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Foliar Spraying with Amino Acids, and Calcium Boron, with/without GA3 on The Vegetative Growth and Productivity of The Valencia Orange Trees

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ABSTRACT

This study was done on 20-year-old fruitful Valencia orange trees budded on Volkamer lemon as rootstock, in an orchard with clay loamy soil that received Flood irrigation and was located in the Al-Bustan area, during the 2018/2019 and 2019/2020 seasons, in the Egyptian governorate of Buhaira , to determine the effect of foliar spray treatment using amino acids , calcium boron with or without Gibberellic acid "GA3" on the vegetative growth and fruit productivity of Valencia orange . The obtained results indicate that the employed treatments have a noticeable activity for enhancing vegetative growth parameters such as shoot length, stem diameter (cm), the average number of leaves/ shoot, and leaf area., relative to untreated, the applied treatments boosted the percentages of fruit set and remaining fruits, as well as limiting fruit dropping and boosting yield per tree and yield per feddan. In general, the combination of foliar spraying with Amino acid at 2g/L + GA3 at 20 ppm followed by Calcium boron at 2g/L + GA3 at 20 ppm was found to be the most successful treatment for the majority of the parameters studied in this study.

KEYWORDS: Valencia orange, Amino acids, calcium boron, Gibberellic acid, growth and productivity

1. INTRODUCTION

In Egypt, orange is one of the most widely grown citrus fruits.. Orange represents a large part of the exported fruit crops, which contribute effectively to the Egyptian agricultural economy. In Egypt, Orange orchards occupy 329849.5 Feddans and produced about 3 million tons of fresh fruits with an average of 9.10 tons/fed (FAOSTAT, 2021). Orange fruits can also be consumed whole or juiced, higher concentrations of pectins, organic acids, plant pigment, vitamins, and minerals can be found in orange fruits. which are used in various industrial processes to treat a variety of illnesses (Hulme, 1971) .

Numerous researchers, such as (Abd-Allah, 2006), found out the advantages of GA3 foliar spray and nutrient elements to produce high yield high fruit quality. According to Elsese et al. (2005), using GA3 alone or in combination with zinc during the early stages of fruiting enhanced the number of mandarin fruits that were harvested.

Amino acids are regarded as precursors and fundamental components of proteins, that are essential to promote cell development. They serve as buffers, including both basic and acidic groups, and aid in preserving a suitable pH balance inside the plant cell. According to Davies (1982), amino acids can change essential physiological processes that determine plant growth and productivity.

In order to maximize plant growth, both vegetative and root growth of fruit seedlings, amino acid fertilizers can improve soil mineral availability to the plant By enhancing the vegetative system, It promotes the development of plants. (Al-Alaf 2017). organic nitrogen fertilizers and natural substances considered as amino acid that play an essential role in maintaining the balance of a plant's growth. and enhance the plant to be more responsive to fertilizers for instance, foliar spray with amino acid quickly penetrates all leaf cells, increases chlorophyll concentration, and gives the plant the energy needed for synthesizing proteins . (Nag et al. 2001).

The foliar spray with fertilizers containing amino acids has been shown in numerous studies to improve fruit crops' vegetative systems (Al-Thafi et al. 2013; Al-Zubaidi 2017; Muhammad 2019; Qabaa 2019; Alalaf 2019; Al-Shareefi et al. 2020).

Fruit quality (fruit set, firmness, size, and TSS) and productivity were also positively impacted by calcium and boron. Foliar fertilization has various advantages, including being more effective than soil application (Chandler et al., 1931), quick responses and equal distribution (Umer et al., 1999). The crucial role of micronutrients, such as B, which improved tree yield and yield quality (Shoeib and El Sayed, 2003). (Shoeib and El Sayed, 2003). Numerous studies on the use of boron have revealed that it plays a significant role in the movement of hormones that activate absorption of the ion , flowering, and produce pollen in trees. (Robbertse et al., 1990; Talaie et al., 2001; Wojcik and Wojcik, 2003) increased fruit set and fruit physical characteristics (Peryea et al., 2003) and it minimizes the causes of the lower yield. (Raese, 1989). Boron participates in several processes, including the transfer of sugar and carbohydrates and protein synthesis. (Abdel-Fattah et al., 2008).

