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Improving Growth, Fruit Set, Yield, Fruit Quality and Shelf Life of "Costata" Persimmon

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THIS investigation was conducted at Hort. Res. Station Orchard, Paramon, Dakahlia governorate during 2010 and 2011 seasons to study the effect of foliar application of Milagrow (250gm/5 l), Pepton, GA_3 (single or in combinations) and Folgers on vegetative growth, leaf content of minerals and chlorophyll, fruit set, yield and fruit quality as well as shelf life of "Costata" persimmon trees (12 years old) grafted on seedling rootstock on loamy soil.

The present results showed that, all treatments improved all growth and yield parameters compared to the control. With regard to the yield and fruit quality, the most effective treatment was spraying "Costata" persimmon trees three times (at full bloom, fruit set and June fruit drop) with a combined treatment of Peptone at 1000 ppm + GA_3 at 20 ppm or Milagrow at 50000 ppm + Pepton at 1000 ppm + GA_3 at 20 ppm.

Keywords: Milagrow, Pepton, Folgers and GA3.

Japanese persimmon (*Diospyros kaki* L.) is one of deciduous fruit trees which belong to the family Ebenaceae. It has been introduced to Egypt in 1911 (Baghdady and Mineasy, 1964), but the main problem is the high fruit drop before maturity, subsequently the final yield is not economical. However, improving yield and fruit quality without adversely effect on the environment is a major goal of horticulturists and could be achieved by using bio-stimulants which may contain microorganisms or natural products as cytokinins, amino acids and organic acids (Russo and Berlyn, 1990). Abd El-Ghany (2005) reported that, fruits June drop occurred due to the competition among the fruits on the nutrients, water and the defect in hormonal balance and could improved vegetative growth, yield and fruit quality of "Costata" persimmon by foliar application of some bio-stimulants and GA_3 which affect the fruit shelf life (Awad and Amenomori, 1971). Looney (1993) found that early fruit cell division normally influenced by natural growth hormones especially cytokinin. GA_3 significantly increased persimmon fruit set, firmness, colour and T.S.S. (El-Fakharani *et al*., 1990 and Hasegawa *et al*., 1991), while it did not affect tannins or fruit juice acidity (Mokhtar and Wally, 1999). Moreover, Guirguis *et al*. (2009) got the highest fruit set and yield as well as the lowest fruit drop of "Mackawa Jiro" persimmon by GA_3 at10 ppm + Sitofex at 5 ppm at full bloom. Also, GA_3 at 50 ppm at full bloom improved pear yield and fruit characters (Nasr *et al*., 2009).

Folgers bio-stimulant has a positive effect on pear foliage, leaf chlorophyll content, fruit set, yield and fruit characters (Eissa *et al*., 2007). Also, Milagrow (Brassinosteroids, BRs) stimulated cell division and elongation, flower bud differentiation, carbohydrate assimilation and ATP activity subsequently improved vegetative growth, enhanced physiological status and directed trees to earlier harvest as well as increased fruit yield and quality (Clause, 1996, Wang *et al*., 2004, Mussig, 2005, Gomes *et al*., 2006, Symons *et al*., 2006 and Gabr *et al*., 2011).

This study aims to increase fruit set, yield, fruit characters and fruit shelf life as well as decrease fruit drop through studying the effect of spraying (Milagrow, Pepton and GA_3) alone or combined and folgers at full bloom, fruit set and at fruit drop of " Costata" persimmon.

Materials and Methods

The present study was performed at Hort. Res. Station, Paramon, Dakahlia governorate, Egypt during 2010 and 2011 seasons. We used 12-year-old "Costata" persimmon trees budded on seedling rootstock and grown on loamy soil. Twenty seven trees (3trees / treatment) were nearly uniform, planted at 4x5 m apart and received similar cultural practices. The chosen trees were spayed three times: at full bloom, fruit set and at June fruit drop with:

- GA_3 at 20 ppm.
- Milagrow at 50000 ppm (contains: 20%P, 10 %K, 3% B and 0.2% Brassinosteroids).
- Pepton at 1000 ppm (based on the energizing power of free amino acids) produced by A.P.C. Europ Co., Avsan Julain, Spain.
- Folgers at 1000 ppm (contains unidentified natural growth stimulants).
- GA_3 + Pepton.
- GA_3 + Milagrow.
- Milagrow + Pepton.
- Milagrow + Pepton + GA_3.
- Control.

