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IMPACT OF SOME SOIL MULCH TREATMENTS ON TREE GROWTH, YIELD, FRUIT QUALITY AND STORABILITY OF VALENCIA ORANGE UNDER TOSHKA CONDITIONS

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ABSTRACT: The present investigation has been done in two consecutive seasons (2005/2006 and 2006/2007) and divided into two parts: 1- Preharvest treatments; at Toshka research station, South Egypt to evaluate the effect of four treatments; i.e., soil mulch with Egyptian clover (*Trifolium alexandrinum* L.) (T1), soil mulch with fenugreek (*Trigonella foenum*) (T2), soil mulch with weed residues (T3) and without mulch as control (T4) on 7-year-old Valencia orange trees (*Citrus sinensis*) to explore their effects on tree growth and yield. 2- Postharvest responses to evaluate the effect of the same treatments on the fruit quality and storability. The results indicated that in the first part, T1 gave the best vegetative growth, meanwhile T3 gave the best initial fruit quality, while in the second part there was no significant difference among treatments for all the studied parameters (juice volume, TSS/acid ratio and vitamin C). Moreover, T1 gave the least chilling injury compared with T2 and T3 after six weeks of cold storage at $5^{o}C \pm 2$. To detect fruit color homogeneity, using Minolta colorimeter CR-400, both of *L, a,* and *b* values were measured and it showed that Toshka climate conditions is much better for fruit color. On the other hand, no mould was observed at the end of storage period. In general, all mulch treatments gave good impact on orange fruit yield and quality characteristics.

Key words: Valencia orange, soil mulch, storability, Toshka, yield, fruit quality, intercrop.

INTRODUCTION

Orange is one of the best known, cultivated and studied fruit trees all over the world. In Egypt, citriculture is based on an intensive production system that is strongly dependent on the use of agrochemicals and synthetic fertilizers, which are responsible for approximately 50% of the total costs of production. Organic farming, envisaging sustainable and environmental friendly agriculture, is an alternative to conventional farming. About 30 countries produce and export certified organic citrus and only 0.6% of the world citrus production is organic, which means that there is a large potential for expansion (Turra *et al.*, 2006).

On the other hand, the organic market niche is highly dependent on the consumers' trust in the system of certification and guarantee of the original products. The organic market development depends on the consumers' perception of the high quality of the organic products. However, quality is a subjective concept that refers to product attributes: a product can be perceived as healthier, it tastes better or it is simply more popular and more in fashion. Quality also refers to the ethical values of the consumer who is in search for a better and less polluted environment or more local products. Organic food has quite a number of benefits such as better taste, fewer chemical residues, superior animal welfare standards, absence of genetically modified organisms, higher natural character etc. (Orboi, *et al.*, 2009). Therefore, researchers carry out many studies on fruit quality, storability and marketability of the organic products to inform the consumers about the above benefits and help them to perceive the greater value of the organic products.

The European Union (EU) market for both certified organic fruit and vegetables was estimated at $1.7 billion in 2002, with fresh organic citrus representing 5-7% of all fresh fruit and vegetable sales and 37% of all organic fruit sold. However, consumption of fresh organic citrus in the EU is still relatively low compared with overall fresh fruit use. Major constraints on additional market share include poor fruit quality and packaging, short shelf life, and inefficiencies in the marketing chain. However, the major exporters of organic fresh citrus to the EU include Italy, Spain and Argentina (Ferguson, 2004).

Organic agriculture practice some techniques to increase soil water holding capacity, organic matter and enhance the soil nutrients which positively reflect on trees growth and consequently fruit quality during the harvesting and the storability periods. Ground cover management systems (GMs) with cover crops (living mulch) or with other organic materials are simple technique for a numerous benefits i.e. soil protection and enhancing its productivity, covering, smothering weeds and increase water use (Verdú and Mas, 2007). GMs are important in managing fruit-tree orchards because of their effects on soil conditions, nutrient availability, tree growth and yields (Shengrui *et. al.,* 2005). On the other hand, a few numbers of studies were found on organic orange fruit quality and its storability.

In this respect, legume living mulch enhance the sustainability of crop production by increasing soil organic matter, improving the long-term nitrogen reservoir of the soil, improving soil structure, conserving soil water and reducing runoff and soil erosion. In contrary, the disadvantages of the living mulch are the cost of seeding; loss of economic production while the mulch crop is growing; lowered soil temperature in spring, and depletion of soil water at planting time (Frye and Blevins, 1989).

The health benefits of organic production have prompted research into pre- and postharvest citrus fruit treatments to maintain and enhance their biological activity.

Therefore, the idea of this investigation was to measure the impact of living mulch as well as the use of weed residues as organic mulch material on Valencia orange trees growth, yield and to evaluate the organic fruit quality during the cold storage period.

MATERIALS AND METHODS

Preharvest Treatments

Thirty six Valencia orange trees (5-year- old) budded on volkameriana rootstock organically grown in sandy-clay soil (the main soil physical and chemical properties is shown in Table 1 and 2) at 4 x 5 m (210 trees feddan) were selected in two consecutive seasons (2005/2006 and 2006/2007) at Toshka research station, South Egypt. The trees were of almost uniform vigor and received the normal practices for pruning, organic fertilization etc. The fertilization program was about 1.75 kg rock-phosphate/tree/ year added in rounded trenches close to the root system around the tree canopy in December. In addition, compost extraction was applied as foliar sprays at monthly intervals from November to September.

