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EFFECT OF SOME DIFFERENT ROOTSTOCKS ON YIELD AND ITS COMPONENTS OF CUCUMBER.

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ABSTRACT

In this study, the effect of different rootstocks on cucumber survivals %, plant growth, fruit, yield and quality were studied by comparing grafted plants with non-grafted ones under plastic house during the winter seasons of 2010/2011 and 2011/2012, The cucumber (*Cucumis sativas* L,) c.v Balqis F1, was grafted onto 6001 (*C.shantosa*), Strong (*C.mixita*), Gumbo (*C.maxima*), Bottle gourd (*Legenaria sosiraria*), Vegetable sponge (*Luffa cylindrica*) and pumpkin (*C.moschata*).
C.V Balqis F1 Non-grafted plants were used as control. Grafting significantly affected survival % , stem length ,stem diameter, internodes length , leaf area , plant fresh and dry weight.
Control plants had low survival %, short stem length, internodes length and low leaf area, plant fresh and dry weights in both seasons.

The highest number of flower/node, per plant and fruit setting % values were obtained from plants grafted onto 6001 followed by those grafted onto strong. The highest early yield and total yield per plant as a number and weight were obtained from plants grafted onto 6001 followed by the grafted onto strong. Grafting cucumber onto 6001 significantly increased fruit weight, length and shape index.
Keywords: cucumber, rootstock, grafting, plant growth, yield, quality.

INTODUCTION

Cucumber is a favorite vegetable in Egypt. It used as a salad and pickles. It occupied 11902 and 11800 feddans in planting under plastic houses and low tunnels.

Within the last years, cucumber has become the main crop in plastic houses in Egypt, due to the higher production and monetary returns because of its short cycle and high economic value in off-season harvest. Cucumber is a warm season vegetable, while plants sown during the cold months (October and November) developed very slowly and leaves were chlorotic (Benzoini *et al* 1991).

There are some problems, which may face cucumber production in plastic houses such as soil borne diseases, insufficient organic matter content in soil, excessive use of mineral fertilizers and chemicals, soil salinity and excessive low temperature in winter even under plastic cover. Using different rootstocks of grafted cucumber can solve some of these problems.

Grafting has many benefits to plants grown in plastic houses, such as increasing tolerance to low temperature (Liebig, 1984), tolerance to soil salinity (Matsubara, 1989), and resistance to soil borne diseases (Oda, 1995).

Eguchi and Koutaki (1986) reported that cucumber plants grafted onto *C.ficifolia* could be used for widespread cucumber production, as the grafted plants were more vigorous than the non grafted ones.

Weng *et al*. (1993) found that cucumber grafted onto *C.ficifolia*, increased leaf area by 44-70 % and chlorophyll content by 3.6-11.7 %. Moreover, El-Aidy *et al*. (1996) reported that grafted cucumber onto *C.ficifolia* rootstocks increased the net assimilation rate, stem length, number of leaves, leaf area and plant fresh and dry weights, compared with the non-grafted plants. They indicated that grafted plants produced high number of female flowers per plant compared to the non-grafted ones. Abde-Alla(2002) studied the effect of soil polarization, fertilizer sort and grafting on growth and productivity of cucumber crop he mentioned that grafted plants onto fig leaf gourd had significantly the highest number of female flowers, followed by grafted plants onto bottle gourd while the lowest values were obtained from control (non-grafted cucumber) in both seasons.

Grafting leads to early fruit production. This was stated by many investigators. Nijs (1980), (1983) and (1984), Weng *et al*. (1993) and El-Aidy *et al*. (1996).

