Juice acidity than Florda Red and Fla 16/33 cultivars, Desert Red cultivars had significantly higher fruit Juice acidity than all studied cultivars, except Tejon, Rubidoux and Fla 3/2. On the contrary, Spring Time cultivar had significantly lower fruit Juice acidity than all studied cultivar. No significant differences were found between Robin and Bemto cultivars. The variations among the experimental peach cultivars were supported the findings previously reported by many other investigators such as Stino and Mansour (1985), Mansour and Stino (1987), Allam (1988), Okie et al. (1993), Brooks *et al.* (1993), Babu and Yadav (2002), Mahajan and Dhillon (2002).

With regarded to the variations in TSS/acidity ratio, the data in Table 3 indicated that Rubidoux fruits had the higher ratio among the early season cultivars in both seasons, while in the mid-seasons cultivars, fruits of Desert Red and Fla 3/2 tended to have much higher TSS to acidity as compared with fruits of the same category. In late-maturing cultivars, fruits of Tejon had significantly higher TSS/acidity than those of Shamy and Soltani in a consistant manner. It was also obvious that strains of the local cultivars namely Hegazy and Soltani contained remarkably less TSS to acidity ratio as compared with other imported low chill cultivars. Late-maturing cultivars did not necessarily had highest TSS to acidity ratio. Brooks et al. (1993) indicated that TSS were not significantly affected by the stage of maturity. Sucrose was the most

abundant sugar at all stages and increased significantly during the later stages of maturity. In accordance with these results those previously reported by Stino and Mansour (1985), El-Sherbini (1986), Okie et al. (1992), Brooks et al. (1993), Babu and Yadav (2002), Mahajan and Dhillon (2002).

Assessment of vitamin C content in various cultivars was shown in Table 3. The data showed that the amount of vitamin C in all caltivars was; generally, low regardless the time of maturity or ripening. In early or late-maturing cultivars, no one was superior in vitamin C as compared with the others in the same category, while in mid-season cultivars, Bemto fruits had significantly higher vitamin C than other studied cultivars in both seasons. No specific trend was found between the time of ripening and the content of vitamin C in the fruit. The strains of the local cultivars Meet Ghamr, namely Soltani, Hegazy and Shamy were not significantly different from imported low-chill cultivars in their vitamin C content.

Anthocyanin content in the fruits of studied cultivars as one of the important quality parameters of peaches was reported in Table 3. The data revealed that Spring Time peaches were superior in their anthocyanin content when compared with the other two early-season cultivars, namely, Robin and Rubidoux in both seasons. Within the mid-seasons cultivars, the highest anthocyanin content was found in Fla 3/2 fruits. Meanwhile, Desert Red fruits that are known with their red cheeks had significantly lower amount of anthocyanin than that found in Fla 3/2 peaches. Moreover, all late-seasons cultivars contained significantly lower amount of anthocyanin than that found in Fla 3/2, Desert Red, or Spring Time. Furthermore, strains of local cultivars Meet Ghamr, namely Shamy, Soltani and Hegazy contained less anthocyanin in their fruits than most other low chilling imported cultivars. In accordance with these results were those reported by Luc et al (1962) and Van Blaricom and Senn (1966).

Since fruit coloration is one of the most important quality parameters in addition to fruit weight, size, firmness, it could be concluded that the low chilling cultivars Fla 16/33 compromised those

desired attributes under the Egyptian cultural conditions while the strains of the local cultivars, namely, Shamy, Soltani and Hegazy had superior physical characteristics as compared with other adopted low chill cultivars. Moreover, Soltani and Hegazy fruits may need further treatments to enhance their anthocyanin content, whether through a proper winter pruning and summer pruning to remove the vigorous upright shoot arising at the interior which improves light penetration or through safe chemical treatments that stimulates ethylene production. On the other hand, well-colored fruits such as those of Spring Time, Desert Red and Fla 3/2 might need further increase in their size, diameter and weight through increasing cell number during the first phase of the double sigmoid curve or through increasing their cell size in the final fruit growth curve. (Scorza *et al.*,1991).

