



## Amino chelate with micronutrients and calcium had effect on date fruits characteristics

Abdalthossein Aboutalebi Jahromi\*, Bahram Naseri

*Department of Horticulture, Jahrom Branch, Islamic Azad University, Jahrom, Iran*

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### Abstract

This study was conducted in order to evaluate the effects of amino chelates on quantitative and qualitative properties of 'Kabkab' date fruit in 'Dashtestan' city, Boushehr province in the year 2012. The experiment was performed as factorial arrangement in randomized complete block design with three replications. The first factor was amino chelate type including: control, calcium amino chelate, micro-nutrient amino chelate and calcium + micro-nutrient amino chelates and the second factor was two application times including: 'Khalal' stage, one week later than the first application. Twenty four 'Kabkab' date palms were selected and all horticultural operations were equally done on them. After operating the treatments, was sampled in 'Tamar' stage and the characteristics including fruit weight, fruit length, fruit diameter, stone weight, stone length, TSS and pH were measured. Results indicated that amino chelates had significant influence on fruit weight, fruit length, stone weight, TSS. Application time affects some properties such as fruit weight, TSS and pH. Calcium amino chelate significantly increased fruit weight, fruit length and TSS. The highest TSS was observed in calcium amino chelate treatment. The greatest and lowest stone weight obtained in calcium amino chelate and control treatments respectively. Calcium and micro-nutrient amino chelates had the highest fruit weight and the lowest fruit weight relative to control treatment. Generally, amino chelates had significant and positive influence on most fruit quantitative and qualitative properties.

\* **Corresponding Author:** Abdalthossein Aboutalebi Jahromi ✉ [aa84607@gmail.com](mailto:aa84607@gmail.com)

## Introduction

Date fruit is very rich in viewpoint of nutrition value. Date palm had been much utilization for human from a long time ago up to now. Date palm is a low-request plant, which is supplying many requirements of mankind. Chemical compositions of date fruit (date fruit nutrition value) depend on cultivar, weather, planting regions, palm grove management and fruit growth and development stage (Aboutalebi and Mohammadi, 2015). Amino chelates roles in the plant are consisting: prevent from fast changes of medium pH; help to proteins synthesis of plant hormones prerequisite; increasing synthesis of basic metabolism such as chlorophyll, glycine and glutamic acid; help to buffering of medium for the better uptake of micro-nutrients in the soil; increasing chlorophyll amount in the green plant's organs and help to chlorophyll stability that increases photosynthesis; increasing prerequisite proteins of plant hormones such as methionine, spermidin and tryptophan (Hamee Aljubury *et al.*, 2001). Amino acids of amino chelates is causing to create of stable complexes and consequently increasing uptake of micro-nutrients (Omamia *et al.*, 2014). There are more than five millions date palms in Boushehr province, which there is more than 70% of them in Dashtestan city. In Dashtestan city, about 80% of date palms are 'Kabkab' cultivar, which have better quality and marketing in relation to size, shape and honeydew. Standard, properties and test method of this cultivar were done by Iranian Standard and Industry researches Institute in the year 1987. 'Kabkab' date fruit is yellow in Khalal stage and is dark brown in Tamar stage. This cultivar is counting soft date fruit and has big fruit and small stone. 'Kabkab' date fruit is consuming in Rotab and Tamar stages. In Rotab stage its color is yellow and transparent and has the best variation between Iranian commercial cultivars. The aims of present study were elevating and improving quantity and quality of 'Kabkab' date fruit; increasing the high quality fruits; increasing crop resistance to alive and non-alive stresses among drying and wilting complication; determination the best nutrition application and evaluation the effect of some amino chelates on date fruit properties.

## Materials and methods

### *Experiment properties*

This study was performed in the garden placed in southern regions of Dashtestan city in the year 2012. The experiment was conducted as factorial arrangement in randomized complete block design with three replications.

### *Treatments*

The first factor was amino chelate type including a<sub>1</sub>) control, a<sub>2</sub>) calcium amino chelate, a<sub>3</sub>) micro-nutrient amino chelate and a<sub>4</sub>) calcium + micro-nutrient amino chelates and the second factor was two application times including b<sub>1</sub>) 'Khalal' stage, b<sub>2</sub>) one week later than the first application.

### *Mode of application*

For this purpose 24 date palms c.v 'Kabkab' were selected so that were equally in relation to age, size, morphology and other properties and then were labeled basis on design's map. The date palms were pollinated in suitable time and equally were done horticultural operations on them. Each plot was consisting one date palm.

### *Measurements*

In Tamar stage, were prepared samples from date palms and the characteristics were measured such as fruit and stone weight by using digital weighing machine; fruit and stone length and fruit diameter by caliper; total soluble solid (TSS) by manual refractometer and flesh pH by pH-meter.

### *Statistical analysis*

The obtained data was analyzed by MSTAT-C software and the means were compared by Duncan's multiple range test (DMRT).