In a grafting trial, Tsambanakis (1984) grafted four cultivars of cucumber onto *C.ficifolia*. Data shown that yields of the grafted cultivars tested (Pepionex 69, Brunex, Titon and Renova) were 22, 20, 29, and 17 kg/m^2 respectively, and the corresponding yield of the non-grafted plants were 15, 13, 15 and 11 kg/m^2. Also, fruit weight, length and growth were increased by grafting. Similar results were obtained by (weng *et al*, 1993, Vissor and Nijs, 1987, El-Aidy *et al*, 1996, Abd-Alla,2002, and Zhang et al, 2009)

In the present study, the influence of grafting on different rootstocks of cucumber plants growth, fruit yield and quality under plastic houses in North of Delta area, Egypt.

MATERIAL AND METHODS

An investigation of experiment using cucumber (*Cucumis sativus* L.),cv.Balqis hybrid plants, was conducted in a private farm at Talkha, Dakahlia Governorate, Egypt, under plastic house during the winter seasons of 2010 / 2011 and 2011/2012 to study the effect of different rootstocks on vegetative growth, flowering, yield and fruit quality of cucumber.

The experiment included 7 treatments cucumber, cv. Balqis hybrid seedling was grafted onto different rootstocks. They could be illustrated as follows:

Cucumber seedling without grafting (control),Cucumber grafted onto 6001, Cucumber grafted onto strong, Cucumber grafted onto Gumbo, Cucumber grafted onto bottle gourd , Cucumber grafted onto Pumpkin, and Cucumber grafted onto vegetable sponge.

The soil was clay loan (45% clay, 11.5% sand, sillt 40.2%, organic matter 1.7% and PH 7.9) in the first season while in the second season (46.6%clay, 11% sand , 40.6% silt, organic matter 1.9% and PH 7.85)

The characters of rootstocks used are presented in Table (1)

Table 1 : Rootstocks characters:-

Rootstock	Roots	Vegetative growth	Resistance					
			Cold	Heat	Fusarum	Verticillum	Pethum	Salinity
6001 (*C.shantosa*)	Strong	Vigurus	+++	+++	+++	++	+	++
Strong *(C.mixita)*	Strong	Vigurus	+++	+++	+++	++	+	++
Gumbo *(C.maxima)*	Strong	Vigurus	+++	+++	+++	++	+	++
Vegetable Sponge *(Luffa cylindrica)*	Strong	High vigurus	++	+++	+++	+	+	+++
Pumpkin *(C.moschata)*	Very strong	Vigurus	+	+++	++	+	Unknown	+++
Bottle Guard *(Lagenoria sicoraria)*	Strong	Vigurus	++	++	++	+	Unknown	Unknown

+++ high resistance, ++ medium resistance, + limited resistance, - un-resistance

Grafting seedlings were transplanted under plastic house on both sides of ridges on November 10th (first season) and November 15th (second season) the ridges were 6 meters in length and 1 meter in width. Plant spacing was 40 cm i.e. plant density was about 2، 5 plants per square meter.

Tongue approach grafting method was used according to Wittwer and Homma (1979) and Yamakawa (1982).

Data were recorded at 30, 60, 90 and 150 days after transplanting for survival % while for other characters were recorded at 150 days from transplanting. Samples of 5 plants were randomly chosen from each experimental unit to determine the following characters: stem length (cm), stem diameter(mm), internodes length (cm), leaf area (m^2), plant fresh weight (g), plant dry weight %, number of flower/eye, No of flower/plant, fruit setting%, average fruit weight, fruit length (cm), fruit diameter (cm) and shape index.

Data of fruit yield included early and total yield. Early fruit yield was determined as a number and weight (kg) of fruits per plot. It was determined on base of yield of the first 4 pickings. Total fruit yield was determined as number and weight (kg)/plant and per plot of all pickings.

The experiment included 7 treatments which were randomly arranged using the complete randomized block design with 3 replications. Data were tested by analysis of variance (Little and Hills, 1972). Duncan's multiple range test (DMRT) was used for the comparisons among treatments means (Duncan, 1955).

