Journal of Plant Production

Journal homepage & Available online at: www.jpp.journals.ekb.eg

Effect of some Natural Extracts on Productivity and Quality of Valencia Orange under New Valley Conditions

Haleem, A. Y.* ; W. M. Ghieth, and A. A. H. Hegazy

Department of Plant Production, Desert Research Center, Cairo, Egypt

Article Information
Received 10/8 /2025
Accepted 1/9 /2025

ABSTRACT

A two-year field experiment was conducted (2019-2020) at Afak Farm, Balat district, New Valley, Egypt, to evaluate the effects of foliar applications of natural biostimulants (yeast, Kelpag, Bio-power) on the productivity and fruit quality of eight-year-old Valencia orange (Citrus sinensis L.) trees. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications and seven treatments: T1 (control, distilled water), T2 and T3 (yeast at 10 and 20 g/L), T4 and T5 (Kelpag at 10 and 20 g/L), and T6 and T7 (Bio-power at 10 and 20 g/L), Foliar sprays were applied twice: two weeks after fruit set and ten days later. Assessed parameters included flowering characteristics, fruit retention, leaf nutrients (N, P, K), yield, and fruit quality. Results showed that all treatments significantly increased the number of leafy and woody inflorescences, flower quantity, and fruit retention compared to the control. Leaf nutrient levels improved significantly, especially with Bio-power at 20 g/L. Yield, fruit weight, volume, pulp percentage, total soluble solids (TSS), juice content, and ascorbic acid improved, while total acidity decreased. The most pronounced improvements were with Kelpak at 20 g/L: yield per tree increased by 13.8%, fruit weight by 3.5%, and TSS by 14.7% compared to control. No significant differences among the three biostimulants at the 20 g/L rate. Findings suggest that foliar application of yeast, Kelpak, or Bio-power at 20 g/L enhances growth, yield, and fruit quality of Valencia orange under arid conditions, with Kelpak showing a slight advantage in quality parameters.

Keywords: Natural extracts, Fruit quality, Valencia Orange, Yield.

INTRODUCTION

With an estimated 140 million tons produced annually, citrus (*Citrus* spp.) is one of the world's most important fruit tree crops and is in high demand both for fresh consumption and for the manufacture of juice. Certain phytochemicals, including vitamins, carotenoids, minerals, flavonoids, phenolic acids, limonoids, volatiles, and sugars, are directly linked to the health and sensory qualities of citrus fruits and how consumers perceive their advantages (Ma *et al.,* 2020 and Talón *et al.,* 2020).

In Egypt, Citrus trees are considered one of the main fruit crops cultivated. In recent years, the area of citrus cultivation has rapidly increased, reaching approximately 529405 feddans, with a total production of around 5142829 tons. Of this, oranges accounted for about 350290 feddans, producing 3471806 tons. Valencia oranges, specifically, covered around 144419 feddans, with an annual production of 1510545 tons, (MALR, 2023).

The Mediterranean climate of Egypt is suited for citrus production. Oranges account for over half of the total fruit production in Egypt. Citrus fruit demand for fresh consumption or juice production varies greatly among national and international marketplaces based on consumer tastes and choices. Of all the orange kinds, Valencia is the most common, particularly in the recently reclaimed areas, thanks to its ancient and contemporary strains. Valencia orange trees, especially in desert lands, are exposed in critical growth periods to difficult climatic conditions, considering recent climatic changes. (Zhong, and Nicolosi, 2020).

Chemical fertilizers have been widely utilized to boost agricultural yields on arable land. A nation may become self-sufficient in food production if it uses more chemical fertilizers in agriculture, yet chemicals have negative effects on organisms and the environment. Furthermore, chemical fertilizers are costly, have an adverse effect on the soil, lower its fertility and water-holding capacity, create nutritional imbalances, and pollute water at unacceptable levels. (Sprent, 1999).

Living microorganisms, plant-based or microbial extracts, soil organic wastes (such as fulvenes and humates), and synthetic compounds are examples of agricultural bio stimulants. It is unclear how bio stimulants work, and they have been ascribed to hormones in different ways. composition, the existence of molecules that are in charge of transporting and absorbing mineral nutrients, or the presence of plant signaling signals (Calvo *et al.,* 2014).