Five branches per tree were labeled and the treatments were arranged in a complete randomized block design to determine: shoot length, number of leaves/ shoot and leaf area (Bleasdale, 1978). Samples of twenty leaves / tree were taken in late September of the 2^{nd} season to determine mineral content (N, P, and K) (Myers and Ferree, 1983**)**. Leaf chlorophyll content was measured as SPAD by chlorophyll meter (Minolta Corporation, Ramsey NJ, USA). Fruit set was assessed as well as number of fruit / tree and fruit yield. These data were used to estimate crop monetary value considering a farm-gate price of LE 1.5/kg for fruit weighed < 90 g, LE 2.0/kg for fruit weighed 90-110g and LE 2.5/kg for fruit weighed > 110g. Picking date (at the stage of greenish yellow colour) was according to Wally *et al*. (1999). Sample of 10 mature fruits / tree were randomly selected to assess skin colour, fruit weight, size and dimensions. Skin firmness was measured by hand pressure tester (MEG, Co.). Thirty fruits were

stored at room temperature (at 20^0c) or cold storage (at 5^0c and 80-85% RH) to assess their shelf life. Fruit juice was used to estimate T.S.S., acidity and Tannins (A.O.A.C., 1970).

Data were statistically analyzed according to Snedecor and Cochran (1990). L.S.D. test was used for comparison between means. Also, regression equations were assessed between leaf area and fruit set percentage, fruit yield and juice TSS as well as correlation coefficient.

Results and Discussion

Vegetative Growth

The response of vegetative growth (shoot length and diameter as well as number of leaves and leaf area) is illustrated in Table 1. The present results showed that all treatments had positiveeffect on vegetative growth compared to control. Also, data revealed that Folgers (92.67 and 84.67 cm) and Peptone (90.0 and 73.67cm) induced the longest significant shoots compared to the control (33.33 and 47.33 cm) during the two seasons, respectively. However, the same trend was noticed with shoot diameter, number of leaves and leaf area of "Costata" persimmon. Unexpectedly, all mixed treatments induced lower vegetative growth than individual ones. This phenomenon may point out an antagonistic effect of the present combinations.

TABLE 1. Effect of stimulant treatments on vegetative growth of "Costata" Persimmon trees.

Treatments	Shoot Length (cm)		Shoot diameter (cm)		Number of leaves		Leaf area (cm^2)	
	2010	2011	2010	2011	2010	2011	2010	2011
Control	33.33	47.33	0.683	0.650	13.00	19.67	23.74	25.31
Milagrow (50000 ppm)	83.67	85.67	0.823	1.020	18.33	20.67	29.64	29.11
Pepton (1000 ppm)	90.00	73.67	0.906	0.910	26.00	25.67	34.52	34.29
Folgers (1000 ppm)	92.67	84.67	0.930	1.120	27.33	25.00	36.55	35.91
Gibberellins (20 ppm)	82.33	100.3	0.760	1.000	20.67	24.67	36.95	38.51
Milagrow + Pepton	62.00	58.00	0.800	0.760	18.00	19.67	27.40	28.78
Milagrow + Gibberellins	52.67	52.33	0.766	0.800	19.33	22.33	30.03	31.30
Pepton + Gibberellins	60.67	62.67	0.800	0.720	19.33	20.33	26.73	26.69
Milagrow + Pepton+ Gibberellins	57.33	76.00	0.763	0.886	19.00	21.67	28.01	27.42
L.S.D at 0.05	0.93	0.92	0.181	0.181	1.06	0.91	1.62	1.94

However, these results are in harmony with those of Kauschmann *et al*. (1996) who stated that Milagrow (Brassinosteroids, BR) play an important role in the control of cell division and elongation, while Mussig (2005) showed that BR apparently coordinates and integrates diverse process required for growth, partly via interactions with phytohormones. Moreover, Gabr *et al*. (2011) noticed a progressive increment of apricot leaf growth parallel to BR concentrations in spraying solution.