RESULT AND DISCUSION

The survival rates of plants grafted onto different rootstocks are presented in Table (2). Data show that plants grafted onto 6001 (*C.shantosa*)

and strong (*C.maxita*) rootstock had, in general, the highest values at the different growth stages (30,60,90 and 150 days after transplanting) compared with the other rootstocks. On the other hand, cucumber plants without grafting (control) had the lowest values. The differences were significant at the both seasons and the different stages. The results there not strange because all rootstock resistance to main born disease in soil (Lee, 1986).

Table 2: Effect of grafting cucumber plants, onto different rootstocks on survival % of Plants at different stages in 2010/2011 and 2011-2012 seasons.

Rootstock	Survival at 30 days		Survival at 60 days		Survival at 90 days		Survival at 150 days	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Balqis , F1 *(Cucumis sativus L)*	71.33 c	70.57e	71.28c	70.00e	70.10c	69.95e	69.97c	69.90e
6001,F1 (*C.shantosa*)	93.67 a	90.00 a	93.60a	89.93a	93.52a	89.50a	93.20a	89.88a
Strong,F1 *(C.mixita)*	81.33 b	86.67b	81.00b	86.40b	81.00b	86.35b	80.89b	86.20b
Gumbo,F1 *(C.maxima)*	79.33 b	82.33 c	79.33b	82.31c	79.21b	82.30c	79.10b	82.28c
Vegetable Sponge *(Luffa cylindrica)*	79.33 b	76.00 d	79.21b	76.00d	79.12b	75.89d	79.00b	75.83d
Pumpkin *(C.moschata)*	78.67 b	75.00 d	78.53b	74.81d	78.41b	74.73d	78.32b	74.68d
Bottle Guard*(Lagenoria sicoraria)*	72.00 c	71.33 e	72.00c	71.00e	69.81c	71.00e	69.70c	70.80e

Means separation within columns and seasons by Dun cem's multiple rang test, P<0.05

The growth performance of grafted plants was compared to non-grafted control plants. The results showed that stem length (cm), stem diameter (cm), internodes length (cm), leaf area (m^2), plant fresh weight (g) and plant dry weight were significantly inflounced by grafting Tables 3,4). Stem length of 6001,F1 (*C.shantosa*) at 264.10 cm and 272.13 in first and second season was significantly higher than other grafted and control plants. The main stem diameter (mm) and internodes length were also affected by grafting . Control plants had the shortest main stem diameter (mm) and internodes length (cm) with 15.63, 15.53 and 7.90, 876 in both seasons respectively when compared to the grafted plants.

It is clear the above-mentioned data that plants grafted onto almost rootstocks in two seasons had higher values for all vegetative growth parameters compared to control. This may be due to that grafted plants can absorb more water and nutrients than non-grafted plants (Masuda and Gomi, 1984).Also, grafted plants can grow better than non-grafted plants under high soil salinity (Matsubara, 1989) lowest temperature (Nijs *et al.*1983) or soil borne disease existence (Lee, 1986). Many workers studied the beneficial effect of grafting cucumber onto *C.Ficifolia* on vegetative growth (Eguchi and Koutaki., (1986), Kim and Lee, (1989), El-Aidy *et al*., (1996), Zhang *et al*., (2009), and Lee ,(1994) studied the effect of different rootstocks on plant growth of cucumber and melon, Significantly different resulted were obtained in plants growth depending on various rootstocks.

Flowering characteristics of grafted and non-grafted plants are presented in Table 5, show that, grafted plants onto 6001 (*C.shantosa)* had significantly the highest number of flower per node, number of flowers per plant and fruit setting %, followed by grafted plants onto Strong (*C.maxima*) while the lowest values were obtained from control (non-grafted) in the both seasons.