II. Vegetative characteristics:

Data of shoot length of studied cultivars was shown in Table 4. The data indicated that there was no specific pattern of shoot length among early-season cultivars other than the shorter shoots of Rubidoux. However, in mid-season cultivars, Hegazy had consistently longer shoots in both seasons followed by Florida Red. Again, among the late season cultivars, it was found that Shamy trees had significantly longer shoots than that found in other cultivars of this category in both seasons. Soltani, as a local cultivar, however did not produce shoot that were longer than the imported cultivar Tejon. In general, the strains of the local cultivars namely Shamy, Soltani and Hegazy tended to have long shoots in summer as compared with other cultivars. The cultivars that compromised desired physical characteristics namely Fla 16/33 tended to have relatively shorter shoots as compared with mid-season cultivars especially in the first season. In support of these findings, Allan *et al.*, (1993) showed that the physiological pattern of growth of low-chill cultivars was characterized by producing strong vegetative growth stage. Low-chill cultivars may also make between 2 to 3 flushes after harvest. With regard to the trunk cross sectional area (TCSA) of studied cultivars, the data in Table 4 showed that parameters of trunk vigor did not relate to the time of fruit maturity. In other words, early-maturing cultivars did not necessarily

have similar TCSA than medium or late cultivars. Moreover, Soltani, Hegazy and Shamy trees (the local cultivars) tended again to have more vigorous vegetative growth aspect as shown in Table 4 since they had relatively longer trunk cross sectional area. Meanwhile, Fla 16/33 trunk vigor did not significantly vary from other midseason Yano *et al.*, (2002) working on various dwarfing in peach trees grafted on to P.Tomentosa and P. persica, he found that peach cultivars grafted on the species persica had smaller TCSA as compared with tomentosa.

III. Nutritional status:

Leaf mineral content of various macro and micro-nutrients of studied cultivars was shown in Tables 5 and 6. The data indicated that nitrogen content in the leaf did not vary among early-season cultivars. In a similar manner, all late-season cultivars had similar nitrogen content in both seasons. Among the mid-season cultivars, Fla 16/33 had significantly higher nitrogen content than that found in other cultivars in both seasons. The local cultivars Hegazy, Shamy and Soltani did not significantly vary in their nitrogen content in both studied seasons. Phosphorus percentage in the leaf of various cultivars was similar in both seasons except in one case in the second season where Fla 3/2 leaves had significantly higher phosphorus content than that of Hegazy.

Similar trend was obtained with potassium since all cultivars did not differ in a significant manner in first season while in second one; Hegazy was superior in potassium as compared with the most cultivars of the mid-seasons category. Furthermore, calcium and magnesium content in the leaves were similar in the first season, while in the second season, most cultivars did not differ in their calcium content except Fla 16/33 and Fla 3/2. Furthermore, no well defined trend was obvious for magnesium in the second season. Thus, macro-nutrients percentages in the leaves were, in general, similar for almost all cultivars except nitrogen that tended again in Fla 16/33 to be relatively higher than most cultivars. These results agreed with those previously found by Sanz *et al.*, (1995), Vitanova (1996) and Tsipouridious *et al.*, (2002).

With regard to the variations in some micro-nutrients in the leaves of studied cultivars, the data in Table 5 and 6 revealed that there

was no significant difference between all cultivars in their leaf content of Fe, Zn, Mn, in the first season. Similar trend was found for Cu content in the leaf except with Soltani leaves that had significantly higher Cu than that found in Fla 16/33, Fla 3/2, Florida Red, Rubidoux and Spring Time. In the second season, no well defined trend of Fe, Zn, Mn and Cu was found among studied cultivars. In general, there was no significant difference among studied cultivars in such determined micro nutrients. Results obtained for Fe, Zn, Mn and Cu were in agreement with the finding of Falandys *et al.*, (1990), Safaa (1994), Sanz *et al.* (1995), and Tsipouridius *et al.*, (2002).

From evaluating the fruit and vegetative characteristics and nutritional status of twelve peach cultivars, it could be recommended to expand growing the imported-low chill cultivars Fla 16/33 (mid-season cultivars, shown in Fig. 1) that was superior in important quality attributes of peach fruits such as weight, color and firmness. The two strains of the local cultivars, namely Hegazy and Soltani (Figs. 2 and 3 respectively) have promising quality parameters but need further color improvement to enhance their anthocyanin content. Furthermore, well colored peaches, in this study, such as Spring Time, Desert Red and Fla 3/2 (Figs. 4, 5, and 6 respectively) could meet the requirements of high standard peaches in Egypt by further increase in their dimensions and weight.

