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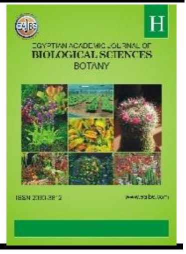

Vegetative Growth and Quality of Washington Navel Orange as Affected by Shading Nets and Potassium Silicate Spraying

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ABSTRACT

The experiment was conducted on Washington navel orange trees grown in sandy soil under a drip irrigation system at El Nubaria, Behera governorate during both experimental seasons of 2018 and 2019 to study the effect of applying a shading net, spraying potassium silicate, and their combination during fruit development to reduce high-temperature stress on fruit drop (%), number of fruits sunscald, number of fruits/ tree, and fruit quality, the experiment followed Randomized Complete Block Design(RCBD). The results showed that, T4 (Shading net (75%) and T7 (Shading net (75 %) + potassium silicate) caused the highest significant increase in shoot length. in the first season, the two shading treatments (T3 and T4) and the three combined treatments (T5, T6, and T7) caused a significant increase in leaf area compared to the control and the rest treatments. In the first season, Treatments (T4, T6, and T7) caused a significant increase in shoot diameter compared to the rest treatments and the control. In the two seasons, control, and the treatments of spray silicate only (one, two, or three times) caused the highest significant percentage of fruit June drop compared to the rest treatments. All treatments caused a significant increase in average fruit weight (g), juice weight (%), and fruit diameter (cm) compared to control. T2 (35% shading net) caused a significant increase in TSS and TA (%) compared to the control and the two shading treatments (65 and 75%). As for vitamin C shading treatments (T2, T3, and T4) did not show any significant differences among them or compared to the control. The highest value of total chlorophyll was obtained from T4 and T7.

INTRODUCTION

Citrus is an important fruit crop in tropical and subtropical countries, it is considered the first among economic fruit crops in Egypt as well as all over the world. Washington navel orange (*Citrus sinensis* L.Osbeck) is one of the most popular citrus fruit in Egypt; for its delicious, taste and nutrition, besides being rich in vitamin C and minerals. Citrus cultivated area in Egypt reached 4444 thousand feddans producing 45 million tons of fruits annually according to FAO (2017).

Environmental stresses such as temperature during critical periods of fruit development and maturation are known to influence fruit yield, peel color, TSS, and acid content. Shading is a pre-harvest cultural practice that has been used to reduce radiation heat load and increase light use- efficiency (Tsai *et al*., 2013). Shade net involves the attenuation of solar irradiance by shading, thereby reducing temperature and wind velocity and increasing humidity. The application of SN in orchards originated from the ameliorative effect of shade on radiation and temperature observed under natural conditions.

Regarding the effect of potassium silicate and the role of silicon for reducing fruit sunscald and increasing growth and yield characters (Tsai *et al*., 2013).However, various studies have demonstrated the importance of silicon application on increasing plant growth significantly (Alvarez and Datnoff, 2001), enhancing their tolerance against various abiotic and biotic stress (Majeed *et al*., 2010 and Sajad *et al*., 2010). Potassium is one of the most important macro-elements which highly mobile in plants at all levels, from the individual cell to xylem and phloem transport. This cation plays a major role in enzyme activation, protein synthesis, stomatal function, stabilization of internal PH, photosynthesis, turgor-related processes, and transport of metabolites. Potassium improves fruit quality by enhancing fruit size, juice contents, color, size, and juice flavor (Tiwari, 2005 and Ashraf *et al*., 2010). In contrast, K deficiency produces small fruits with a thin peel. The application of potassium increased mineral content and crop yield (El-Safty *et al*., 1998), also improved crop quality (Wei *et al*., 2002).

This investigation carried out to study the influence of shading nets or foliar application of potassium silicate and their combination on yield and fruit quality of Washington navel orange.

MATERIALS AND METHODS

This investigation was conducted during two consecutive seasons (2018 and 2019) on 7-year-old Washington Navel orange (*Citrus sinensis* L. Osbeck) trees budded on Volkamariana rootstock planted at 4× 5 meters apart, received normal horticultural practices, and grown in sandy soil under drip irrigation system at El- Nubaria region, El- Behera governorate, Egypt. It was aimed to investigate the influence of shading nets or foliar application of potassium silicate and their combination on Washington navel orange.