However, Walter and Nawacki (1978) showed that amino acids can affect plant growth and development through their influence on GA_3 biosynthesis, while Thon *et al*. (1981) stated that amino acids provide plant cells an available source of N which can be taken more rapidly than organic nitrogen. Meanwhile, Kowalczyk and Zielony (2008) found that amino acids treatment have positive effect on plant growth where they significantly mitigate the injuries caused by a biotic stresses, while Shehata *et al*. (2011) said that amino acids play an important role in plant metabolism and protein assimilation as well as may take part in micronutrients absorption and serve as a source of nitrogen (Datir *et al*., 2012). Also, Eissa *et al*., (2007) found a strong positive effect of Folgers treatments on pear foliage characters. However, GA_3 treatments significantly increased vegetative growth of *Araucaria heterophylla* seedlings (Gul *et al*., 2006), "Canino" apricot (Hoseen *et al*., 2008) and "Leconte" pear (Aly *et al*., 2012) and Pumpkin (Shirzad *et al*. 2013).

Leaf chlorophyll and nutrient content

Chlorophyll

Results in Table 2 showed insignificant effect between the present treatments and the control (43.93 and 45.25 SPAD), except Pepton treatment in the first season (49.73 SPAD). Otherwise, Folgers treatment induced the lowest leaf chlorophyll content through the two studied seasons (42.82 and 43.12 SPAD). However the former investigation showed that Milagrow treatment greatly stimulated accumulation of photosynthates (Krizek and Mandava, 1983) as well as they were essential for many physiological functions (Montoya *et al*., 2005) where they induced progressive increment of apricot leaf chlorophyll (Gabr *et al*., 2011). Moreover, Abd El-Aziz and Balbaa (2007) and Shehata *et al.* (2011**)** reported that amino acids spray caused an increase in photosynthetic pigments content. Meanwhile, leaf chlorophyll content was significantly increased by the treatment of Folgers (Eissa *et al*., 2007), Pepton (Ibrahim *et. al.,* 2010) and GA_3 (Gross *et al*., 1984 and Shahin *et al*. 2010).

Leaf nutrient content

Data in Table 2 showed that GA_3 treatment significantly induced the highest nitrogen leaf content (1.67%) followed by Milagrow + Pepton (1.46%) Milagrow + GA_3 (1.36%) and Milagrow + Pepton + GA_3 (1.35%), respectively. With respect to phosphorus leaf content, data showed unclear trend where P leaf content of control, GA_3 and Millagrow + GA_3 treatments were the same, while the rest treatments induced less P leaf content. However, Folgers (1.41%) and Milagrow + Pepton (1.34%) treatments significantly induced higher K leaf

content than both the control (1.16%) and the rest treatments. Generally, the obtained results are in agreement with those of Eissa *et el.* (2007) and Aly *et al.* (2012**)** who found no clear trend to spray of Folgers and GA_3 on pear leaf content of NPK. Otherwise, Abo Sedera *et al*. (2010) on strawberry and Shahin *et al*. (2010) on " Anna " apple reported higher NPK leaf content due to Pepton (amino acids), Fertifol (25% N, 16% P, 12%K, 0.25% Mg, 300 ppm Zn, 1900 ppm Mn. 850 ppm Cu, 100 ppm Mo and 200 ppm B) and GA_3 at 20 ppm. Also, Hassan *et al*. (2010) on " Hollywood " plum trees found that GA_3 and Aminofert (20% amino acids, 12% organic acids and 3.6% chelated micro-elements) caused a pronounced increase in leaf N and K content while leaf P content decreased in both seasons of study.

TABLE 2. Effect of stimulant treatments on leaf chemical content of "Costata" Persimmon trees.