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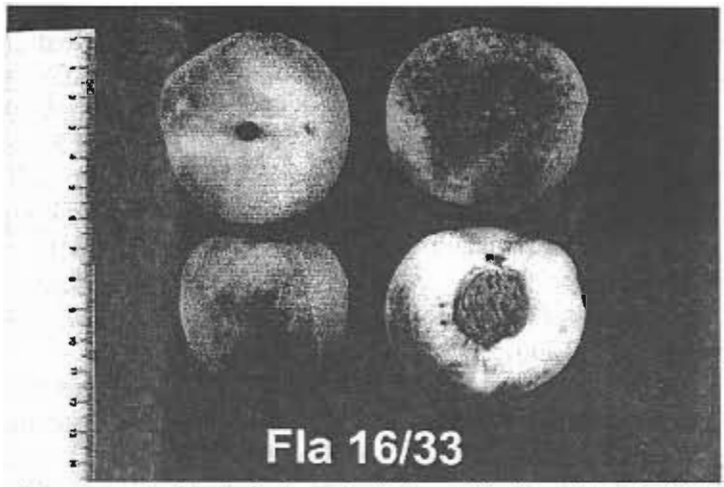

Fig. 1: The morphological characteristics of fruit and leaf of Fla 16/33 cultivar.

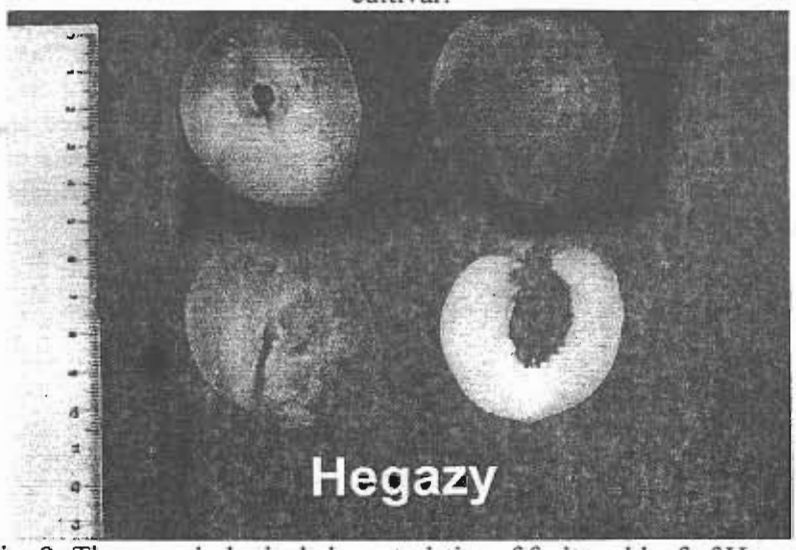

Fig. 2: The morphological characteristics of fruit and leaf of Hegazy cultivar.

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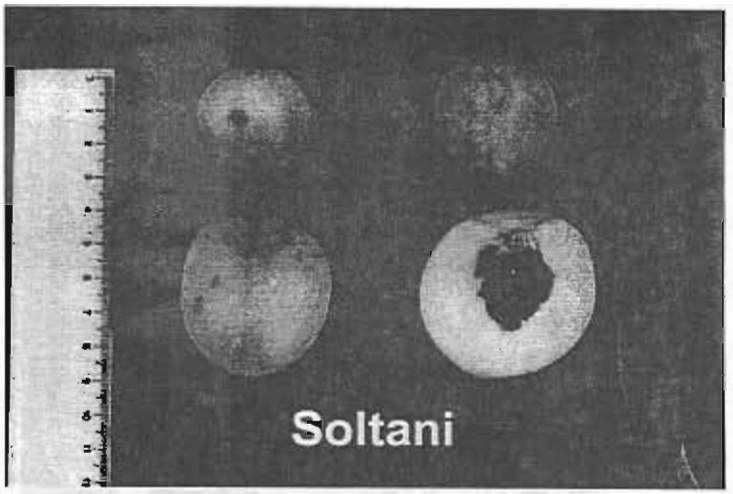

Fig. 3: The morphological characteristics of fruit and leaf of Soltani cultivar.