## Results

### *Fruit weight*

Fruit weight was influenced by application time. Interaction between amino chelates and application time showed that the treatments had various act on fruit weight in different application time (Table 3). Calcium amino chelate had the highest fruit weight

and had significant difference to other treatments. There was no significant difference between micro-nutrient amino chelate alone and complex of both amino chelates. The lowest fruit weight was observed

in control treatment (Table 1). Application time in Khalal stage had more influence on fruit weight although two application time had no significant difference together (Table 2).

**Table 1.** Effect of amino chelates on quantity and quality of 'Kabkab' date fruit.

Characteristics	Fruit weight (g/10 fruits)	Fruit length (cm)	Fruit diameter (mm)	Stone weight (g)	Stone length (cm)	pH	TSS (%)
Amino chelates							
Control	†91.205 <sup>c</sup>	3.765 <sup>c</sup>	6.467 <sup>b</sup>	3.865 <sup>a</sup>	2.368 <sup>a</sup>	7.100 <sup>a</sup>	4.117 <sup>b</sup>
Calcium amino chelate	91.495 <sup>a</sup>	3.903 <sup>a</sup>	6.933 <sup>a</sup>	3.502 <sup>b</sup>	2.228 <sup>a</sup>	7.050 <sup>a</sup>	4.283 <sup>a</sup>
Micro-nutrient amino chelate	91.303 <sup>b</sup>	3.780 <sup>bc</sup>	6.517 <sup>a</sup>	3.763 <sup>ab</sup>	2.043 <sup>a</sup>	7.133 <sup>a</sup>	4.233 <sup>ab</sup>
Calcium + micro-nutrient amino chelates	91.293 <sup>b</sup>	3.882 <sup>ab</sup>	6.900 <sup>b</sup>	3.798 <sup>ab</sup>	2.043 <sup>a</sup>	7.050 <sup>a</sup>	4.200 <sup>ab</sup>

†Means in each column having same letter have not significant difference ( $p < 0.05$ ) according to DMRT.

#### Fruit length

Application time had no significant influence on fruit length (Table 2). Difference trend between amino chelates was various by change of application time (Table 3). Calcium amino chelate had the highest influence on fruit length although placed with calcium

+ micro-nutrient amino chelates in the same statistical group. The lowest fruit weight was observed in control treatment (Table 1). Both application time had similar effect on fruit length and had no significant different together (Table 2).

**Table 2.** Effect of application time of amino chelates on quantity and quality of 'Kabkab' date fruit.

Characteristics	Fruit weight (g/10 fruits)	Fruit length (cm)	Fruit diameter (mm)	Stone weight (g)	Stone length (cm)	pH	TSS (%)
Application time							
Khalal stage	†91.42 <sup>a</sup>	3.82 <sup>a</sup>	6.70 <sup>a</sup>	3.94 <sup>a</sup>	2.60 <sup>a</sup>	7.05 <sup>a</sup>	4.26 <sup>a</sup>
One week after the first application	91.35 <sup>a</sup>	3.83 <sup>a</sup>	6.70 <sup>a</sup>	3.51 <sup>b</sup>	2.28 <sup>a</sup>	7.11 <sup>a</sup>	4.05 <sup>b</sup>

†Means in each column having same letter have not significant difference ( $p < 0.05$ ) according to DMRT.

#### Fruit diameter

Fruit diameter significantly influenced by amino chelates. The greatest fruit diameter was relative to calcium amino chelate although had no significant difference with micro-nutrient amino chelate. The lowest fruit diameter was observed in control and calcium + micro-nutrient amino chelate treatments (Table 1). Application time had no significant influence on fruit diameter (Table 2). Interaction between the factors was significant ( $p < 0.01$ ). In fact difference trend between amino chelates significantly was various by change of application time (Table 3).

control treatment. The lowest stone weight was relative to calcium amino chelate although had no significant difference with two other amino chelates. The lowest fruit diameter was observed in control and calcium + micro-nutrient amino chelate treatments (Table 1). Application time had significant influence on stone weight (Table 2). Interaction between the factors was significant ( $p < 0.01$ ). In fact difference trend between amino chelates significantly was various by change of application time (Table 3).

#### TSS

Amino chelates had positive and significant influence on TSS. The highest TSS was observed in calcium amino chelate treatment although had no significant difference with two other amino chelates. The lowest

#### Stone weight

Stone weight significantly influenced by amino chelates. The greatest stone weight was observed in

TSS was relative to control treatment (Table 1). Application time had significant influence on TSS so that TSS amount in application time of Khalal stage significantly was more than other time of application (Table 2). Interaction between the factors was

significant ( $p < 0.01$ ). In fact the factors did not operate orthogonal and difference trend between amino chelates significantly was various by change of application time (Table 3).

