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EFFECT OF FOLIAR SPRAYING WITH VITAMIN C AND DRY YEAST ON GROWTH AND FRUIT QUALITY OF MANGO CV. HENDY MOLOKY

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ABSTRACT

This investigation was carried out during the two consecutive seasons of 2004 and 2005 on mango trees (Mangifera indica L.) cv. Hendy Moloky grown in a private orchard at Belbeis district, Sharkia Governorate , Egypt to evaluate the effect of foliar spraying with vitamin C (Vit .C) at 0.05 % [without spraying (control), spraying at beginning fruit set or spraying at 20 days after beginning fruit set], active dry yeast (D. Y.) at 1 % [without spraying (control), spraying at beginning fruit set or spraying at 20 days after beginning fruit set] and their interactions on fruit quality and plant growth.

Spraying with vitamin C at beginning fruit set or at 20 days after fruit set increased fruit weight and size as well as TSS % and Vit. C content in fruit juice. Peel weight was increased by spraying Vit. C at beginning fruit set, while fruit juice acidity was decreased under the effect of Vit. C spraying at 20 days after fruit set. All tested Vit. C treatments increased leaf fresh and dry weights as well as leaf tissue contents of chlorophyll a, chlorophyll b and total chlorophyll (a+b) as compared to the treatment without Vit.C.

Dry yeast spraying applied at beginning fruit set increased fruit weight, size, and fruit juice content of Vit. C. When D.Y. applied at 20 days after fruit set, it increased leaf fresh and dry weight as well as leaf tissue contents of photosynthetic pigments. Peel weight and its ratio to pulp weight, TSS % and TSS/ acidity ratio in fruit juice were increased by D.Y. spraying at beginning fruit set or at 20 days after fruit set.

As for interaction effects, the highest fruit weight and fruit peel weight were obtained when trees sprayed with D.Y. at fruit set x without Vit. C interaction. The combination treatment of Vit. C x D.Y applied at fruit set for each increased fruit size and fruit pulp weight. The uppermost values for chlorophyll a, chlorophyll b and total chlorophyll

(a+b) in leaf tissues were recorded under treatment effect of spraying Vit. C at fruit set x spraying D.Y. at 20 days after fruit set. The all interaction treatments between Vit. C and D.Y. increased fruit juice content of vitamin C and TSS/ acidity ratio.

Key words: Mango, Mingifera indica , foliar spray , Vit.C , Dry yeast ,fruit quality.

INTRODUCTION

Mango (*Mangifera indica* L.) is one of the most popular fruit crops in Egypt, the total area of mango tree reached 184204 *feds* with total production of 532422 tons (Statistics of Ministry of Agric, 2007, Egypt). Many commercial mango cultivars suffered from high fruit drop, which reaching about 99 % loss of fruitless, such trees need to improve fruit quality by using safe means. Therefore, it is anticipated that vitamin C or/ and yeast may improve fruit quality.

According to Oertli (1987), vitamin C (ascorbic acid) is inorganic compound in higher plants which is required in trace amount to maintain normal growth. The functions of vitamin C are reversal of stress effects (temperature and poisons), antioxidants, protection of chloroplast and electron transport system. In addition, it also stimulates respiration, cell division and many enzyme activities.

Ascorbic acid (vitamin C) foliar application was reported to induce many stimulating effects on growth and some physiological activities of different plants (Oertili, 1987 & Nomier, 2000). In addition, ascorbic acid revealed an effect on the metabolism of gibberellic acid (Kamiya *et al*., 1984).

Yeast is considerable as a natural source of vitamin Bs and most of the essential elements (Nagodawithana, 1991). Vitamins B may indirectly promote plant growth and development by enhancing endogenous levels of various growth factors such as cytokinins and gibberellins (Kadandaranalah and Rao, 1985). Spraying of active dry yeast (0.05, 0.1, 0.2 %) either alone or in combination with 0.2 % urea was reported to increase fruit weight and dimensions, total soluble solids, total sugars, acidity and Vit. C (ascorbic acid) content of Balady mandarin (Ebrahiem *et al.,* 2000).