A foliar spray of calcium can be used as a macronutrient. Some fruit quality parameters are positively impacted by spraying ($Ca2+$). (Asgharzade and Babaeian, 2012). They stated that calcium contributed to improved fruit shelf life, yield, fruit firmness, and TSS increase. Calcium blocks physiological disorders, reduces respiration rate , inhibits fruit decay, and weight loss. (Magee et al., 2002). Plich and Wojcik (2002) confirmed that foliar spray Stanley and Dbrowicka Prune cvs. (*Prunus domestica L.)* with calcium increased the firmness of the fruit at harvest and, as a result, slowed the fruit's ability to soften when stored for a long time at low temperatures. Addittionally , Shukla (2013) indicated that the foliar spray with Ca , B , and (Ca + B) on gooseberry , results showed that the combination treatment at 0.4% produced the highest yield, dry matter, juice content, ascorbic acid , fruit size, and fruit length.

The aim of this study was to determine the influence of using gibberellic acid (GA3) and amino acids and Ca B on increasing vegetative growth and productivity of Valencia orange trees grown in the Al-Bustan area, Buhaira governorate, Egypt.

2. MATERIALS AND METHODS

The current investigation was carried out during 2018/2019 and 2019/2020 seasons at a suitable orchard located in the Al-Bustan area, Buhaira governorate, Egypt .This study used (Citrus sinensis L. Osbeck) that were 20 years old . For this experiment therty bearing trees were carefully chosen and dedicated. All trees were planted 4X6 metres apart on Volkamer lemon rootstock with flood irrigation grown in clay loamy soil.

Trees were randomly chosen and healthy, relatively consistent in their growth vigour, free of diseases, and regularly receiving the same horticulture practises as for chemical and organic farming in this area.

These studies were done to examine the impact of some stimulant compounds on vegetative growth, leaf nutritional requirements and some fruiting aspects as well as some fruit characteristics of the orange cultivar "valencia". The investigated treatments representative of the different nine treatments besides the ordinary treatment (control) as follows.

1 - Spray trees with tap water (control treatment).
2- Spray trees with GA_3 at 20 ppm.
3- Spray trees with amino acids at 1 g/L.
4- Spray trees with amino acids at 1 g/L + GA_3 at 20 ppm.
5- Spray trees with amino acids at 2 g/L.
6- Spray trees with amino acids at 2 g/L + GA_3 at 20 ppm.
7- Spray trees with calcium boron at 1.0 cm/L.
8- Spray trees with calcium boron at 1.0 cm/L + GA_3 at 20 ppm.
9- Spray trees with calcium boron at 2.0 cm/L.
10- Spraytrees with calcium boron at 2.0 cm/L + GA_3 at 20 ppm.

Each treatment in the study was replicated four times, and each replication was represented by a single tree. The treatments were arranged in a completely randomized block design.

2.1.Vegetative Growth Measurements:

The impact of all investigated anti-salt stress materials on some vegetative growth traits was evaluated, on four selected branches well distributed around the main stem of each replicate (tree) were tagged. On each selected branch ten newly emerging shoots were tagged and the vegetative growth characteristics were measured in late October during both seasons, as follows:

1. Shoot length (cm)
2. Shoot diameter (cm) at the base of the shoot
3. Number of leaves / Shoot
4. Leaf area (cm^2) by using Chou (1966) equation

2.2. Fruiting measurements:

2.2.1. Fruit set percentage:

Fruit set percentage was estimated according Fouad *et al.,* (1992) equation.

2.2.2. Fruit retention and drop %:

Fruit retention (%) and drop (%) were estimated in the 1st week of July during both seasons.

According to the following equation:

Fruit retention (%)

$$= \frac{\text{No. of presented (remained) fruits at a given date}}{\text{No. of setting fruitlets}} X100$$

Fruit drop (%) =

$$= \frac{(\text{No. of set fruitlets} - \text{No. of presently retained fruitlets})}{\text{Number of setting fruitlets}} X100$$

Yield:

Fruit harvesting was carried out in mid of February during both seasons, then fruits weighted in kilogrammes after being counted. The yield was estimated as either kg/tree or the number of fruits/tree.

