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Effect of compound fertilizer (Amcolon) Addition and foliar spray of amino acids (Tecamin) on the chemical properties of the local variety orange saplings (Citrus sinensis)

ABSTRACT

This experiment was conducted in the lath house - Department of Horticulture and Landscape - College of Agriculture - Tikrit university during 2021 growing season, to study the effect of compound fertilizer addition (Amcolon) and amino acid (Tecamin) on chemical properties of orange saplings. It consisted two factors, the first is compound fertilizer at three levels, (0, 25 and 50 g plant-1) and the second is spraying with amino acid at three levels. (0, 1.25 and 2.5 ml. L-1). The experiment was designed according to Randomized Complete Block Design (RCBD) with three replications. The results showed that: Amcolon fertilizer at 50 g plant-1 increased significantly all studied properties (carbohydrates, chlorophyll, dry matter percent, nitrogen, phosphorous and potassium in leaves) which were 3.171%, 1.918 mg g-1, 70.15%, 2.072%, 0.2967%, 1.800%), respectively. Whereas, the spraying treatments with amino acids at 2.5 ml L-1 had highest values in same previous properties (3.057%, 1.637 mg g-1, 68.218%, 1.833%, 0.2867 and 1.508%), respectively.

INTRODUCTION

Citrus is one of the most important fruit crops in the world. Orang *Citrus sinensis* is one of the most famous types of citruses spread around the world. It belongs to Rutaceae family which is originally found in subtropical regions, then spread to other regions of the world (Al-Khafaji et al., 1990). The rank of orange is first in citrus and second among other fruits. The global production rate of citrus is about 152,448,800 tons and the global production of oranges is about 75,413,374 tons, Brazil produce about 16,713,543 tons and it its rank in the first place in the world (FAO 2018). In Iraq, orange cultivation is spread in the central and south-central regions, where the environmental conditions are appropriate. the number of fruit trees is about 6,383,881 trees, and the average production of one tree is (22.4 kg tree^{-1}) and the amount of production is 142.717 tons. Salah al-Din governorate comes in the first place, followed by Baghdad and then Diyala in in terms of the amount of production (Central Statistical Office, 2020). A number of countries, including some of the Middle East countries, suffer from the problem of food, which can only be solved by increasing the quantity of fruit production and improving the quality of fruits, and this comes through a group of factors, including the addition of chemical fertilizers, which was confirmed in many studies (CSA, 2011). Studies have shown that spraying plants with organic fertilizers containing amino acids led to an increase in their content of chlorophyll and growth and an increase in their ability to withstand environmental stresses (Nazi,D et al., 2002). The studies also indicated that the effects of foliar

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fertilization include an increase in yield, resistance to diseases and insects, an improvement in the ability of plants to resist drought, and an improvement in the qualitative and quantitative characteristics of fruits (Havlin et al., 2005). Several studies have proven that amino acids can directly or indirectly affect the physiological activities of the plant, besides, amino acids help improve soil bacteria, which facilitates the absorption of soil nutrients (El-Naggar et al., 2013). Amino acids are known as biological stimulants and have positive effects on plant growth and yield and greatly reduce injuries caused by abiotic stresses (Sadak et al., 2015). Amino acids are carboxylic acids that contain one or more amino groups, which are basic and necessary compounds in the process of manufacturing nucleic acids and protein. (Al-Daoudi, 1990 and Singh, 1999). Fikry, et al. (2020) found in a study conducted on 5-year-old Murcott tangerine trees to evaluate the effect of nitrogen fertilization, which led to a significant increase in the content of nitrogen, phosphorous and potassium in leaves. In a study done by Silas et al. (2017) the addition of different levels of nitrogen, phosphorous and potassium on the growth of sweet orange cultivar Kinnow that the treatment (10 kg plant-1 fertilizer farm, 1 kg plant-1 farm fertilizer, 65 g nitrogen, 40 One gm of phosphorous, 60 gm of potassium) gave the best plant height (87.33 cm), number of leaves (412.04), number of branches (28.06), and stem diameter (2.13 cm). In the study of Ahmed et al. (2012) it showed that spraying Valencia orange trees at 12 years old and grafted on the citrus root with the amino acid tryptophan at a concentration of 25, 50, 100 mg / liter caused a direct increase in most of the characteristics of vegetative growth (branch length, branch diameter, number of leaves, leaf area) and for the two growing seasons except for the length of the branches and leaf area, which decreased at the high concentration of 100 mg / liter, that the content of leaves from the total chlorophyll was not significantly affected by the spraying treatments compared to the control treatment. The treatment of 3 ml l^{-1} was superior to the rest of the other treatments, with a percentage of 2.58 and 2.53% for nitrogen, 0.154 and 0.165% phosphorous, and 1.73 and 1.86% potassium in the two seasons respectively. And between EL-Gioushy et al. (2018) when they studied spraying with different levels of amino acid 0, 1, 2, and 3 cm 3 L-1 on navel orange trees at the age of 12 years grafted on the origin of Citrus aurantium, and spraying was done five times starting from full flowering and then with an interval of one month during In the years 2016 and 2017, all experimental treatments were superior in the percentage of total carbohydrates in leaves and the concentration of major elements (NP K) compared to the control treatment during the two seasons of the study, and the treatment 3 cm 3 L-1 was characterized by giving the best results.The treatment 4 g l^{-1} gave the highest values for the two seasons of the study compared to the comparison treatment. Medan (2021) has shown apricot trees of the cultivar "Zaginya" that spraying with the amino acid arginine led to Significant difference in the leaves content of nitrogen, total chlorophyll and total carbohydrates. The experiment was conducted to know the effect of chemical fertilizer Amcolon and amino acids on transplants of the local cultivar of orange.