Spray fruit plants with active dry yeast has recently received apparent interest. The possibility of using active dry yeast for improving growth, fruit quality and productivity of fruit crops was mentioned by Subba Rao (1984), Nijjar (1985), Abdalla *et al*., (1998) and Nomier (2000).

So, the present investigation was outlined to explore alternative practices

that may enhance growth and fruit quality of mango cv. Hendy Moloky by using some foliar spray treatments with vitamin C (ascorbic acid) or/ and active dry yeast.

MATERIALS AND METHODS

This investigation was carried out during the two consecutive seasons of 2004 and 2005 on mango trees (*Mangifera indica* L.) cv. Hendy Moloky grown in a private orchard at Belbeis district, Sharkia Governorate, Egypt to evaluate the effect of foliar spraying with vitamin C and active dry yeast, each alone or in combinations, on fruit quality and plant growth.

The experiment included nine treatments, which were the combinations between 3 levels of single foliar spray with vitamin C (Vit. C) at 0.05%*; i.e.,* without spraying (control), spraying at beginning fruit set or spraying at 20 days after beginning fruit set and 3 levels of single foliar spray with active dry yeast (D.Y.) at 1%*; i.e.,* without spraying (control), spraying at beginning fruit set or spraying at 20 days after beginning fruit set .The dry yeast was mixed with sugar at a ratio 1: 1 and dissolved in tap water then lifted for two hours before spraying. Fruit set was on February 4th in the first season, while it was on March 30th in the second one. The treatments were set up in a factorial experiment between vitamin C and dry yeast in a complete randomized design with three replicates for each treatment; each replicate was represented as one tree. So, the experimental treatments were as follows:

1. Without Vit C x without D.Y. (control)
2. Without Vit C x spraying 1%D.Y. at beginning fruit set
3. Without Vit C x spraying 1%D.Y. at 20 days after beginning fruit set
4. Spraying 0.05% Vit C at beginning fruit set x without D.Y.
5. Spraying 0.05% Vit C at beginning fruit set x spraying 1% D.Y. at beginning fruit set
6. Spraying 0.05% Vit C at beginning fruit set x spraying 1%D.Y. at 20 days after beginning fruit set
7. Spraying 0.05 % Vit. C at 20 days after beginning fruit set x without D.Y.
8. Spraying 0.05% Vit. C at 20 days after beginning fruit set x spraying 1% D.Y. at beginning fruit set
9. Spraying 0.05% Vit. C at 20 days after beginning fruit set x spraying 1% D.Y. at 20 days after beginning fruit set**.**

Orchard trees were 10 years old, grown at 7x7 meters apart under flood irrigation system. The orchard soil chemical and physical properties are presented in Table A.

Table A. Physical and chemical properties of orchard soil

Parameter	Value at depth (cm)		
	30	**60**	**90**
	Physical properties		
Sand %	46.8	56.2	41.8
Silt %	33.2	28.2	48.2
Clay %	20.0	15.6	10.0
Texture	**Silty loam**	**Sandy loam**	**Sandy loam**
Chemical properties			
pH	7.72	7.96	8.08
E.C. m mhose/ cm	0.208	0.136	0.140
$CaCO_3$ %	2.47	2.47	2.47

All experimental units (trees) received similar agricultural practices whenever needed. Additionally, all trees were routinely fertilized with calcium super phosphate (15.5 % P_2O_5) at 150 kg/*fed* on December 1st, potassium sulphate (48-52 % K_2O) at 200 kg /*fed*. on March 1st and ammonium sulphate (20.5 % N) at 200 kg/*fed* divided in two equal doses on February 15th and September 15th .