2.3. Statistical analysis:

Using the analysis of variance method recommended by Snedecor and Cochran (1980), the results acquired through the two seasons of this experiment were statistically analysed. However, the Duncan's multiple range test (Duncan, 1955) was used to compare means at the 5% level of probability

3. RESULTS AND DISCUSSION

3.1. Effect of foliar spray of amino acids & calcium boron without and with GA3 and interaction between them on some vegetative growth parameters.

The orange plants' response to the effects of each studied variable was examined. " factor i.e., GA_3 foliar application, amino acids and calcium boron and their interactions. .

3.1.1. Shoot length and stem diameter (cm).

Concerning the specific effect of (Without or with GA_3) foliar application rates, data concerned in Table (1) illustrated that the shoot length and stem diameter responded specifically with GA_3 during the both seasons of the experimental study. However, the greatest increase in shoot length and stem diameter was significantly exhibited by those Valencia orange trees supplied with GA_3 (16.72 & 16.76 cm) and (0.396 & 0.398 cm) during two growing seasons. But the reverse trend was detected without GA_3 rates (14.33 & 14.36 cm) and (0.359 & 0.361 cm)

Table 1. Effect of foliar spray with amino acids; calcium boron and without and with GA_3 and combination between on shoot length and stem diameter (cm) of Valencia orange during the two successive seasons.

Parameters	Shoot length (cm)			Stem diameter (cm)		
Treatments	**Without- GA3**	**With- GA3**	**Mean**	**Without- GA3**	**With- GA3**	**Mean**
			First season; 2018/2019			
Spraying trees with tap water (control).	11.38j	13.70i	12.54E	0.333g	0.340fg	0.337D
Spraying trees with amino acids at 1 g/L.	14.88g	17.17c	16.03C	0.361de	0.403bc	0382BC
Spraying trees with amino acids at 2 g/L.	15.60e	18.23a	16.92A	0.377d	0.423a	0.400A
Spraying trees with Ca B at 1.0 cm/L.	14.53h	16.62d	15.58D	0.355ef	0.397c	0.376C
Spraying trees with Ca B at 2.0 cm/L.	15.25f	17.87b	16.56B	0.368de	0.415ab	0.392B
Mean	14.33B	16.72A		0.359B	0.396A	
			Second season; 2019/2020			
Spraying trees with tap water (control).	11.46i	14.00h	12.73E	0.335f	0.343ef	0.339D
Spraying trees with amino acids at 1 g/L.	14.97f	17.17c	16.07C	0.362cd	0.405b	0.384BC
Spraying trees with amino acids at 2 g/L.	15.45e	18.25a	16.85A	0.380c	0.426a	0.403A
Spraying trees with Ca B at 1.0 cm/L.	14.43g	16.57d	15.50D	0.358de	0.402b	0.380C
Spraying trees with Ca B at 2.0 cm/L.	15.48e	17.83b	16.66B	0.371cd	0.416ab	0.394AB
Mean	14.36B	16.76A		0.361B	0.398A	

Means followed by the same letter in a column or row do not differ significantly according to Duncan's New Multiple Range tests at P = 0.05.

which induced significantly the least shoot length and stem diameter during both the 2019 and 2020 seasons.

Regarding to the specific effects of several substances under research that have been studied i.e., amino acids and calcium boron foliar application, as illustrated by the data in the same tables that all examined applications substantially improved the control trees. Spraying trees with amino acids at 2 g/L. treatment was the greatest values (16.92 & 16.85 cm) and (0.400 & 0.403 cm) for shoot length and shoot diameter in the two successive seasons, respectively. However, both (spraying trees with Ca B at 2.0 cm/L.) and (sprayed with amino acids at 1 g/L.) assessed second and third statistically, respectively. Additionally, the control trees showed the lowest value, thus rendering them statistically inferior. (12.54 & 12.73 cm) and (0.337 & 0.339 cm) in shoot length and stem diameter during both seasons.

