J. Plant Production, Mansoura Univ., Vol. 5 (3): 443-456,2104

EFFECT OF GRAFTING ON THE CUCUMBER YIELD AND QUALITY UNDER HIGH AND LOW TEMPERATURES.

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ABSTRACT

Two experiments were conducted during the summer and winter seasons of 2013 to study the effect of grafting using different rootstocks on the yield and quality and chemical analysis of cucumber (*Cucumis sativus L*.) cultivar "Hady" under high and low temperatures**.** The experiments consisted of 5 treatments, 4 rootstocks, namely Bottle Gourd (*Lagenaria siceraria* Standl.), Supper Shintosa (*Cucurbita maxima* Duchesne×*Cucurbita moschata* Duchesne), Squash 3 (*Cucurbita pepo*) and Ferro' (*C. maxima* × *C. moschata*), in addition to non-grafted control. Data were recorded on plant length and physical characters of fruits 30, 60 and 90 days after planting, early and total yield/m2, chemical characters (percentage of dry matter, TSS and total and reducing sugars) of cucumber fruits and percentage of N, P and K in cucumber leaves. The results indicated that Ferro rootstock increased plant height, physical characters, early and total yield of cucumber fruits in both summer and winter seasons, as compared with non-grafted control. No significant effect was detected from using rootstocks on N, P and K percentage in cucumber leaves, except grafting cucumber on Bottle Gourd rootstock which significantly increased N% only in the winter season. Chemical contents of cucumber fruits were not affected by grafting in summer season, while Bottle Gourd increased total sugars and Ferro rootstock caused significant increase in the percentage of dry matter and reducing sugars in winter season as compared with non grafted plants.

INTRODUCTION

Grafting was traditionally used to refine woody plants, but since more than 50 years it is applied also in herbaceous fruit vegetables to enhance the tolerance of elite cultivars to biotic and abiotic stress conditions (Lee et al., 2010; Flores et al., 2010; Rouphael et al., 2010). In Japan, Korea, the Mediterranean basin, and several European countries, grafting of cucurbits (*e.g*.,cucumber, melon, and watermelon) has become a common practice. As with other vegetables, the main purpose of employing this technology in cucurbits is to control *Fusarium wilt* and other soil borne diseases (Crinò *et al.*2007, Lee *et al.,* 2010). Grafting restricts input of agrochemicals against soil borne pathogens and is, therefore, considered an environment friendly cultivation technique, which is strongly recommended for integrated crop management systems (Rivard and Louws 2008). However, the impact of grafting on cucurbits includes not only stronger resistance against pathogens but also a higher tolerance to abiotic stress conditions such as salinity, heavy meta, nutrient stress, thermal stress, water stress, organic pollutants, and

alkalinity (Colla *et al*., 2010a,b,c and,2011; Rouphael *et al*. 2008 a,b; Savvas*et al*., 2009, 2010; Schwarz *et al*.,2010).

Because of its low-temperature sensitivity, which includes numerous physiological disorders under suboptimal temperatures, cucumber is either cultivated year-round indoors in greenhouses or as a typical summer crop outdoors in summer. The production of cucumber in plastic houses becomes very low during the coldest months in Egypt (Januray and February). To solve this problem in greenhouses in European countries are heated in winter months. Due to secrecy of energy and increasing energy prices in addition to world concern about environmental problems related with CO2 emissions from the combustion of fossil fuel, heating solution is not economic. A simple option to decrease the greenhouse temperature is the breeding of new cultivars that are better adapted to low temperatures. As a fast alternative for the relatively slow breeding process aimed to lower the energy demand of tomato, grafting of existing elite commercial cultivars onto selected rootstocks is regarded as a promising tool (Heuvelink and Kierkels, 2005).

Many investigators reported that cucumber plants grafted onto *Cucurbita ficifolia* could be used for widespread cucumber production, as the grafted plants were more vigorous than the non grafted ones and had increased of shoot fresh weight under protected cultivation (Shimada and Moriya, 1977; Nijs, 1984; Eguchi and Koutaki, 1986;; Weng*et al.,* 1993; El-Aidy*et al.,* 1996).