Treatments	Chlorophyll (SPAD reading)		N (%)	P (%)	K (%)
	2010	2011	2011	2011	2011
Control	43.93	45.25	1.000	0.140	1.160
Milagrow (50000 ppm)	44.91	49.11	1.250	0.120	1.090
Pepton (1000 ppm)	49.73	48.74	1.110	0.120	1.070
Folgers (1000 ppm)	42. 82	43.12	0.940	0.110	1.410
Gibberellins (20 ppm)	44.14	43.15	1.670	0.140	1.020
Milagrow + Pepton	46.38	47.56	1.460	0.130	1.340
Milagrow + Gibberellins	46.35	44.09	1.360	0.140	1.270
Pepton + Gibberellins	44.81	46.48	1.180	0.110	1.090
Milagrow + Pepton + Gibberellins	45.15	47.49	1.350	0.120	1.220
L.S.D at 0.05	3.78	4.07	0.245	0.001	0.155

Fruit set, number of fruits/tree, yield /tree and per Feddan

Results in Table 3 showed that, all treatments increased fruit set percentage compared to the control (30.6 and 32.67%) However, GA_3, Folgers and Milageow + GA_3 induced the highest fruit set in the 1st season (58.69, 54.40 and 53.93%) while in the 2nd, Pepton + GA_3, GA_3, Folgers and Milageow + GA_3 were the highest (62.20, 58.33, 57.46 and 55.65%), respectively.

Number of fruits/tree significantly increased as a result of all treatments. However, in 2010 season Milagrow + Pepton, Pepton + GA_3 and Pepton + GA_3 + Milagrow get the highest number of fruits (250.0, 243 and 224.5), while in 2011 season Folgers, Pepton + GA_3,pepton GA_3 + Milagrow and Milagrow + Pepton were the highest respectively (350.5, 333.0 , 304, 302.7 and 301.5) compared to control (135 and 198.5). Moreover, the fruit yield per tree and per feddan significantly increased by all the present treatments compared to control (11.16 and 14.49 kg / tree as well as 2.230 and 2.893 ton / feddan). However,

Pepton + GA_3 gave the highest yield per tree (29.72 and 40.51 kg) and per Feddan (5.940 and 8.097 ton) in the two studied seasons, respectively followed by Pepton + GA_3 + Milagrow, and Milagrow + Pepton in the first season (27.62 and 26.72 kg / tree as well as 5.520 and 5.337 ton / feddan), respectively but in the second season followed Folgers, GA_3 and Milagrow + Pepton (37.99, 36.48 and 32.68 kg and 7.660, 7.293 and 6.533 ton / Feddan), respectively.

Table 3 showed the monetary value of " Costata " persimmon yield/tree as affected by the present treatments. It can be noticed that all treatments markedly increased yield monetary value than the control (16.75 and 21.73 LE). However, the most effective treatments were Pepton + GA_3 (74.31 and 101.30 LE) in the two studied seasons, respectively and GA_3 treatment in 2^{nd} season only (91.19 LE).

TABLE 3. Effect of stimulant treatments on fruit characteristics of "Costata" Persimmon trees.

Treatments	Fruit set (%)		Fruit number / Tree		Yield / tree (kg)		Yield / feddan (Ton)		Monetary value / tree (LE)	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Control	30.60	32.67	135.0	198.5	11.16	14.49	2.230	2.893	16.75	21.73
Milagrow (50000 ppm)	39.71	40.72	147.0	292.0	15.53	31.61	3.130	6.320	31.35	63.22
Pepton (1000 ppm)	33.00	33.77	142.0	202.0	11.95	23.41	2.383	4.677	23.91	79.02
Folgers (1000 ppm)	57.40	57.46	169.0	350.5	17.27	37.99	3.450	7.660	34.55	76.65
Gibberellins (20 ppm)	58.69	58.33	154.0	304.0	15.45	36.48	3.753	7.293	38.62	91.19
Milagrow + Pepton	49.94	50.00	250.0	301.5	26.72	32.68	5.337	6.533	53.45	65.37
Milagrow + Gibberellins	53.93	55.94	166.0	292.5	16.97	27.42	3.390	5.480	33.93	54.85
Pepton + Gibberellins	47.45	62.20	243.0	333.0	29.72	40.51	5.940	8.097	74.31	101.30
Milagrow + Pepton + Gibberellins	52.75	53.65	224.5	302.7	27.62	31.65	5.520	6.323	69.05	63.30
L.S.D at 0.050	2.26	3.61	3.1	3.4	1.79	1.95	1.271	1.217	1.47	1.14

Meanwhile, the former studies cleared that, GA_3 spray significantly increased the fruit set percentage of persimmon **(**Wally *et al*., 1999**)** pear (Kabeel & Fawaaz, 2005, Chitu *et al.*, 2007 and Nasr *et al*., 2009) and apricot (Hoseen *et al*., 2008). Also, Sugiyama and Kuraishi (1989) on "Navel" orange and Eissa *et al*. (2007) reported higher fruit set as a result of Milagrow (Brassinolide) and Folgers spray on Le-Conte pear. Also, Braun and Wild (1984), Kalinich *et al*.