According to the effects of the interactions between various treatments on both investigated growth traits (shoot length and stem diameter) of Valencia orange trees, data shown in Table (1) showed that the individual effect of each factor i.e., (without and with GA3 and amino acids, calcium boron and control) treatments ,during both seasons. The foliar application were directly reflected on their combinations. However, the combinations between the (With GA3) foliar application rates (With GA3 + spraying trees with amino acids at 2 g/L.) foliar applied combination treatment exhibited statistically the greatest value in shoot length and stem diameter of Valencia orange trees during both seasons, respectively. On the opposite, the control treatment of Valencia orange trees showed statistically inferior as induced the least value (11.38 & 11.46 cm) and (0.333 & 0.335 cm) in shoot length and stem diameter in the both seasons, respectively.

3.1.2. Number of leaves per shoot and leaf area.

Data in Table (2) illustrated that the average number of leaves per shoot and leaf area (cm^2) responded specifically to the (GA_3) foliar application treatments. Furthermore, the same trend previously found with shoot length was also detected in this concern. In other words, the (GA_3) treatments (8.56 &8.89) and (24.35 & 24.82 cm^2) were superior and exhibited the highest levels of the number of leaves per shoot and leaf area parameters during the two seasons, respectively. Meanwhile , the least number of leaves per shoot (6.73 & 7.11) and average leaf area (20.11 &

Table 2. Effect of foliar spray with amino acids; calcium boron and without and with GA3 and combination between on the number of leaves/plant and leaf area (cm2) of Valencia orange during the two successive seasons .

Parameters	Number of leaves/plant			leaf area (cm2)		
Treatments	Without- GA3	With- GA3	Mean	Without- GA3	With- GA3	Mean
			First season; 2018/2019			
Spraying trees with tap water (control).	5.67i	6.00h	5.84E	15.64i	15.77hi	15.71D
Spraying trees with amino acids at 1 g/L.	6.67g	9.00c	7.84C	15.99h	26.39c	21.19C
Spraying trees with amino acids at 2 g/L.	7.67e	10.00a	8.84A	23.51f	27.36a	25.44A
Spraying trees with Ca B at 1.0 cm/L.	6.67g	8.00d	7.34D	21.23g	25.26d	23.25B
Spraying trees with Ca B at 2.0 cm/L.	7.00f	9.78b	8.39B	24.17e	26.98b	25.58A
Mean	6.73B	8.56A		20.11B	24.35A	
			Second season; 2019/2020			
Spraying trees with tap water (control).	6.33h	7.00g	6.67D	16.36i	17.06h	16.71E
Spraying trees with amino acids at 1 g/L.	7.11fg	9.22c	8.17B	17.43g	26.56c	22.00D
Spraying trees with amino acids at 2 g/L.	7.78e	9.67b	8.73A	24.31e	27.95a	26.13A
Spraying trees with Ca B at 1.0 cm/L.	7.00g	8.33d	7.67C	22.13f	25.41d	23.77C
Spraying trees with Ca B at 2.0 cm/L.	7.33f	10.22a	8.78A	24.33e	27.14b	25.74B
Mean	7.11B	8.89A		20.91B	24.82A	

Means followed by the same letter in a column or row do not differ significantly according to Duncan's New Multiple Range tests at P = 0.05.

20.91 cm2) were statistically produced by the treatment (without GA3) foliar applied during the two seasons, respectively.

Results in Tables (2) revealed that the number of leaves per shoot and average leaf area followed approximately the same result during the both seasons. All studied treatments significantly exhibited the highest number of leaves per shoot and average leaf area relative to control treatments during both 2019 and 2020 seasons, respectively. However, the greatest number of leaves per shoot and the average leaf area showed a significant correlation to the (spraying trees with amino acids at 2 g/L) treated trees followed statistically by (trees sprayed with Ca B at 2 g/L) in both seasons. In contrast, the opposite result with untreated) control.

Which induced, statistically, the lowest number of leaves per shoot and the average leaf area during the two seasons, respectively.

Concerning to the interaction and influence of the various (GA3) and (amino acids, calcium boron, and control) combinations treatments on the number of leaves per shoot and average leaf area, data in Table (2) showed the highest number of leaves/shoots and average leaf area. Were always in concomitant with those two combinations between the (GA3 + spraying trees with amino acids at 2 g/L) then followed (GA3 + spraying trees with Ca B at 2 g/L 2) combination treatments. Contrary to that, the opposite trend was detected with untreated and (without GA3) treatments, while both significantly reduced the average leaf area and the number of leaves per shoot during the 2019 and 2020 growing seasons. In addition, the other combination treatments between the two ranges mentioned above with a relatively variable response trend.