Grafting cucumber plants onto *Cucurbita ficifolia* rootstock grew faster (Nijs, 1980), had higher values of plant fresh weight (Nijs, 1984;) and were more vigorous (Eguchi and Koutaki ,1986)than non-grafted ones. Under low temperature conditions, grafting cucumber *on Cucurbita ficifolia* rootstock increased stern length, leaf number, and leaf area of the scions as compared with non-grafted plants (Nijs, 1984).Also, grafting cucumber on *Cucurbita ficifolia* had better growth than non-grafted plants under partially shaded and humid plastic houses conditions in midsummer (Lee 1989).Similarly, El-Aidy*et al.* (1996) studied the effect of grafting on vegetative growth of cucumber plants under plastic house. They found that grafted plants onto *Cucurbita ficifolia* had longer stems, more leaves, larger leaf area and higher fresh and dry weights than non-grafted ones.

Kabeel (1999) studied the effect of cut grafting method using fig leaf gourd, bottle gourd, pumpkin *(Cucurbit amoschata),* squash and non-grafted cucumber "Pasandra F1" on vegetative growth. He found that fig leaf gourd and bottle gourd had the most promotive effect on plant length in autumn growing season, while the fig leaf gourd and pumpkin rootstocks had the most increasing effect on plant length in spring plantation. However, all used rootstocks had no significant effect on number of leaves per plant. The fig leaf gourd and bottle gourd as rootstocks showed the highest values of leaf area and fresh and dry weights of plant compared with the other used rootstocks or the control. In another study, Abd-Alla (2002) grafted cucumber plants Nile cv. , onto squash, pumpkins *(Cucurbitalmoschata), pumpkin (C. maxima),* bottle gourd, fig leaf gourd and non-grafted cucumber and found that the plants grafted onto fig leaf gourd and bottle gourd had the highest values of stem length, number of leaves, leaf area and fresh and dry weights of

leaves compared with the other used rootstocks or the non-grafted ones. On the other hand, when Huaifu *et al.* (2006) investigated the growth of cucumber *(Cucumis sativus)* grafted on smooth luffa*(Luffalcylindrica [L. aegyptiacap*) compared with self-rooted plants they found that cucumber grafted on smooth luffa showed significantly higher values for the plant height; stem thickness and fresh and dry mass of grafted seedlings compared to non-grafted plants

Increases in yield early were reported due to grafting cucumber onto *Cucurbitaficifolia* (Nijs, 1980) fig leaf gourd and pumpkin (Kabeel,1999) squash, pumpkin *(C. moschata),* pumpkin2 *(C. maxima)* bottle gourd and leaf gourd rootstocks (Abd-Alla ,2002), compared with the non-grafted plants.
Several reports indicated that cucumber grafting could be used for increase total yields. This was proved due to grafting onto C. *ficifolia* (Tsambanakis , 1984)*, Sicyosa ngulatus* rootstock (Visser and Nijs ,1987), fig leaf gourd and pumpkin (Kabeel ,1999), squash, pumpkin *(C. moschata),* pumpkin2 *(C. maxima)* bottle gourd and leaf gourd rootstocks (Abd-Alla ,2002) and *Lagenariasiceraria, Cucurbita ficifolia, C. maxima, Benincasa hispida* and *C. pepo* (Fedorov*et al.,* 2005).

The quality of cucumber fruits was found to be affected by grafting. In this regard, kabeel (1999) and Abd-Alla (2002) found that grafting cucumber onto pumpkin or squash led to raise TSS% of fruits. On the contrary, Hongli *et al.* (2003) recorded negative effect for grafting, where contents of soluble sugar, vit. C, amino acids particularly, glutamic and aspartic acids decreased and the contents of nitrate, tannititrable acid increased in the grafted cucumber on fig leaf gourd *(Cucurbitcificifolia)* and Sintozwa*(Cucurbita maxima x C.' moschata).* Other studies suggested that grafting (rootstock) has no significant effect on fruit dry matter and soluble sugar content of cucumber under unstressed conditions (Zhu et al., 2006a,b; Zhong and Bie, 2007).

Contradictory results were recorded concerning effect of grafting on mineral contents of cucumber plants. While grafting led to increase in N, p and K in a study (El-Aidy *et al.*1996), it increased N and P only and showed no constant trend on the K content in cucumber leaves in another study (Abd-Alla 2002) . In contrast,.Canizares *et al.* (2005) stated that grafting cucumber did not affect N and P contents, but grafted plants had higher K content in plant shoots compared to non-grafted ones.
The present investigation aimed to study the effect of grafting using different rootstocks on the cucumber yield and quality under high and low temperatures.

