Egypt.J. Hort. 30, No. 3-4, pp. 239-251 (2003)

Effect of Girdling and Foliar Application with Some Sources of Potassium and Calcium on Fruit Drop, Yield and Fruit Quality of Persimmon Trees

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THE PRESENT investigation was conducted during 2001 and 2002 seasons to study the effect of girdling and / or foliar spray with some sources of calcium and potassium on fruit drop, yield and fruit quality of Costata persimmon trees as well as leaf N, P, K and Ca contents. The experimental results revealed that trees girdled only or plus sprayed with calcium or potassium reduced the percentages of June, preharvest and total fruit drop significantly. Moreover, foliar spray with potassium citrate plus girdling treatment was more effective in reducing June, preharvest and total fruit drop %, since it recorded (11.72, 8.81 and 20.53 %). Whereas, the control trees recorded the highest values (81.15, 7.35 and 88.50 %, respectively) as mean of two seasons. Sequence, the highest yield (23.23 kg/tree) was obtained with potassium citrate spray plus girdling treatment. Also, other treatments used were effective in increasing the yield as yield efficiency or kg per tree than the control. Moreover, physical fruit characters such as weight, volume, dimensions and firmness, as well as TSS % and V.C were improved by different treatments used than the control. Furthermore, leaf N, P, K and Ca contents were significantly increased by different treatments than the control, except for leaf Ca content which decreased by girdling treatments in both seasons of study.

The cultivated area of persimmon (*Diospyros kaki*, L.) has increased from 29 fed. in 1979 to 1368 fed. in 2000 and the production was increased from 139 to 6761 tons, respectively (according to the statistics of Ministry of Agriculture, Egypt in 2001). Dakahlia Governorate has occupied about 750 fed. from the total area cultivated. Costata is the leading cultivar in Egypt , but the blossom and young fruit sheddings, especially on young trees is the major problem for this cultivar. In this respect, Gould (1940) mentioned that Costata cultivar belongs to the pistillate group, so, its fruit setting is true parthenocarpically. Young parthenocarpic fruits tend to be more easily to drop than young fruits from pollinated flowers (Chandler, 1957). Bargioni *et al.* (1979) postulated that drop of persimmon fruit cultivar "Lycopersicum" was negligible but drop of seedless fruit was very marked and occurred in all time, when fruit growth rate was low.

They noticed that seedless fruit contained less auxin and cytokinin than normal fruit and no GA_3. Masahiko *et al.* (1987) studied fruit drop for 12 varieties of Japanese persimmon, reported that fruit drop was confined to the early developmental stages in all varieties except for Okitsu No. 15 which showed a heavy late drop. Generally, yearly fluctuation of fruit set was small in pollinated fruit. On the contrary, there was large fluctuation in non-pollinated fruits, for example, from 9 % to 84 % in "Tenjigosho" parthenocarpic fruit set of non-pollinated fruit. The natural drop of flowers and fruits from persimmon trees (*Diospyros kaki* L.) were studied by Elizabeth (1991), she found that there were two maximums of effective drop : 55 and 77 days after flowering which occurred at 2.6 and 4.5 cm fruit diameter.

Trunk girdling of persimmon increased return bloom and yield (Naito *et al.*, 1981). Strapping lateral branches with wires (partial girdling) enhanced fruit set and fruit quality of persimmon cvs. Saijo and Moekawa-Jiro (Hasegawa & Nakajima, 1991) and promotes fruit growth and maturity of persimmon cv. Nishimurawase (Hasegawa & Nakajima, 1992). Strapping secondary scaffold branches also enhanced fruit set and quality of persimmon cvs. Saijo, Izu and Matsumotowase Fuyu (Hasegawa & Sobajima, 1992). El-Shaikh *et al.* (1999) studied the effect of girdling and different concentrations of growth regulators on fruit drop of persimmon cv. Costata. They reported that girdling treatment during full bloom significantly increased final yield comparing with the control. Hasegawa *et al.* (2003) found that fruit set of cv. Matsumotowase Fuyu persimmon was higher by using trunk strapping than control trees. Also, they found that the previous treatment increased fruit size, weight and fruit soluble solids content.

Recently, more attention was paid to potassium foliar nutrition to increase fruit set, yield and improve fruit quality by increasing sugar content and enhancing colour (Sharma *et al.*, 1990 and Ezz & El-Kobbia, 2000, on mango). Meanwhile, potassium is known to be involved in energy metabolism processes, protein synthesis and sugars synthesis and translocation (Mengel & Kirkby, 1987).