The investigated treatments were as follows:

- T1: Tap water spray without shad net (control).
- T2: Shading net (30%) from 15th April to 1st September.
- T3: Shading net (65%) from 15th April to 1st September.
- T4: Shading net (75%) from 15th April to 1st September.
- T5: Shading net (30%) from 15th April to 1st September with Foliar application of potassium silicate.
- T6: Shading net (65 %) from 15th April to 1st September with Foliar application of potassium silicate.
- T7: Shading net (75 %) from 15th April to 1st September with Foliar application of potassium silicate.
- T8: Foliar application of potassium silicate one time on 1st April at the rate of 5 cm/l water.
- T9: Foliar application of potassium silicate two times on 1st April and 1st June at the rate of 5 cm/l water.
- T10: Foliar application of potassium silicate three times on 1st April, 1st June, and 1st August at the rate of 5 cm/l water.

At the beginning of this study, samples of soil were taken to determine physical and chemical characteristics (Tables 1 and 2) according to Chapman and Partt (1978).

Table 1: Soil physical properties of the experimental site for the two seasons

Seasons	Mechanical analysis			Soil texture	Soil moisture (%)		
	Sand (%)	Silt (%)	Clay (%)		Field capacity	Wilting point	Available water
2018	57.7	24.1	18.2	Sandy loam	35.2	14.7	20.4
2019	57.3	23.9	18.9	Sandy loam	36.0	14.5	21.1

Table 2: Soil chemical properties of the experimental site for the two seasons

Seasons	Soil E.C (ds/m)	Soil pH (1: 2.5)	Total $CaCO_3$	Organic matter (%)	Available macronutrients (ppm)			Total N (%)
					N	P	K	
2018	1.9	8.2	20.9	0.29	36.8	3.99	77.0	0.15
2019	1.8	8.2	21.3	0.28	37.8	4.55	79.0	0.13

Forty uniform trees distributed in the orchard were selected for this investigation. The Randomized Complete Block Design (RCBD) was used with four replications. In the spring, four branches were chosen from each tree and marked. June drop (%), fruit sun scalds (%), number of cracked fruits, number of fruits/ tree were counted according to Westwood (1978) then, June drop and fruit sunscald percentages were calculated according to the equations:

$$\% \text{ June drop} = \frac{\text{Number of fruitlets} - \text{Number of fruits in late June}}{\text{Number of fruitlets}} \times 100$$

$$\% \text{ Fruit sun scalds} = \frac{\text{Number of sun scald fruits}}{\text{Total number of fruits on tree}} \times 100$$

At harvest time, a sample of 5 fruits per tree from each replicate (tree) was collected randomly in both seasons and then transported quickly to the laboratory of the Plant Production Department, Faculty of Agriculture, Saba- Basha- Alexandria University- to determine some physical properties as average fruit weight (g), average fruit juice (%), average fruit diameter (cm) and average fruit navel (g).

Also, some chemical properties were determined as TSS (%)by using a hand refractometer according to Lacey *et al*. (2001).

Acidity (%): fruit juice was determined according to the (A.O.A.C., 2000) by titration with 0.1 N sodium hydroxide using phenolphthaleinas an indicator and expressed as a citric acid percentage.

Vitamin C (Ascorbic Acid): vitamin C content was determined in fruit juice using 2,6- dichlorophenol-indo-phenol blue dye as mg ascorbic acid per 100 ml Juice (A.O.A.C., 2000).

The total chlorophyll index was measured by chlorophyll meter (SPAD- 502, Minolta Co. Japan), an average of 3 measurements from different spots of fruit was considered (Yadava, 1986).

At the end of growing seasons, the ten selected shoots were measured for the average of shoot length (cm), shoot diameter (cm) using hand caliber and leaf area according to this formula, leaf area (cm2) = 0.49 (length of leaf × width of the leaf) + 19.69 (Ahmed and Morsy, 1999).

Data obtained was exposed to the proper method of statistical analysis of variance as described by Gomez and Gomez (1984). The treatment means were compared using the

Least Significant Differences (L.S.D.) at 5% level probability by using the Randomized Complete Block Design (RCBD)as obtained by CoStat 6.311, 1998-2005 as a statistical program.

RESULTS AND DISCUSSION

Vegetative Properties:

1. Shoot Length (cm):

Data in Table (3) showed that, in the two seasons, T4(Shading net (75%) and T7 (Shading net (75 %) + potassium silicate) caused the highest significant increase in shoot length compared to the other treatments and the control, except to T3. In the meantime, T2, T5, and T6 caused a significant increase in shoot length compared to the rest treatments. No significant differences were also found.