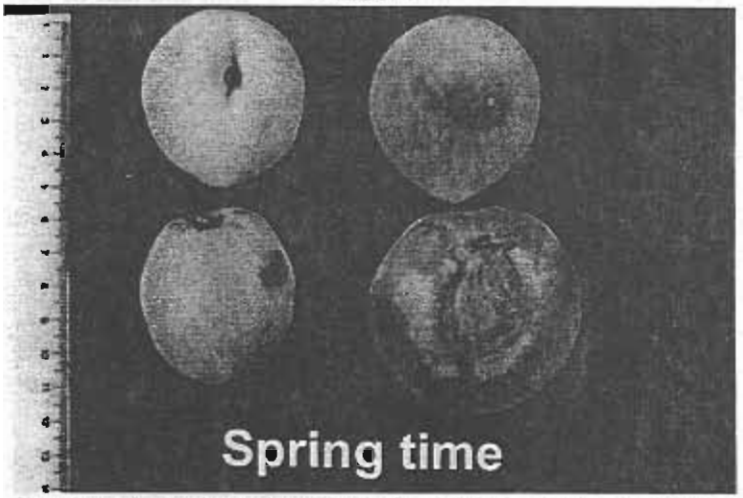

Fig. 4: The morphological characteristics of fruit and leaf of Spring Time cultivar.

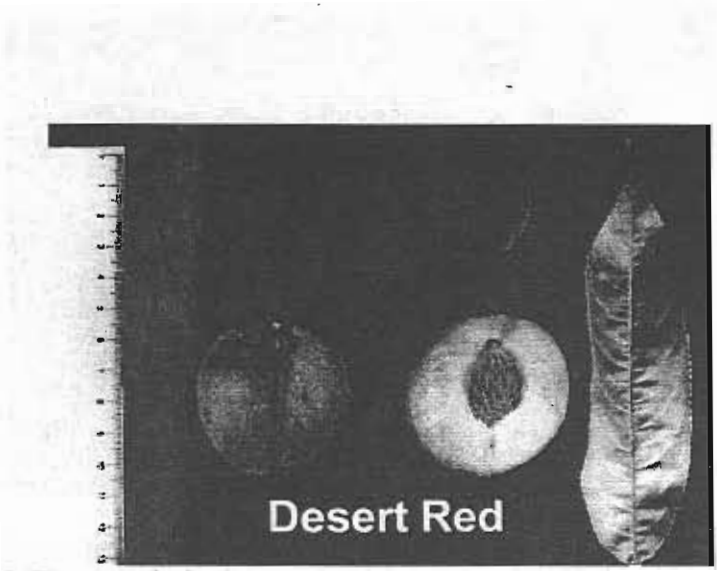

Fig. 5: The morphological characteristics of fruit and leaf of Desert Red cultivar.

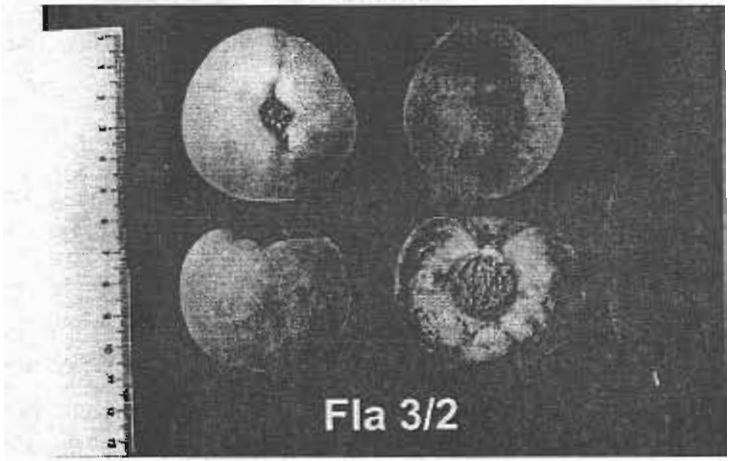

Fig. 6: The morphological characteristics of fruit and leaf of Fla 3/2 cultivar.

Table (1): Fruit physical characteristics of the studied peach cultivars during 2003 season.