3.2. Response of some fruiting parameters:

Concerning to the fruit characteristic investigated (fruit set percentage , fruit retention and fruit drop as well as yield (kg/tree) and yield (ton/fed.)) in response to the specific effect, of the tested factors i.e., GA_3 foliar application, amino acids and calcium boron as well as their interaction during 2018/2019 and 2019/2020 seasons (Tables 3, 4 & 5).

3.2.1. Fruit set and fruit retention percentages:

According to data in Table (3), showed that the percentage of fruit set on Valencia orange trees in response to the influence of GA3 treatments and found that the fruit set percentage was affected by the investigated levels of GA_3

Table 3. Effect of foliar spray with amino acids; calcium boron and without and with GA3 and combination between on fruit set (%) and fruit retention (%)of Valencia orange during the two successive seasons .

Parameters	Fruit set (%)			Fruit retention (%)		
Treatments	**Without- GA3**	**With- GA3**	**Mean**	**Without- GA3**	**With- GA3**	**Mean**
	First season; 2018/2019					
Spraying trees with tap water (control).	10.25j	11.28i	10.77E	12.97h	13.39h	13.18E
Spraying trees with amino acids at 1 g/L.	12.83g	22.14c	17.49C	17.00f	22.31c	19.66C
Spraying trees with amino acids at 2 g/L.	19.19e	25.15a	22.17A	19.89d	25.26a	22.58A
Spraying trees with Ca B at 1.0 cm/L.	11.95h	20.26d	16.11D	15.42g	22.02c	18.72D
Spraying trees with Ca B at 2.0 cm/L.	*18.18* f	*24.28* b	21.23B	17.98e	24.42b	21.20B
Mean	14.48B	20.62A		16.65B	21.48A	
	Second season; 2019/2020					
Spraying trees with tap water (control).	13.57g	11.43j	12.50E	13.14i	13.84h	13.49E
Spraying trees with amino acids at 1 g/L.	12.91h	22.44c	17.68C	17.10f	22.10c	19.60C
Spraying trees with amino acids at 2 g/L.	19.80e	25.01a	22.41A	19.78d	25.36a	22.57A
Spraying trees with Ca B at 1.0 cm/L.	12.16i	20.42d	16.29D	15.76g	22.09c	18.93D
Spraying trees with Ca B at 2.0 cm/L.	18.32f	24.70b	21.51B	18.08e	24.43b	21.26B
Mean	15.35B	20.80A		16.77B	21.56A	

Means followed by the same letter in a column or row do not differ significantly according to Duncan's New Multiple Range tests at P = 0.05.

treatments. While the highest values with GA3 treated trees (20.62 & 20.80 %) and (21.48 & 21.56 %) exhibited statistically the highest percentage of fruit set and fruit retention (%) during both seasons, respectively. Whereas, the untreated Valencia orange trees had the least values (10.77 & 12.50 %) and (13.18 and 13.49 %) of fruit set and fruit retention percentages during two seasons, respectively. The same result was found during both seasons.

Concerning the effect of amino acids and calcium boron, data obtained during the two seasons as shown from the same Tables displayed obviously that all treatments significantly improved the percentages of fruit set and fruit retention as foliar application relative to control. Differences in percentage of fruit set and retention due to the differential investigated treatments foliar application were significant as compared to each other in most cases during both seasons.

According to data during both seasons and represented in Tables (3) revealed that percentage of the fruit set and fruit retention of Valencia orange trees followed a firm trend regarding their response to the interaction effect of the various combinations between the different factors (GA3) and (spraying trees with amino acids at 2 g/L.) foliar application, during the two seasons, respectively. The highest percentages of fruit set and fruit retention were significant associated with foliar application (with GA3 plus spraying trees with amino acids at 2 g/L) treated trees, while both (spraying trees with Ca B at 2 g/L) and (spraying trees with amino acids at 1 g/L) combinations came descending second and third to the superior combination from the standpoint of statistic. On the contrary, the least fruit set and fruit retention percentages were significantly in close relationship to those Valencia orange trees subjected to control foliar application treatment in both seasons.