Under tree head sprinkler irrigation system was used to irrigate the experimental trees. The irrigation intervals were done daily during spring, summer and autumn, and every two days during winter. Trees received 3500 m^3 fed^{-1} $year^{-1}$.

Experimental design

The Complete Randomized Block Design (CRBD) design with four treatments and three replicates was used throughout the whole work. The work has been divided into two parts: (I) preharvest treatments in the field and (II) postharvest responses in the storage room. The treatments were as follow; soil mulch with Egyptian clover (*Trifolium alexandrinum*) L. (T1), soil mulch with fenugreek (*Trigonella foenum*) (T2), soil mulch with weed residues (T3) and without mulch as control (T4).

Table 1. Main physical properties of the soil under experimental trees (soil classification according to ISSS)

Depth (cm)	Particle size distribution g /Kg^{-1}			Texture
	Sand	Silt	Clay	
0-30	853.3	40	106.7	Sandy Clay

Table 2. Main chemical constituents in the paste extract of the experimental soil

EC	pH	N	P	K	Ca++	Mg++	Na+	Cl-	SO4	HCO_3
ds m^{-1}			ppm				Meq l^{-1}			
0.166	8.04	36.00	38.37	13.04	2.92	0.67	11.46	2.94	12.84	0.51

Each replicate was represented by 3 trees; as such the total number of experimental trees was 36. Data were statisticaly analysed using the Statistical Analysed System (SAS, V8). The effects were tested using the general Linear Model. Multiple comparisons of means of the mulch treatments was performed according to Duncan test (Snedecor & Cochran, 1972).

Soil preparation

Soil between trees was hand weeded and ploughed then the seed bed was prepared. Compost (8.4 ton feddan^{-1}) was added and mixed with the soil. The compositions of the compost was as follows; Ec 3.5 mm/cm, ph (7.9), NPK % were (1.7, 0.7, 1.5), Fe, Mn, Cu, Zn in ppm were (1250, 140, 150, 22), organic matter 45% and C/N ratio 15:1

Seeds were then sown by the end of December 2005 with a rate of 10.9 – 13 kg fed^{-1} for the *Trifolium alexandrinum* L. and 13 – 15.2 kg fed^{-1} for *Trigonella foenum* (the common rate in Egypt). Moreover, the weed residues were used to mulch the soil between tree rows and cover crops were incorporated into soil when reached full bloom.

Soil analysis

Soil samples were taken in May in every season. They were taken horizontally at a distance 200 cm from tree trunk and vertically at a depth of (0 – 30 cm) from soil surface. Dimensions of the used auger cylinder were 5cm radius and 25 cm height. Soil moisture percentage was determined in samples taken from the same site in May each season. The samples were dried at 105 °C till constant weight. Soil organic matter content was analyzed by means of the Wakley and Black method (Black *et al.*, 1982 and Jackson, 1967). Total N was determined by shaking 20 g of soil with 100 ml of K_2SO_4 during two hours. An aliquot of 50 ml of the filtered extract was subjected to steam distillation with MgO and Devarda alloy to determine N according to the method described by Keeney and Nelson (1982). Available phosphorus was determined by shaking 10 g of soil with 100 ml of $NaHCO_3$ 0.5 N during two hours; pH was adjusted to 8.5. Phosphorus was determined in 20 ml of the filtered extract calorimetrically by spectrophotometer using the stannous chloride method described by Jackson (1958). Exchangeable potassium was determined by shaking 5 g of soil with 100 ml of ammonium acetate + ammonium hydroxide 0.5 N during two hours; pH was adjusted to 7. Exchangeable potassium was determined in 20 ml of the filtered extract using flame photometer according to the method described by Black *et al.*, (1982).

Vegetative growth attributes of Valencia orange trees

At the beginning and at the end of the experiment, tree canopy volume (m^3) was calculated according to the equation: [Canopy volume (m^3) =0.5236 x height x diameter square] as stated by Turell (1965). The yearly increments were calculated.

In addition, ten shoots of the current spring flush, randomly distributed around the tree canopy, were tagged. The leaf area (cm^2) was determined using leaf area meter apparatus (model CI- 203, USA). The same labeled shoots were used to calculate fruit set percentage as follows; number of set fruitlets/number of flowers x 100.

Leaf mineral contents

Samples were taken in (Aug.) of mature leaves from the middle locations of non fruiting shoots of the previous autumn flush around the four tree directions (north, south, east and west). Samples were dried at 70 °C until a constant wt. and finely ground and digested in a mixture of perchloric: sulphuric acid (1:3 v/v). The following determinations were carried out: total nitrogen (%) using Kjeldahl method (Naguib, 1969), phosphorus (%) by ascorbic acid method (Watanabe and Olsen, 1965), potassium using the photometric method outlined by (Brown & Lilliland (1946).

Yield/fed/ton

The yield /fed /ton was theoretically calculated as (average fruit weight/kg x average fruit number/tree x 210 tree/fed)/1000.

