



## Enhancing of Fruit Set %, Yield and Fruit Quality of “Washington” Navel Orange by Different Agrochemical Foliar Sprays in Application Times

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### ABSTRACT

The present investigation was conducted at private orchard at Barshome Kalyoubeya Governorate Egypt, on Washington Navel orange trees at fifteen years old during (2019 and 2020) seasons. This objective was to study the effect of foliar spraying trees by three recommended doses of commercial liquid (Berelex), (Dotra CATY-BOR), (Microfalcon) and control (water only), on June drop, fruit set, yield and fruit quality in two different times by groups. The first group was spraying only once at (full bloom), the second group was sprayed twice at (full bloom and at marble stage). The trees which were sprayed two times gave the highest values than trees which sprayed once and the control in most parameters. Spraying GA<sub>3</sub> at 75 ppm two times was more effective in reducing fruit drop (June drop), peel thickness and acidity. Farther more it, enhancing initial fruit set %, final fruit set retention %, fruit weight, juice volume and VC with significant increase in yield as number of trees or as Kg/tree. The minimum values were obtained by the control. So according to previous results, foliar spraying of GA<sub>3</sub> at 75 ppm twice at full bloom and the marble stage of 'Washington orange' trees can be recommended.

**Keywords:** Washington Navel orange trees, Gibberellic Acid, Dotra, Microfalcon, June drop, yield, fruit quality.

### 1. Introduction

Washington Navel orange trees (*Citrus sinensis* L. Osbeck) is one of the most important citrus varieties grow in Egypt. It conforms to two serious problems of poor fruit set and heaving fruit drop. It is parthenocarpic cultivar thus decrease yield and fruit quality. Young parthenocarpic fruits tend to be more easily to drop than young fruits from pollinated flowers (Schafer *et al.*, 1999). The initial dropping is due to abscission of week fruitlets which appear a thesis. Abscission layer at the stem resulting of fruit drop is formed due to imbalance of auxins, cytokinins and gibberellins (Balal *et al.*, 2011). The problem of June drop and preharvest fruit drop is extensive in many Egyptian orchards especially because Navel orange is a parthenocarpic and might be controlled by foliar sprays of calcium and boron, however date and number of applications must be considered to obtain best results (El-Kobbia *et al.*, 2011).

The use of growth regulators has become an important component of agro technical procedures play an important role in the growth, flowering and fruit set of different crops particularly Gibberellic acid and naphthalene acetic acid since it encourage fruit set and reduce fruit drop in many citrus species (Almeida *et al.*, 2004). Plant growth regulators have been well studied for fixing the fruit set (Modise *et al.*, 2009), to reduce premature fruit drop (Ashraf *et al.*, 2010 and 2012), increasing the yield and improving the fruit quality (Bons *et al.*, 2015). Ibrahim *et al.*, (2011) found that spraying GA<sub>3</sub> three times a season at 10 ppm on Washington Navel orange trees beginning of flowering, full bloom and fruit set gave the maximum fruit set, fruit retention % and reduced total drop percentage.

Effective supply of nutrients and plant regulators is necessary to produce high quality citrus fruits and control excessive citrus fruit drop which involves selection of appropriate combination of nutrients and plant growth regulators and their rate, time and methods of application (Ashraf *et al.*, 2013). The micronutrients are required in small amount, but a great role in plant metabolism (Katyal, 2004) and

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(Kazi *et al.*, 2012). The micronutrients play an important role in the development and growth of new cells in plant meristem as citrus needs exhaustive nutrition has an impact in terms of macro and micro nutrients (Yogendra *et al.*, 2018). Abd El-Ghany (2005) reported that fruit drop before June drop (initial drop) occurred due to the competition among the fruit on nutrients water with trouble in hormonal balance. Similarly, deficiency of micronutrients Zn, Cu, Fe and Mn in the soil of citrus orchard practices affects the fruit yield, quality and fruit dropping (Ibrahim *et al.*, 2007) and (Ashraf *et al.*, 2012). Nutrition such as amino acid, calcium and boron could influence the number of flowering and fruit set (Abd El-Aziz and El-Azazy, 2016).

The aim of this study is to evaluate the effect of GA<sub>3</sub> and some sources of nutrients elements on June drop, initial and retention fruit set, yield and fruit quality.