Cultivars	Fruit weight (gm)	Firmness (pounds/ inch²)	Flesh weight (gm)	Stone weight (gm)	Flesh / stone ratio	Fruit length (cm)	Fruit diameter (cm)	Length/ Diameter ratio
1- Robin	52.72^{g}	7.20^{cd}	48.68^{de}	4.03^{c}	12.08^{j}	3.93^{c}	4.36^{c}	0.90^{bc}
2- Rubidoux	62.35^{e}	6.84^{cd}	58.25^{d}	4.10^{c}	14.21^{i}	4.60^{b}	4.73^{c}	0.97^{b}
3- Spring Time	86.84^{c}	7.80^{c}	81.30^{b}	5.53^{a}	14.70^{h}	5.93^{a}	4.70^{c}	1.09^{a}
4- Desert Red	47.58^{gh}	8.52^{bc}	43.52^{e}	4.07^{c}	10.69^{k}	4.47^{b}	4.31^{c}	1.04^{ab}
5- Bemto	43.91^{h}	6.00^{d}	41.51^{e}	2.39^{d}	17.37^{f}	2.83^{e}	5.43^{b}	0.52^{e}
6- Florda Red	76.93^{d}	7.44^{cd}	72.90^{c}	4.03^{c}	18.09^{e}	4.57^{b}	5.37^{b}	0.85^{c}
7- Fla 16/33	124.02^{a}	8.88^{bc}	118.32^{a}	5.70^{a}	20.76^{b}	5.60^{a}	6.03^{a}	0.93^{bc}
8- Fla 3/2	93.67^{c}	6.72^{cd}	85.67^{b}	4.67^{b}	18.34^{d}	5.57^{a}	5.50^{b}	1.02^{ab}
9- Hegazy	88.28^{c}	18.37^{a}	84.27^{b}	4.00^{c}	21.07^{a}	4.07^{bc}	4.61^{c}	0.88^{c}
10- Shamy	62.41^{e}	9.36^{bc}	58.61^{d}	3.80^{c}	15.42^{g}	3.37^{d}	4.67^{c}	0.72^{d}
11- Soltani	115.99^{b}	8.16^{c}	110.61^{a}	5.38^{a}	20.56^{c}	4.47^{b}	4.38^{c}	1.02^{ab}
12- Tejon	54.52^{f}	9.72^{b}	49.71^{de}	4.81^{c}	10.33^{l}	4.50^{b}	5.13^{c}	0.88^{c}
$L.S.D._{0.05}$	7.52	1.56	8.32	0.51	0.044	0.36	0.33	0.08

* Means, within a column, followed by the same letter(s) are not significantly different according to L.S.D.0.05.

Table (2): Fruit physical characteristics of the studied peach cultivars during 2004 season.

Cultivars	Fruit weight (gm)	Firmness (pounds/ inch^2)	Flesh weight (gm)	Stone weight (gm)	Flesh /stone ratio	Fruit length (cm)	Fruit diameter (cm)	Length/ Diameter ratio
1- Robin	57.52^{f}	7.80^{de}	53.82^{f}	3.70^{d}	14.55^{i}	3.77^{c}	4.17^{d}	0.91^{cd}
2- Rubidoux	67.51^{e}	8.04^{d}	63.41^{e}	4.10^{cd}	15.47^{i}	4.23^{b}	4.53^{d}	0.93^{c}
3- Spring Time	90.94^{d}	8.52^{d}	85.87^{d}	5.07^{a}	16.94^{h}	5.23^{a}	4.20^{d}	1.25^{a}
4- Desert Red	54.91^{f}	8.64^{d}	50.94^{f}	3.97^{cd}	12.83^{k}	4.33^{b}	4.37^{d}	0.99^{bc}
5- Bonito	46.71^{g}	5.76^{f}	44.41^{g}	2.30^{e}	19.31^{f}	2.53^{d}	5.67^{a}	0.45^{e}
6- Florda Red	91.90^{d}	8.04^{d}	87.66^{d}	4.23^{bc}	20.72^{e}	4.50^{b}	4.90^{c}	0.92^{cd}
7- Fla 16/33	130.12^{a}	9.96^{c}	125.24^{a}	4.88^{ab}	25.66^{a}	5.27^{a}	5.70^{a}	0.92^{cd}
8- Fla 3/2	100.37^{c}	6.84^{e}	96.04^{c}	4.33^{bc}	22.18^{c}	5.23^{a}	5.27^{b}	1.01^{bc}
9- Hegazy	94.93^{d}	18.53^{a}	90.73^{d}	4.20^{c}	21.60^{d}	4.17^{b}	4.43^{d}	0.94^{c}
10- Shamy	67.58^{e}	11.64^{b}	64.13^{e}	3.73^{d}	17.19^{g}	3.70^{c}	4.47^{d}	0.84^{d}
11- Soltani	119.15^{b}	10.44^{c}	114.52^{b}	4.63^{b}	24.73^{b}	4.63^{b}	4.37^{d}	1.06^{b}
12- Tejon	59.12^{f}	10.68^{c}	54.25^{f}	4.87^{ab}	11.14^{l}	4.33^{b}	4.63^{cd}	0.93^{c}
L.S.D.$_{0.05}$	3.98	1.08	4.02	0.43	0.059	0.33	0.37	0.09

* Means, within a column, followed by the same letter(s) are not significantly different according to L.S.D.0.05.