The obtained results could be interpreted as the rootstock may surpass cucumber in size of the root system, than a significant amount of xylem sap could be translocated by the rootstock, it is known to contain fairly high concentration of mineral, organic substances and plant hormones such as cytokines and gibberellins which many control in number of flowers per node (Masuda and Gomi, 1982 and Lee, 1994). Similar resulted were reported by Abde-Alla (2002) studied the effect of grafting plants onto Fig leaf gourd had significantly the highest number of female flower, followed by grafted onto Bottle gourd while the lowest values were obtained from control (non-grafted) in both seasons.

From the other hand, grafting onto different rootstocks increased vegetative growth parameter at different growth stages (Tables 3 and 4) and that may affect flowering positively.

Table 3: Effect of grafting cucumber plant, onto different rootstocks on vegetative growth in 2010/2011 and 2011-2012 seasons.

Rootstock	Stem length (cm)		Stem diameter (mm)		Internodes height (cm)	
	1st	2nd	1st	2nd	1st	2nd
Balqis , F1 *(Cucumis sativus L)*	239.33 f	240.83 f	15.63 e	15.53 d	7.90 c	8.67 b
6001,F1 (*C.shantosa*)	264.10 a	272.13 a	17.57 a	17.37 a	12.33 a	11.00 a
Strong,F1 *(C.mixita)*	260.33 b	268.87 b	17.30 ab	17.27 a	11.67 ab	10.10 ab
Gumbo,F1 *(C.maxima)*	260.03 b	261.86 c	17.03 b	17.17 ab	10.83 ab	10.00 ab
Vegetable Sponge *(Lufa cylindrica)*	257.50c	258.30d	16.43 c	16.93 b	10.50 a	9.43 ab
Pumpkin *(C.moschata)*	250.50c	256.57d	16.07 d	16.37 c	10.00 b	9.33 ab
Bottle Guard*(Lagenoria sicoraria)*	248.83 e	252.97 e	15.63 e	16.20 c	9.67 bc	8.97 b

Means separation within columns and seasons by DMRT test, P<0.05

Table 4 : Effect of grafting cucumber plant, onto different rootstocks on vegetative growth in 2010/2011 and 2011/2012

Rootstock	Leaf area (m^2)		Plant fresh weight (g)		Plant dry matter (%)	
	1st	2nd	1st	2nd	1st	2nd
Balqis , F1 *(Cucumis sativus L)*	0.152 f	0.164 f	70.03 ef	80.50 a	14.67 f	16.30 e
6001,F1 (*C.shantosa*)	0.222 a	0.229 a	91.93 a	86.87 b	19.50 a	21.80 a
Strong,F1 *(C.mixita)*	0.205 b	0.215 b	86.10 b	85.77 bc	18.07 b	21.03 b
Gumbo,F1 *(C.maxima)*	0.205 b	0.215 b	81-63 c	85.33 bc	17.93 b	1947 c
Vegetable Sponge *(Lufa cylindrica)*	0.189 cd	0.199 d	79.77 cd	85.30 bc	16.90 d	19.53 c
Pumpkin *(C.moschata)*	0.186 d	0.195 d	77.73 de	84.93 c	16.20 d	18.33 d
Bottle Guard*(Lagenoria sicoraria)*	0.174 e	0.189 e	73.57 f	83.73 d	15.07 e	16.77 e

Means separation within columns and seasons by DMRT test, P<0.05

Fruit yield and quality characteristics of grafted and non-grafted plants in both seasons are presented in Tables (6, 7) Early yield as a number and weight and total yield as a number weight per plot (kg) in both seasons were significantly, affected by grafting onto different rootstocks. The highest values were obtained from grafted plants onto 6001 (*C.shantosa*) followed those grafted onto Strong (*C.maxima*). On the other hand, the lowest values were obtained from control (non-grafted plants).