MATERIAL AND METHODS

Two experiments were conducted during the summer and winter seasons of 2013 to study the effect of grafting using different rootstocks on

the yield and quality and chemical analysis of cucumber (*Cucumis sativus L*.) cultivar Hady under high and low temperatures. The summer season experiment was carried out in clay soil in net house at the experimental station, Faculty of Agriculture, University of Cairo, while the winter experiment was conducted in sandy soil in plastic house in a private farm located in Aiat, Giza Governorate, Egypt.

Treatments

Five treatments were used, i.e. four grafting rootstocks and control treatment (without grafting).

Rootstocks:

The rootstocks used were as follows:

1. Bottle Gourd (*Lagenaria siceraria* Standl.),obtained from local markets
2. Supper Shintosa (*Cucurbita maxima* Duchesne×*Cucurbita moschata* Duchesne, JSI , Holland)
3. Squash 3 (*Cucurbita pepo*, Sakata Japan),
4. Ferro (*C. maxima* × *C. moschata*, Reck Zoan, Holland)

Grafting method

Cut (hole insertion) grafting method was used according, to the methods described by Kawaide (1985)

1. Rootstock seeds were also sown in (84 eyes) filled with a mixture of peat Moss: vermiculite (1:1 v/v) under plastic house on 27 th February 2013 (for summer planting) and on 20 th October 2013 (for winter planting) , while cucumber scion seeds were also sown in seedling foam trays (84 eyes) filled with the same medium of rootstocks but on 9 th March 2013(for summer planting) and 10 th November 2013(for winter planting)
2. After germination and appearance of the first true leaf of rootstock seedlings, they were located in 10 cm back plastic bags, containing the same mixture of peat Moss and vermiculite (1:1 v/v), supplemented with 50 g of a fungicide for each 50 kg of the mixture.
3. Seedling of rootstocks and the scions were ready for grafting at the appearance of the second true leaf on 25th March 2013and on 25th November 2013, for summer and winter plantings, respectively.
4. Seedlings of rootstocks were picked between the two cotyledons after removing the top of the seedling with a razor blade, creating a V-shaped cut between the cotyledons. An inverse V-shaped cut was made on the stem of the scion, 2 cm below the cotyledons, to fit the cut in the rootstock. Scion and rootstocks were held with a grafting clip.
5. The seedlings were placed under plastic tunnel for optimum temperature and humidity.
6. The compatibility was determined after 7 days in relatively high temperature 25-30^{o}C and 10 days in relatively low temperature 20-25^{o}C, from conducting after grafting stage watching the new growth on the scions.
7. The plastic tunnel was gradually opened for adaptation and preparing the grafting seedlings for transplanting in the plastic house.

Transplants of grafted and non-grafted cucumber were planted in net house greenhouse on 10th April 2013 and plastic house on 14th December 2013, for summer and winter planting, respectively. The treatments were set in three replicates; each contained 30 plants on both sides of 120 cm width rows at 50 cm apart, between the plants within each side. The plants were irrigated using drip irrigation lines and fertilized with 1 m^3 farm yard manure, 22 kg N, 9 kg $P_2 O_5$ and 25 kg K_2O / 100 m^2. Other cultural practices; such as plant protection against weeds, diseases and insects; were performed whenever they were thought to be necessary as recommended for commercial cucumber production under protected cultivation.

Data Recorded:

Data were recorded on 10 plants in the middle of each treatment on the following characteristics of cucumber plants:-

1- Plant height (cm) It was determined 30, 60 and 90 days after transplanting.

2- Yield

1.1. Early yield:

It was estimated as the weight of fruits for all harvested fruits of the first 4 pickings.

2.2. Total yield:

Data of total yield included weight of fruits all over the harvesting season.

2. Physical characters of fruits (30, 60 and 90 days after transplanting)**.:**

3.1. Average fruit weight

3.2. Average fruit diameter

3.3. Average fruit length

3. Chemical characters of cucumber fruits (60 days after planting).

4.1. Dry matter %

4.2. Total soluble solids TSS content

4.3. Total and reducing sugars in cucumber fruits.

4. Mineral contents of leaves:

N, P and K contents of leaves.