## 2. Materials and Methods

This investigation was carried out on Washington Navel orange trees (*Citrus sinensis* L. Osbeck) at fifteen years old during (2019 and 2020) seasons, planted on private orchard located at Barshome Kalyoubeya Governorate, Egypt. The selected trees were uniform in vigour, growth and productivity which were planted 5x5 meter under basin irrigation system, and normal agricultural practices in loamy soil. The soil texture of the experimental site was loamy with organic matter 2.04%; pH 8.4; E.C. 0.32 dsn<sup>-1</sup>; CaCO<sub>3</sub> 1.6%; available macroelements (%): P 2.8, K 47.2, Ca 1000 and Mg 114; available microelements (ppm): Fe 7.6, Mn 3.4, Zn 1.4 and Cu 1.7.

Trees were divided in two groups and each group consists of three treatments with three replicates. Each replicate is represented by three trees, per each was carried out in Randomized Complete Block Design. The first group was sprayed with its three treatments once (\*) at full bloom (28 April) under order condition. The second group by its three treatments was sprayed twice (\*\*), once at full bloom (28 April) and the second at late May before June drop, when fruits reached marble stage (15mm) diameter (El-Kobbia *et al.*, 2011). The previous two groups were sprayed by three specified solutions by three recommended doses of liquid commercial (Berelex), (Dotra) and (Micro falcon) Table (1). Such amount of the solution was enough to spray trees sequentially. Furthermore, another third group division, trees with the same replication design were sprayed with water only, it is consider as a control.

**Table 1:** Composition of the commercial liquid

| Commercial liquid | Composition                                |
|-------------------|--|
| Berelex           | 40 SC Net weigh 2.5 g                      |
| Dotra             | CAty-BOR “B 1%, Ca 10%, N 6% + amino acid” |
| Micro falcon      | “Zn 3%, Mn 2%, Mg 1% + amino acid + EDTA”  |

The treatments were as follows:

- (T<sub>1</sub>) Control “water only”.
- (T<sub>2</sub>) Berelex (GA<sub>3</sub>) at 75 ppm.
- (T<sub>3</sub>) Dotra “CAty-BOR” at 1L/600L.
- (T<sub>4</sub>) Micro falcon at 1L/600L.

In this investigation at this location, the full drop of fruitlets beginning after nearly 40 days from the full; flowering which recorded from (28-30 April) until nearly late May to June drop. Similarly, fruits formed after two weeks of fruitlets (Ashraf *et al.*, 2013).

### 2.1. Measurements

#### I. Initial Fruit Set %

Twenty new spring shoots were labelled around each experimental tree. The number of flowers on each labelled shoot was count in the bloom reached over flower stage. Later on the numbers of set fruitlets were counted on the same tagged set fruitlets shoots (Abd El-Aziz and El-Azazy, 2016), using the following formula.

$$\text{Initial fruit set \%} = \frac{\text{Number of fruit setting on the bunch}}{\text{Total number of flowers per bunch}} \times 100$$

## II. June Drop %

After June drop were recorded at 1<sup>st</sup> July (Hikal, 2013) as follows:

$$\text{June drop \%} = \frac{\text{Accumulative number of fruit drop}}{\text{Total number of fruits at 1}^{\text{st}} \text{ July}} \times 100$$

## III. Final Fruit Retention %

At harvest date fruits were calculated through deterring both the accumulative numbers of dropping fruit and number of fruits at picking date (yield), as the following formula.

$$\text{Final fruit retention \%} = \frac{\text{Yield as number of fruit/tree at harvest date}}{\text{accumulative No. of fruit drop} + \text{yield as No. of fruit/tree}} \times 100$$

## IV. Yield (Kg/tree)

The yield was harvested at 15<sup>th</sup> December in the two years, which calculated as weight (Kg) and number of fruits/tree.

## V. Fruit Quality

Sample of ten fruits per tree from each replicate was collected randomly at harvest time to determine some physical and chemical properties. The physical properties as average fruit weight (g), fruit juice volume (cm<sup>3</sup>) and peel thickness (mm). The chemical properties were determined as TSS % by using hand refractometer, total acidity of juice (TA %) of each sample was determined as percentage of Citric acid and Vitamin C (VC) as mg/100ml juice. All these analysis evaluated according to methods AOAC (2000), and subjected to computerized statistical analysis using 0.05 according to Snedecor and Cochran (1989).