Recorded data:

At harvesting, 10 fruit samples for each replicate were used to determine fruit quality parameters which implicated average fruit weight (g), fruit size (cm^3), peel weight (g), pulp weight (g) and peel to pulp ratio (%). Additionally, total soluble solids (TSS %) was determined using a hand refractometer, total titratable acidity was calculated by titration against 0.1 N sodium hydroxide in presence of phenolphthalein dye according to the method described by A.O.A.C. (1980**)** and ascorbic acid (Vitamin C) content, as milligram per 100 milliliter fruit juice, was determined by titration in presence of 2,6 dichloro phenol-indophenol dye as indicator against 2 % oxalic acid solution as substrate (Lucoss, 1944). Then, TSS/ Acid ratio was calculated.

To determine plant growth effects, samples of mature leaves grown on unfruitful shoots were randomly taken at harvest date and average leaf area (cm^2) was determined using Planymeter, as well as leaf fresh and dry weights were determined and leaf hydration ratio (%) was calculated according to the following equation: (leaf fresh weight - leaf dry weight)/ leaf fresh weight ×100.

Also, leaf disk samples were obtained at harvest to determined leaf tissue contents (mg/ g fresh weight) of chlorophyll a, chlorophyll b, total chlorophyll (a+ b) and carotenoides according to Wettestein (1957).

Statistical analysis:

The obtained data were subjected to statistical analysis according to Snedecor and Cochran (1980). Mean comparing was done using New L.S.D method at 0.05 level.

RESULTS

Results of the present investigation are illustrated in the Tables form 1 to 5. Data presentation will mainly consider the parameters that indicated consistent trends and significant differences throughout the two experimental seasons.

1-Average fruit weight (g)

Effect of vitamin C spraying (Vit. C)

Data in Table 1 show that spraying mango trees with Vit C at beginning fruit set or at 20 days later increased average fruit weight (g) comparing to unsprayed control trees. The increments were significant only in the first tested season. The highest fruit weight (340.87 g) came from the Vit C spraying at 20 days after fruit set in the first season. Control plants recorded the least value in this respect.

Effect of dry yeast spraying (D.Y.)

The differences between the effects the tested dry yeast spraying applications on average fruit weight were significant only in the first season and the tested treatments failed to affect significantly in the second one. However, D.Y. spraying at the two tested dates significantly increased fruit weight comparing to unsprayed treatment during first season (Table 1).

Effect of interaction between Vit. C and D.Y

The interaction treatments between Vit C and D.Y. had significant effect on fruit weight during the two tested seasons (Table 1). Spraying dry yeast at fruit set x without spraying with Vit.C treatment resulted in the heaviest fruits in both seasons. While, the least weights (311.63 & 310.57g) came from treatments of without spraying dry yeast x spraying Vit. C at fruit set in the first season and spraying dry yeast at fruit set x spraying Vit. C at 20 days after fruit set in the second season.

2-Fruit size (cm^3)

Effect of vitamin C spraying (Vit. C)

The fruit size (Table 1) generally, ranged from 320.56 to 324.00 cm^3 in the first season and from 304.17 to 324.44 cm^3 in the second one. However, fruit size was increased after Vit C spraying, regardless the application date, comparing to control

treatment. This trend was significant only in the second season. The least fruit size was noticed in control plants in both seasons.

Effect of dry yeast spraying (D.Y.)

Data of the same Table 1 clear that D.Y. spraying, especially when it applied at beginning fruit set, significantly increased fruit size comparing to control treatment during the two seasons.

Effect of interaction between Vit. C and D.Y.

The interaction treatments showed significant effect regarding fruit size (Table 1). The fruit size revealed positive and significant response during the tow experimental seasons under the combination treatment effect of spraying Vit C x spraying D. Y. at fruit set for each comparing to the most of other interaction treatments

3- Peel and pulp weight (g)

Effect of vitamin C spraying (Vit. C)

It is clear that spraying Vit. C increased peel and pulp weights as compare to unsprayed control treatment (Table 2). Vit. C spraying at fruit set significantly increased peel weight (83.49 g) in the second season, while pulp weight (201.11 g) was significantly enhanced by Vit. C spraying at 20 days after fruit set during the first season. There were no significant differences between the two tested application dates in this regard during the two seasons.