Methods of chemical analysis

1.Mineral nutrients content (N, P and K %):

Dry matter samples of leaves were ground in a Willy mill and kept for N, P and K determinations. The dry material was wet digested with sulphuric acid-hydrogen peroxide mixture as described by Koch and McMeeking, (1924) and Lowther, (1980). Total N, P and K was determined according to the following methods:

1.1 Total nitrogen; was determined in the digestion product using the micro Kjeldahl method (Pregel, 1945).

1.2 Total phosphorus; was determined, colorimetrically, using a spectrophotometer at 650 1.un (Frie *et al.,* 1964 and King, 1951).

1.3. Total potassium; was determined using flame photometer (Jackson, 1967).

2. **Total soluble solids content (TSS %):**

It was estimated in fruit juice by using a hand refractometer

3. **Dry matter percentage of fruit flesh**:

It was determined by allowing 100 g of fruit flesh to dry in an oven at 70°C till constant weight.

4. **Reducing and non-reducing sugars:**

They were determined of each fruit samples according to Malik and Singh (1980) method. Sugars were extracted from 0.5 g ground dried material by distilled water, and then determined by phenol sulfuric method and nelson arsenste-molibdate colorimetric method for total and reducing sugars, respectively. The non-reducing sugars were calculated by the difference between total and reducing sugars.

The experimental design and statistical analysis:

The experimental design was a completely randomized design (CRD) with three replicateo. All recorded data were statistically analyzed according to the method described by **Little and Hills (1972).** Revised Least significant difference test was used for the comparison among treatment's means (Gomez and Gomez, 1984)

RESULTS AND DISCUSSION

1- Effect of rootstock types on plant height at different plant stages

Results in Table 1 indicated that all rootstocks in the summer season, except squash 4, Super Shintosa, and in Bottle Gourd, 30, 60 and 90 days after planting, respectively, showed higher values of plant height, as compared with the control. On the other hand, using any rootstock in winter caused significant increase in plant height over non-grafted control. It was also clear that Ferro was the most superior rootstock in the respect of stimulative effect on plant height in both summer and winter plantings.

These results may be attributed to the strength roots of rootstocks that permit better growth. Similar results were found by Shimada and moriya, (1977); Nijs, 1984; Eguchi and Koutaki, 1986; Kim and Lee, 1989; Weng*et al.,* (1993); El-Aidy*et al.,* (1996) who reported that cucumber plants grafted onto *Cucurbita ficifolia* could be used for widespread cucumber production, as the grafted plants were more vigorous than the non grafted ones and had increased of shoot fresh weight under protected cultivation. Similarly, El-Aidy *et al.* (1996) studied the effect of grafting on vegetative growth of cucumber plants under plastic house. They found that grafted plants onto *Cucurbita ficifolia* had longer stems, more leaves, larger leaf area and higher fresh and dry weights than non-grafted ones. Kabeel (1999) studied the effect of cut grafting method using fig leaf gourd, bottle gourd, pumpkin (*Cucurbita moschata*), squash and non-grafted cucumber Pasandra F1 on vegetative growth. He found that figleaf gourd and bottle gourd had the most stimulative effect on plant length in autumn growing season, while the figleaf gourd and pumplc in rootstocks had the most increasing effect on plant length in spring plantation. The figleaf gourd and bottle gourd as rootstocks showed the highest values of leafa rea and fresh and dry weights of plant compared with the other used rootstocks or the control. In another study, Abd-Alla (2002) grafted cucumber plants Nile cv. , onto squash, pumpkins (*Cucurbita moschata*), pumpkin (*C. maxima*), bottle

gourd, figleaf gourd and non-grafted cucumber and found that the plants grafted onto figleaf gourd and bottle gourd had the highest values of stem length, number of leaves, leaf area and fresh and dry weights of leaves compared with the other used rootstocks or the non-graftedones.On the other hand, when Huaifu *et al.* (2006) investigated the growth of cucumber *(Cucumis sativus)* grafted on smooth luffa (*Luffa cylindrica [L. aegyptiaca)* compared with self-rooted plants they found that cucumber grafted on smooth luffa showed significantly higher values for the plant height; stem thickness and fresh and dry mass of grafted seedlings compared to non-grafted plants.