Horizontal root system extension and vertical root penetration

The maximum vertical root system penetration in soil at 80 cm from tree trunk was determined. The maximum horizontal root system extension from tree trunk in the four tree directions was measured and expressed in cm according to (Newman, 1966).

Postharvest Responses

All fruits of different preharvest treatments were harvested, inspected visually and the defected fruits were discarded. The rest was sorted and graded prior to packging in 3Kg carton boxes for each treatment.

All packages were transported to Horticulture Research Institute' laboratory. The samples were immediately labeled, weighed and stored in a refrigerator storage (5°C±2) and 90% RH, and the fruits were not waxed or treated with any postharvest fungicide. The following physico-chemical analyses were measured on the fruits after 0, 15, 30, 45 and 60 days in three replicates, 5 fruits were measured at each sampling date.

Fruit shape index

The fruit polar and equatorial diameters were measured using caliper then the fruit shape index was calculated according to the equation: fruit index = fruit polar/fruit equatorial. The fruit shape was characterized as flat, round and oblong on the bases of shape index (polar diameter/ equatorial diameter) of < 1.0, around 1.0 and > 1.0, respectively.

Fruit weight and juice volume

They were determined by weighing fruits periodically during storage periods, and the juice volume was measured.

Peel color

It was evaluated objectively by Minolta CR400 chromameter (Minolta Camera Co. Osaka, Japan), which measures L*, a* and b*. The L*, measures color lightness (L* values are always positive where higher values are lighter), a* measures color chromaticity that indicates color direction (a* values may be negative or positive with +a* is the red direction and –a* is the green direction) and b* is the second chromaticity measure on the L*, a* and b* scale. It indicates color direction with +b* is the yellow direction and –b* is the blue direction (Nunes *et. al.*, 2007).

Total soluble solids, acidity and TSS/acid ratio

They were measured in the supernatant that have been collected from 20g fruit. TSS% was measured using a hand-held refractometer. Titratable acidity was measured with 0.1*N* NaOH. The TSS/ acid ratio was calculated.

Fruit decay

Discarded fruits were removed, counted and recorded. They include all spoiled fruits resulting from fungal or bacterial infection. Percentage of decay was calculated in relation to the total initial number of stored fruits.

Chilling injury

Symptoms include pitting, brown staining, and increased decay incidence. Percentage of injured fruits were calculated in relation to the total initial number of stored fruits.

RESULTS AND DISCUSSION

Tree Growth

Tree canopy and leaf area

Data in Table 3 show significant differences in the tree canopy increments (m^3) and the leaf area (cm^2) in both experimental seasons. The highest values were obtained from the use of soil living mulch followed by weed residues mulch. The reason could be due to that the legumes living mulch crops fixed additional amount of atmospheric nitrogen to the soil which was reflected on the tree vegetative growth. Moreover, the roots of the living mulch crops can increase the availability forms of some nutrients as well as it provides habitat for some important soil organism which break up compacted soil layers (Sustainable Agriculture Network, 1998). Generally, soil mulch treatments resulted in highest values in comparison with the control. It might be because the mulch treatments cover the soil surface, reduce the moisture evaporation, and increase the soil biological activities which affect positively on the root moisture and nutrition absorption. These results are in agreement with Faber, *et al.*, (2001) who stated that organic mulches enhance tree canopy and in general, fruit-tree growth is boosted by mulch practices (Merwin and Stiles, 1994 and Neilsen *et al.,* 2003).

Leaf mineral contents

Leaf nitrogen content was significantly affected with the mulch treatments in comparison with the control Fig. 1. The values ranged from 1.36 to 2.10 % and 1.37 to 2.54 % in the first and second season, respectively. The highest values resulted from the living mulch treatments without significant difference between them, whereas the lowermost value resulted from the control treatment. However, all leaf nitrogen values were lower than the deficiency level >2.4 % in the first season meanwhile, the values were almost in the optimum levels (2.4- 2.6 %) in the second season with the living mulch treatments (Embleton *et al.,* 1967). These results can be explained with the advantages of cultivating legume cover crops between the tree rows i.e. nitrogen fixation, boosting the organic matter, decreasing the soil pH and consequently increase the nutrients availability to be absorbed. As explained previously, the nitrogen increments enhanced

Table 3. Effect of soil mulch on Valencia orange tree canopy volume and leaf area

Parameters	Treatments	Living mulch with Egyptian clover	Living mulch with Fenugreek	Mulch with weed residues	Control
Tree canopy increment (m^3)	First season	1.93 a	0.98 b	0.96 b	0.73 c
	Second season	2.03 a	1.33 b	1.01 c	0.71 d
Leaf area (cm^2)	First season	21.47 a	20.43 a	18.30 b	17.13 b
	Second season	21.13 a	20.60 a	19.10 ab	17.00 b

Means followed by the same letter are not significantly different at P= 0.05 (Duncan test)

