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EFFECT OF NUTRITION ON CHEMICAL CHARACTERISTICS OF ORANGE FRUITS

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Abstract

The aim of this study was to determine the chemical characterization of orange fruits using applications of nutrition minerals and growth substance during at private farm in wadi el-netron , ELbehari governorate, Egypt during in December2011. The results showed during maturity time increasing the total soluble solid (TSS), pH, percentage of liquid, (TSS/acidity)and carotenoids while chlorophyll a, chlorophyll b and acidity were decreased.With one application of nutrition minerals and with growth substance were the lowest value of chlorophyll, a (chl,a) and chlorophyll, b (chl,b) as follow 0.42 and 0.45 (mg/100g) while with control management were the highest value to total soluble solid (Tss) and carotenoids (car.) as follow 10.07(Brix,%) and 15.77 (mg/100g). The pattern of changes was clearly observed from the absorption spectra of the green and orange When orange is fully ripe, chlorophyll would be greatly reduced or may disappear completely and carotenoids becomes the dominant pigment in the fruit surface.

Key words**:** *acidity and carotenoids, growth substance, orange fruits, total soluble solids*

INTRODUCTION

Citrus industry is an important component the Egyptian National income. Citrus cultivated area in Egypt reached nearly 382027 feddan in 2006, while area in due production reached 341718 feddan producing about 3211709 tons of citrus fruits. Harvested orange area in Egypt are 101421 (Ha) and the production are 2577720 tones [5]. It is well-known that the orange is one of the most abundant sources of vitamin C, however, it also contains considerable amounts of sugar, carotenoids, flavonoids, essential oil and some minerals. Among citrus fruits, there is currently a growing interest for blood orange, a natural variety of Citrus sinensis, with crimson, blood-coloured flesh owing to the presence of anthocyanins, highly recommended to reduce the risk of heart disease, some types of cancer, and low-density lipoprotein (LDL) cholesterol accumulation. Color grading is an important process for the agriculture industry especially in food processing, fruit and vegetable grading. The color of products is often used to determine quality and price. Consumers have developed distinct correlations between color and the overall quality of a specific product. Industries use machine vision technology to grade the products based on their surface colors for maintaining quality and price of products.

The percentage of acid was determined based on citric acid by titration of a juice aliquot to pH 8.3, with the aid of a pH meter. These percentages were also used to calculate the soluble solids to acid ratio. In California, the ratio of percentage soluble solids to percentage acid is one of the standards used to determine the legal maturity of oranges; a ratio of 8 to 1 or greater is considered mature [2]. The fruit 'Hamlin' orange trees were taken as a sample two weeks before harvest. The fruit juice quality analyses including: juice content, brix, acid, brix/acid ratio, and amount of solids per unit fresh weight of the fruits which acid (%) decreased, brix and soluble solids in juice (kg /100 kg fruit) increased with ripening [1]. Fruit quality is an important factor affecting its market value, transportation and storage requirements. Fruit quality indices consist of internal quality, such