Table 1: Effect of grafting on plant height 30, 60 and 90 days after planting (summer and winter plantings, 2013)

	Summer planting			Winter planting		
Rootstock	30 day	60 day	90 day	30 day	60 day	90 day
Bottle Gourd	65.00	66.00	113.30	40.33	80.33	135.00
Super Shintosa	57.00	63.67	164.00	43.33	108.00	150.00
Squash 3	48.33	66.67	156.30	37.33	87.00	143.70
Ferro	69.33	69.67	196.50	51.00	118.30	163.00
LSD at 0.05	7.54	5.52	7.34	5.44	8.03	11.08

2- Effect of rootstock types on N%, P% and K% in cucumber leaves

As shown in Table 2, there were no significant differences between control plants and grafted cucumber on all rootstocks in N% in the summer season and P% and K% in both seasons. On the other hand, grafting cucumber on Bottle Gourd rootstock significantly increased N% in the winter season as compared with control. Contradictory results were recorded concerning effect of grafting on mineral contents of cucumber plants. While grafting led to increase in N, P and K in the study of El-Aidy*et al.* (1996), grafting increased N and P and showed no constant trend on the K content in cucumber leaves in the study of Abd-Alla (2002). In contrast, Canizares*et al.* (2005) stated that grafting cucumber did not affect N and P contents, but grafted plants had higher K content in plant shoots compared to non-grafted ones. The contradiction in different results may be attributed to using different rootstocks under different conditions.

Table 2: Effect of grafting on the percentage of nitrogen, phosphorus and potassium in cucumber (summer and winter plantings, 2013)

	Summer planting			Winter planting		
Rootstock	N%	P%	K%	N%	P%	K%
Bottle Gourd	3.94	0.67	3.15	4.46	0.66	2.48
Super Shintosa	3.80	0.57	3.15	3.90	0.68	2.18
Squash 3	3.74	0.92	3.17	3.92	0.59	2.90
Ferro	3.36	0.91	3.45	3.85	0.67	2.97
Non-grafting	4.27	0.62	3.63	3.54	0.47	2.75
LSD at 0.05	N.S	N.S	N.S	0.91	N.S	N.S

3 Effect of rootstock types on some physical characteristics of cucumber fruits:

Data presented in Tables 3, 4 and 5 clearly indicated that grafting on Ferro rootstock showed the most supper effect on physical characters of fruits as it led to remarkable increase in physical characters of cucumber fruits in summer season as compared with non-grafted control. Such increase was significant regarding length and diameter of fruits at all stages and average fruit weight 30 and 60 days after planting. On the other hand, grafting on Squash 3 rootstock also significantly increased weight of fruits 30 and 60 days after planting, and fruit diameter 60 and 90 days after planting.

Table 3: Effect of grafting on physical characters of cucumber fruits, 30 days after planting (summer planting, 2013)

Rootstock	Fruit weight (g)	Fruit length (cm)	Fruit diameter (mm)
Bottle Gourd	64.00	13.17	27.00
Super Shintosa	58.50	12.00	25.83
Squash 3	70.00	12.50	25.50
Ferro	70.67	15.00	30.17
LSD at 0.05	6.88	1.70	3.37

Table 4; Effect of grafting on physical characters of cucumber fruits, 60 days after planting (summer planting, 2013)

Rootstock	Fruit weight (g)	Fruit length (cm)	Fruit diameter (mm)
Bottle Gourd	66.00	12.00	26.17
Super Shintosa	63.67	14.00	24.17
Squash 3	66.67	13.00	27.50
Ferro	69.67	14.17	31.17
L. S. D. at 0.05	5.52	2.08	5.56

Table 5: Effect of grafting on physical characters of cucumber fruits, 90 days after planting (summer planting, 2013)

Rootstock	Fruit weight (g)	Fruit length (cm)	Fruit diameter (mm)
Bottle Gourd	66.33	13.33	26.83
Super Shintosa	63.67	13.00	23.50
Squash 3	67.50	13.00	27.00
Ferro	69.00	15.00	30.50
L. S. D. at 0.05	N.S.	N.S.	1.91

Ferro rootstock caused significant increase in cucumber fruit weight, diameter and length in winter in all plant stages, except fruit length after 60 days from planting as compared with non grafted plants. Squash 3 also caused significant increase in fruit weight and diameter 30 days after planting, fruit weight 60 days after planting as well as fruit lengh and diameter, 90 days after

planting as compared with non-grafted control (Table 6, 7 and 8). Data presented in these tables also indicted that average fruit weight, 30 days after planting and fruit diameter, 60 days after planting were increased due to grafting on Super Shintosa, as compared with the control treatment. The present results revealed the superiority effect of "Ferry" rootstock, followed by Squash 3 over the other rootstocks and non grafted control on the physical characters of cucumber fruits under both summer and winter plantings.