Table (3): Fruit chemical characteristics of the studied peach cultivars during 2003 and 2004 seasons.

Cultivars	TSS (%)		Acidity (%)		TSS / acid		V. C mg/100ml juice		Anthocyanin (mg/100 gm fresh weight)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
1- Robin	11.80$_{c}$	10.73^{cd}	0.57^{cd}	0.61^{cd}	20.87^{bc}	17.69^{c}	0.57^{bc}	0.59^{ef}	0.74^{ef}	0.70^{de}
2- Rubidoux	13.40^{a}	12.53^{a}	0.50^{cd}	0.47^{de}	26.62^{a}	26.83^{a}	0.61^{bc}	0.57^{f}	0.50^{f}	0.56^{ef}
3- Spring Time	9.73^{e}	10.13^{e}	0.45^{d}	0.46^{e}	21.79^{b}	22.35^{b}	0.73^{bc}	0.76^{d}	1.51^{c}	1.40^{b}
4- Desert Red	11.13^{cd}	11.13^{cd}	0.42^{d}	0.54^{d}	26.38^{a}	20.84^{bc}	0.78^{bc}	0.77^{d}	1.65^{b}	1.31^{b}
5- Bemto	11.40^{cd}	10.73^{cd}	0.55^{cd}	0.58^{cd}	20.86^{bc}	18.64^{c}	1.25^{a}	1.21^{a}	0.41^{f}	0.48^{f}
6- Florda Red	11.67^{c}	11.20^{c}	0.65^{cd}	0.64^{c}	18.04^{c}	17.69^{c}	0.78^{bc}	0.98^{c}	0.61^{ef}	0.57^{ef}
7- Fla 16/33	11.40^{cd}	11.53^{bc}	0.68^{c}	0.62^{c}	16.78^{c}	18.55^{c}	0.81^{b}	0.96^{b}	1.02^{d}	1.04^{c}
8- Fla 3/2	12.53^{b}	11.87^{b}	0.57^{cd}	0.50^{de}	22.17^{b}	23.80^{ab}	0.56^{bc}	0.64^{e}	2.06^{a}	2.02^{a}
9- Hegazy	9.73^{e}	10.13^{e}	1.04^{b}	1.15^{a}	9.46^{d}	8.80^{e}	0.67^{bc}	0.62^{ef}	0.74^{e}	0.73^{d}
10 Shamy	11.00^{cd}	10.67^{d}	0.63^{cd}	0.88^{b}	17.58^{c}	12.15^{d}	0.57^{bc}	0.54^{f}	0.66^{ef}	0.61^{e}
11- Soltani	9.20^{e}	10.07^{e}	1.26^{a}	1.15^{a}	7.46^{d}	8.75^{e}	0.62^{bc}	0.54^{f}	0.47^{f}	0.51^{f}
12- Tejon	10.67^{d}	11.07^{cd}	0.45^{d}	0.51^{de}	23.87^{ab}	21.80^{bc}	0.52^{c}	0.55^{f}	0.71^{e}	0.61^{ef}
L.S.D.$_{0.05}$	0.57	0.53	0.14	0.08	2.87	3.21	0.16	0.06	0.16	0.098

* Means, within a column, followed by the same letter(s) are not significantly different according to L.S.D.0.05.

Table (4): Vegetative characteristics of the studied peach cultivars, during 2003 and 2004 seasons.

Cultivars	Shoot length (cm)		TCSA **	
	2003	2004	2003	2004
1- Robin	44.00^{de}	51.33^{d}	19.20^{ab}	21.93^{b}
2- Rubidoux	36.00^{f}	46.00^{e}	21.43^{a}	24.80^{a}
3- Spring Time	43.00^{e}	48.00^{de}	18.43^{b}	21.20^{bc}
4- Desert Red	53.67^{c}	51.33^{d}	16.75^{bc}	19.30^{c}
5- Bemto	35.33^{f}	41.67^{e}	16.07^{c}	19.63^{c}
6- Florda Red	54.67^{bc}	62.67^{bc}	17.13^{bc}	20.50^{bc}
7- Fla 16/33	43.00^{e}	51.00^{de}	17.97^{bc}	20.97^{bc}
8- Fla 3/2	38.67^{ef}	54.67^{c}	17.20^{bc}	20.30^{bc}
9- Hegazy	67.87^{a}	73.00^{a}	20.67^{ab}	22.53^{b}
10- Shamy	59.00^{b}	65.33^{b}	16.67^{bc}	18.70^{c}
11- Soltani	48.33^{d}	59.00^{c}	20.87^{a}	23.03^{ab}
12- Tejon	50.67^{cd}	55.67^{c}	17.33^{bc}	21.10^{bc}
L.S.D.$_{0.05}$	4.97	5.30	3.35	2.24