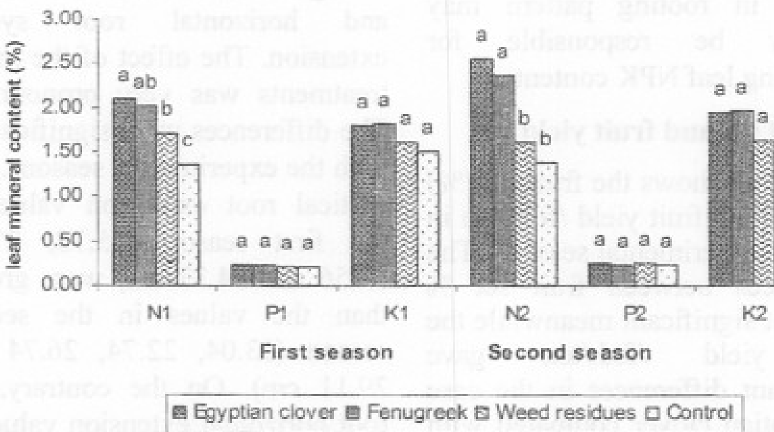

Fig. 1. Effect of some soil mulch treatments on Valencia orange tree leaf mineral content

Means followed by the same letter are not significantly different at P= 0.05 (Duncan test)

The optimum level of leaf N, P and K contents are 2.4-2.6 %, 0.14- 0.24 % and 0.70-1.09 % according to Embleton *et al.*, 1967) leaf area and the vegetative growth in general (Merwin and Stiles, 1994; Neilsen *et al.*, 2003).

On the other hand, there were no significant differences on leaf phosphorus contents as well as leaf potassium contents in both the experimental season. However, the control treatment gave the lowermost values. In general, all leaf phosphorus values were in the optimum levels (0.14-0.24 %) in both seasons whereas the potassium values reached the excessive levels > 1.7 % in the second season (Embleton *et al.*, 1967).

As it will mention, the positive change in rooting pattern may partially be responsible for improving leaf NPK contents.

Fruit set and fruit yield

Figure 2 shows the fruit set (%) and the total fruit yield /fed./ton in both the experimental seasons. The differences between fruit set % were not significant meanwhile the fruit yield /fed./ton gave significant differences in the case of Egyptian clover compared with the control in both seasons. However, there were no significant differences between Egyptian clover compared with fenugreek and weed residues as well as between fenugreek and weed residues compared to the control.

The fruit yield values ranged from 6.77 to 8.17 and 6.78 to 8.31 ton/fed. The increments percentages were 20.68, 14.18 and 9.31% and 22.57, 18.44 and 12.24% with the mulch treatments (Egyptian clover, fenugreek and weed residues) in comparison with the control in both the first and second season, respectively. These results are in agreement with Merwin and Stiles (1994) and Neilsen *et al.* (2003) who stated that fruit yield is positively affected by mulch practices.

Tree root system extension

Figure 3 shows both the vertical and horizontal root system extension. The effect of the mulch treatments was very pronounced. The differences were significant in both the experimental seasons. The vertical root extension values in the first season (15.78, 27.56, 32.56 and 34.33 cm) were greater than the values in the second season (13.04, 22.74, 26.74 and 29.11 cm). On the contrary, the root horizontal extension values in the first season (90, 140, 186.7 and 223.3 cm) were less than the values in the second season (90, 141.7, 190 and 240 cm) for T1, T2, T3 and the control, respectively. The obtained results showed an important effect of mulches on root

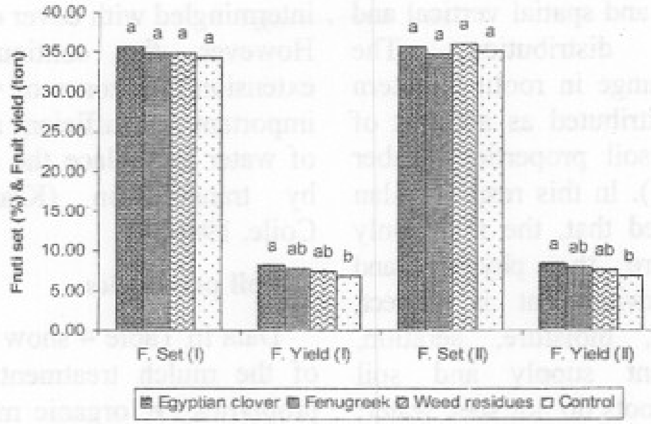

Fig.2. Effect of some soil mulch treatments on Valencia orange fruit set (%) and fruit yield

Means followed by the same letter are not significantly different at P =0.05 (Duncan test)

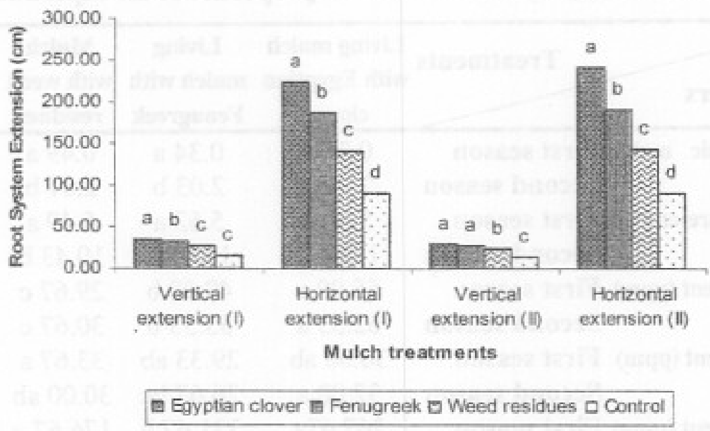

Fig.3. Effect of some soil mulch treatments on Valencia orange tree root system extension