2. Leaf Area (cm^2):

Data in Table (3**)**, in the first season, the two shading treatments (T3 and T4) and the three combined treatments (T5, T6, and T7) caused a significant increase in leaf area compared to the control and the rest treatments. In the meantime, T2 caused a significant increase in leaf area compared to the three potassium treatments and the control, whereas, no significant differences were found among them. In the second season, T4, T6, and T7 caused a significant increase in leaf area compared to the other treatments and the control. While no significant differences were found among the three potassium treatments in one hand and compared to the control in the other hand.

3. Shoot Diameter (mm):

Data in Table (3), in the first season, Treatments (T4, T6, and T7) caused a significant increase in shoot diameter compared to the rest treatments and the control. In the meantime, T2, T3, and T5 caused a significant increase in shoot diameter compared to the two higher concentrations of potassium (T9 and T10) and the control. In the second season,T4 and T7 treatments significantly increased the shoot diameter compared to the other treatments, except for T3 and T6 treatments. A significant difference was also found between T2 and T5 compared to the control and the three potassium treatments, where there was no significant difference was found among them.

These results are in line with those reported by Wei *et al.* (2006), Retamales *et al.* (2008), and Shahak *et al.* (2016). They revealed that the effect of shading networks on vegetative growth and leaf area has positive effects, due to the refraction of light intensity and increase of shade and reduce heat stress.

Table 3: Effect of shading net and spray potassium silicate on green growth chemical parameters of Washington navel orange in 2018 and 2019 seasons

Treatment	Shoot length (cm)		leaf area (cm2)		Shoot diameter (mm)	
	Seasons					
	2018	2019	2018	2019	2018	2019
T1	22.6 ^{d}	22.8 ^{d}	30.5 ^{d}	31.6 ^{d}	6.0^{ef}	5.9 ^{c}
T2	26.8 ^{bc}	27.0 ^{bc}	33.7 ^{bc}	33.9 ^{c}	6.3 ^{cd}	6.2 ^{b}
T3	27.9 ^{ab}	28.1 ^{ab}	34.9 ^{ab}	35.5 ^{bc}	6.5 ^{bc}	6.5 ^{ab}
T4	29.1 ^{a}	29.3 ^{a}	36.0 ^{a}	36.8 ^{ab}	6.8 ^{a}	6.7 ^{a}
T5	26.3 ^{c}	26.5 ^{c}	34.5 ^{ab}	35.1 ^{bc}	6.4 ^{bcd}	6.2 ^{b}
T6	27.2 ^{bc}	27.4 ^{bc}	35.5 ^{ab}	35.7 ^{abc}	6.6 ^{ab}	6.5 ^{ab}
T7	29.4 ^{a}	29.6 ^{a}	35.9 ^{a}	37.5 ^{a}	6.8 ^{a}	6.7 ^{a}
T8	23.3 ^{d}	23.5 ^{d}	30.7 ^{d}	30.9 ^{d}	6.2 ^{de}	5.8 ^{c}
T9	23.6 ^{d}	23.8 ^{d}	30.3 ^{d}	30.3 ^{d}	5.9 ^{f}	5.8 ^{c}
T10	23.5 ^{d}	23.7 ^{d}	30.8 ^{d}	31 ^{d}	6.0^{f}	5.9 ^{c}

June Drop (%):

The results in Table (4) showed that in the two seasons, control, and the treatments of spray silicate only (one, two, or three times) caused the highest significant percentage of fruit June drop compared to the rest treatments (the three shaded net and the three shaded net with spray silicate). In the first season, the shaded treatments (T2, T3, and T4) and the two shaded net+ spray potassium silicate treatments (T5 and T6) had the lowest significant differences compared to T7. In the second season, T2, T3 and T5 had the lowest significant in the percentage of June drop compared to T4, T6 and T7.

Fruit Disorders:

1. Number of Fruits Sunscald:

As the percentage number of fruit sun scald, the results in Table (4) also showed that the highest significant percentage of fruit sun scald was found in the control compared to all treatments. In contrast, T2, T3, T4, T5, T6 and T7 treatments had no fruit sun scald at all. While, T8, T9 and T10 had an intermediate effect, as T10 had a significant decrease in fruit sun scald compared to T8 on one side and had no significant differences compared to T9 on the other hand in the two experimental seasons.

2.Number of Cracked Fruits:

The results in Table (4) also showed that, in the two seasons, all treatments caused a significant decrease in the number of cracked fruits compared to the control, except for T9 in the second season. In the first season, T2 and T5 caused the lowest significant cracked fruits compared to the other treatments, while, the treatments of shaded net T2, T3, and T4(35, 65 and 75%) and T5 (shad net 35% and spray silicate one time) caused the lowest significant cracked fruits compared to the other treatments in the second.