Table 6: Effect of grafting on physical characters of cucumber fruits, 30 days after planting (winter planting, 2013/2014)

Rootstock	Fruit weight (g)	Fruit length (cm)	Fruit diameter (mm)
Bottle Gourd	59.67	11.83	22.67
Super Shintosa	64.67	12.17	22.67
Squash 4	68.67	12.50	25.67
Ferro	68.67	15.17	25.67
Non-grafting	50.67	12.17	21.67
L. S. D. at 0.05	9.38	1.57	2.56

Table 7: Effect of grafting on physical characters of cucumber fruits, 60 days after planting (winter planting, 2013/2014)

Rootstock	Fruit weight (g)	Fruit length (cm)	Fruit diameter (mm)
Bottle Gourd	64.00	12.33	24.67
Super Shintosa	61.67	13.00	25.67
Squash 4	66.67	12.67	24.00
Ferro	68.67	15.00	24.00
L. S. D. at 0.05	4.63	2.00	1.96

Table 8: Effect of grafting on physical characters of cucumber fruits, 90 days after planting (winter planting, 2013/2014)

Rootstock	Fruit weight (g)	Fruit length (cm)	Fruit diameter (mm)
Bottle Gourd	62.67	12.00	21.33
Super Shintosa	65.33	14.00	24.00
Squash 4	65.00	14.33	26.00
Ferro	69.00	15.00	27.33
L. S. D. at 0.05	N.S.	1.62	2.89

3- Effect rootstock types on early and total yield of cucumber:

Data presented in Table 9 showed that early yield in both seasons and total yield in the summer season were significantly higher than the control when cucumber was grafted onto Ferro and Squash 3 rootstocks, while the total yield significantly way increased only in the winter season when cucumber scion was

grafted on Ferro rootstock as compared with control. The superior effect of the rootstocks Ferro and Squash 3 on cucumber yield in the present study is attributed to their positive effect on average fruit weight, length and diameter (Tables 2 – 8). In this respect, several reports indicated that cucumber grafting could be used for increase total yield. This was proved due to grafting onto C. *ficifolia* (Tsambanakis, 1984), *Sicyosangulatus*rootstock (Visser and Nijs ,1987) figleaf gourand pumpkin (Kabeel ,1999) squash, pumpkin (*C. moschata*), pumpkin2 (*C. maxima*) bottle gourd and leaf gourd rootstocks (Abd-Alla, 2002) and *Lagenaria siceraria, Cucurbita ficifolia, C. maxima, Benincasa hispida* and *C. pepo* (Fedorov*et al.,* 2005).

Table 9: Effect of grafting on early and total yield (kg/m2) of cucumber (summer and winter plantings, 2013)

	Summer plant		winter plnat	
Rootstock	**Early yield**	**Total yield**	**Early yield**	**Total yield (kg/ m^2)**
Bottle Gourd	2.083	5.125	2.250	7.708
Super Shintosa	2.083	7.083	2.332	7.875
Squash 4	2.668	8.583	3.083	10.00
Ferro	3.083	11.668	3.583	14.750
LSD at 0.05	0.528	1.68	2.10	1.980

4- Effect of rootstock types on some chemical characteristics of cucumber fruits:

There were no significant differences between control plants and all rootstocks in all chemical contents (percentage of dry matter, TSS and total and reducing sugars) of cucumber fruits in summer planting, when these contents were determined 60 days after planting (Table 10). On the other hand, grafting on Bottle Gourd increased total sugars in cucumber fruits in winter season, using Ferro rootstock under the same conditions caused significant increase in the percentage of dry matter and reducing sugars as compared with non grafted plants (Table 11).