3.2.2. Fruit drop (%) and the number of fruit/tree.

Data in Table (4) illustrate the effect of spraying without and with GA_3 on the total fruit drop (%) of Valencia orange trees in the two successive seasons. percentage of fruit drop was significantly affected by no foliar application GA_3 treatments in both seasons. Fruit drop percentage character was significantly higher in the without GA_3 than with GA_3 foliar application in both seasons, respectively.

Data tabulated in Table (4) indicated that the highest fruit drop percentage during both seasons

Table 4. Effect of foliar spray with amino acids; calcium boron and without and with GA3 and combination between on fruit drop (%) and the number of fruits/trees of Valencia the two successive seasons.

Parameters	Fruit drop (%)			No. of fruits/tree		
Treatments	**Without- GA3**	**With- GA3**	**Mean**	**Without- GA3**	**With- GA3**	**Mean**
	First season; 2018/2019					
Spraying trees with tap water (control).	87.03a	86.61a	86.82A	268.3i	272.7h	270.5E
Spraying trees with amino acids at 1 g/L.	83.00c	77.69f	80.35C	285.7f	299.3c	292.5C
Spraying trees with amino acids at 2 g/L.	80.11e	74.74h	77.43E	292.7e	326.7a	309.7A
Spraying trees with Ca B at 1.0 cm/L.	84.58b	77.98f	81.28B	279.3g	297.0d	288.2D
Spraying trees with Ca B at 2.0 cm/L.	82.02d	75.58g	78.80D	293.3e	318.0b	305.7B
Mean	83.35A	78.52B		283.9B	302.7A	
	Second season; 2019/2020					
Spraying trees with tap water (control).	86.86a	86.16b	86.51A	269.7h	276.7g	273.2E
Spraying trees with amino acids at 1 g/L.	82.90d	77.90g	80.40C	285.3e	302.7c	294.0C
Spraying trees with amino acids at 2 g/L.	80.22f	74.64i	77.43E	297.3d	327.3a	312.3A
Spraying trees with Ca B at 1.0 cm/L.	84.24c	77.91g	81.08B	281.7f	298.3d	290.0D
Spraying trees with Ca B at 2.0 cm/L.	81.92e	75.57h	78.75D	297.7d	318.7b	308.2B
Mean	83.	78.44B		286.3B	304.7A	

Means followed by the same letter in a column or row do not differ significantly according to Duncan's New Multiple Range tests at P = 0.05.

were recorded with control.

Data in Table (4) show the effect of GA3 without or with on the number of fruit/tree of Valencia orange trees in the both seasons. The greatest significance values were achieved with GA3. (302.7 and 304.7 fruit No./tree) treatments in both seasons. While, the least significant values were found in the absence of GA3 (283.9 and 286.3 fruit No./tree) in both seasons, respectively.

The highest levels of fruit drop were observed in the control (86.82 & 86.51%) in both seasons, respectively. meanwhile, the lowest fruit drop percentage (77.43 & 77.43 %) was obtained in trees that treated with amino acids at 2 g/L) in both seasons, respectively.

The obtained date indicated that the highest values of the number of fruits/tree (309.7 & 312.3 fruit No./tree) were observed with spraying trees with amino acids at 2 g/L) treatment in both seasons. meanwhile, the results showed that the lowest number of fruit/tree (270.5 and 273.2 fruit No./tree) were obtained with untreated trees during two seasons, respectively.

Concerning the interaction between GA3 and amino acids, Ca B treatments, data indicated that the highest values of fruit drop (%) (87.03 & 86.86 %) were recorded without GA3 plus control treatment in both seasons, respectively. Meanwhile, the lowest value of fruit drops percentage (74.74 & 74.64 %) was obtained in treatment included GA3 plus spraying trees with amino acids at 2 g/L in both seasons, respectively Data demonstrated that the highest values of the number of fruit/tree (326.7 & 327.3) were obtained with GA3 plus spraying trees with amino acids at 2 g/L. Meanwhile, the lower values of the number of fruit/tree in the two seasons (268.3 & 269.7 fruit No./tree) were obtained without GA3 + control during the both seasons, respectively.