Effect of dry yeast spraying (D.Y.)

Data of Table 2, also show that sprayed trees with D.Y. at beginning fruit set or at 20 days later had fruits with heaviest peels than those resulted from unsprayed control trees, with no significant differences between the two application dates. For pulp weight, D.Y. spraying at the beginning fruit set significantly increased pulp weight (210.53 & 212.35 g in the first and second seasons, respectively) comparing to control or spraying at 20 days after fruit set beginning. The lowest values for peel and pulp weights came from the treatment without D.Y. spraying in the two seasons.

Effect of interaction between Vit. C and D.Y.

The increases in fruit peel weight were obvious with the combination treatments of spraying D.Y. at fruit set x without Vit. C or spraying Vit. C at fruit set, while the least peal weights were observed in fruits resulted on unsprayed control trees or on sprayed ones with Vit C only without D.Y. spraying during the both seasons (Table 2). Also, data of the same Table 2 clear that pulp weight reached maximum values with the combination treatments between D.Y. at fruit s et x

without Vit. C or spraying Vit. C at fruit set or 20 days later as compare to the most other interaction treatments during the two seasons.

4- Peel to pulp ratio (%)

Effect of vitamin C spraying (Vit. C)

Generally, Peel to pulp ratio % (Table 2) ranged from 40.49 to 44.04 % in the first season and from 39.04 to 39.80 % in the second one. The differences between the tested Vit. C treatments for peel to pulp ratio were insignificant in the both seasons.

Effect of dry yeast spraying (D.Y.)

All tested D.Y. spray treatments significantly increased peel/pulp ratio(%)in the two experimental seasons (Table 2). The least values were recorded from the treatment without foliar spray with dry yeast.

Effect of interaction between Vit. C and D.Y.:

The interaction (Vit C x D.Y) was significant in the two seasons (Table 2). Peel to pulp (%) reached maximum values with the combinations between D.Y. spraying x Vit. C spraying at 20 days after fruit set for each in the first season and D.Y. spraying x Vit. C spraying at fruit set for each in the second season. Vit. C spraying at 20 days after fruit set in the first season or at fruit set in the second one without D.Y. interaction tended to reduce peel to pulp (%) comparing to the other interaction treatments.

5. Total soluble solids TSS (%), acidity (%) and TSS/ acid ratio

The responses of juice parameters at harvesting to Vit. C, dry yeast spraying at the two application dates and their interactions are represent in Table 3.

Effect of vitamin C spraying (Vit. C)

It is clear that TSS % was significantly promoted (19.39 & 18.83 % in the first and second seasons, respectively) when Vit.C was sprayed at beginning fruit set date in comparison with the treatment without Vit. C. In addition, differences between the tow tested application dates with Vit. C*; i.e.,* at fruit set or at 20 days later were insignificant in both seasons.

Spraying Vit. C at 20 days after fruit set depressed fruit juice acidity (0.60 & 0.49 %) at harvesting comparing to fruit juice acidity of unsprayed trees with Vit.C (0.65 & 0.50 %) in the two seasons.

Concerning TSS/ acid ratio (Table 3), Vit.C spraying at beginning fruit set or at 20 days later significantly increased TSS/ acid ratio during the two seasons comparing to control plants.

Effect of dry yeast spraying (D.Y.)

Generally, effects of D.Y. spraying on TSS %, acidity % and TSS/ acid ratio in fruit juice follow similar trend as in Vit. C spray applications (Table 3), since spraying D.Y. at fruit set beginning or at 20 days later significantly increased TSS %, significantly decreased acidity. Thus, significant increments were recorded, in the same Table 2, under D.Y. spray applications concerning TSS/ acid ratio comparing to control treatment during the two seasons.

Effect of interaction between Vit. C and D.Y.

The interaction (Vit C x D.Y) was significant in the two seasons respecting acidity and TSS/ acid ratio. In addition, the interaction effect on TSS % was significant in the second season only (Table, 3).