Also, calcium has received a considerable attention in improving production of fruit trees not only due to its relationship to physiological disorders, but also due to its other desirable effects like extending storage life and increasing firmness (Eliwa *et al.*, 1999; Ashour, 2000 on apple and El-Shobaky & Mohamed, 2000 on citrus). Calcium is required for cell elongation and cell division (Burstrom, 1968 and Rizzi & Abruzzes, 1998).

The purpose of this study was to investigate the effect of girdling and spraying different calcium and potassium sources on fruit drop, yield, fruit quality and leaf mineral content of persimmon trees cv. Costata.

Material and Methods

This investigation was carried out during two successive seasons (2001 and 2002) on 6-year-old trees of persimmon "Costata" cv. (*Diospyros kaki*, L.) budded on *D. virginiana* rootstock grown on a loamy soil at El-Bramon, Horticultural Research Farm, Dakahlia Governorate. Selected trees were nearly equal in vigour, planted at 4 x 4 meters apart and received the normal agricultural practices. The different treatments were applied as follows:

1- Spraying with potassium citrate at 1 % (38 % K).
2- Spraying with potassium citrate at 1 % plus girdling.
3- Spraying with potassium phosphate at 1 % (30 % K).
4- Spraying with potassium phosphate at 1 % plus girdling.
5- Spraying with calcium citrate at 1 % (25 % Ca).
6- Spraying with calcium citrate at 1 % plus girdling.
7- Spraying with calcium sulphate at 1 % (29 % Ca).
8- Spraying with calcium sulphate at 1 % plus girdling.
9- Girdling only.
10- Control (untreated trees).

Spraying treatments were applied after one week from petal full.

Girdling procedures

Girdling was carried out by using a special girdling knife to remove a 3/16 inch wide strip of bark around the main branches. It was applied at the same time of spraying.

These treatments were arranged in a randomized complete block design with three replicates for each treatment and every replicate was represented by two trees. The following parameters were determined.

Fruit drop

Four limbs, representing all tree sides were marked and their fruits were counted before treatments then the number of fruits abscised was recorded periodically to calculate June drop (at the last week of May), pre-harvest drop (at maturity), and the total fruit drop percentage was calculated.

Yield

At harvest time (yellow green stage) the number of fruits were calculated for each tree and expressed per one centimeter square from trunk cross sectional area at 40 cm above ground (yield efficiency). Also, the weight of fruits per tree was recorded as kg/ tree (yield) .

Fruit characteristics

Twenty fruits from each replicate were picked at the stage of yellow green colour to determine the following characteristics, fruit weight (gm), volume (ml) and dimensions (cm). Fruit firmness was determined by using penetrometer (pressure tester) fitted with a 11 mm plunger and recorded as lb/inch 2. Total soluble solids percentage (TSS) was measured in fruit juice by hand

refractometer. Total acidity % in fruit juice was determined as malic acid according to A.O.A.C. (1985). Ascorbic acid was determined by titration against 2,6-dichlorophenol indophenol blue dye according to A.O.A.C. (1985), and expressed as mg /100 ml of juice.

Leaf mineral contents

Leaf sample consisting of 40 leaves for each replicate was collected in September from the middle portion of the current season growth (Westwood, 1978) ,washed with tap water then with distilled water oven dried at 70 C till constant weight, ground and digested according to the method described by Piper (1950).

Total nitrogen was determined by microkjeldahl method described by Pregl (1945), while phosphorus was determined colorimatrically according to Murphy & Reily (1962) and K, Ca were determined by using an atomic absorption spectrophotometer (3300) according to Wild *et al.* (1985).

Statistical analysis

The obtained data were statistically analyzed. Means were compared using the New-L.S.D , according to Snedecor & Cochran (1980).

Results and Discussion

Fruit drop

Table 1 presents the data of fruit drop of Costata persimmon in the two seasons in response to girdling and foliar application with some sources of calcium and potassium. Generally, all treatments decreased June, preharvest and total fruit drop significantly than the control. Moreover, calcium sulphate as foliar spray was less effective in reducing fruit drop. However, girdling trees significantly decreased fruit drop than trees without girdling. Spraying trees with some calcium and potassium sources decreased fruit drop than control, also girdling plus foliar spray with calcium or potassium sources showed high significant effect in this respect. The lowest values of June, preharvest and total drop % were recorded with potassium citrate spray plus girdling (11.72, 8.81 and 20.53 %, whereas, the control recorded the highest values (81.15, 7.35 and 88.50 %) as the mean of two seasons. These results are in line with El-Shaikh *et al.* (1999) who reported that girdling treatment at full bloom decreased fruit drop and consequently increased the yield comparing with the control of Costata persimmon. Ashour (2000) found that calcium and potassium spray increased the yield as number and weight of Anna apple fruits.