* Means, within a column, followed by the same letter(s) are not significantly different according to L.S.D.0.05.
** (TCSA): trunk cross sectional area (cm2).

Table (5) : Leaf mineral composition of the studied peach cultivars in 2003 (dry weight basis).

Cultivars	Percent (%)					Parts per million (ppm)			
	N	P	K	Ca	Mg	Fe	Zn	Mn	Cu
1- Robin	2.15^{b}	0.24	1.14	2.67	1.17	162.44	29.17	92.67	15.55^{ab}
2- Rubidoux	2.32^{b}	0.23	1.16	2.71	0.85	144.11	32.33	89.47	10.90^{b}
3- Spring Time	2.58^{ab}	0.22	1.15	2.75	1.16	133.00	30.37	72.23	14.59^{b}
4- Desert Red	2.30^{b}	0.24	1.11	2.47	0.91	162.55	32.40	87.67	15.74^{ab}
5- Bemto	2.59^{ab}	0.24	1.15	3.04	1.18	154.44	41.71	83.90	16.14^{ab}
6- Florda Red	2.75^{ab}	0.24	1.15	2.83	1.54	160.66	38.04	87.20	12.27^{b}
7- Fla 16/33	2.84^{a}	0.22	1.11	3.02	1.19	136.11	37.66	68.33	12.28^{b}
8- Fla 3/2	2.37^{b}	0.22	1.17	3.19	1.22	147.89	32.78	87.80	12.03^{b}
9- Hegazy	2.10^{b}	0.21	1.15	2.67	1.14	168.84	37.41	64.23	14.97^{ab}
10- Shamy	2.33^{b}	0.23	1.11	2.50	1.17	139.89	33.89	86.13	17.49^{ab}
11- Soltani	2.32^{b}	0.22	1.14	2.63	1.13	144.88	37.22	84.87	18.66^{a}
12- Tejon	2.24^{b}	0.23	1.10	2.83	1.53	143.44	36.92	79.47	17.12^{ab}
$L.S.D._{0.05}$	0.43	NS	NS	NS	NS	NS	NS	NS	3.81

* Means, within a column, followed by the same letter(s) are not significantly different according to L.S.D.0.05.

Table (6): Leaf mineral composition of the studied peach cultivars in 2004 (dry weight basis).

Cultivars	Percent (%)					Parts per million (ppm)			
	N	P	K	Ca	Mg	Fe	Zn	Mn	Cu
1- Robin	2.12^{d}	0.22^{ab}	1.24^{c}	2.63^{b}	0.95^{bc}	144.33^{b}	26.61^{e}	73.60^{bc}	5.27^{b}
2- Rubidoux	2.36^{c}	0.24^{ab}	1.27^{bc}	2.76^{ab}	0.81^{c}	137.97^{bc}	30.28^{de}	86.87^{ab}	13.43^{b}
3- Spring Time	2.64^{b}	0.23^{ab}	1.21^{c}	2.79^{ab}	0.84^{c}	115.20^{cd}	27.44^{e}	61.27^{cd}	18.70^{ab}
4- Desert Red	2.33^{c}	0.23^{ab}	1.18^{cd}	2.76^{ab}	0.59^{d}	147.43^{ab}	28.61^{de}	62.77^{cd}	16.53^{b}
5- Bemto	2.22^{cd}	0.22^{ab}	1.31^{b}	2.62^{b}	1.03^{b}	155.53^{ab}	47.02^{a}	86.83^{ab}	18.43^{ab}
6- Florda Red	2.45^{bc}	0.23^{ab}	1.16^{cd}	2.57^{b}	1.16^{ab}	137.53^{bc}	31.65^{d}	88.00^{a}	13.03^{b}
7- Fla 16/33	2.92^{a}	0.19^{ab}	1.23^{c}	2.83^{a}	0.98^{b}	105.93^{d}	34.10^{cd}	69.40^{c}	14.93^{b}
8- Fla 3/2	2.37^{c}	0.25^{a}	1.09^{d}	2.95^{a}	1.17^{a}	114.47^{cd}	42.50^{b}	89.63^{a}	3.37^{b}
9- Hegazy	2.00^{d}	0.18^{b}	1.34^{b}	2.13^{c}	0.92^{bc}	161.37^{a}	32.08^{d}	54.73^{d}	15.53^{b}
10- Shamy	2.13^{d}	0.23^{ab}	1.23^{c}	2.31^{c}	0.77^{c}	134.77^{bc}	37.03^{c}	74.67^{bc}	16.37^{b}
11- Soltani	2.19^{cd}	0.24^{ab}	1.28^{bc}	2.43^{bc}	0.63^{d}	110.50^{cd}	26.81^{e}	83.93^{ab}	21.73^{a}
12- Tejon	2.32^{cd}	0.21^{ab}	1.44^{a}	2.47^{bc}	1.05^{ab}	126.40^{c}	37.61^{c}	87.50^{b}	20.27^{a}
$L.S.D._{0.05}$	0.20	0.032	0.097	0.223	0.147	16.75	4.06	3.38	3.69