The highest values of TSS % were recorded with the combination treatments of spraying Vit. C at fruit set x spraying D.Y. at fruit set or at 20 days later in both seasons.

The least values of total acidity came from the combination effect between Vit. C and D.Y. spray application at 20 days after beginning fruit set for each.

For TSS/ acid ratio, the all interaction treatments between the tested Vit. C and D.Y. levels at the two application dates resulted in increases in fruit juice TSS/ acid ratio comparing to control treatment (Table 3). This effect was significant in several cases in the two seasons.

6- Vitamin C content (mg/100 ml juice)

Effect of vitamin C spraying (Vit. C)

All tested Vit. C spray applications increased Vit. C content in fruit juice compared to unsprayed control treatment in the two seasons (Table 3). This trend was significant only during the first season.

Effect of dry yeast spraying (D.Y.)

Data of the same Table 3 show that spraying D.Y. at fruit set date resulted in, during the two tested seasons, an increase in Vit. C content as mg/100 ml fruit juice comparing to unsprayed control trees or D.Y. sprayed once at 20 days after fruit set.

Effect of interaction between Vit. C and D.Y.

The interaction (Vit C x D.Y) was significant in the first season only regarding Vit. C content in fruit juice (Table 3). All interaction treatments of Vit C x D.Y tended to increase Vit. C content in fruit juice comparing to unsprayed control plants (unsprayed Vit. C x unsprayed D.Y. treatment).

7. Leaf fresh and dry weight (g)

Effect of vitamin C spraying (Vit. C)

Table 4 clears that all tested Vit.C treatments increased leaf fresh and dry weights as compared to the treatment without Vit.C in the both seasons. The differences between all tested treatments were significant in the two seasons, except for leaf dry weight in the second season which was insignificant. The least fresh (2.43 & 2.40g) and dry (1.01 & 1.36) weights were recorded in the treatment without Vit. C spraying in the both seasons.

Effect of dry yeast spraying (D.Y.)

Spraying D.Y. at 20 days after fruit set date resulted in the highest leaf fresh (3.26 &3.13 g) and dry (1.30 & 1.63 g) weights in the first and second seasons, respectively (Table, 4). In addition, the differences between this treatment and spraying D.Y. at fruit set date treatment were significant in the both seasons.

Effect of interaction between Vit. C and D.Y.

Data of the same Table 4 indicate that treatments of spraying D.Y. at 20 days after fruit set interacted with Vit. C spraying at fruit set or at 20 days later tended to increase average leaf fresh and dry weights comparing to the most of other interaction treatments. The interaction treatments (Vit C x D.Y) had significant effect for leaf fresh weight in the second season and for leaf dry weight in the first one only.

8. Leaf hydration ratio (%) and leaf area (cm^2)

Effect of vitamin C spraying (Vit. C)

The differences between tested Vit.C treatments were significant in both seasons regarding leaf hydration ratio (Table 4). The highest values (58.54 & 54.58, %) were recorded in tree leaves treated with spraying Vit. C at 20 days after fruit set during first and second seasons, respectively.

Concerning the effect of Vit. C on the leaf area (Table 4) there was no clear trend could be traced throughout the two experimental seasons.

Effect of dry yeast spraying (D.Y.)

As for D.Y. spray effects on leaf area, spraying D.Y. at 20 days after fruit set recorded the highest leaf area (50.18 & 52.89 cm^2) compared to the other D.Y. treatments in the two seasons as.

Unconfirmed trend was noticed during the two tested seasons regarding the effect of D.Y. applications on leaf hydration ratio (Table 4).

Effect of interaction between Vit. C and D.Y.

The same Table 4 indicates that the interaction treatment of foliar spray with Vit. C at 20 days after fruit set x without D.Y. spraying resulted in high leaf hydration ratio

values. While, foliar spray with Vit. C at 20 days after fruit set x foliar spray with D.Y. at 20 days after fruit set treatment gave the highest average leaf area during both seasons as compare to the most of other interaction treatments.