Yield

Results in Table 1 clearly showed that all treatments were effective in increasing yield efficiency or yield weight (kg) per tree than the control. The best results in this respect was obtained with potassium citrate spray at 1% plus girdling which gave the highest yield (23.23 kg/tree). Generally spraying with calcium and potassium plus girdling significantly increased the

TABLE 1. Fruit drop and yield of Costata persimmon as affected by girdling and foliar spray with potassium and calcium during 2001 and 2002 seasons.

Treatments	June drop %			Preharvest drop %			Total drop %			Yield efficiency			Yield /tree (kg)		
	2001	2002	Mean	2001	2002	Mean	2001	2002	Mean	2001	2002	Mean	2001	2002	Mean
Potassium citrate at 1%	61.27	77.23	69.25	9.50	9.39	9.45	70.77	86.65	78.71	1.95	1.80	1.88	5.85	7.35	6.60
Potassium citrate at 1% + Girdling	10.91	12.54	11.72	12.07	5.55	8.81	22.98	18.08	20.53	5.82	7.71	6.77	20.49	25.97	23.23
Potassium phosphate at 1%	63.15	72.31	67.73	10.34	3.00	6.67	73.49	75.31	74.40	1.82	1.75	1.79	8.11	7.82	7.96
Potassium citrate at 1% + Girdling	11.99	17.17	14.58	14.60	2.56	8.58	26.59	19.73	23.16	5.10	5.45	5.28	19.61	20.20	19.90
Calcium citrate at 1%	66.57	73.33	69.95	5.01	4.43	4.72	71.58	77.7	74.64	1.80	2.01	1.91	7.10	8.61	7.86
Calcium citrate at 1% + Girdling	14.14	13.27	13.71	11.99	10.75	11.37	26.13	24.03	25.08	5.60	7.05	6.33	18.15	22.61	20.38
Calcium sulphate at 1%	69.67	83.61	76.64	12.57	3.84	8.21	82.54	87.45	84.99	1.40	2.07	1.74	5.04	8.35	6.70
Calcium sulphate at 1% + Girdling	15.72	19.52	17.62	10.00	12.89	11.45	25.72	32.42	29.07	5.85	6.20	6.03	18.43	19.27	18.85
Girdling only	17.85	23.64	20.75	13.57	11.89	12.73	31.43	35.53	33.48	3.58	3.90	3.74	16.06	17.73	16.90
Control	72.73	89.58	81.15	9.70	5.00	7.35	82.42	94.58	88.50	1.05	1.75	1.40	4.93	7.52	6.23
N-LSD at 5%	6.95	7.66	---	5.53	2.11	---	8.05	11.38	---	0.42	0.36	---	1.23	1.39	---
1%	9.09	10.03		---	2.71		10.52	14.84		0.55	0.48		1.61	1.82	

yield of persimmon trees than the control or spraying calcium or potassium alone. In this respect, El-Shaikh *et al.* (1999) mentioned that girdling treatment during full bloom increased final yield of persimmon Costata cv. Ashour (2000) found that both calcium and potassium as foliar spray increased the yield of Anna apple.

Fruit physical characteristics

Weight and volume of fruit

Data in Table 2 indicated that, girdling only significantly increased fruit weight and volume than control. Moreover, girdling plus calcium and potassium were more effective in this respect. These results could be attributed to the effect of girdling in increasing the accumulation of carbohydrate in the parts above wounds (Beruter & Feusi,1997), beside the role of potassium in metabolism processes , sugar synthesis and translocation (Mengel & Kirkby, 1987) . Our results are in agreement with those reported by El-Shaikh *et al.* (1999), they reported that fruits resulted from girdled trees were biggest in weight and size , while the smallest for control trees of Costata persimmon .

Diameter and length of fruit

Data presented in Table 2 showed that potassium spray plus girdling significantly increased both diameter and length of fruits than the control. As for the effect of calcium foliar application, data in the same table indicated that calcium spray alone slightly increased fruit length but had no effect on fruit diameter. Girdling alone significantly increased both length and diameter than the control. The best results in this respect where obtained with potassium or calcium spray plus girdling. These results are in line with those reported by Kilany & Kilany (1991), who reported that spraying potassium significantly increased polar cross diameter of apple fruit. Mostafa (2002) found that girdling after fruit set increased both length and diameter of Dorsett Golden apple fruits.