## 3. Results and Discussion

### 3.1. Percentages of Initial Fruit Set, June Drop and Final Fruit Retention

The results of this investigation (Table 2) point out clearly that all treatments significant increase initial fruit set % than the control. It is noticed that the trees which sprayed two times (\*\*) gave the best results in this respect than one time (\*) and the control. Also, this result may be due to the important date of spraying treatments in the marble stage before June drop. General speaking, the initial fruit set % was recorded maximum values after spraying (GA<sub>3</sub> 75 ppm) treatment even once or twice followed by Dotra then Macrofalcon treatments. While control treatment (water only) was recorded the minimum values in this respect. These results may due to the effect of growth regulator and the source of macro and micro nutrients. Initial fruit set % by T<sub>2</sub>\*\* has given the value of (59.22 & 60.83 %) while T<sub>2</sub>\* was (54.53 & 55.73 %) consecutively in the two seasons. The minimum values (46.88 & 47.10 %) were obtained by the control. In addition, it can be notice that, there were no significant differences on initial fruit set % between T<sub>2</sub>\*\* and T<sub>3</sub>\*\* but a significant differences between T<sub>2</sub>\* and T<sub>3</sub>\* and that is true in both seasons that for the reasons of the effect of date and number of spraying treatments.

Regard to June drop %, data in Table (2) clearly showed that, all treatments significantly decrease June drop % than the control and that is true in both seasons. Generally, the trees of all treatments (T<sub>2</sub>\*\*, T<sub>3</sub>\*\* and T<sub>4</sub>\*\* ) which sprayed twice were more effective than the other treatments (T<sub>2</sub>\*, T<sub>3</sub>\* and T<sub>4</sub>\*) which sprayed once on reducing June drop%. It clearly means that there was a significant difference between the number and the time of spraying on the positive effect of June drop except between T<sub>2</sub>\*\* and T<sub>3</sub>\*\* and T<sub>3</sub>\* and T<sub>4</sub>\* treatments in both seasons. According to GA<sub>3</sub> treatments, it is evident that trees which sprayed twice (T<sub>2</sub>\*\* ) gave the least June drop % as the values (84.44 & 83.85 %) in the first and the second seasons respectively followed by T<sub>3</sub>\*\* and T<sub>4</sub>\*\* which recorded (85.70 & 84.12%) and (90.07 & 90.90 %) consecutively in both seasons of investigation. While, the control gave the highest significant values was recorded (94.20 & 93.30 %) sequentially. On the other hand, spraying trees once at full bloom only has taken the same trend in the two seasons.

As for the final fruit retention %, it has taken nearly the same trend of initial fruit set %, and that is true as results of decreasing June drop. Regard with the twice spraying by GA<sub>3</sub>, Dotra and

Microfalcon significantly increased the final fruit retention (after June drop) over the control at nearly both seasons.

**Table 2:** The percentage of initial fruit set, June drop and final fruit retention as affected by different agrochemical foliar sprays in two times during 2019 and 2020 seasons

| Treatments  | Initial fruit set % |                     | June drop %       |                     | Final fruit retention % |                     |
|---|---------------------|---------------------|-------------------|---------------------|-------------------------|---------------------|
|   | Spraying once (*)   | Spraying twice (**) | Spraying once (*) | Spraying twice (**) | Spraying once (*)       | Spraying twice (**) |
| <b>2019 season</b>                                    |                     |                     |                   |                     |                         |                     |
| T <sub>1</sub> Control "water only"                   | 46.88 d             | 46.88 c             | 94.20 a           | 94.20 a             | 2.21 d                  | 2.21 c              |
| T <sub>2</sub> Berelex (75ppm GA <sub>3</sub> )       | 54.53 a             | 59.22 a             | 87.60 c           | 84.44 c             | 2.51 a                  | 2.86 a              |
| T <sub>3</sub> Dotra "CA <sub>2</sub> -BOR" (1L/600L) | 53.29 b             | 58.99 a             | 91.61 b           | 85.70 c             | 2.42 c                  | 2.86 a              |
| T <sub>4</sub> Micro falcon (1L/600L)                 | 51.03 c             | 55.25 c             | 91.59 b           | 90.07 b             | 2.46 b                  | 2.51 b              |
| <b>2020 season</b>                                    |                     |                     |                   |                     |                         |                     |
| T <sub>1</sub> Control "water only"                   | 47.10 d             | 47.10 c             | 93.30 a           | 93.30 a             | 2.07 d                  | 2.07 c              |
| T <sub>2</sub> Berelex (75ppm GA <sub>3</sub> )       | 55.73 a             | 60.83 a             | 88.85 c           | 83.85 c             | 2.50 a                  | 2.66 a              |
| T <sub>3</sub> Dotra "CA <sub>2</sub> -BOR" (1L/600L) | 53.50 b             | 60.79 a             | 91.61 b           | 84.12 c             | 2.41 b                  | 2.59 a              |
| T <sub>4</sub> Micro falcon (1L/600L)                 | 52.06 c             | 58.29 b             | 91.19 b           | 90.90 b             | 2.30 c                  | 2.40 b              |

Means in column followed by the same letter are not significantly different according to LSD test (P = 0.05).