9- Leaf photosynthetic pigments (mg/g Fresh weight)

Leaf photosynthetic pigments*; i.e.,* chlorophyll a, chlorophyll b, total chlorophyll a+b and carotenoides (mg/ g fresh weight) as affected with Vit. C and D.Y. foliar spray applications as well as their interactions are shown in Table 5.

Effect of vitamin C spraying (Vit. C)

Generally, chlorophyll a, chlorophyll b and total chlorophyll a+b were significantly increased in leaf tissues of sprayed trees with Vit. C at fruit set or at 20 days later comparing to unsprayed treatment during the two seasons. Spraying Vit. C at fruit set had superior effect in this respect than praying Vit. C at 20 days after the beginning of fruit set.

Effect of dry yeast spraying (D.Y)

Data in Table 5 show that leaf chlorophyll a (0.625 & 0.588), chlorophyll b (0.640 & 0.778), total chlorophyll (a+ b) (1.264 & 1.371) and carotenoides (0.543 & 0.594) contents reached maximum values under the effect of foliar spraying with D.Y. at 20 days after beginning the fruit set in the first and second seasons, respectively. Differences between the tested D.Y. treatments for chlorophyll b, total chlorophyll a+b and carotenoides contents were significant in the two seasons. While, differences for chlorophyll a were significant in the first season only.

Effect of interaction between Vit. C and D.Y.

The interactions (Vit C x D.Y) had significant effects for chlorophyll a during the first season only, while for chlorophyll b, total chlorophyll and carotenoides during the both seasons. The uppermost values for chlorophyll a (0.744 & 0.589 mg/g fresh weigh), chlorophyll b (0.712 & 0.897 mg/g fresh weight) and total chlorophyll (1.456 & 1.479 mg/g fresh weight) resulted from the combination treatment of foliar spraying with Vit.C at fruit set x foliar spraying with D.Y. at 20 days after fruit set in the first and second seasons, respectively.

DISCUSSION

Ascorbic acid (Vit. C) foliar application was reported to induce many stimulating effects of growth and some physiological activities of different plants. Kamiya *et al.* (1984) stated that the physiological effect of ascorbic acid included: stimulation of lipase, catalase and peroxides isoenzymes activities. In addition, ascorbic acid

revealed an effect on the metabolism of gibberellic acid. Also, Oertli, (1987) suggested that the functions of Vit. C include reversal stress effects (temperature and poisons), antioxidants, protection of chloroplast and electron transport system. It also, stimulates respiration activities, cell division and many enzymes activities.

The general positive effects of applying active dry yeast were attributed to its content of different nutrients as N, P and K and some common amino acids (Abou-Zaid, 1984). Also, yeast contains some natural growth regulators*; i.e.,* auxin (Kihlbery, 1972; Wareing and Philips, 1973 and Moor, 1979) and Cytokinins (Ferguson *et al*., 1987). In addition, application of active dry yeast is very effective in releasing CO_2 which improves net photosynthesis (Larson *et al*., 1962, Hegab *et al*., 1997; Mansour, 1998; Attala *et al.*, 2000 and Abd El- Moniem *et al*., 2002). It contains higher values of proteins and large amount of vitamin b which plays a key role in improving growth and controlling the incidence of fungi diseases (FAO, 1971 and Idso *et al*., 1995).

Yeast is considerable as a natural source of Bs vitamins and most of the essential elements (Nagadawithana, 1991). B-Vitamins practicable in plant growth and development indirectly by enhancing endogenous levels of various growth factors such as cytokinins and gibberellins (Kadandaranalah and Rao, 1985).