Fruit firmness

Results in Table 2 indicate that in the first season, spraying calcium or potassium spray alone or plus girdling significantly increased fruit firmness than control fruits. Also, girdling alone has significant effect in this respect. However, fruit firmness was not affected by treatments in the second season. The obtained results agree with those of Eliwa *et al.* (1999) on apple. Ashour (2000) who reported that both calcium and potassium spray increased fruit firmness of Anna apple. On the contrary, Mostafa (2002) indicated that girdling of Dorsett Golden apple trees reduced fruit firmness than that of control.

Fruit chemical characteristics

Data from Table 3 presented that spraying calcium or potassium alone or plus girdling gave higher TSS values than control. The highest percentage of TSS resulted from potassium citrate plus girdling followed by potassium citrate spray alone. Also, calcium spray alone or with girdling and girdling only has significant effect in this respect.

TABLE 2. Fruit physical characteristics of Costata persimmon as affected by girdling and foliar spray with potassium and calcium during 2001 and 2002 seasons.

Characters / Treatments	Fruit weight (g)			Fruit volume (ml)			Fruit length (cm)			Fruit diameter (cm)			Fruit firmness (lb/in.^{2})		
	2001	2002	Mean	2001	2002	Mean	2001	2002	Mean	2001	2002	Mean	2001	2002	Mean
Potassium citrate at 1%	90.0	105.0	97.5	90.8	110.3	100.6	5.52	5.97	5.75	5.61	5.78	5.70	19.60	19.77	19.69
Potassium citrate at 1% + Girdling	120.0	136.7	128.3	124.0	137.0	130.5	6.14	6.47	6.31	6.24	6.48	6.36	20.33	20.30	20.32
Potassium phosphate at 1%	101.3	111.7	106.5	100.7	112.7	106.7	5.98	6.16	6.07	5.83	6.17	6.00	18.88	21.08	19.98
Potassium citrate at 1% + Girdling	115.3	138.3	126.8	116.0	140.0	128.0	6.07	6.79	6.43	6.12	6.34	6.23	19.29	20.50	19.89
Calcium citrate at 1%	94.7	109.0	101.8	94.7	110.7	102.7	5.68	6.06	5.87	5.82	5.85	5.84	19.75	20.43	20.09
Calcium citrate at 1% + Girdling	109.3	130.7	120.0	110.0	131.7	120.8	5.98	6.49	6.24	5.96	6.39	6.18	19.67	20.92	20.30
Calcium sulphate at 1%	91.6	119.3	105.5	87.2	120.0	103.6	5.42	6.33	5.87	5.54	5.97	5.76	19.00	21.54	20.27
Calcium sulphate at 1% + Girdling	123.3	136.7	130.0	122.0	138.7	130.3	6.21	6.56	6.39	6.19	6.47	6.33	20.33	20.79	20.56
Girdling only	114.7	124.0	119.4	125.7	125.7	125.7	5.99	6.53	6.26	6.13	6.19	6.16	20.08	21.33	20.71
Control	98.7	104.3	101.5	99.3	106.7	103.0	5.45	6.27	5.86	5.83	5.97	5.90	17.83	19.33	18.58
N-LSD at 5%	10.1	10.2	---	10.2	5.9	---	0.20	0.29	---	0.27	0.35	---	0.77	NS	---
1%	13.1	13.2		13.2	7.7		0.26	0.37		0.35	0.44		0.99		

TABLE 3. Fruit chemical characteristics of Costata persimmon as affected by girdling and foliar spray with potassium and calcium during 2001 and 2002 seasons.