as soluble solids content (SSC) and total acidity (TA), and external quality, such as size and weight. As a result, there are many types of fruit sorters based on size or weight of the fruit [8]. The fruit physical properties of 'Grand Naine' banana plants significantly increased as a result of using Effective Micro-organisms (EM1) as a biofertilizer. The treatment which received (40 kg P2O5+ EM1) gave the highest value on all treatments during both seasons. Pulp TSS%, acidity%, TSS/acid ratio, starch%, total sugars%, N%, P%, and K% of 'GrandNaine' ripe fruits increased by adding EM1 [4].Several physicochemical characteristics (ash, acidity, crude fat, crude fiber, sugars, moisture, ascorbic acid and soluble solids) and concentration of macro elements (Ca, Mg, Na, K) and trace elements (Al, Cd, Cr, Cu, Fe, Mn, Pb, Zn) were measured in harvested mature, green pineapple (Ananas comosus L.) fruits during their off vine, open air, room temperature storage-ripening period of eight days. The results showed that the Mbezi pineapple fruits had high moisture content (68 – 89%), moderate titratable acidity (0.80 – 1.50%), low crude fat content (0.12%), low crude fibre amounts (0.40%), low ash content (0.20%), high reducing sugars (14.2 – 22.8%), high total sugars (15.2 – 30.0%), high total soluble solids (15.7 – 29.3%) and high ascorbic acid content (7.9 – 33.4%) [9].During maturity time the carotenoids increased from 4.80 to 15.77 mg/100g, while chlorophyll a&b decreased from 1.92 to 0.72, from 3.01 to 1.18 mg/100g, respectively. The results showing in Fig.IV.3 the relationships between different maturity time and total soluble solid (Tss), pH, acidity, percentage of liquid, and (TSS/acidity), during maturity time increasing the total soluble solid (TSS), pH, percentage of liquid and (TSS/acidity) increased from 8.20 to 10.06 (Brix,%), from 2.84 to3.07 from 41.54 to 49.83 % and from 6.7 to 9.00 respectively while decreased acidity from 1.25 to 1.07 % [6].The maximum value of percentage of liquid and Tss/acidity by using two application of nutrition minerals and with growth substance were 51.15 % and 12.13 while chlorophyll a decreased to 0.42 mg/100g [10].

The physical and chemical parameters of fruits are important indicators of their maturation and internal and external quality, decisive factors for accomplishment of market demands that have encouraged a lot of researches under different conditions overseas. The main objective of this study was to study the effect of nutrition minerals and growth substance on orange ripening.

MATERIALS AND METHODS

This experiment were at private farm in wadi el-netron, ELbehari governorate, Egypt during winter 2011 to study the effect of fertilization on some chemical properties while maturity period.

- Valencia orange fruits.

The samples were harvested by hand and selected randomized. All samples were individually numbered.

Table1. Some chemical characteristics of orange fruit *Valencia*

Parameter	Value
TSS	9.06-10.07 (Brix, %)
Liquid	48.22-51.15 (%)
pH	2.99 - 3.18
Acidity	0.92- 1.15
Tss/acidity	8.21-12.13
Carotenoids	9.54-15.78 (mg/100g)
chlorophyll a	0.42-0.83 (mg/100g)
chlorophyll b	0.45-1.13 (mg/100g)

-Treatments were:

A: Without nutrition minerals + without growth substance (control)

B: Without nutrition minerals + with growth substance.

C: With one application of nutrition minerals + without growth substance

D: With one application of nutrition minerals + with growth substance

-The chemical properties

-*TSS* was estimated from a single digital refractometer reading taken from the

combined juice extracted from the orange with range of 0~32% Brix to measure sugar concentration.

- *pH value* in the orange juice measured by ph meter with accuracy of 0.01

-*Acidity* was determined in orange juice by using 0.1 M NaOH standard solution, on the juices [7].

-*spectophotometer*: has arrange 390 to 900 nm, it used for measuring the absorption at wave length 470,645and 662, chlorophyll and carotenoids content of crude extracts in different plants were determined following the method of [11] with slight modification as follows:

About 0.1 g of dried plant extract was mixed with 1.5ml of 85% acetone in dark brown test tube and let the mixture to stand for 15hrs at room temperature.

The mixture was then filtered on cotton cloth and the clear filtrate was completed to 5ml by 85% acetone solution.

Extinction was measured spectrophotometrically in l cm cell at wave length of 470, 645 and 662 nm versus 85% acetone solution as blank at each wave length.

The amounts of carotenoids were calculated according to the following equations [3]:

Chl ,a = 11.75 A662 – 2.35 A645

Chl ,b = 18.61 A645 – 3.96 A662

Carx+c =((1000 A470 – 2.27 Chl, a – 81.4 Chl, b) / 227)

RESULTS AND DISCUSSIONS

There are differences between the use of fertilizer and pesticides during fruit formation and included changes in sugar, amino acid and organic acid composition. Maturity of orange is a combination of processes, including the breakdown of chlorophyll and build-up of carotenes.