3. Number of Fruits/ Tree:

The results in Table (4) also showed that all treatments significantly increased the number of fruits/ tree compared to the control in the two experimental seasons. T5 (shaded net 35%+ spray silicate one time) had the highest number of fruits/ tree compared to the other treatments.

However, the fruit is unable to utilize the excess radiation (Gindaba and Wand, 2005) which when accumulated would result in rising fruit surface temperature and ultimately localized burning of the fruit skin under the hot climate. When radiation is so intense, temperature reductions are not enough that radiation can burn fruit even when evaporating water droplets are on the fruit surface, shading net reflects some solar irradiance (including UV- B) in addition to reducing fruit surface temperature (Gindaba and Wand, 2005). Due to these distinctive effects, sunburn was almost eliminated under the shading treatment. The extra radiation load causes heat stress and reduces Co2 assimilation and yield potential (Tsai *et al*., 2013). These results are in the same trend with those obtained by Abd El-Aal and Oraby (2013), El-Khawaga (2014), El- Gioushy(2016), Kotb and Abdel-Adl (2017), and Emad Eldin and Hussein (2018), they observed positive effects of silicon (Si) on the growth and development of crops. While, Smit, (2007), Retamales *et al.* (2008) showed a significant reduction in sunscald was realized when using shading nets which gave the highest fruit yield.

Table 4: Effect of shading net and spray potassium silicate on June drop (%), number of fruits sunscald, number of cracked fruits, and the number of fruits/ tree

Treatment	June drop (%)		Number of fruits Sun scald		Number of cracked fruits		Number of fruits/trees	
	Seasons							
	2018	2019	2018	2019	2018	2019	2018	2019
T1	97.7 a	97.6 abc	26.7 a	24.7 a	5.2 a	6.5 a	234 h	223 h
T2	96.1 de	96.1 f	0 c	0 c	0.2 d	0.5 de	387 b	369 b
T3	96.8 cd	96.7 def	0 c	0 c	1 c	0.7 de	350 c	332 c
T4	96.8 cd	97 bcd	0 c	0 c	1 c	1 cde	337 d	319 d
T5	95.9 e	96.1 ef	0 c	0 c	0.2 d	0.2 e	392 a	374 a
T6	96.3 cde	96.9 cde	0 c	0 c	1.2 c	1.2 cd	321 e	303 e
T7	97.9 bc	97.5 abcd	0 c	0 c	1 c	1.5 c	311 f	293 f
T8	97.6 ab	97.9 a	24 b	22 b	4.2 b	6.2 b	221 i	203 j
T9	97.8 a	97.8 a	23.7 b	21.7 b	4.2 b	6.2 ab	235 h	217 i
T10	97.7 a	97.8 ab	24.7 b	22.7 b	3.7 b	5.5 b	265 g	247 g

Physical Properties:

1. Fruit Weight (g):

Data in Table (5) showed that, in the two seasons, all treatments caused a significant increase in the weight of fruits compared to the control. The two treatments (T2 and T5) significantly increased the weight of fruits compared to the other treatments. The treatments (T3, T4, T6, T7, T9, and T10) caused a significant increase in fruit weight compared to the treatment (T8).

2. Juice Weight (%):

Data in Table (5**)**, also showed that T3 and T4 treatments caused a significant increase in juice weight compared to the control and the rest treatments, except for T6 and T7. In the meantime, No significant differences were found among the three potassium treatments or compared to the control.

3. Fruit Diameter (cm):

In the two seasons, Data in Table (5), the three shading treatments (T2, T3, and T4) significantly increased fruit diameter compared to the control, the three combined treatments (T5, T6, and T7), and the three potassium treatments (T8, T9, and T10). In the meantime, No significant differences were found among the three combined treatments and the three potassium treatments but there had a significant increase in fruit diameter compared to the control.

4. Weight Navel (g):

Data in Table (5) showed that the three shading treatments (T2, T3, and T4) and the three combined treatments (T5, T6, and T7) had a significant decrease in navel weight compared to the control and the three potassium treatments (T8, T9, and T10). No significant difference was found among the three potassium treatments or compared to the control, in the two experimental seasons.