The increase in early yield and total yield as a number and weight per plot in both seasons in grafted onto 6001 (*C.shantosa*) is mainly due to the consequent higher vegetative growth (Table 3 and 4), number of flowers per eye, per plant and high fruit setting % (Table 5).), Also the increase of net assimilation rate (NAR) values which was a limiting factor to the yield (Watson,1958). From another hand, root death in cucumber at the onset of harvesting caused by competition for assimilates between fruits and root could be prevented by grafting cucumber onto Fig leaf gourd (Vlugt, 1986).Similar results were obtained by Lee (1986) when using cucumber plants grafted onto shantosaNo.1 (*C.maxima* x *C.moschata*) under low temperature conditions. Also Abde-Alla (2002) reported that grafted cucumber plants significantly increased total fruit yield per m^2 (as weight and number of fruits quality), Characteristics of grafted and non-grafted plants are presented in Table 7. Average fruit weight (g) and fruit length (cm) show that grafted plants onto 6001 (*C.shantosa*) had the highest values followed by those grafted onto Strong (*C.maxita*) while the lowest values were obtained from non-grafted plants. The differences were significant in both seasons. Fruit diameter and shape index were not significantly affected by all different rootstock in both seasons. The enhancement in average weight and length with different rootstocks may be due to the differences in the effectiveness of their root systems, or in the interaction between root and shoot (Nijs, 1980 and Zijilstra *et al*., 1994), hence, that may lead to variable ability of mineral uptake.

Similar results were obtained by El-Aidy *et al*., (1996) and Abde-Alla (2002).

Table 5: : Effect of grafting cucumber plants, onto different rootstocks on flowering and fruit setting% at 150 days from transplanting in 2010/2011 and 2011/2012 season.

Rootstock	No. of flower/eye		No. of flower/plant		Fruit setting %	
	1st	2nd	1st	2nd	1st	2nd
Balqis , F1 *(Cucumis sativus L)*	2.00 c	2.33 b	60.58 d	64.73 d	52.67 d	51.33 e
6001,F1 *(C.shantosa)*	5.67 a	6.33 a	121. 45 a	156.60 a	68.00 a	60.33 a
Strong,F1 *(C.mixita)*	5.00 ab	5.67 a	109.65 a	150.82 b	64.00 b	65.67 b
Gumbo,F1 *(C.maxima)*	4.33 b	3.67 b	103.96 b	95.93 bc	58.33 c	60.00 c
Vegetable Sponge *(Lufa cylindrica)*	2.67 c	3.33 b	65.47 bc	100.73 cd	58.33 c	59.33 c
Pumpkin *(C.moschata)*	2.33 c	3.33 b	58.37 c	91.58 d	57.00 c	57.00 cd
Bottle Guard*(Lagenoria sicoraria)*	2.33 c	3.33 b	59.95 d	93.91 cd	52.67 d	55.67 d

Means separation within columns and seasons by DMRT test, P<0.05

Table 6 : Effect of grafting cucumber plants, onto different rootstocks on early and total as a number and weight in 2010/2011 and 2011/2012 season.

Rootstock	Early yield				Total yield			
	Number/plot		Weight/plot (kg)		Number/plot		Weight/plot (kg)	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Balqis , F1 *(Cucumis sativus L)*	190.94f	187.11e	15.50d	15.93c	566.67d	561.33a	46.50d	47.80c
6001,F1 (*C.shantosa*)	343.28e	328.89a	18.62a	18.58a	1021.33a	986.67a	55.93a	55.77a
Strong,F1 *(C.mixita)*	312.35b	294.66d	18.33a	18.33a	930.00a	884.00b	55.10a	55.00a
Gumbo,F1 *(C.maxima)*	243.40d	360.78c	18.13a	17.67a	783.00b	782.33c	54.40a	53.10ab
Vegetable Sponge *(Lufa cylindrica)*	234.83e	251.11b	17.42b	16.93bc	725.00bc	753.33c	52.30b	50.83bc
Pumpkin *(C.moschata)*	261.86c	229.32e	16.77c	16.70bc	699.00bc	688.00d	50.40c	49.30c
Bottle Guard*(Lagenoria sicoraria)*	191.05f	195.66e	16.32c	16.43c	666.00cd	587.00e	48.97c	49.13 c

Means separation within columns and seasons by DMRT test, P<0.05

Table 7 : Effect of grafting cucumber plants, onto different rootstocks on fruit characteristics in 2010/2011 and 2011/2012 season.