(1985), Vardhini and Rao (1998) as well as Hayat *et al*. (2000) and Gabr *et el*. (2011) reported a significant increase in fruit yield/ tree as a result of Milagrow which may improves the assimilation efficiency of photosynthetic carbon and protein biosynthesis. El-Fakharany *et al*. (1995), Makarem and Mokhtar (1996) and Shahin *et al*. (2010) obtained the best fruit yield of " Anna " apple by GA_3 spray at full bloom, fruit set and after 3 weeks. Eissa *et al*. (2007) improved pear yield components by Folgers spray. Abo Sedera *et al.* (2010) and Shehata *et al*. (2011) get better yield by the treatments of amino acids.

Fruit characteristics

Data in Tables 4, 5 & 6 showed the response of "Costata" persimmon fruit characteristics (Fruit weight, size, dimensions, firmness and colour as well as fruit juice T.S.S., acidity and tannins) to the present treatments. Generally, GA_3, Pepton + GA_3 and Pepton + GA_3 + Milagrow induced the highest significant fruit weight and size in the two studied seasons. With regard to fruit firmness Millagrow (12.44 and 13.63 Ib/ $inch^2$) Pepton + GA_3 (12.92 and 12.89 Ib/$inch^2$) as well as Milagrow + Pepton + GA_3 (12.04 and 12.20lb/$inch^2$) supported persimmon fruit to be more suitable firm Moreover, the present treatments clearly improved the fruit colour at harvest specially Milagrow, GA_3 and the combination treatments (Table 5). On the other hand, the fruit dimensions (length and diamenter) did not show a clear trend. However, the fruit juice T.S.S. increased significantly as affected by Milagrow, Pepton + GA_3 and Milagrow + Pepton (21.0,19.5 and 19.0%) in the 1^{st} season and by Milagrow + Pepton, Milagrow + Papton + GA_3 and Milagrow (20.0, 20.0 and 19.0%) in the 2^{nd} season, respectively (Table 6), The present treatments could significantly lower the fruit juice acidity than the control (0.32 and 0.26%). The most effective treatments in 2010 season were Folgers and Milagrow + GA_3 (0.10 and 0.10%) while in 2011season were Pepton + GA_3, Milagrow, and Milagrow + Pepton + GA_3, (0.17,0.18 and 0.18%), respectively. Moreover, Milagrow + Pepton + GA_3, Folgers and Milagrow + Pepton coused the least significant tannins in persimmon fruits through the two studied seasons while Milagrow significantly minimized the fruit juice Tannins only in the 2^{nd} season (0.459%). The positive effect of these treatments extended to " Costata" "persimmon fruits after harvest. However, Table 7 showed that Pepton + GA_3 and Milagrow + Peptone applications recorded the least decay percent after 21 days at room temperature (25 and 33.3% respectively). Moreover, Milagrow + Pepton , GA_3, Milagrow + GA_3 and Peptone + GA_3 treatments clearly stretched the fruit shelf life to 49 days in the cold storage (at 5 ºC) than control (71.4%) or the other treatments where they effectively minimized the percentage of fruit decay to 37.5, 42.9, 42.9% and 42.9%, respectively.

TABLE 4. Effect of stimulant treatments on physical characteristics of "Costata" Persimmon fruits.