Changes in the pattern of the absorption spectra were observed for the orange sample with different ripeness stages.

The results in fig. 2 showing that acidity decreased in treatments A, B, C and D from 1.25, 1.47, 1.34 and 1.45 % to 1.08, 1.15, 1.01 and 1.14 % during maturity period.

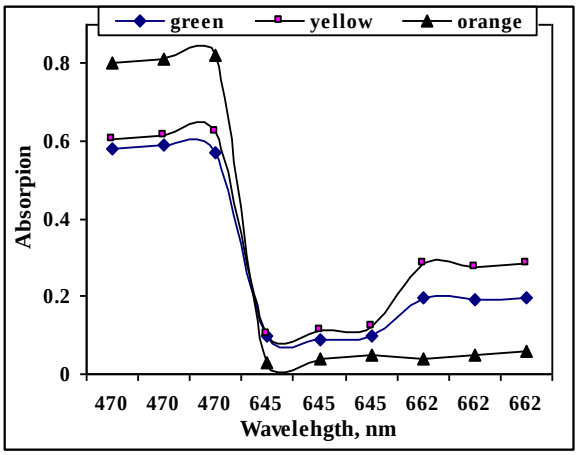

Fig.1. Relationship between wavelength and absorption spectra of three oranges with green, yellow and orange colors.

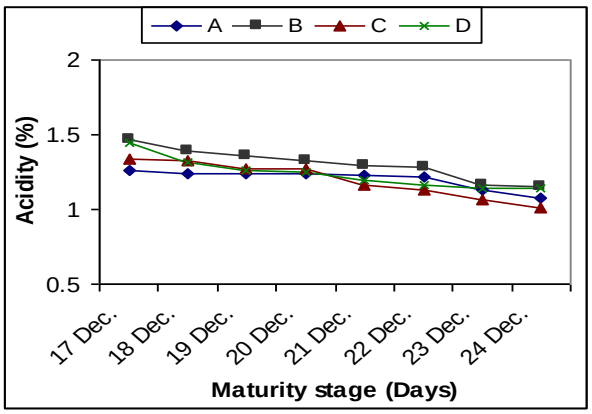

Fig. 2. Effect of nutrition minerals and growth substance on acidity during maturity stage

The results in fig. 3 showing that liquid percentage increased in treatments A, B, C and D from 41.45, 42.72, 40.06 and 41.95 % to 49.83, 50.86, 48.75 and 50.66 % during maturity period.

The results in fig. 4 showing that pH increased in treatments A, B, C and D from 2.84, 2.83, 2.72 and 2.89 to 3.08, 2.99, 3.18 and 3.11 during maturity period.

The results in fig. 5 showing that total soluble solid (TSS) increased in treatments A, B, C and D from 8.27, 8.87, 8.87 and 8.87 (Brix, %) to 10.07, 9.93, 9.80 and 9.73 (Brix, %) during maturity period.

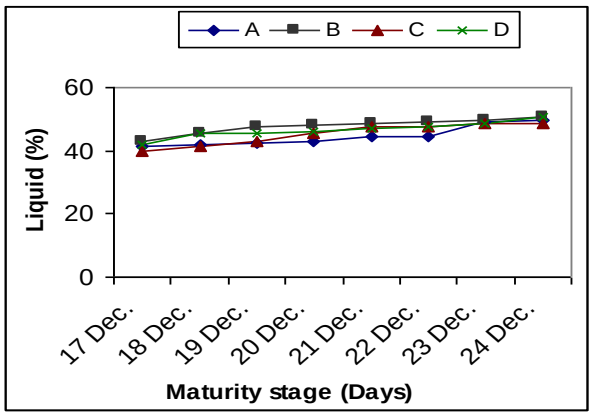

Fig. 3. Effect of nutrition minerals and growth substance on percentage of liquid during maturity stage