By increasing resource acquisition (nitrogen, phosphorus, and essential minerals), producing Siderophore, stimulating the production of phytohormones, or indirectly by increasing plant tolerance of pathogens as part of integrated pest management, the use of various types of bio fertilizers, such as nitrogen fixers, phosphorus solubilizes, phosphorus mobilizers, and potassium solubilizes, enhances citrus growth. It also maintains soil fertility and protects the environment. By boosting biological N fixation, nutrient availability and uptake, and natural hormone stimulation, bio fertilizers may increase crop output (Kannaiyan, 2002; Abdel-Moniem *et al.,* 2003; Hegab *et al.,* 2005 and El- Salhy *et al.,* 2006).

Reducing chemical fertilization particularly N fertilizer is crucial to lowering pollution levels in the environment and producing safe produce. In this regard, using bio fertilizers is a reasonably good strategy. It has

* **Corresponding author.**
E-mail address: dratef.haleem@gmail.com
DOI: 10.21608/jpp.2025.411054.1497

microorganisms that help plants get the nutrients they need from natural sources, reducing the need for fertilizers. Various compounds that increase yield in terms of quality and quantity while lowering manufacturing costs and environmental pollution (El-Haddad *et al.,* 1993; Verna, 1999; Ram Rao *et al.,* 2007, El-Salhy *et al*., 2011 and Alalaf 2020).

Citrus trees treated with foliar bio stimulants during full bloom and a month later may have delayed abscission, higher fruit set, better fruit quality, and better control over maturation. Additionally, it aims to save fertilization costs and prevent pollution and soil salinity by using less mineral fertilizer (Abd El-Motty and Orabi, 2013 and El-Boray *et al.,* 2015).

In Washington navel orange trees, potassium humate, active dry yeast, and amino green produced the greatest values of vegetative growth indices in descending order (Mustafa and. El-Shazly 2013).

Biofertilizers are eco-friendly, cost-effective, non-toxic, and easy to apply, making them a sustainable alternative to chemical fertilizers. They help preserve soil biodiversity, maintain soil structure, and enhance long-term agricultural productivity (Deepali and Gangwar, 2010; Thomas and Singh, 2019). Commonly known as microbial inoculants, these organic products are derived from beneficial microorganisms associated with plant roots and the rhizosphere. They have been shown to promote plant growth and increase crop yields by 10–40% through mechanisms such as enhancing biological nitrogen fixation, improving nutrient availability and uptake, and stimulating the synthesis of natural plant growth hormones (Kannaiyan, 2002; Jankowski and Dubis, 2008; Kawalekar, 2013).

Yeasts are a rich source of phytohormones and a natural, safe bio fertilizer (Abou El- Yazied and Mady 2012). Some phytohormones that promote plant growth can be produced by it. Auxins, a class of molecules with an indole ring, are one type of these regulators. By controlling a number of physiological and developmental processes, indole-3acetic acid (IAA), the main auxin class member that promotes plant growth, is known to elicit quick and sustained reactions in plants. Using yeast extract to increase the development and yield of various plant species (Kasahara, 2016 and Nutaratat, *et al.,* 2016).

Therefore, this study was conducted to assess the impact of foliar applications of yeast, Kelpak, and Bio-power on the growth performance, yield, and fruit quality of Valencia orange (Citrus sinensis L.) trees.

MATERIALS AND METHODS

The experiment was carried out during two consecutive growing seasons (2019 and 2020) at Afak Farm in the Balat region, New Valley Governorate, Egypt, using eight-year-old Valencia orange trees (Citrus sinensis L.) grafted onto Volkamer lemon (Citrus volkameriana L.) rootstock. The trees were grown in silty clay soil and spaced at 6 m × 4 m.

The seven spray treatments were used in this experiment:

T1: control (spraying water only)
T2: Spraying Yeast extract at 10 g/L water
T3: Spraying Yeast 20 extract at g/L water
T4: Spraying Kelpak at 10 g/L water
T5: Spraying Kelpak at 20 g/L water
T6: Spraying bio-power at 10 g/L water
T7: Spraying bio-power at 20 g/L water

Preparation of Yeast extract:

Carbon and nitrogen sources in a 6:1 ratio were used to activate the dry, pure yeast powder (Barnett *et al*., 1990). With roughly 12,000 yeast cells per milliliter, this ratio is ideal for achieving the maximum vegetative production of yeast. Then, right before use, the medium was frozen and thawed. For all treatments, Tween-20 was added as a spreading agent. Mahmoud (2001) examined the yeast extract used in this study for phytohormones, "macro and micro" mineral elements, amino acids, total carbohydrates, reducing sugars like glucose, enzymes, and vitamins. Bio-power and Kelpak are bio stimulants that include vitamins, hormones, macro and microelements, and amino acids (proteins).