Means followed by the same letter are not significantly different at P =0.05 (Duncan test) system architecture by increasing root length and spatial vertical and horizontal distribution. The positive change in rooting pattern could be attributed as a result of improving soil properties. (Faber *et al.,* 2001). In this respect, Alan (1997) stated that, the roots only grow where the physical and chemical environment is correct; temperature, moisture, aeration, pH, nutrient supply and soil structure. Roots do not seek water; they grow where moisture is available. In most soils, a satisfactory growing environment exists only within the top 50 cm from the soil surface. In fact, the greatest proliferation of tree roots will be found thoroughly intermingled with cover crop roots. However, the continuous root extension into zones of wet soil is important for sufficient absorption of water to replace the water lost by transpiration (Kramer and Coile, 1940).

Soil properties

Data in Table 4 show the effect of the mulch treatments on soil properties i.e. organic matter, soil moisture content, soil NPK contents. Soil organic matter, moisture and P contents had no significant differences in the first season whereas soil N and K contents did.

Table 4. Effect of soil mulch on some soil properties of the experimental site

Parameters	Treatments	Living mulch with Egyptian clover	Living mulch with Fenugreek	Mulch with weed residues	Control
Soil organic matter	First season	0.38 a	0.34 a	0.49 a	0.36 a
($g.kg^{-1}$)	Second season	2.80 a	2.03 b	2.01 b	0.43 c
Soil moisture content	First season	5.55 a	5.62 a	5.49 a	5.42 a
(%)	Second season	12.08 a	12.05 a	10.43 b	5.76 c
Soil N content (ppm)	First season	55.00 a	49.00 b	29.67 c	19.00 d
	Second season	62.33 a	55.33 b	30.67 c	17.67 d
Soil P content (ppm)	First season	30.00 ab	29.33 ab	33.67 a	27.67 b
	Second season	32.00 a	26.67 bc	30.00 ab	25.67 c
Soil K content (ppm)	First season	267.67a	221.67 b	176.67 c	165.33 c
	Second season	301.67 a	251.67 b	175.33 c	165.33 d

Means followed by the same letter are not significantly different at P= 0.05 (Duncan test)

On the other hand, all soil mulch treatments have significant differences on the measurable soil parameters in the second season. The results clearly showed that organic matter influenced by soil mulch treatments with average of 2.28 % in the second season in contrast with 0.40 % in the first one while the control treatments gave 0.36 % and 0.43 % in the first and second season, respectively. The same trend was noticed with the soil moisture and N contents while the effect was not clear enough with soil P and K contents. According to current results we may conclude that the various types of soil mulch influence soil physical and chemical properties differently and these are in agree with (Garland and Mills, 1991; Walsh *et al.,* 1996a; Werner, 1997; Neilsen *et al.,* 2003). Moreover, applied organic mulches to citrus orchards pronounced soil moisture (reducing evaporative loss) and soil nutrient status (Faber, *et al.,* 2001). The maintenance of a living cover understory increased soil N concentration and its availability (Hoagland *et al.,* 2008).

Fruit quality and storability

Postharvest storage at low temperature for more or less extended periods is necessary to extend the commercial storage-life of citrus fruit. Fruit quality and yields are affected by ground management system practices (Merwin and Stiles, 1994; Neilsen *et al.,* 2003),

Fruit shape index

Fig. 4 indicates that fruits produced under Toshka conditions has a good shape (Spheroid) and they are very homogenat. All values were >1 which means that the fruit is oblong (UPOV, 1998).

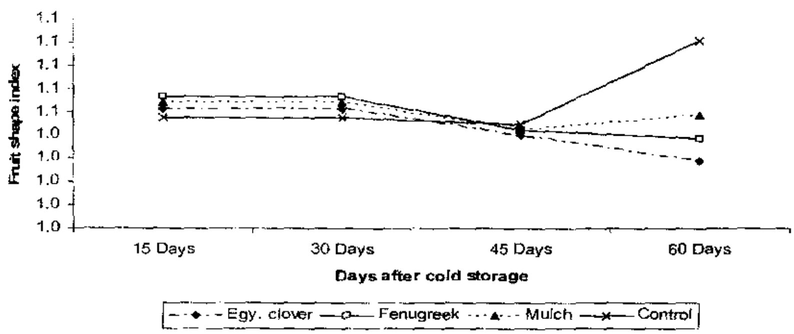

Fig. 4. Effect of some soil mulch treatments on Valencia orange fruit shape index

There was no great significant difference between treatments except at the end where the control fruits become more oblong due to the higher weight loss during the storage period. However, fruit size and yield of marketable oranges was greater from mulch treatments compared to the control (Wyenandt and Heckman, 2006).