MATERIALS AND METHODS

This experiment was carried out in the lath house / the Department of Horticulture and Landscape /College of Agriculture / Tikrit University for the growing season 2021 on the one-year-old seedlings of orange, a local variety, which were grafted onto the sour orange *Citrus aurantium* rootstock. Irrigation and weeds control operations were also carried out to control insects and diseases. The lath house was covered with green net (Saran) from June to August that the shading rate was 50%. The experiment was begun at 1/3/2021 and finished at 1/12/2021.

Table (1) Some chemical and physical characteristics of the soil

The value	The value
7.54	7.54
2.4	2.4
1.12 -1 g. kg	1.12 -1 g. kg
Soil components	Soil components
37%	37%
32%	32%
31%	31%
Texture	Texture
0.14%	0.14%

It was done for analysis in the Department of Soil and Water Resources - College of Agriculture - Tikrit University

The study included the following factors:

- The first factor is compound fertilizer (Amcolon) with three levels:

1-Without adding (the control treatment).
2-25 g plant^{-1}
3-50 g plant^{-1}
Amcolon consist of 30%N, 10%P and 10%K + TE. It was applied six times, at the beginning of March, April, May, September, October and November.

- The second factor is the amino acid (Tecamin) with three levels:

1- Without adding (the control treatment)
2- 1.25 ml L^{-1}
3- 2.5 ml L^{-1}
The amino acid was sprayed in the morning until completely wet using a 3-liter hand-held sprinkler, after three days of treatment with Amcolon fertilizer.

Studied characteristics:

Samples were taken at the end of the season, specifically on 12/1/2021

1.Carbohydrate content in leaves (%) was estimated according to Joslyn (1970).
2.Chlorophyll content of leaves (mg g^{-1} fresh weight) was measured according to the method of Knudson et al. (1977) as the following equations:
Chlorophyll a (mg g-1 mw) = (13.70) (A665) – (5.76) (A649)
Chlorophyll b (mg g-1 mw) = (25.80) (A649) – (7.60) (A665)
Total Chl (mg g-1 mw) = Chl a + Chl, b
A = wavelength.

3.Dry matter percentage in leaves (%): was calculated (Al Sahhaf, 1989).
4.Nitrogen content of leaves (%) was determined using Microkjeldahl apparatus according to the method presented in Jones and Steyn (1973).
5.Phosphorous content of leaves (%) was determined by the ammonium molybdate blue colorimetric method, according to the method presented in (Bhargava and Raghupathi, 1999).
6.Potassium content of leaves (%) was estimated using a flame photometer type 378_Elicocl according to the method presented in (Bhargava and Raghupathi, 1999).