Treatments	TSS %			Acidity %			V.C (mg/100 ml of juice)		
	2001	2002	Mean	2001	2002	Mean	2001	2002	Mean
Potassium citrate at 1%	19.6	19.7	19.7	0.720	0.707	0.710	19.67	20.33	20.00
Potassium citrate at 1%+Girdling	20.1	20.8	20.5	0.633	0.647	0.640	22.00	22.33	22.17
Potassium phosphate at 1%	16.2	16.9	16.6	0.670	0.693	0.680	20.00	20.67	20.34
Potassium phosphate at 1%+Girdling	17.4	16.9	17.2	0.657	0.670	0.660	22.00	20.67	21.34
Calcium citrate at 1%	19.2	17.9	18.6	0.663	0.647	0.660	20.00	20.67	20.34
Calcium citrate at 1%+Girdling	19.5	18.9	19.2	0.630	0.693	0.660	24.67	25.33	25.00
Calcium sulphate at 1%	16.0	17.0	16.5	0.620	0.603	0.610	22.00	22.00	22.00
Calcium sulphate at 1%+Girdling	18.7	17.7	18.2	0.610	0.603	0.610	19.33	19.33	19.33
Girdling only	18.4	17.7	18.1	0.653	0.670	0.660	19.33	19.67	19.50
Control	15.9	16.1	16.0	0.740	0.760	0.750	18.00	17.00	17.50
N-LSD at 5%	1.6	1.4	---	0.086	NS	---	2.25	2.22	---
1%	2.1	1.8		---			3.08	2.52	

With regard to total acidity in the juice data in the same table revealed that, all treatments reduced the acidity % compared with the control especially in the first season. Conversely, acidity was not affected significantly by treatments in the second season.

Concerning ascorbic acid (V.C) content, data from the same table revealed that most treatments significantly increased VC content than control.

These results are in agreement with those obtained by Hasegawa *et al.* (2003) who found that fruit soluble solids of persimmon cv. Motsumotowase Fuyu were increased by trunk strapping . Ashour (2000) who found that calcium and potassium spray increased TSS but reduced the content of total acidity of Anna apple. Mostafa (2002) found that girdling of Dorsett Golden apple increased TSS but decreased the acidity in fruit juice. El-Shobaky & Mohamed (2000) reported that vitamin C content of Washington Navel orange was increased by calcium and potassium spray.

Leaf minerals content

Data in Table 4 show the effect of girdling and spraying some calcium and potassium sources on leaf N, P, K and Ca content of Costata persimmon.

Nitrogen content in the leaves was affected significantly in the two seasons. Spraying calcium or potassium alone or plus girdling increased nitrogen content in the leaves than those of the control. However, the differences were highly significant in both seasons. Also, girdling alone improved N percentage in the leaves rather than those of the control or other treatments.

TABLE 4. Nitrogen, phosphorous, potassium and calcium percentages in leaves of Costata cultivar as affected by girdling and foliar spray with potassium and calcium during 2001 and 2002 seasons.

Characters	Nitrogen %			Phosphorous %			Potassium %			Calcium %		
Treatments	2001	2002	Mean	2001	2002	Mean	2001	2002	Mean	2001	2002	Mean
Potassium citrate at 1%	1.477	1.450	1.463	0.282	0.292	0.287	1.410	1.777	1.594	1.046	1.045	1.046
+Potassium citrate at 1%+Girdling	1.527	1.530	1.529	0.306	0.310	0.308	1.597	1.633	1.615	0.815	0.806	0.811
Potassium phosphate at 1%	1.480	1.417	1.449	0.231	0.230	0.231	1.640	1.607	1.624	1.124	1.226	1.125
Potassium phosphate at 1%+Girdling	1.527	1.703	1.615	0.232	0.230	0.231	1.263	1.620	1.442	0.796	0.803	0.800
Calcium citrate at 1%	1.573	1.360	1.467	0.230	0.231	0.231	1.397	1.777	1.587	1.252	1.262	1.257
Calcium citrate at 1%+Girdling	1.443	1.363	1.403	0.215	0.214	0.215	1.437	1.627	1.532	0.616	0.604	0.610
Calcium sulphate at 1%	1.483	1.403	1.443	0.285	0.283	0.284	1.523	1.763	1.643	1.223	1.273	1.248
Calcium sulphate at 1%+Girdling	1.480	1.333	1.407	0.355	0.351	0.353	1.520	1.630	1.575	0.742	0.710	0.726
Girdling only	1.923	2.030	1.977	0.232	0.235	0.234	1.667	1.637	1.652	0.905	0.916	0.911
Control	1.387	1.320	1.354	0.214	0.211	0.213	1.317	1.460	1.389	1.026	1.025	1.026
N-LSD at 5%	0.021	0.036	---	0.003	0.002	---	0.020	0.014	---	0.009	0.138	---
1%	0.028	0.048		0.004	0.003		0.030	0.018		0.013	0.185	

Concerning phosphorus content in the leaves, results indicated that different treatments significantly raised up its percentages than those of the control. In this respect, the highest values were obtained from spraying calcium sulphate plus girdling followed by potassium citrate spray plus girdling according to the mean of the two seasons of this study.

Regarding potassium content in the leaves, results showed that all treatments increased potassium contents in the leaves than those of the control. Girdling alone was more effective in this respect.