3.2.3. Yield (Kg/tree) and (ton/fed):

As shown in Table (5) the yield (kg/tree) and (ton/fed.) of Valencia orange trees were significantly varied among different without or with GA_3 foliar application treatments. However, all applications of GA_3 on Valencia orange trees increased significantly with GA_3 than without GA_3 (55.61 & 56.32 kg/tree) and (9.73 & 9.86 ton/fed.) in both seasons, Table (5) show that yield (kg/tree) and (ton/fed.) were significantly raised during both seasons.

The data shows that application with amino acids

Table 5. Effect of foliar spray with amino acids; calcium boron and without and with GA3 and combination between on yield (kg/tree and ton/fed.) of Valencia orange during the two successive seasons .

Parameters	Yield (kg/tree)			Yield (ton/fed.)		
Treatments	Without- GA3	With- GA3	Mean	Without- GA3	With- GA3	Mean
	First season; 2018/2019					
Spraying trees with tap water (control).	45.73i	46.87h	46.30E	8.00g	8.20fg	8.10E
Spraying trees with amino acids at 1 g/L.	49.66f	54.43c	52.05C	8.69e	9.53c	9.11C
Spraying trees with amino acids at 2 g/L.	51.55e	63.43a	57.49A	9.02d	11.10a	10.06A
Spraying trees with Ca B at 1.0 cm/L.	48.20g	52.77d	50.49D	8.43ef	9.23cd	8.83D
Spraying trees with Ca B at 2.0 cm/L.	51.42e	60.53b	55.98B	9.00d	10.59b	9.80B
Mean	49.31B	55.61A		8.63B	9.73A	
	Second season; 2019/2020					
Spraying trees with tap water (control).	46.12i	47.74h	46.93E	8.07g	8.35fg	8.21E
Spraying trees with amino acids at 1 g/L.	50.38f	55.11c	52.75C	8.82e	9.65c	9.24C
Spraying trees with amino acids at 2 g/L.	53.02e	64.20a	58.61A	9.28d	11.24a	10.26A
Spraying trees with Ca B at 1.0 cm/L.	49.23g	53.67d	51.45D	8.62ef	9.39cd	9.01D
Spraying trees with Ca B at 2.0 cm/L.	53.03e	60.86b	56.95B	9.28d	10.65b	9.97B
Mean	50.36B	56.32A		8.81B	9.86A	

Means followed by the same letter in a column or row do not differ significantly according to Duncan's New Multiple Range tests at P = 0.05.

and calcium boron the most effectively improved the yield (kg/tree) and (ton/fed.) than control and other treatments in both seasons, spraying trees with amino acids at 2 g/L gave the highest values (57.49 & 58.61 kg/tree) and (10.06 & 10.26 ton/fed.) in both seasons, respectively. Meanwhile, the results show that the lower values of yield (46.30 & 46.93 kg/tree) and (8.10 & 8.21 ton/fed.) were obtained with trees treated by spraying with tap water (control) in both seasons, respectively.

Concerning the interaction between with or without GA3 and amino acids and Ca B foliar applied treatments, data indicated that, the superior values of yield (kg/tree) and (ton/fed.) (63.43 & 64.20 kg/tree) and (11.10 & 11.24 ton/fed.) were obtained in with GA3 + Spraying trees with amino acids at 2 g/L foliar applied treated in the two seasons, respectively. Meanwhile, the least values of yield (45.73 & 46.12 kg/tree) and (8.00 and 8.07 ton/fed.) were obtained in without GA3 foliar application + spraying tap water in the two season, respectively.

4. Discussion

Micronutrients can more easily be absorbed and transported into plant tissue due to the chelating activity of amino acids on those substances and their low molecular weight and permeability of cell membranes . (1993) Westwood. Ahmed *et al*., (2012) observed that spraying Valencia orange trees (14 years old) with amino acid tryptophan at concentrations of 25, 50, and 100 ppm led to a enhanced vegetative growth traits compared to the control.