RESULTS AND DISCUSSION

1-Carbohydrate in leaves (%)

Table (2) shows that percentage of carbohydrate in the leaves had affected by adding Amcolon fertilizer. The third level (50g plant^{-1}) recorded highest value in this parameter 3.171%, while the control treatment gave the lowest value 2.816 %. spraying amino acids have had a significant effect for this trait, as we find that the third level (2.5 ml L^{-1}) has moral superiority over the rest of the levels, which recorded an increase (3.057%), while the comparison treatment (control) recorded the most valuable value of 2.908%. with regard to the interaction between the two factors. It was find that the third level of Amcolon fertilizer and the third and second level of amino acids, had a significant superiority over the rest of the interactions was 3.206%, and it did not differ significantly from the interaction between the third level of Amcolon and the second level of amino acids, that amounted 3.190%, while control treatment recorded the lowest value of 2.653%.

Table (2) Effect of compound fertilizer (Amcolon), spraying with amino acids (Tecamin) and their interaction on the total carbohydrates in leaves (%)

Amio acid / Amcolon	0.00 (control)	1.25 ml L^{-1}	2.50 ml L^{-1}	Effect of Amcolon fertilizer
0.00 (control)	2.653 f	2.873 e	2.923 de	2.816 c
25 g plant^{-1}	2.956 d	2.963 d	3.043 c	2.987 b
50 g plant^{-1}	3.116 b	3.190 a	3.206 a	3.171 a
Effect of amino acids	2.908 c	3.008 b	3.057 a	

* The averages of each group followed by different letters indicate that there are significant differences between them according to Duncan's multiple range test at 5% probability

2- Chlorophyll content of the leaves (mg g^{-1} fresh weight):

The results in Table (3) indicate that the chlorophyll content of leaves was significantly affected by the addition of Amcolon fertilizer, as the third level (50 g. pot^{-1}) had a significant effect on the remaining levels 1.918 mg g^{-1}fresh weight, compared to the comparison treatment (no addition) which gave the lowest percentage amounted 1.236 mg g^{-1}fresh weight. The spraying treatment with amino acids gave a significant increase in the content of chlorophyll leaves, as the third level (2.5 ml l^{-1}) was moral superiority over the rest of the levels, which amounted 1.637 mg g^{-1} fresh weight compared with control (no addition), which gave a percentage of 1.411 mg g^{-1} fresh weight. As the results of the same table indicated the interaction between the two factors, it was found that the third level of each of the Amcolon fertilizer and amino acids recorded a significant superiority over the rest of the interactions which approch2.046 mg g^{-1} fresh weight. The comparison treatment gave the lowest percentage 1.223 mg g^{-1} fresh weight.

Table (3) Effect of compound fertilizer (Amcolon), spraying with amino acids (Tecamin) and their interaction on the chlorophyll content of leaves (mg g^{-1} fresh weight)

Amio acid / Amcolon	0.00 (control)	1.25 ml L-1	2.50 ml L-1	Effect of Amcolon fertilizer
0.00 (control)	1.223 g	1.230 g	1.256 f	1.236 c
25 g plant-1	1.260 f	1.323 e	1.610 d	1.397 b
50 g plant-1	1.750 c	1.960 b	2.046 a	1.918 a
Effect of amino acids	1.411 c	1.504 b	1.637 a	

* The averages of each group followed by different letters indicate that there are significant differences between them according to Duncan's multiple range test at 5% probability

3- Dry matter in leaves (%):

As noted in Table (4), the superiority of the adding Amcolon fertilizer treatment, it gave the highest rate of dry weight at the third level (50 g) amounted 70.115, while the comparison treatment (no addition) gave the lowest percentage 65.800. In the treatment with amino acids, there were no significant differences between the levels, as well as between the interaction and the presence of significant differences between the treatments. The interaction treatment between Amcolon fertilizer and amino acids at the third level gave the highest dry weight percentage 70,587 and did not differ significantly with the interaction between the third level of Amcolon fertilizer and the second level of amino acids Mentres que o tratamento de comparación para a interferencia rexistrou o valor máis baixo which amounted to 65.447.