As for calcium content, results showed that both calcium and potassium spray increased calcium content compared with those of control. On the other hand, spraying calcium and potassium plus girdling or girdling alone decreased calcium content than those of control.

From the above mentioned results, it is obvious that spraying calcium or potassium alone or plus girdling increased N,P and K contents but calcium content decreased by using girdling treatments. The obtained results are in line with those reported by Abd El-Migeed (2002) on Washington Navel orange trees who found potassium foliar sprays enhanced the levels of N, P and K in the leaves. Moon *et al.* (2002) working on persimmon cv. Fuyu trees, they reported that calcium contents of leaf, fruit peel and flesh were increased by spraying liquid calcium compound extracted from oyster shell and $CaCO_3$. Priestly (1976) mentioned that calcium concentrations in girdling limbs of apple trees were very low because calcium depended on phloem transport.

From this investigation, it could be concluded that mineral status, yield as well as fruit quality of persimmon Costata cv. trees grown under Dakhlia conditions could be greatly enhanced by girdling plus foliar spraying with calcium or potassium liquids. Since, spraying potassium citrate at 1 % plus girdling was more effective in reducing fruit drop, increasing yield and improving fruit quality of Costata persimmon trees.

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(*Received* 20 /12/2003)

تأثير التحليق والرش ببعض مصادر البوتاسيوم والكالسيوم على تساقط الثمار والمحصول وصفات الجودة لأشجار الكاكى صنف كوستاتا

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أجرى هذا البحث خلال موسمى ٢٠٠١ ، ٢٠٠٢ لدراسة تأثير التحليق والرش الورقى ببعض المصادر المختلفة للكالسيوم والبوتاسيوم على تساقط الثمار والمحصول وصفات جودة الثمار وكذلك محتوى الأوراق من العناصر لأشجار الكاكى صنف كوستاتا.

وقد أوضحت النتائج المتحصل عليها أن التحليق فقط أو بالإضافة إلى رش الكالسيوم والبوتاسيوم أدى إلى تقليل نسبة الثمار الساقطة خلال تساقط يونيو وتساقط ما قبل الجمع والتساقط الكلى بالمقارنة بأشجار المقارنه. علاوة على ذلك فإن معاملة الرش بسترات البوتاسيوم ، بالإضافة إلى التحليق كانت أكثر تأثيرا فى تقليل موجات التساقط المختلفة حيث سجلت (١١,٧٢، ٨,٨١، ٢٠,٥٣%) فى حين أن أشجار المقارنه سجلت أعلى قيم للتساقط (٨١,١٥ ، ٧,٣٥ ، ٨٨,٥٠ %) لكل من تساقط يونيو، تساقط ما قبل الجمع والتساقط الكلى على التوالى كمتوسط لكلا الموسمين ، وكذلك فإن أعلى محصول (٢٣,٢٣ كجم / شجرة) كمتوسط للموسمين تم الحصول عليه من المعاملة السابقة. بالإضافة إلى ذلك فإن باقى المعاملات المستخدمة أدت إلى زيادة المحصول (كفاءة المحصول أو كجم / شجرة) مقارنة بالمقارنه. علاوة على ذلك أدت المعاملات أيضا إلى تحسين صفات جودة الثمار سواء الصفات الطبيعية (وزن الثمرة ــ حجم الثمرة ــ أبعاد الثمرة ــ الصلابة) وأيضا الصفات الكيماوية (نسبة المواد الصلبة الذائبة الكلية وفيتامين C) فى حين قللت من حموضة الثمار وذلك مقارنة بالأشجار الغير معاملة كذلك أظهرت النتائج أن محتوى الأوراق من النيتروجين ، الفوسفور ، البوتاسيوم والكالسيوم قد زاد معنويا نتيجة تلك المعاملات باستثناء محتوى الأوراق من الكالسيوم الذى قلت نسبته معنويا نتيجة معاملات التحليق خلال موسمى الدراسة.

وبصفة عامة يمكن القول بأن معاملات التحليق بالاضافة إلى رش الكالسيوم اوالبوتاسيوم كانت أفضل وأكثر فاعلية فى تقليل موجات التساقط لثمار الكاكى صنف كوستاتا بالإضافة إلى زيادة المحصول وتحسين صفات الجودة للثمار وزيادة المحتوى المعدنى للأوراق وبصفة خاصة عند استعمال سترات البوتاسيوم ١ ٪ بالإضافة إلى التحليق.