Treatments	Fruit weight (g)		Fruit size (cm^3)		Fruit length (cm)		Fruit diameter (cm)	
	2010	2011	2010	2011	2010	2011	2010	2011
Control	82.78	73.00	73.0	71.0	6.200	5.500	5.600	5.400
Milagrow (50000 ppm)	106.7	108.3	109.0	109.0	5.467	5.400	6.000	5.967
Pepton (1000 ppm)	106.8	115.9	95.0	110.0	6.033	5.700	6.000	5.467
Folgers (1000 ppm)	101.9	109.4	101.0	111.0	5.467	5.933	5.400	5.433
Gibberellins (20 ppm)	115.3	120.0	117.0	121.0	6.133	6.167	6.000	6.000
Milagrow + Pepton	106.9	108.3	111.0	109.0	5.533	6.000	5.767	5.800
Milagrow + Gibberellins	102.2	93.78	102.6	95.0	6.067	5.367	5.533	5.400
Pepton + Gibberellins	122.4	121.7	126.0	121.0	6.067	6.367	5.967	6.167
Milagrow + Pepton + Gibberellins	123.1	104.4	122.0	108.0	6.267	6.100	5.967	5.800
L.S.D at 0.050	1.4	1.5	1.7	1.3	0.094	0.054	0.077	0.074

TABLE 5. Effect of stimulant treatments on the fruit colour of "Costata" persimmon trees.

Treatments	2010			2011		
Control	Majolica	yellow	59/1	Orange	buff	507
Milagrow (50000 ppm)	Tangerine	orange	8	Tangerine	orange	9
Pepton (1000 ppm)	Majolica	yellow	59/1	Spanish	orange	010/1
Folgers (1000 ppm)	Majolica	yellow	59/1	Carrot	read	612/1
Gibberellins (20 ppm)	Spanish	orange	010/1	Majolica	yellow	59/1
Milagrow + Pepton	Cadmium	orange	8	Tangerine	orange	9
Milagrow + Gibberellins	Yellow	ocher	07/1	Yellow	ocher	07/1
Pepton + Gibberellins	Cadmium	orange	8	Yellow	ocher	07/1
Milagrow + Pepton + Gibberellins	Yellow	ocher	07/1	Tangerine	orange	9

TABLE 6. Effect of stimulant treatments on physical and chemical properties of "Costata" persimmon fruits .

Treatments	Fruit Firmness (Lb/inch^2)		T.S.S.%		Acidity %		Tannin %	
	2010	2011	2010	2011	2010	2011	2010	2011
Control	11.27	9.50	16.50	17.50	0. 32	0.26	1.742	1.366
Milagrow (50000 ppm)	12.44	13.63	21.00	19.00	0.34	0.18	1.330	0.459
Pepton (1000 ppm)	8.817	9.160	11.50	16.50	0.18	0.28	1.454	1.454
Folgers (1000 ppm)	6.230	10.92	13.50	13.00	0.10	0.22	0.365	0.499
Gibberellins (20 ppm)	8.56	10.86	13.00	15.50	0.16	0.22	0.998	0.998
Milagrow + Pepton	11.23	11.03	19.00	20.00	0.20	0.32	0.374	0.374
Milagrow + Gibberellins	10.22	10.68	16.00	16.00	0.10	0.20	1.945	1.790
Pepton + Gibberellins	12.92	12.89	19.50	18.50	0.17	0.17	0.665	0.665
Milagrow + Pepton + Gibberellins	12.04	12.20	12.00	20.00	0.16	0.18	0.208	0.208
L.S.D at 0.050	0.27	0.39	1.48	0.99	0.06	0.05	0.145	0.155

Generally, the present findings are supported by the former investigators where Wally *et al.* (1999) on persimmon and Eissa *et al.* (2007**)** on pear reported a significant increase in fruit quality as a result of Folgers spray. Also Refaat and Naguib (1998**)** as well as Abo-Sedera *et al.* (2010) and Ibrahim et *al.* (2010) get an increase of fruit weight and T.S.S. as a result of Pepton (amino acids) spray which may have important role on the biosynthesis of chlorophyll molecules and in turn affected carbohydrate content. In addition to, Milagrow (Brassinolides) application increased fruit weight and T.S.S. while decreased fruit juice acidity of orange (Wang *et al.*, 2004) grape, (Symons *et al*., 2006) and apricot (Gabr *et al*., 2011) as well as promoted fruit ripening.