These results are in harmony with those results recorded by El-Khawaga (2014), El-Gioushy(2016),Kotb and Abdel-Adl (2017), and EmadEldinand Hussein (2018). They showed that, the positive effects of silicon (Si) on the growth and development of crops, the beneficial effect of silicate application is supported by the findings of Olivia *et al*. (2016). They pointed out that, the Si role in reinforcing plants for being tolerant of different environmental stress such as alleviating both biotic and abiotic stress which could be reflected positively on both growth and fruiting activities. While, Smit, (2007), Retamales *et al*. (2008) and Tsai *et al*. (2013) found that, using shading nets gave the highest fruit yield and its component characters.

Table 5: Effect of shading net and spray potassium silicate on some fruit characters of Washington navel orange in 2018 and 2019 seasons

Treatment	Fruit weight (%)		Juice weight (%)		Fruits Diameter (cm)		Navel weight (g)	
	Seasons							
	2018	2019	2018	2019	2018	2019	2018	2019
T1	223.7 d	220.2 d	44.2 c	44.5 c	7.25 c	7.02 c	19.75 a	21.75 a
T2	260.7 a	257.3 a	46.9 b	47 b	9.07 a	8.55 a	12.5 b	13 b
T3	246 b	242.5 b	47.9 a	48.3 a	8.97 a	8.52 a	15.5 b	13 b
T4	246.3b	242.8 b	48.3 a	48.2 a	9 a	8.6 a	12.75 b	13.25 b
T5	258.3 a	254.8 a	47.2 b	47 b	9.02 a	8.05 b	12.5 b	13 b
T6	245 b	241.5 b	47.7 ab	47.7 ab	8.22 b	8.92 b	13.25 b	13.5 b
T7	245.5 b	242 b	48.1 a	47.9 ab	8.3 b	8 b	15.4 b	13 b
T8	230.3 c	226.75 c	44.6 c	43.8 c	8.24 b	7.85 b	19.75 a	21.75 a
T9	242 b	238.5 b	44.6 c	44.2 c	8.2 b	7.7 b	19.25 a	20.75 a
T10	242.7 b	239.3 b	44.8 c	44.5 c	8.32 b	7.7b	19.5 a	22 a

Chemical Parameters:

1. Total Soluble Solids (%):

Data in Table (6), showed that T2 (35% shading net) caused a significant increase in TSS (%) compared to the control and the two shading treatments (65 and 75%). No significant differences were found among T5, T6 and T7 treatments (shading silicate + spray potassium silicate) or compared to the control. Also, no significant differences were found in TSS (%) content among silicate treatments (one, two and three times of spray) or compared to control.

2. Total Acidity (%):

In the two seasons, Data in Table (6), showed that T2 (35% shading net) caused a significant increase in TA (%) compared to the control and the two shading treatments (65 and 75%). No significant differences were found among T5, T6 and T7 treatments (shading silicate + spray potassium silicate) or compared to the control except to T5 for TA (%) content. Also, no significant differences were found in total acidity (%) content among silicate treatments (one, two and three times of spray) or compared to control.

3. Vitamin C \ (mg/100 ml juice):

Data in Table (6), showed that, as for vitamin C, shading treatments (T2, T3 and T4) did not show any significant differences among them or compared to the control, in the two seasons. While, in shading net + spray potassium silicate, the lowest significant value of vitamin C was shown in T6 compared to T5 and T7 and the control, While T10 (spraying potassium silicate three times) caused a significant increase in vitamin C compared to T8 and the control.

4. Leaf Chlorophyll (SPAD):

Results in Table (6) showed that the lowest value of total chlorophyll was obtained from T5 and T7, in the two experimental seasons. As for total chlorophyll, the three shading treatments caused a significant decrease in leaf chlorophyll compared to the control, except for 65 and 75% shading net in the first season. The three shading net+ spraying potassium silicate (T5, T6 and T7) caused a significant decrease compared to the control and no significant differences were found among them. No significant differences were also found among T8, T9 and T10 or compared to the control.

The decrease in fruit juice chemical properties (TSS and acidity) exhibited by the silicate spray treatments may be attributed to the dilution effect resulted from increasing the (weight, the volume of each individual fruit and its fruit juice weight) as previously discussed with the fruit physical characteristics. These results are in the same line with those results recorded by El-Khawaga (2014), El- Gioushy (2016), Kotb and Abdel-Adl (2017) andEmadEldinand Hussein (2018). They revealed the positive effects of silicon (Si) on the growth and development of crops. While, Smit, (2007) and Retamales*et al.* (2008) found a significant reduction in sunscald was realized when using shading nets which gave the highest fruit yield and its component characters.