Fruit weight and juice volume

Fig. 5 shows the evaluation of fruit weight and juice volume in the second season whereas the differences in the first season were not obvious. Fruit weight as well as juice volume decreased with the increase of storage period. The deterioration of citrus fruits during storage results mainly from transpiration and respiration (Sornsrivichai *et al.*, 1992). Excessive fruit weight and juice volume loss occurred after 60 days of storage period. This can be due to the transpiration which can adversely affect the quality of fruits as it results in deformation and loss of gloss (Kawada and Albrigo, 1979). However, the mulch treatments with Egyptian clover gave the best fruit weight and juice volume values followed by mulch with weed residues and Fenugreek whereas the control gave the lowest values. Soil mulch enhances the soil properties and increase root water absorption and tree growth that resulted in increasing fruit weight and consequently fruit juice volume (Shirgure *et al.*, 2003). On the other hand, the mulch treatments modify the micro-climate (increase humidity and reduce temperature) under trees which affect the fruit quality properties. Moreover, according to the previous results of increasing soil nitrogen content into the soil, as a result of

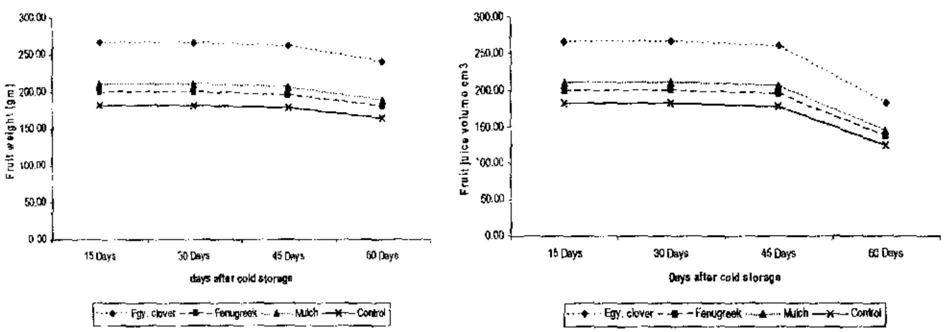

Fig. 5. Effect of some soil mulch treatments on Valencia orange fruit weight and juice volume

Egyptian clover treatment, increase fruit peel thickness (Dasberg, *et al.*, 1983) that can protect the fruit from loosing much water during the storability.

Fruit color L, a, h and b evolution

As shown in Fig. 6, the fruit color lightness L* values were higher with the mulch treatments compared with the control. The mulch with weed residues resulted in higher values followed by fenugreek and Egyptian clover, respectively. However, the L* values declined after 45 days of storability.

The color chromaticity that indicates color direction a* gave positive trend with the mulch treatments compared with the control. Egyptian clover gave the higher values followed by fenugreek and weed residues, respectively.

The second chromaticity measure b* that indicates color direction shows no changes after 30 days of storability then the values increased to indicate more yellow color to reach its maximum after 45 days after that the values decreased. The minimum values were after 60 days.

Fruit TSS/acid ratio and Vit. C content

As shown in Fig. 7, TSS/acid ratio and Vit. C content showed stable increments after 15, 30 and 45 days of cold storage then TSS/acid ratio increased to reach its maximum values after 60 days while Vit. C decreased. Yiu, *et al.*, 2006 stated that TSS/acid ratio increase as the storage period increase. On the other hand, mulch treatments (weed residues, Egyptian clover and fenugreek) gave the lowest values of TSS/acid ratio, respectively whereas the control treatment resulted in the highest values. This can be due to that the fruits that produced from the mulch treatments vary in soil moisture content see table, 4 mulch affecting water and salt absorption that decrease TSS and increase acidity resulting in the variability of TSS/acid ratio. In contrary, Rapisarda, *et al.* 2008 reported that TSS/TA ratio increased during storage in all orange varieties with the exception of 'Valencia' orange where a drop was observed on the 65^{th} day of storage.

In contrary, Vitamin C content was high with the mulch treatments compared with the control. In this respect, vitamin C levels degraded over time and severely reduced after 60 days of