Meanwhile, Eliwa *et al.* (1998) on persimmon and Hoseen *et al.* (2008) on apricot did not obtain clear effect of GA_3 application on fruit quality. Contrarily, Nasr *et al*. (2009) and Wally and Abdellatif (2009), showed that GA_3 spray improved apricot fruit quality. Moreover, Fruit juice Tannins of "costata" persimmon did not affected by GA_3 spray as Eliwa *et al.* (1998) and Wally *et al.* (1999). Differently, Guirguis *et al*. (2009) stated that, GA_3 treatment lowered tannins content in "Mackawa Jiro" persimmon subsequently affected its harvest date as well as increased its shelf-life period and storage ability.

TABLE 7. Effect of stimulant treatments on the decay percent during room and cold storage of "Costata" persimmon fruits.

Treatments	After 13 days		After 18 days		After 21 days		After 25 days		After 32 days		After 42 days		After 49 days	
	Room	Cold storage	Room	Cold storage	Room	Cold storage	Room	Cold storage	Room	Cold storage	Room	Cold storage	Room	Cold storage
Control	0	0	20.0	0	100.0	0	100	14.3	100	28.6	100	57.1	100	71.4
Milagrow (50000 ppm)	100	0	100.0	0	100.0	0	100	0	100	14.3	100	50.0	100	62.5
Pepton (1000 ppm)	14.3	0	75.0	0	100.0	0	100	14.3	100	25.0	100	57.1	100	71.4
Folgers (1000 ppm)	0	0	20.0	0	100.0	0	100	0	100	0	100	0	100	57.1
Gibberellins (20 ppm)	20.0	0	50.0	0	66.6	0	100	14.3	100	14.3	100	14.3	100	42.9
Milagrow + Pepton	0	0	20.0	0	33.3	0	100	14.3	100	20.0	100	20.0	100	37.5
Milagrow + Gibberellins	20.0	0	66.6	0	100.0	0	100	0	100	0	100	0	100	42.9
Pepton + Gibberellins	0	0	25.0	0	25.0	0	100	0	100	0	100	0	100	42.9
Milagrow + Pepton+ Gibberellins	0	0	20.0	0	75.0	0	100.0	12.5	100	250	100	25.0	100	62.5

The present data showed a positive effect (mostly significant) of the studied treatments (especially GA3 and Folgers treatments) on the leaf area and number of leaves (Table 1). The increase of number of leaves and leaf area mean much dense photosynthesis. However, data illustrated in Fig. 1, 2 , 3 indicate a positive correlation and regression between leaf area (Independent factor) as well as all of fruit set percentage, fruit yield and juice TSS (Dependent Factors) through the two studied seasons.

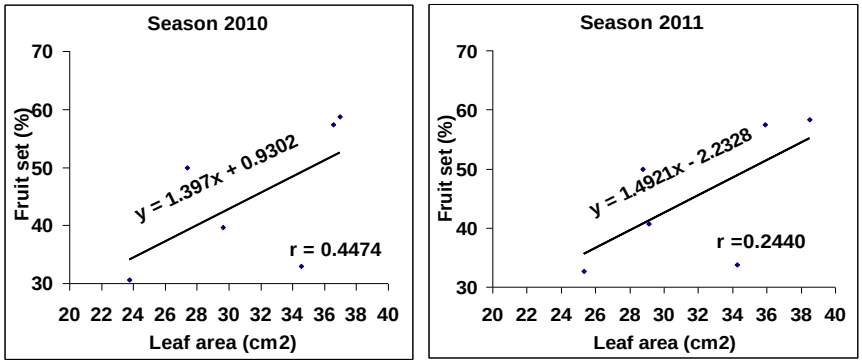

Fig.1. Relationship between leaf area (cm^2) and fruit set (%).