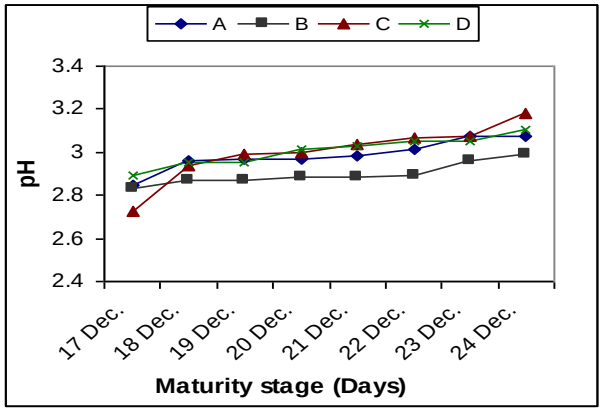

Fig. 4. Effect of nutrition minerals and growth substance on pH during maturity stage

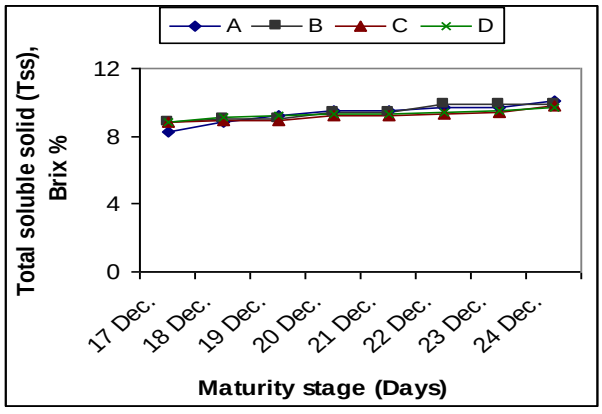

Fig. 5. Effect of nutrition minerals and growth substance on total soluble solid (TSS) during maturity stage

The results in fig. 6 showing that TSS/acidity increased in treatments A, B, C and D from 6.78, 6.53, 6.73 and 6.40 to 9.00, 8.22, 9.75 and 8.31 during maturity period.

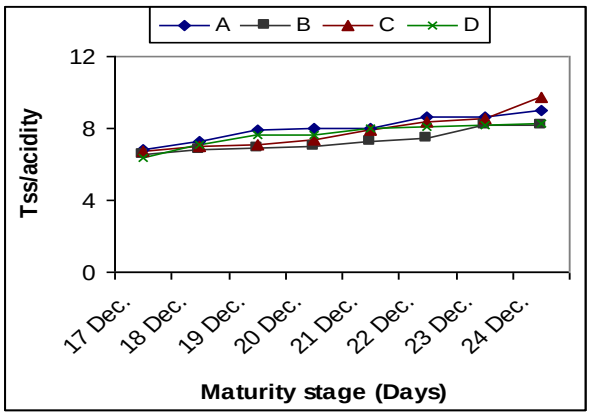

Fig. 6. Effect of nutrition minerals and growth substance on (TSS/acidity) during maturity stage

The results in fig. 7 showing that carotenoids (car.) increased in treatments A, B, C and D from 4.81, 7.04, 7.26 and 6.70 (mg/100g) to 15.78, 11.27, 10.14 and 10.35 (mg/100g) during maturity period.