* Means, within a column, followed by the same letter(s) are not significantly different according to L.S.D.0.05.

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الملخص العربى

دراسات فسيولوجية و تقسيمية على بعض أصناف الخوخ
B: تقييم الخصائص الثمرية و و الخضرية و الحالة الغذائية.

كريم محمد فرج[1]، عمرو محمد هيكل[1]،عاطف محمد ابراهيم[2]
[1] قسم البساتين (فاكهة)، كلية الزراعة بدمنهور، جامعة الاسكندرية ص ب 22516 ، دمنهور.
[2] قسم الفاكهة، كلية الزراعة بالشاطبى، جامعة الاسكندرية ، الاسكندرية.

اجري هذه البحث خلال موسمين متتالين 2003 ، 2004 باستخدام اثنتى عشرة صنف من الخوخ ذات احتياجات البرودة المحددودة سواء من الاصناف المستوردة او التى كانت اصلها كسلالات من الصنف المحلى ميت غمر، و كانت هذة الاصناف اما مبكرة النضج مثل روبن، روبيدوكس، سبرنج تايم، او من اصناف منتصف الموسم مثل فلوريدا ريد، فلا 32/16، فلا 2/3، ديزرت ريد، بيمتو، حجازى، اما الاصناف المتاخرة النضج فكانت شامى، سلطانى، و تيجن. و كانت كل الاصناف مطعومة على اصل النيماجارد و منزرعة فى منطقة النوبارية بمحافظة البحيرة و تحت نفس المعاملات الزراعية و الظروف المناخية، و كان الهدف من هذة الدراسة تقييم الخصائص الثمرية (سواءالصفات الطبيعية او الكيماوية للثمرة)، و الخصائص الخضرية مثل طول الفرخ، و محيط الجذع، و كذلك الحالة الغذائية للاوراق من حيث محتواها من بعض العناصر الكبرى (كالنيتروجين و الفوسفور و البوتاسيوم و الكالسيوم و الماغنسيوم) او بعض العناصر الصغرى (مثل الحديد و الزنك و المنجنيز و النحاس) بغرض التعرف على افضل هذة الاصناف من حيث تحقيقها لمعايير صفات الجودة للتصدير او للتسويق المحلى بطريقة افضل (اهمها وزن الثمار و قطرها و كمية اللحم بها و درجة تلوينها). و قد اتضح من نتائج التقييم تفوق الصنف فلا 16 / 33 (Fla 16/33) بالمقارنة بالاصناف المدروسة حيث جمع بين صفات الجودة الهامة المشار اليها اما الصنفين المحليين حجازى و سلطانى فقد تفوقا فى معظم الصفات الطبيعية و لكنهما يحتاجا لمزيد من تحسين اللون (كثافة الانثوسيانين) و من ناحية اخرى، فان الاصناف جيدة التلوين مثل سبرنج تايم، و ديزرت ريد، و فلا 2/3 فقد تحتاج للمعاملات الزراعية التى تزيد من وزنهم و قطرهم و بالتالى حجمهم حتى تستوفى متطلبات التصدير بعد تبنى زراعتهم بواسطة منتجى الخوخ فى مصر.