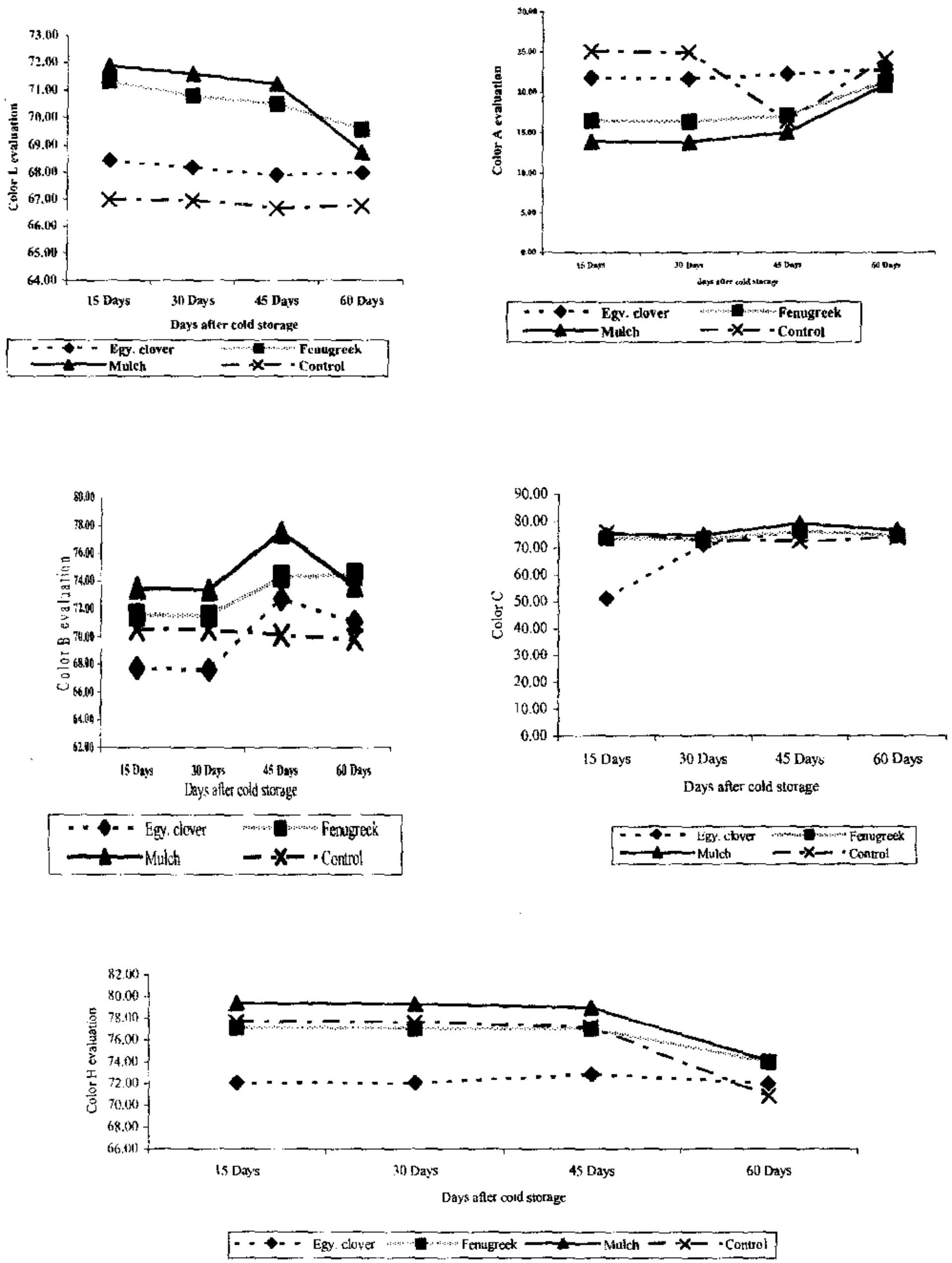

Fig. 6. Effect of some soil mulch treatments on Valencia orange fruit color

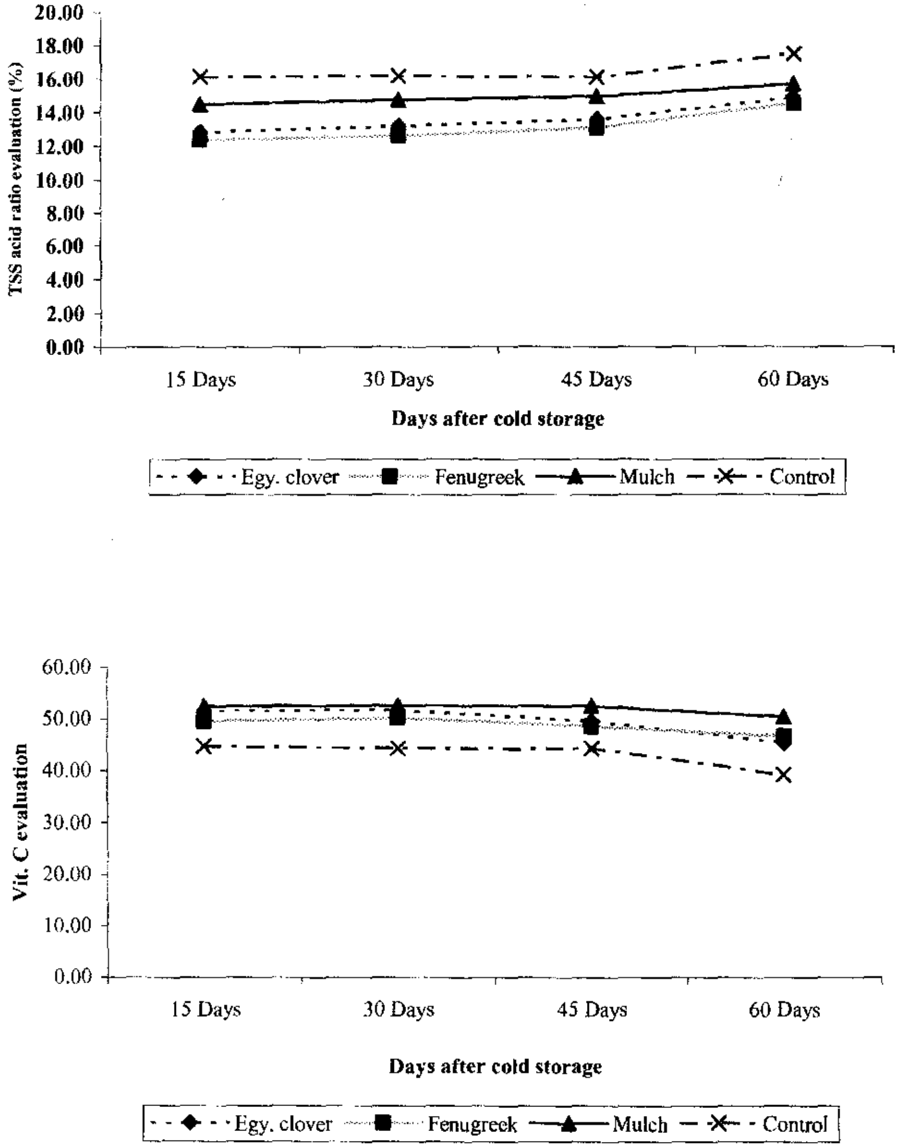

Fig.7. Effect of some soil mulch treatments on Valencia orange fruit TSS/acid ratio and Vit. C content

storability. This can be happen because the higher total soluble solids including fructose the greater loss of vitamin C (Nagy, 1980).