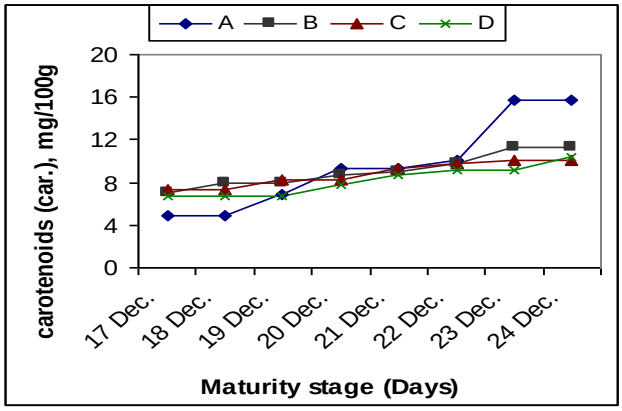

Fig. 7. Effect of nutrition minerals and growth substance on carotenoids concentration during maturity stage

The results in fig. 8 showing that chlorophyll a (chl, a) decreased in treatments A, B, C and D from 1.93, 2.84, 2.58 and 2.08 (mg/100g) to 0.72, 0.53, 0.83 and 0.42 (mg/100g) during maturity period.

The results in fig. 9 showing that chlorophyll b (chl, b) decreased in treatments A, B, C and D from 3.02, 3.91, 3.91 and 3.00 (mg/100g) to 1.18, 0.80, 0.76 and 0.45 (mg/100g) during maturity period.

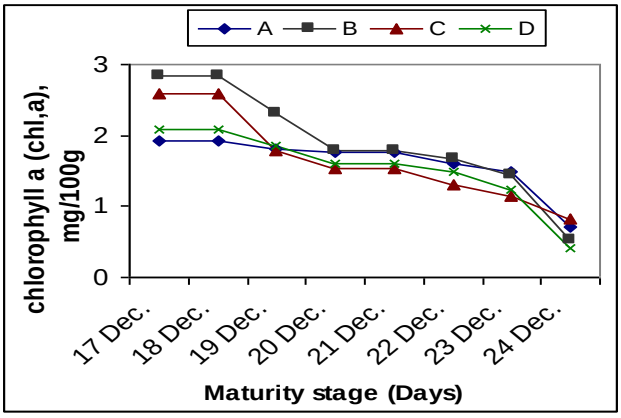

Fig. 8. Effect of nutrition minerals and growth substance on chlorophyll, a concentration during maturity stage

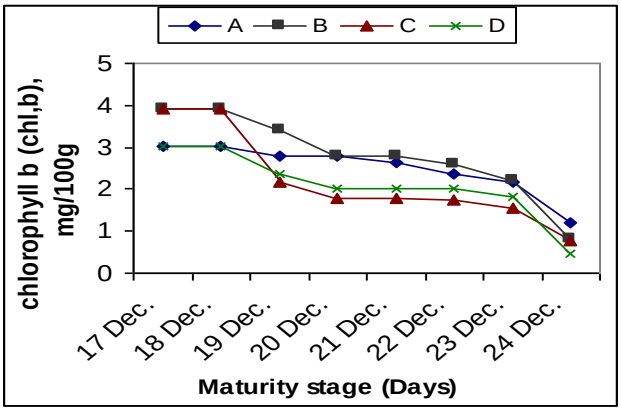

Fig. 9. Effect of nutrition minerals and growth substance on chlorophyll, b concentration during maturity stage

CONCLUSIONS

Without nutrition minerals and without growth substance (control) were the highest value to total soluble solid (TSS) and carotenoids (car.) as follow 10.07(Brix,%) and 15.77 (mg/100g).

Without nutrition minerals and with growth substance was the highest value of liquid percentage as follow 50.86%.

With one application of nutrition minerals and without growth substance were the lowest value of acidity as follow 1.01% and the highest value of pH and Tss/acidity as follow 3.18 and 9.75.

With one application of nutrition minerals and with growth substance were the lowest value of chlorophyll,a (chl,a) and chlorophyll,b (chl,b) as follow 0.42 and 0.45 (mg/100g)

The orange sample with the green color would contain a large amount of chlorophyll a and chlorophyll b it had a strong absorption peak at 662 and 645 nm, respectively as orange fruit ripeness from the green stage to the orange stage.

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