The positive effect of yeast applications on berry length could be due to encourage the uptake of various nutrients, active photosynthesis process, cell division and cell enlargements by yeast which considered as a source of IAA and cytokinin hormones (Omran, 2000). In addition, respect active dry yeast was found to improve the growth, nutritional status , yield and fruit physical as well as chemical properties of fruit trees (Ahmed *et al*., 1997; Akl *et al* ., 1997; Atawia & El-Desouky, 1997; Hegab *et al.*, 1997; El-Mogy *et al.*, 1998: Ebrahiem *et al.*, 2000; Amen *et al.*, 2000; Laz *et al.*, 2000, Nomeir, 2000; Omran, 2000; El-Ghany *et al.*, 2001; El-Galil *et al.*, 2003 and Hassan *et al.*, 2005).

Conclusively, from the abovementioned results, it could be concluded that mango *cv.* Hendy Moloky respond to foliar spraying with ascorbic acid at 0.05 % in combination with active dry yeast at 1 % when applied at beginning fruit set or at 20 days after beginning fruit set, where it increased fruit weight and size and improved fruit quality.

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تأثير الرش الورقي بفيتامين ج والخميرة الجافة على النمو وجودة ثمار المانجو صنف هندي ملوكي

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أجرى هذا البحث خلال الموسمين المتتاليين ٢٠٠٤-٢٠٠٥على المانجو صنف هندي ملوكي المنزرعة في مزرعة خاصة في ببلبيس ، محافظة الشرقية ، مصر ، لتقيم تأثير الرش الورقي بفيتامين ج بتركيز ٠.٠٥% (بدون رش ، الرش عند بداية عقد الثمار ، أو الرش بعد ٢٠ يوم من بداية عقد الثمار) وبالخميرة الجافة بتركيز ١% (بدون رش والرش ، الرش عند بداية عقد الثمار ، أو الرش عند ٢٠ يوم من بداية عقد الثمار) والتفاعل بينهما على جودة الثمار ونمو الأشجار.

أدى الرش بفيتامين ج عند بداية العقد أو بعد ٢٠ يوم من بداية العقد إلى زيادة كل من وزن وحجم الثمرة ومحتواها من المواد الصلبة الذائبة وفيتامين ج ، زاد وزن القشرة بالرش بفيتامين ج عند العقد ، بينما نقصت حموضة الثمار بالرش بفيتامين ج بعد٢٠ يوم من بداية العقد ، زاد كل من الوزن الغض والجاف للورقة و محتوى أوراق الأشجار من كلوروفيل أ ، كلوروفيل ب والكلوروفيل الكلى (أ+ب) بالرش بفيتامين ج سواء عند بداية عقد الثمار أو بعد ٢٠ يوم من بداية العقد.

أدى الرش بالخميرة عند بداية عقد الثمار إلى زيادة كل من وزن وحجم الثمار ومحتوى الثمار من فيتامين ج ، وكذلك أدى الرش بالخميرة بعد ٢٠ يوم من بداية العقد إلى زيادة كل من الوزن الغض والجاف للورقة و محتواها من صبغات التمثيل الضوئي ، أدى الرش بالخميرة عند بداية العقد أو بعد ٢٠ يوم من بدايته إلى زيادة كل من وزن قشرة ولب الثمرة و المواد الصلبة الكلية والنسبة بين المواد الصلبة الكلية والحموضة بعصير الثمرة.

أعطت معاملة التفاعل بين رش الأشجار بالخميرة عند بداية عقد الثمار x بدون رش فيتامين ج أعلى وزن لكل من الثمرة والقشرة ، أدت معاملة التفاعل بين الرش بالخميرة والرش بفيتامين ج عند بداية عقد الثمار لكل منهما إلى زيادة حجم الثمرة ووزن لبها.

سجلت معاملة التفاعل بين الرش بفيتامين ج عند بداية عقد الثمار x الرش بالخميرة بعد ٢٠ يوم من بداية العقد أعلى القيم لمحتوى الأوراق من كلوروفيل أ ، كلوروفيل ب والكلوروفيل الكلى (أ+ب) ، أدت كل معاملات التفاعل إلى زيادة محتوى عصير الثمار من فيتامين ج والنسبة بين المواد الصلبة الذائبة والحموضة.