Table (4) Effect of compound fertilizer (Amcolon), spraying with amino acids (Tecamin) and their interaction on dry matter in leaves (%)

Amio acid / Amcolon	0.00 (control)	1.25 ml L-1	2.50 ml L-1	Effect of Amcolon fertilizer
0.00 (control)	65.447 c	65.593 c	66.360 c	65.800 b
25 g plant^{-1}	66.380 c	66.900 bc	67.710 abc	66.996 b
50 g plant^{-1}	69.657 ab	70.103 a	70.587 a	70.115 a
Effect of amino acids	67.161 a	67.532 a	68.218 a	

* The averages of each group followed by different letters indicate that there are significant differences between them according to Duncan's multiple range test at 5% probability

4- Nitrogen of leaves (%):

Table (5) indicates the response of nitrogen in the leaves by adding Amcolon fertilizer, as the third level of the fertilizer showed the highest significant difference 2.072%, while the comparison treatment gave the lowest percentage, which amounted 1.267%. The result showed that the treatment with spraying the amino acid significantly affects as the third level (2.5 ml.l^{-1}) significantly on the remaining levels amounted to 1.833% compared to the comparison treatment which amounted 1.537%, while we find that the interaction between the two factors had a significant effect as the interaction between the third level of Amcolon fertilizer and the amino acid gave the highest percentage 2.306% compared to the comparison treatment which recorded the lowest percentage was 1.226 %.

Table (5) Effect of compound fertilizer (Amcolon), spraying with amino acids (Tecamin) and their interaction on nitrogen (%) in leaves

Amio acid / Amcolon	0.00 (control)	1.25 ml L-1	2.50 ml L-1	Effect of Amcolon fertilizer
0.00 (control)	1.226 g	1.236 g	1.340 f	1.267 c
25 g plant^{-1}	1.516 e	1.773 d	1.853 c	1.714 b
50 g plant^{-1}	1.870 c	2.040 b	2.306 a	2.072 a
Effect of amino acids	1.537 c	1.683 b	1.833 a	

* The averages of each group followed by different letters indicate that there are significant differences between them according to Duncan's multiple range test at 5% probability

5- Phosphorous in leaves (%):

Table (6) shows that there are significant differences in phosphorous content of leaves as a result of the addition of Amcolon fertilizer, the third level (50 g. plant^{-1}) was significantly superior to the remaining levels, which gave the highest percentage of 0.2967%, while the comparison treatment (non-addition) gave the lowest percentage which reached 0.2065%. In terms of the effect of spraying with amino acids on the phosphorous content of leaves, find out that the third level gave the highest value of 0.2867% and was significantly superior with remaining levels, while control treatment gave the lowest value of 0.2269% and the interaction A interacción entre os dous factores tivo un efecto significativo, polo que a interacción entre o terceiro nivel de fertilizante Amcolon e os aminoácidos foi significativa en comparación co resto dos tratamentos, que deron un 0,3116%. A superposición de comparación deu o valor máis baixo de 0,1275%

Table (6) Effect of compound fertilizer (Amcolon), spraying with amino acids (Tecamin) and their interaction on phosphorous content (%) in leaves

Amio acid / Amcolon	0.00 (control)	1.25 ml L-1	2.50 ml L-1	Effect of Amcolon fertilizer
0.00 (control)	0.1275 f	0.2264 e	0.2656 d	0.2056 d
25 g plant^{-1}	0.2669 cd	0.2769 bcd	0.2829 bcd	0.2756 cbd
50 g plant^{-1}	0.2863 bc	0.2922 b	0.3116 a	0.2967 a
Effect of amino acids	0.2269 c	0.2652 b	0.2867 a	

* The averages of each group followed by different letters indicate that there are significant differences between them according to Duncan's multiple range test at 5% probability

6- Potassium of leaves (%):

Table (7) shows that the addition of Amcolon fertilizer has a significant effect on the potassium content of leaves, as we find that the third level of it (50 g. plant $^{-1}$) has significantly outperformed the remaining levels, giving an increase of 1.800%, while the comparison treatment without adding the lowest percentage amounted to 1.124%. We also note that the treatment of spraying with amino acids has a effect on this trait, as we find that the third level (2.5 ml L^{-1}) has achieved a significant superiority over the remaining levels, which recorded an increase of 1.508%, while the comparison treatment (non-addition) reached the lowest increase It reached 1.392%. In regard to the interaction between the two factors, the moral effect of the interaction between the third level of Amcolon fertilizer and amino acids gave the moral superiority over the remaining interactions, as it gave 1.816%,

Table (7) Effect of compound fertilizer (Amcolon), spraying with amino acids (Tecamin) and their interaction on potassium (%) in leaves