Elwan *et al*., (2008) noticed that all shoot and root traits were significantly higher in the sour orange (Citrus aurantium L.) seedlings when boron and NAA spraying were combined. Ibrahim and Al-Wasfy (2014) found that four treatments with a combination of boric acid, potassium sulphate, potassium silicate, and sodium selenite greatly increased the leaf area of Valencia orange plants.. Masoud *et al.*, (2019) When boric acid, zinc sulphate, and potassium silicate were studied for their effects on Baldy mandarin tree development, it was shown that applying B, Zn, and Si foliar treatments individually or together greatly improves shoot and leaf characteristics growth when compared to the control. While increasing the concentrations of B, Zn, or Si had no noticeable impact. Laila *et al., (*2019) examined the effect of calcium carbonate and kaolin sprayed on the mineral content, pigment, and vegetative growth of Kalamata and Manzanillo olive trees. Under both kaolin and calcium carbonate, they found a significant difference in the two cultivars' shoot length, shoot diameter, and leaf area. Aly *et al., (*2015) evaluated the impact calcium chloride, zinc sulphate, and potassium sulphate foliar spray on fruit yield and quality of Washington navel orange trees and found that all treatments improved weight of fruits per tree (kg), and yield weight/feddan (kg) compared to the control. Meena *et al*., (2016) found that spraying with the combination of calcium nitrate 3.0% , boric acid 0.6% and zinc sulphate 0.6%) resulted to maximized yield per tree, and anticipated yield per hectare.. Alaa El-Din and Abo El-Enin (2017) evaluated the influence of GA3, K, and Ca foliar spray , alone or the interaction between them on 'Washington' Navel orange. According to the findings, all treatments enhanced fruit set and production. Moawad *et al., (*2017) examined the influence of Boric acid, potassium silicate, and calcium chloride spraying on Balady mandarin trees. They confirmed that the percentages of initial fruit setting, fruit retention, number of fruits per tree, and weight (kg) of Balady mandarin trees are all improved by the application of boric acid, potassium silicate, and calcium chloride separately and together .Ashour *et al., (*2017) examined the effects of GA3 at 100 ppm, 6-benzyl amino purine at 100 ppm, and boric acid at 250 ppm and their combination on fruit set, yield, and fruit quality of (Phonix dactylifera L) Barhee cv., They found that the trend in bunch weight and the yield/palm were identical. Compared to untreated, various treatments significantly impacted fruit set and bunch weight in both seasons. El-Sharabasy and Ghazzawy (2019) According to findings on the impact of adding borax on fruit physical characteristics of the Barhi date palm cultivar, both the fruit set and the yield % were considerably impacted by different borax concentrations

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الملخص العربي

الرش الورقي بالأحماض الأمينية والكالسيوم بورون مع أو بدون حمض الجبريلليك وتأثيرها على النمو الخضري والإنتاجية لأشجار البرتقال الفالنشيا

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أجريت هذه الدراسة على أشجار البرتقال فالنسيا بعمر ٢٠ عام مطعمة على أشجار ليمون فولكمار بأحد البساتين ذات تربة سلتية طينية بمنطقة البستان– محافظة البحيرة – مصر خلال عامى ٢٠١٨/٢٠١٩ و ٢٠١٩/٢٠٢٠ وذلك لدراسة تأثير الرش الورقى بالاحماض الأمينية والكالسيوم بورون في وجود أو عدم وجود حمض الجبريلليك علي النمو الخضري والمحصول ومكوناته. هذا وقد أظهرت النتائج التى تم الحصول عليها أن جميع المعاملات المستخدمة حسنت بشكل كبير صفات النمو الخضرى طول المحموع الخضرى, قطر الساق, عدد الأوراق للمجموع الخضرى ومساحة الورقة. بالإضافة إلى ذلك فقد أدت جميع المعاملات إلى تحسين نسبة عقد الثمار وخفضت نسبة تساقط الثمار مقترنا ذلك بزيادة معنوية فى محصول الشجرة و الفدان مقارنة بالكنترول. بصفة عامة. يعتبر رش الأحماض الأمينية بمعدل ٢جم/لتر + ٢٠ جزء فى المليون من حامض الجبريليك أفضل المعاملات تلاهها فى ذلك رش الكالسيوم بورون بمعدل ٢ جم/لتر + ٢٠ جزء فى المليون من حامض الجبريليك حيث أدت تلك المعاملات إلى تعظيم كل صفات النمو والمحصول موضع الدراسة.