The obtained results are in agreement with Modise *et al.*, (2009) on navel oranges, Ibrahim *et al.*, (2011) on "Washington" Navel orange trees", Ashraf *et al.*, (2012) and Mahaveer *et al.* (2017) on fruit crop, they reported that excessive fruit drop can be controlled by exogenous application of plant growth regulators (GA<sub>3</sub>) in many citrus species and varieties.

Regarding to the application of Dotra and Macrofalcon treatments were more effective than the control in reducing June drop. It may due to the macro and micro nutrient effect. These results accordance with those found by Kazi *et al.*, (2012) on sweet orange, Hikal (2013) on Washington navel orange and Yogendra *et al.*, (2018) on sweet orange.

In the same concern Ganie *et al.*, (2013) reported that boron fertilization regardless of application mode increase fruit set. Similar results reported by Ashraf *et al.*, (2013) who mentioned that plant growth regulators and nutrients (SA, 2, 4-D, K and Zn) or their combinations significantly improved fruit setting per tree in all selected orchard. The minimum setting was recorded in trees sprayed with distilled water. Nearly results was by Abd El-Azize *et al.*, (2016) who reported that the effect of spraying trees three times during winter time, full bloom and after two weeks by the combination of calcium-boron (Ca - B 1.5 %), amino acids (AA 1 %) and low biuret urea (LBU 1 %) showed the best results on fruit set %.

### 3.2. Yield and Its Components

Data in (Table 3) indicated that concerning all treatments significant increased number of fruits, average of fruit weight and yield (Kg/tree) than the control in the two spraying (once and twice) in both seasons. It can be remarked that twice spraying was more effective in this respect than one spraying. Meanwhile, the highest significant of yield and its components was obtained when Washington Navel orange trees were sprayed twice with Berelex (75 ppm GA<sub>3</sub>) and Dotra (1L/600L), with no significant differ between them, in both seasons. Except for the trees that were sprayed once, there were significant differences between all treatments including the control. On the other hand, the minimum significant number of fruits, average of fruit weight and yield (Kg/tree) were recorded in trees sprayed with distilled water (control). Generally, the above results disclosed that the trees sprayed with agrochemical foliar treatments enhanced the highest number of fruits, average of fruit weight and yield. Furthermore, the increasing in yield by the previous treatments might due to the increasing in fruit retention and the decrease in fruit drop by the same treatments obtained.

**Table 3:** The yield and its components of Washington Navel orange trees as affected by different agrochemical foliar sprays in two times during 2019 and 2020 seasons

| Treatments                                      | Number of fruits /tree |                     | Average of fruit weight (g) |                     | Yield (Kg) / tree |                     |
|---|------------------------|---------------------|-----------------------------|---------------------|-------------------|---------------------|
|   | Spraying once (*)      | Spraying twice (**) | Spraying once (*)           | Spraying twice (**) | Spraying once (*) | Spraying twice (**) |
| <b>2019 season</b>                              |                        |                     |                             |                     |                   |                     |
| T <sub>1</sub> Control “water only”             | 370.16 d               | 370.16 c            | 215.00 d                    | 215.00 c            | 79.85 d           | 79.85 c             |
| T <sub>2</sub> Berelex (75ppm GA <sub>3</sub> ) | 400.97 a               | 430.20 a            | 286.00 a                    | 302.00 a            | 114.68 a          | 130.00 a            |
| T <sub>3</sub> Dotra “CATy-BOR” (1L/600L)       | 391.71 b               | 431.70 a            | 251.00 b                    | 293.00 a            | 98.32 b           | 126.49 a            |
| T <sub>4</sub> Micro falcon (1L/600L)           | 379.50 c               | 401.60 b            | 227.00 c                    | 248.00 b            | 86.14 c           | 99.60 b             |
| <b>2020 season</b>                              |                        |                     |                             |                     |                   |                     |
| T <sub>1</sub> Control “water only”             | 362.90 d               | 362.90 c            | 200.00 d                    | 200.00 c            | 72.58 d           | 72.58 c             |
| T <sub>2</sub> Berelex (75ppm GA <sub>3</sub> ) | 441.26 a               | 470.10 a            | 240.00 a                    | 252.00 a            | 105.40 a          | 118.47 a            |
| T <sub>3</sub> Dotra “CATy-BOR” (1L/600L)       | 429.60 b               | 468.00 a            | 213.00 b                    | 253.00 a            | 91.51 b           | 118.40 a            |
| T <sub>4</sub> Micro falcon (1L/600L)           | 388.20 c               | 402.00 b            | 205.00 c                    | 236.00 b            | 79.58 c           | 94.87 b             |