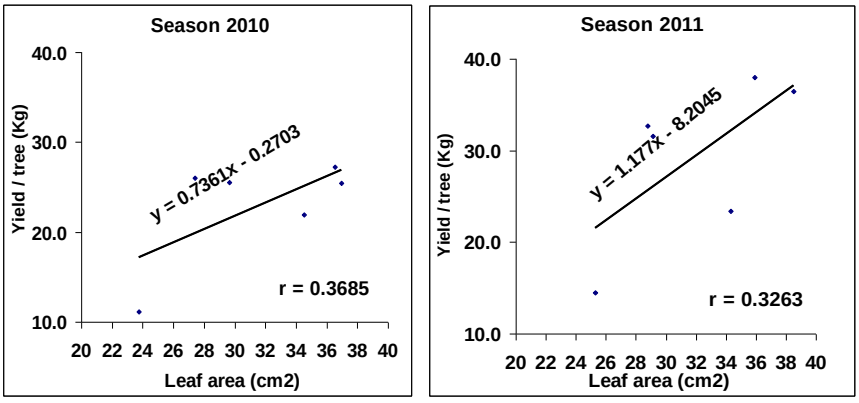

Fig. 2. Relationship between leaf area (cm^2) and yield / tree (Kg).

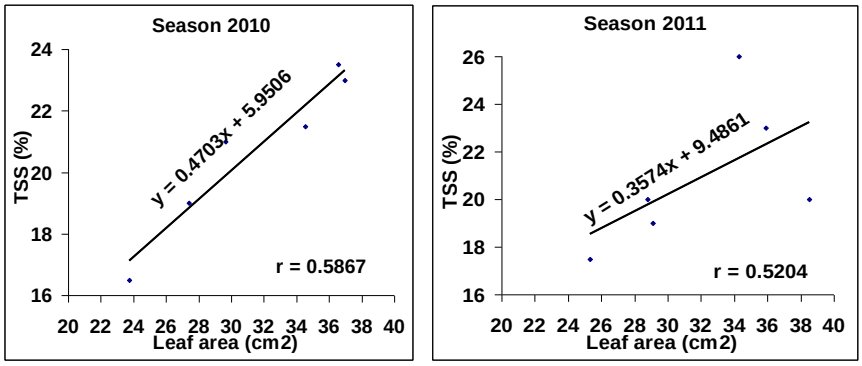

Fig. 3. Relationship between leaf area (cm^2) and TSS (%).

Conclusions

The present data showed that, the most treatments positively affected "Costata" persimmon growth. However, we can conclude that, single treatments were more effective on vegetative growth. Also, Folgers, GA_3 and Milagrow+ Pepton induced significant increase in leaf N and K while leaf P content did not show clear trend. Meanwhile, single and combined treatments caused obvious increase in yield components and fruit quality attributes. Therefore, we can recommend the growers of "Castata" persimmon to spray their orchards three times: at full bloom, fruit set and at fruit drop with Pepton + GA_3 which induced the highest fruit set percentage, number of fruits / tree, fruit yield with more suitable firmness and longer shelf life as well as much monetary value to increase their income.

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تحسين النمو والعقد والمحصول ومواصفات جودة الثمار وقابليتها للتخزين فى ثمار الكاكي صنف كوستاتا

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أجري هذا البحث فى مزرعة محطة البحوث الزراعية – البرامون – محافظة الدقهلية خلال موسمي 2010 – 2011 لدراسة تأثير الرش بالمركبات الآتية : ميلاجروا ، ببتون ، الجبرالين (منفرداً أو مخلوطين معاً) والفولجارز على النمو الخضري ومحتوى الأوراق من العناصر السمادية الرئيسية والكلورفيل وكذلك على نسبة العقد والمحصول و العائد النقدى للمحصول وجودة الثمار وقابليتها للتخزين وذلك على أشجار الكاكي صنف كوستاتا عمرها 12 عام مطعومة على أصل بذري ونامية فى أرض طميية.

أظهرت النتائج أن كل المعاملات المدروسة حسنت كل مظاهر النمو والمحصول على الشاهد. وقد كانت أكثر المعاملات تأثيراً على المحصول وجودة الثمار هي رش الأشجار ثلاث مرات (فى قمة التزهير، عند العقد وأثناء تساقط الثمار فى شهر يونيو) بمركب ببتون (1000 جـزء فى المليـون) + جبـرالين (20 جزء فى المليون) أو بالمعاملة بميلاجروا (50000 جزء فى المليون) + ببتون (1000 جزء فى المليون) + الجبرالين (20 جزء فى المليون).