Rootstock	Average fruit weight (g)		Fruit length (cm)		Fruit diameter (cm)		Shape index	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Balqis , F1 *(Cucumis sativus L)*	54.25g	55.75f	12.90e	12.70e	3.27a	3.20b	3.49c	3.52c
6001,F1 (*C.shantosa*)	87.17a	87.50a	18.17b	16.63a	3.87a	3.83a	4.68a	4.81a
Strong,F1 *(C.mixita)*	81.17b	81.50b	16.27a	15.67ab	3.73a	3.67ab	4.51a	4.55ab
Gumbo,F1 *(C.maxima)*	78.07c	77.17c	14.87b	14.67bc	3.70a	3.67ab	4.34ab	4.39ab
Vegetable Sponge *(Lufa cylindrica)*	74.50d	74.00d	14.20bc	14.53c	3.50a	3.50ab	4.13abc	4.31abc
Pumpkin *(C.moschata)*	62.33e	63.00e	13.87bcd	13.97cd	3.43a	3.37ab	3.97abc	4.96bc
Bottle Guard*(Lagenoria sicoraria)*	55.75f	57.50f	13.43cd	13.42ab	3.43a	3.23b	3.73bc	3.81bc

Means separation within columns and seasons by DMRT test, P<0.05

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تأثير بعض الأصول المختلفة علي المحصول ومكوناتة في الخيار

طـــه محمـــد الســـيد الجـــزار :محمـــود محمـــد زغلـــول : وليـــد محمـــد الســـعدي و عبدالغني هارون عبدالغني الـقـللي
كلية الزراعة – جامعة المنصورة

أجريت هذه الدراسة في مزرعة خاصة بطلخا- المنصورة - محافظة الدقهلية خلال الموسمين الزراعيين ٢٠١٠/٢٠١١ و٢٠١١/٢٠١٢ حيث تمت دراسة تأثير بعض الأصول المختلفة علي محصول الخيار من حيث النسبة المئوية لإستمرار النباتات في النمو من الزراعة وحتي نهاية المحصول والنمو الخضري والمحصول ومكوناتة مقارنة بالنباتات الغير مطعومة – معامل المقارنة - (الكنترول) وذلك تحت ظروف الصوب البلاستيكية وكان صنف الخيار المستخدم هو هجين بلقيس حيث طعم علي الأصول الأتية : ٦٠٠١, إسترونج , جمبوا , القرع العوام , اللوف والقرع العسلي وإستخدم صنف هجين بلقيس بدون تطعيم كمعاملة مقارنة (كنترول). ولقد أوضحت النتائج تأثير معنوي علي نسبة نجاح النباتات طوال الموسم وطول الساق وقطر الساق وطول السلاميات والمساحة الورقية والوزن الطازج والجاف للنبات.

وقد أظهرت معاملة المقارنة (الكنترول) أقل القيم للقياسات السابقة في كلا الموسمين .

كما سجلت النتائج أعلي معدل لعدد الأزهار علي العين علي النبات وأعلي نسبة عقدعلي النباتات المطعومة علي أصل ٦٠٠١ أتبعه في هذا الصدد الخيار المطعوم علي أصل على أصل إسترونج.

كما أوضحت النتائج أعلي محصول مبكر ومحصول كلي للنبات كعدد ووزن حينما طعمت النباتات غلي أصل ٦٠٠١ وتلاه في ذلك الصدد الخيار المطعوم علي أصل إسترونج كما أظهر الخيار المطعوم علي أصل ٦٠٠١ زياده معنوية في وزن وطول ومعامل الشكل للثمار فى كلا الموسمين..