Means in column followed by the same letter are not significantly different according to LSD test (P = 0.05).

These results are in harmony with the findings by Hafez-Omaira & El-Metwally, (2007) on Washington Navel orange, Moneruzzaman *et al.*, (2011) on Apple, Ibrahim *et al.*, (2011) on Washington Navel orange, Mahaveer *et al.*, (2017) on fruit crops and Anurag *et al.*, (2018) on Kinnow mandarin. They recorded that the number of fruit/plant, average of fruit weight and yield (Kg/tree) were maximized by spraying GA<sub>3</sub>. On the other side, Saleem *et al.*, (2008) on citrus observed that the application of GA<sub>3</sub> had reduced fruit weight.

### 3.3. Fruit Physical Characteristics

Data in Table (4), show that all foliar treatments under study significant increase fruit juice volume and decrease fruit peel thickness than the control (water only) in both spraying (once and twice) in the two seasons except trees foliar sprayed once with Micro falcon (1L/600L) in the two seasons when peel thickness was conceded. In addition, T<sub>2</sub> gave the highest fruit juice volume followed by T<sub>3</sub> and T<sub>4</sub> respectively, while was more effective in reducing peel thickness than the other treatments and the control consecutively. Generally, most treatments used under this study significantly recorded increase fruit juice volume and low fruit peel thickness as compared with the control. Our results may be due to the increasing in fruit weight with increasing in juice volume which resulting in low fruit peel thickness.

**Table 4:** The fruit juice volume and peel thickness of Washington Navel orange fruits as affected by different agrochemical foliar sprays in two times during 2019 and 2020 seasons

| Treatments                                      | Fruit juice volume (cm <sup>3</sup> ) |         |                     |         | Peel thickness (cm) |        |                     |        |
|---|---------------------------------------|---------|---------------------|---------|---------------------|--------|---------------------|--------|
|   | Spraying once (*)                     |         | Spraying twice (**) |         | Spraying once (*)   |        | Spraying twice (**) |        |
|   | 2019                                  | 2020    | 2019                | 2020    | 2019                | 2020   | 2019                | 2020   |
| T <sub>1</sub> Control “water only”             | 91.0 d                                | 95.9 c  | 91.0 d              | 95.9 d  | 0.74 a              | 0.76 a | 0.74 a              | 0.75 a |
| T <sub>2</sub> Berelex (75ppm GA <sub>3</sub> ) | 125.4 a                               | 129.9 a | 131.2 a             | 136.0 a | 0.58 c              | 0.65 c | 0.51 d              | 0.57 d |
| T <sub>3</sub> Dotra “CATy-BOR” (1L/600L)       | 115.3 b                               | 116.8 b | 125.1 b             | 126.9 b | 0.65 b              | 0.70 b | 0.59 c              | 0.67 c |
| T <sub>4</sub> Micro falcon (1L/600L)           | 101.9 c                               | 112.8 b | 110.2 c             | 119.2 c | 0.73 a              | 0.75 a | 0.65 b              | 0.70 b |

Means in column followed by the same letter are not significantly different according to LSD test (P = 0.05).

These results agree with those obtained by Saleem *et al.*, (2008) on Citrus, Ashraf (2013) on Kinnow, Mahaveer *et al.*, (2017) on fruit crops and Yogendra *et al.*, (2018) on sweet orange. They

recommended that foliar application of GA<sub>3</sub> and nutrients (K, B, Cu and Zn) reduced peel thickness and improved juice content.