Amio acid / Amcolon	0.00 (control)	1.25 ml L-1	2.50 ml L-1	Effect of Amcolon fertilizer
0.00 (control)	1.122 f	1.123 f	1.126 F	1.124 c
25 g plant^{-1}	1.263 e	1.264 e	1.583 D	1.370 b
50 g plant^{-1}	1.790 c	1.795 b	1.816 a	1.800 a
Effect of amino acids	1.392 b	1.394 b	1.508 a	

* The averages of each group followed by different letters indicate that there are significant differences between them according to Duncan's multiple range test at 5% probability

We note from the results that the effect of the fertilizer led to a significant increase as shown in Tables 2,3,4,5,6 and 7), especially in the carbohydrate content of leaves. This increase is due to the role of nitrogen, phosphorous and potassium in the fertilizer, as nitrogen has a role in increasing the leaf area and the amount of chlorophyll tables and the consequent increase in the products of photosynthesis and the accumulation of carbohydrates, with evidence that its deficiency causes a decrease in the percentage of processed carbohydrates, especially starch (Al-Sahhaf, 1989). Nitrogen helps in building the vegetative system and the biological representation of chlorophyll pigment, and then increasing its concentration in the leaves, as well as its role in the synthesis of amino acids and proteins. It also agrees with Gehad et al (2005). The increase in moral nitrogen and potassium in orange leaves is due to the effect of amino acids, which is an essential component of nitrogen and enters into nitrogen metabolism and increases the activity of mitochondria, as well as the role of amino acids absorbed by plant leaves in reducing the effectiveness of the enzyme Urease, which reduces nitrogen loss through volatilization. The results also agreed with what was found Fayed et al. (2019) on peach trees Florida prince. As for the amino acid spray treatments, which led to an increase in chlorophyll levels in the higher concentrations, it may be attributed to the increased levels of cytokinins in those treatments (Aziz, 2013).

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تأثير إضافة السماد المركب (Amcolon) والرش بالأحماض الامينية (Tecamin) في الصفات الكيميائية لشتلات البرتقال (Citrus sinensis L.) صنف محلي

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الكلمات المفتاحية:
السماد المركب، Amcolon ، الاحماض الامينية ، Tecamin، شتلات البرتقال ، الصفات الكيميائية.

الخلاصة

أجريت هذه التجربة في الظلة الخشبية التابعة لقسم البستنة وهندسة الحدائق لكلية الزراعة / جامعة تكريت خلال موسم النمو 2021 لدراسة تأثير أضافة السماد المركب (Amcolon) بثلاثة مستويات (0 ، 25، 50 غم نبات1-) تمت الإضافة بواقع ستة مواعيد في بداية اذار والرشة الثانية في نيسان والرشة الثالثة في أيار اما الدفعة الثانية فكانت في شهر أيلول وشهر تشرين الاول وشهر تشرين الثاني والرش بالأحماض الامينية (Tecamin) بثلاثة مستويات (0 ، 1.25 ، 2.5 مل لتر-1). تم الرش بالأحماض الامينية صباحاً حتى البلل التام باستعمال مرشة يدوية سعة 3 لتر بعد ثلاثة أيام من المعاملة بالسماد المركب بواقع ستة مواعيد للرش، رشت الشتلات في بداية اذار والرشة الثانية في نيسان والرشة الثالثة في أيار اما الدفعة الثانية فكانت في شهر أيلول وشهر تشرين الاول وشهر تشرين الثاني على شتلات البرتقال صنف محلي وبعمر سنة واحدة ومطعمة على أصل النارنج. تم تنفيذ تجربة عاملية في تصميم القطاعات العشوائية الكاملة وبثلاثة مكررات. أعطى السماد المركب بالمستوى 50 غم نبات-1 زيادة معنوية في كل من الصفات الكيميائية المتمثلة بالكربوهيدرات في الأوراق، محتوى الأوراق من الكلوروفيل، المادة الجافة في الأوراق، النتروجين ، الفسفور والبوتاسيوم في الاوراق (3.171 %، 1.918 ملغم غم1- ، 70.115%، 2.072%، 0.2967% ، 1.800%) على التوالي ، كما أظهرت معاملة الرش بالحماض الأميني لاسيما التركيز العالي (2.5 مل لتر-1) زيادة معنوية في الصفات الكيميائية المدروسة ذاتها والتي بلغت قيمها 3.057%، 1.637 ملغم غم 1- ، 68.218%، 1.833 %، 0.2867 %، 1.508 % على التوالي .