**Table 3.** Effect of treatment-derived application time  $\times$  amino chelates on quantity and quality of 'Kabkab' date fruit.

Characteristics	Fruit weight (g/10 fruits)	Fruit length (cm)	Fruit diameter (mm)	Stone weight (g)	Stone length (cm)	pH	TSS (%)
Khalal stage							
Control	91.568	3.889	6.95	3.62	2.30	7.00	4.20
Calcium amino chelate	91.598	3.897	6.90	3.69	2.30	7.70	4.30
Micro-nutrient amino chelate	91.445	3.756	6.65	3.60	2.10	7.20	4.40
Calcium + micro-nutrient amino chelates	91.300	3.680	6.38	3.70	2.10	7.10	4.40
One week after the first application							
Control	91.236	3.800	6.80	3.45	2.40	7.10	4.40
Calcium amino chelate	91.325	3.920	6.90	3.82	2.10	7.02	4.00
Micro-nutrient amino chelate	91.220	3.770	6.40	3.80	2.00	7.00	4.00
Calcium + micro-nutrient amino chelates	91.568	3.889	6.95	3.62	2.30	7.00	4.20

#### pH

Amino chelates had no significant influence on pH. There was no significant difference between amino chelates and control treatment. (Table 1). Application time had no significant influence on pH (Table 2). Interaction between the factors also was no significant. In fact the factors did operate orthogonal and difference trend between amino chelates was not various by change of application time (Table 3).

#### Discussion

Amino chelates affect more quantitative and qualitative properties of date fruit than control treatment. Fruit weight is among the most important quantitative indexes for date fruit, which amino chelates significantly affected it. Application of calcium and micro-nutrient amino chelates had the highest influence on fruit weight. The results demonstrated that correct application on amino chelates accompanying calcium and other micro-nutrients can be increase fruit weight. Regard to the application of treatments was as spraying method can be achieve to suitable yield by low consumption of

amino chelates. Therefore, proper and equilibrant nutrition by amino chelates has satisfactory results on weight of date fruit. Meanwhile, application of amino chelates is economical than many nutrients. In the same direction, many researchers had have been studied the effects of growth simulators and plant growth regulators on date palm and their reports are confirmer of the results of the present study (Gourge and Hiljman, 1991; Izadi, 1999; Mohammadi *et al.*, 2008). Amino chelates significantly increased fruit length. The highest fruit length was observed in calcium amino chelate treatment. Amino chelates roles in the plant are consisting: prevent from fast changes of medium pH; help to proteins synthesis of plant hormones prerequisite; increasing synthesis of basic metabolism such as chlorophyll, glacine and glotamic acid; help to buffering of medium for the better uptake of micro-nutrients in the soil; increasing chlorophyll amount in the green plant's organs and help to chlorophyll stability that increases photosynthesis; increasing prerequisite proteins of plant hormones such as metionin, spermidin and tryptophan. The obtained results are according to the

findings of many researchers such as Katamchi (1967), Izadi (1999) and Bahrami (1997). One of the very positive results of present study is effect of amino chelates on properties of date fruit's stone. The greatest stone weight was relative to control treatment. The lowest stone weight obtained in calcium amino chelates although two other amino chelate had the stone weight less than control treatment. Increasing flesh/stone ratio is among qualitative characteristics of date fruit so that whatever this ratio be larger, date fruit will has better marketing demand. On the other hand, large stone in date fruit is an undesirable characteristic. Therefore, by correct using of amino chelates can be decrease date fruit stone and increase flesh/stone ratio. Application of amino chelates has been affected some chemical properties of date fruit such as pH and TSS. In other words, these materials can be affect and improve the fruit quality. In addition, application of amino chelates decreased many disorders such as wilting, blowing out and sun burning of date fruits. Nowadays, high waste of date fruit and reducing its quality is one of the principle problems in date fruit production. Application of amino chelates increase date fruit quality and production of one degree fruits. The highest TSS was observed in calcium amino chelate treatment. There was no significant different between micro-nutrient amino chelate and control treatment. Already some researchers reported that some plant growth regulators such as auxins and polyamines decreased TSS (Izadi, 1999; Bahrami, 1997). There was no significant difference between times of application in the many evaluated characteristics. It seems two application in Kimri and Khalal stages had suitable effectiveness on fruit characteristics and no need to repeat it later. While, because of application in the first time had proper reaction so more application does not recommended. Two factors of amino chelates and time of application in many properties had significant interaction. Therefore, these factors have not been operated orthogonally. Generally, can be concluded that amino chelates had significant influence on quantitative and qualitative properties of Kabkab date fruit such as fruit weight, fruit length and fruit diameter, stone

properties and chemical properties such as pH and TSS. Thus, amino chelates accompanying calcium and micro-nutrients can be used for increasing and improving qualitative and quantitative characteristics of Kabkab date fruit. Regards to total results application of calcium amino chelate in Khalal stage is recommending.

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