### 3.4. Fruit Chemical Characteristics

With regard to the chemical parameters on "Washington" Navel orange trees, are shown in Table (5) revealed that all treatments significantly increased TSS %, VC (mg/100 g juice) and decrease total acidity % than the control in both spraying (once or twice) and in the two seasons. However, no significant differences were noticed among the treatments under study Berelex (75ppm GA<sub>3</sub>), Dotra (1L/600L) and Micro falcon (1L/600L) for both seasons when TSS % were concerned. Meanwhile, the highest significant fruit VC content was obtained when trees were sprayed once or twice with GA<sub>3</sub> in comparison the other used treatments and the control in the 1<sup>st</sup> and the 2<sup>nd</sup> seasons. On the other wise, treated trees in twice with Micro falcon (1L/600L) gave the lowest significant values of acidity (1.02 %) in the first season and treated once with GA<sub>3</sub> in the second seasons (1.00 %) when compared with the other treatments including the control. Generally, the above results disclosed that the trees sprayed with agrochemical foliar treatments enhanced the highest improvement of all chemical properties study.

Our results partially agreed with the findings of Ingle *et al.*, (2001) on Nagpur mandarin, El-Sabagh and Ahmed, (2004) on Anna apple, Moneruzzaman *et al.*, 2011 on Wax apple and Hikal (2013) on Washington Navel orange trees. They reported that, application of GA<sub>3</sub> increased TSS % and VC. On the other hand, Saleem *et al.*, (2008) found that application of GA<sub>3</sub> reduced TSS % and VC content of Sweet orange.

**Table 5:** Some chemical characteristics of Washington Navel orange fruits as affected by different agrochemical foliar sprays in two times during 2019 and 2020 seasons

| Treatments                                      | TSS %             |                     | TA %              |                     | VC (mg/100 g)     |                     |
|---|-------------------|---------------------|-------------------|---------------------|-------------------|---------------------|
|   | Spraying once (*) | Spraying twice (**) | Spraying once (*) | Spraying twice (**) | Spraying once (*) | Spraying twice (**) |
| <b>2019 season</b>                              |                   |                     |                   |                     |                   |                     |
| T <sub>1</sub> Control "water only"             | 11.05 b           | 11.05 b             | 1.04 b            | 1.04 a              | 42.19 d           | 42.19 d             |
| T <sub>2</sub> Berelex (75ppm GA <sub>3</sub> ) | 12.50 a           | 12.51 a             | 1.01 a            | 1.00 c              | 56.20 a           | 55.91 a             |
| T <sub>3</sub> Dotra "CATy-BOR" (1L/600L)       | 12.31 a           | 12.29 a             | 1.02 a            | 1.01 bc             | 53.81b            | 53.50 b             |
| T <sub>4</sub> Micro falcon (1L/600L)           | 12.22 a           | 12.26 a             | 1.04 b            | 1.02 b              | 49.00 c           | 46.77 c             |
| <b>2020 season</b>                              |                   |                     |                   |                     |                   |                     |
| T <sub>1</sub> Control "water only"             | 11.15 b           | 11.15 b             | 1.07 a            | 1.07 a              | 46.89 d           | 46.89 d             |
| T <sub>2</sub> Berelex (75ppm GA <sub>3</sub> ) | 12.60 a           | 12.62 a             | 1.00 c            | 1.03 b              | 57.00 a           | 60.08 a             |
| T <sub>3</sub> Dotra "CATy-BOR" (1L/600L)       | 12.41 a           | 12.43 a             | 1.05 b            | 1.06 a              | 55.03 b           | 56.09 b             |
| T <sub>4</sub> Micro falcon (1L/600L)           | 12.33 a           | 12.33 a             | 1.05 b            | 1.02 b              | 51.16 c           | 52.99 c             |

Means in column followed by the same letter are not significantly different according to LSD test (P = 0.05).

### 4. Conclusion

The present investigations of foliar spray of (Berelex), (Dotra CATY-BOR) and (Microfalcon) on Washington Navel orange trees were spraying once at (full bloom) and twice at (full bloom and at marble stage), it revealed that the lowest percentage of June drop and increase on initial fruit set %, final fruit retention % and thus increase of yield and its components, with the highest fruit weight, juice percentage, ascorbic acid as well as minimum titratable acidity and peel thickness were observed with the treatment foliar spraying GA<sub>3</sub> at 75 ppm twice. Hence, it can be inferred that the application of growth regulators like GA<sub>3</sub> is beneficial in increasing the tree productivity and fruit quality of Washington Navel orange. The treatment T<sub>2</sub>\*\* (75ppm GA<sub>3</sub>) was the best in terms of overall enhancement of yield and fruit quality attributes of Washington Navel orange.

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