Table 6: Effect of shading net and spray potassium silicate on some fruit chemical parameters of Washington navel orange in 2018 and 2019 seasons

Treatment	Total soluble solids (TSS) (%)		Total acidity (TA) (%)		Vitamin C (mg/100 ml juice)		Leaf chlorophyll (SPAD)	
	Seasons							
	2018	2019	2018	2019	2018	2019	2018	2019
T1	10.7 b	10.5 b	0.77 C	0.74 c	47.2 c	45.2 c	52 c	52.75 d
T2	14.1 a	13.7 a	0.9 ab	0.87 ab	48.1 bc	46.1 bc	54.75 b	56 c
T3	12 b	11.8 b	0.87 abc	0.84 abc	47.4 c	45.4 c	57.25 a	56.75 bc
T4	11.2 b	11.1 b	0.85 abc	0.82 abc	47 cd	45 cd	58.25 a	58.5 a
T5	12.2 b	12 ab	0.92 a	0.9 a	47.7 c	45.6 c	54.75 b	55.5 c
T6	11 b	10.8 b	0.82 abc	0.8 abc	45.8 d	43.8 d	55.5 b	56 c
T7	10.7 b	10.5 b	0.82 abc	0.8 abc	47.7 c	45.7 c	58.5 a	58 ab
T8	11 b	10.8 b	0.85 abc	0.82 abc	48.5 bc	46.5 bc	52.5 c	52.5 d
T9	11.2 b	11.1 b	0.8 bc	0.77 bc	49.1 ab	47.1 ab	52.5 c	52.5 d
T10	11.5 b	11.5 b	0.8 dc	0.77 bc	49.6 a	47.6 a	52.5 c	52.75 d

CONCLUSION

Considering the observed results, it can be concluded that, the foliar application of potassium silicate on time at 1st April at the rate of 5 cm/l water (T8) and shading net (30%) from 15th April to 1st September (T2) for getting high yield and low sunburn of orange fruits under the conditions of Nubaria governorate, Egypt.

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ARABIC SUMMARY

النمو الخضرى وجودة البرتقال أبو سرة تأثراً بشباك التظليل والرش بسليكات البوتاسيوم

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أجريت تجربة ميدانية على أشجار فاكهة البرتقال ابوسرة واشنطن التي تزرع في التربة الرملية تحت نظام الري بالتنقيط في منطقة النوبارية، محافظة البحيرة ، خلال الموسمين لعام ٢٠١٨ و٢٠١٩ لدراسة تأثير تطبيق شبكة التظليل والرش بسيليكات البوتاسيوم على نمو الثمار و تقليل الإجهاد الناتج عن درجات الحرارة المرتفعة وتاثرها على تساقط الثمار(٪) ، وعدد الثمار المصابة بلسعة الشمس ، وعدد الثمار / شجرة ، وجودة الثمار ، وقد اتبعت التجربة تصميم القطاعات كاملة العشوائيه (RCBD).

أظهرت النتائج أن(T4 شبكة التظليل (75٪) و(T7 شبكة التظليل (75٪) + (سيليكات البوتاسيوم) تسببت في أعلى زيادة معنوية في طول الفرخ في الموسم الأول ، معاملتي التظليل(T3 و T4)وجميع المعاملات الثلاثة (T5و T6 و T7) تسببت في زيادة معنوية في مساحة الورقة مقارنة بالكنترول وباقى المعاملات في الموسم الأول ، تسببت المعاملات(T4 و T6 وT7) في زيادة معنوية في قطر الفرخ مقارنة بالكنترول وباقى المعاملات .في الموسمين كانت معاملة الكنترول ومعاملات الرش بالسيليكات (مرة أو مرتين أو ثلاث مرات) سببت أعلى نسبة معنوية من تساقط الثمار في شهر يونيو مقارنة بباقي المعاملات.في الموسمين أدت جميع المعاملات إلى زيادة معنوية في متوسط وزن الثمرة (%) ووزن العصير (جرام) وقطر الثمرة (سم) مقارنة بالكنترول.

تسبب T2 (شبكة تظليل 35٪) في زيادة معنوية في TSS و TA (٪) مقارنة بالكنترول ومعاملتي التظليل (65 و75 %) أما علاجات التظليل (T2 و T3 و T4)لم تظهر أي فروق معنوية بفيتامين سي ذات دلالة إحصائية بينهم أو مقارنة بالكنترول . تم الحصول على أعلى قيمة للكلوروفيل الكلي منT4 وT7 .