Fruit chilling injury

As shown in Fig. 8, chilling symptoms started slightly after 30 days of storage at 5°C under treatments condition except with Egyptian clover treatment where the symptoms appeared after 45days of storage. Moreover, the results showed that more than 60% of control fruits were injured with chilling after 45 days of storage. These results are in agreement with Grierson and Ben-Yehoshua, (1986) who stated that oranges are considered to be non-climacteric fruit, storage treatment can increase fruit respiration because of possible chilling injury.

Fruit decay

As a result of this study, there were no decay in the stored fruits in all treatments till the end of storage period which reflect how much the conditions in Toshka are suitable to produce clean oranges.

In conclusion, the obtained results showed that the use of mulch as an alternative environment friendly technique for orange production under Toshka condition is promising where the tree growth, tree root extension shows positive trend and fruit quality is high even after long period of cold storage without any synthetic chemicals additives. However, other fruit quality parameters e.g. chilling injury needs further investigation.

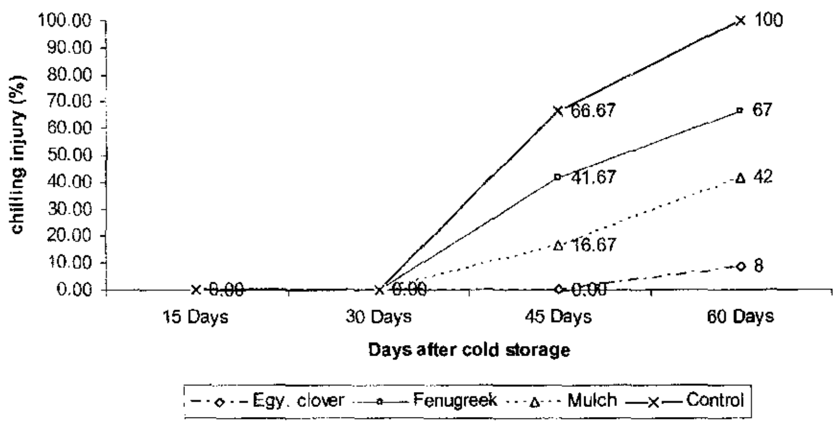

Fig. 8. Effect of some soil mulch treatments on Valencia orange fruit chilling injury (%)

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تأثير بعض معاملات تغطية سطح التربة على نمو الأشجار والمحصول وجودة الثمار والقدرة التخزينية للبرتقال الفالنشيا تحت ظروف منطقة توشكى

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أجرى البحث فى موسمين متعاقبين (٢٠٠٥– ٢٠٠٦ / ٢٠٠٦– ٢٠٠٧) وتمت الدراسة على مرحلتين: الأولى – دراسة تأثير معاملات ما قبل الجمع على نمو الأشجار وأجريت التجربة فى محطة البحوث بتوشكى لتقييم تأثير عدد ٤ معاملات وهى تغطية سطح التربة بزراعة محصول البرسيم المصرى كمحصول تغطية T1 ، تغطية سطح التربة بزراعة الحلبة كمحصول تغطية T2، تغطية سطح التربة باستخدام مخلفات الحشائش T3، وبدون تغطية لسطح التربة كمقارنة T4 على نمو أشجار البرتقال الفالنشيا والمحصول .الثانية– دراسة تأثير المعاملات السابقة على الجودة و القدرة التخزينية للثمار.

وقد أظهرت النتائج فى المرحلة الأولى أن المعاملة الأولى T1 أعطت أفضل نمو خضرى فى الوقت الذى أعطت فيه المعاملة الثالثة T3 أفضل مواصفات جودة بينما فى المرحلة الثانية لم يكن هناك فروق معنوية بين جميع المعاملات فى جميع الصفات المدروسة (حجم العصير، المواد الصلبة الكلية الذائبة، الحموضة، فيتامين ج)

وفضلا عن ذلك فقد أعطت المعاملة الأولى أقل أضرار برودة بالمقارنة بالمعاملة الثانية والثالثة بعد ٦ أسابيع من التخزين. ولدراسة تجانس اللون فقد استخدم جهاز المينولتا CR -400 لدراسة قيم الـــ (L ، a،b) وقد أظهرت النتائج أن المناخ تحت ظروف منطقة توشكى هو أفضل ملائمة لتلوين الثمار. على الجانب الآخر لم تظهر أعراض أعفان على الثمار فى نهاية فترة التخزين. وبصفة عامة فقد أظهرت كل معاملات التغطية للتربة تأثير جيد على مواصفات وجودة محصول البرتقال.