Table 10: Effect of grafting on the percentage of dry matter, total suable sugars and total and reduction sugars in cucumber fruits, 60 days after planting (summer planting, 2013)

Rootstock	**Fruit dry matter (%)**	**TSS %**	**Total sugars (%)**	**Reducing sugars (%)**
Bottle Gourd	6.89	6.33	3.59	3.26
Super Shintosa	8.48	6.17	4.35	3.23
Squash 4	8.48	6.33	4.70	4.07
Ferro	9.05	6.17	4.57	3.43
LSD at 0.05	N.S.	N.S.	N.S.	N.S.

In this regard, kabeel (1999) and Abd-Alla (2002) found that grafting cucumber onto pumpkin or squash led to raise TSS% of fruits. On the contrary, Hongli*et al.* (2003) recorded negative effect for grafting, where contents of soluble sugar, vit. C, amino acids particularly, glutamic and aspartic acids decreased and the contents of nitrate, tannititrable acid

increased in the grafted cucumber on figleaf gourd *(Cucurbitcificifolia)* and Sintozwa*(Cucurbita maxima x C.' moschata).* Other studies suggested that grafting (rootstock) has no significant effect on fruit dry matter and soluble sugar content of cucumber under unstressed conditions (Zhu et al., 2006a,b; Zhong and Bie, 2007).

Table 11: Effect of grafting on the percentage of dry matter, total suable sugars and total and reduction sugars in cucumber fruits, 60 days after planting (winter planting, 2013/2014)

Rootstock	Fruit dry matter (%)	TSS %	Total sugars (%)	Reducing sugars (%)
Bottle Gourd	8.09	6.33	11.96	3.32
Super Shintosa	8.91	6.17	10.86	4.17
Squash 4	8.01	6.33	10.38	1.61
Ferro	10.67	6.17	9.88	6.87
LSD at 0.05	1.77	N.S.	1.22	4.03

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تـأثير التطعـيم علـى جـودة و محصـول الخيـار تحـت درجـات الحـرارة العاليـة والمنخفضة.

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أجريت تجربتين خلال فصلى صيف وشتاء (٢٠١٣- ٢٠١٤/ ٢٠١٣) تهدف إلى دراسة تأثير استخدام الأصول المختلفة على المحصول و الجودة والتحليل الكيماوى للخيار صنف هادي تحت ظروف درجات الحرارة العالية والمنخفضة .تكونت كل تجربة من ٥ معاملات عبارة عن ٤ اصول ، وهي الكوسة الخشابى (Lagenaria siceraria Standl .)، و سوبر شينتوزا (Cucurbita maxima Duchesne×Cucurbita moschata Duchesne)، أسكواش ٣ (Cucurbita pepo) و فيرو ' (C. maxima × C. moschata)، بالإضافة إلى معاملة الكنترول غير المطعمة . سجلت البيانات على طول النبات و الصفات الطبيعية لثمار الخيار بعد٣٠، و ٦٠، و ٩٠، يوما بعد الزرعة ، والمحصول المبكر والكلى، والصفات الكيميائية (نسبة المادة الجافة ، المواد الصلبة الذائبة ، السكريات المختزلة والكلية) فى ثمار الخيار، وكذلك نسبة النيتروجين، و الفوسفور والبوتاسيوم في أوراق الخيار .أشارت النتائج إلى أن استخدام الأصل فرو FRRO ادى الى زيادة فى ارتفاع النبات والصفات الطبيعية للثمار ، والمحصول المبكر و المحصول الكلي من ثمارالخيار في كل من الموسمين الصيفى والشتوى ، بالمقارنة مع معاملة الكنترول غير المطعمة. ولم يلاحظ وجود أي تأثير معنوى من استخدام الأصول على نسبة كل من النيتروجين والفوسفور، و البوتاسيوم في أوراق الخيار، عدا التطعيم على اصل الكوسة الخشابى والتي رفعت بشكل ملحوظ النسبة المئوية للنيتروجين فقط في فصل الشتاء لم تتأثر المحتويات الكيميائية لثمار الخيار بنسبة التطعيم في موسم الصيف، في حين زودت الكوسة الخشابى السكريات الكلية وكما مع الأصل فيرو نسبة المادة الجافة و السكريات المختزلة في الثمار فى فصل الشتاء مقارنة مع النباتات غير المطعومة.

قام بتحكيم البحث

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