Kelpak is a natural seaweed extract biostimulant used as a foliar spray on trees to enhance growth, flowering, and stress tolerance. It contains natural auxins and cytokinins that improve root development, fruit set, and overall plant vigor (Produced by Kelp Products (Pty) Ltd., South Africa).

Bio-power is a non-hormonal, microbially derived agricultural biostimulant designed for foliar application on plants. It is patented by the Academy of Scientific Research and Technology under patent number 221165 and was awarded the Outstanding Merit Award in 2002 by the Academy. It contains: Amino acids (6.012%), Vitamins (0.081%), Macronutrients (34.33%), Micronutrients (3.96%), Unsaturated fatty acid esters (1.8%), Emulsifying agents (1.3%) and Chelating agents (4.44%).

Both treatments were applied to the same trees. To make solutions, water was added in 10 or 20 g/L increments. Two sprays of each item were applied to the chosen trees; the first was applied two weeks after the fruit set, and the second was applied ten days later. The following metrics were examined in order to assess how these treatments affected fruit quality, yield, growth, and nutrient status.

Flowering Characteristics: -

The percentage of leafy and woody inflorescences during the spring growth cycle was measured by counting each type during the first week of April and calculating the percentage in relation to the total number of inflorescences. Additionally, the number of flowers on each inflorescence was counted, and the proportion of blossoms on each inflorescence was then noted.

Fruit retention: By dividing the number of developed fruits per inflorescence by the number of hermaphrodite flowers per inflorescence, the fruit retention percentage was computed and reported as a percentage.

3-Determination of NPK in leaves: Leaf samples for N, P, and K determination were collected from 4–6-month-old spring flush leaves taken from non-fruiting shoots, with the third leaf from the apex sampled during July–August. (Wilde *et al*., 1985).

4-Yield per tree: The yield per tree (kg) was calculated by multiplying the average fruit weight (g) by the total number of fruits on each tree after the fruits were harvested and their weight (g) was noted.

5-Fruit quality parameters: To ascertain the physical and chemical characteristics, ten ripe fruits were randomly selected from each tree at harvest time.

a- Fruit physical characteristics: - Fruit volume, pulp fruit percentage, and fruit weight (g) were all measured.

b–Fruit chemical characteristics: According to AOAC (2000), the percentages of juice, ascorbic acid (Vitamin C) content (mg/100 ml Juice), and the percentage of total acidity (g citric acid /100 g F.Wt.) were used to calculate the total soluble solids (T.S.S.) using a hand refractometer.

Statistical analysis: -

Three replicates, two trees each, were used in the study's fully randomized block design. According to Snedecor and Cochran (1990), the least significant difference (NEW LSD) test was applied at the 5% level to distinguish between means.

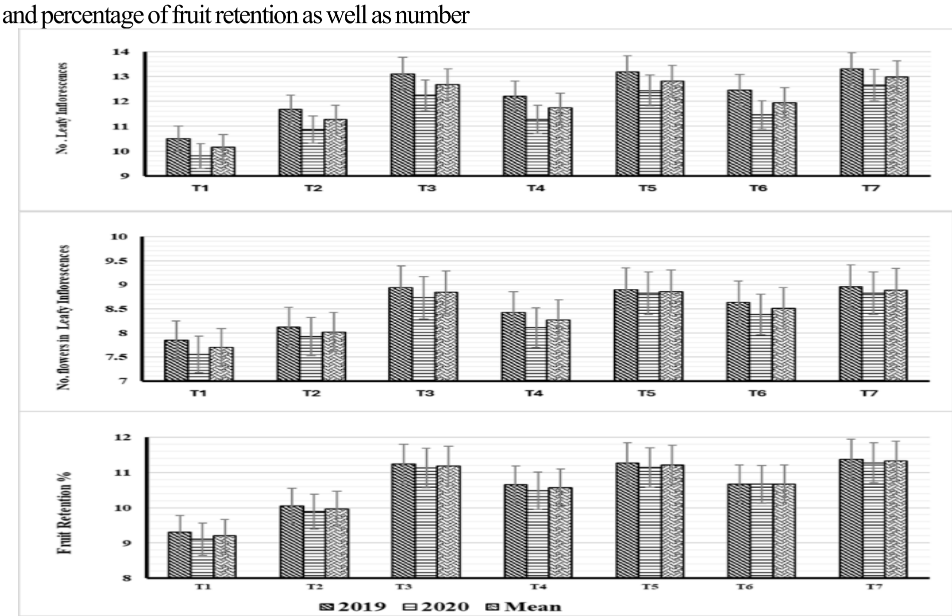
RESULTS & DISCUSSIONS

Results

1- Inflorescence types, fruit retention and leaf nutritional status:

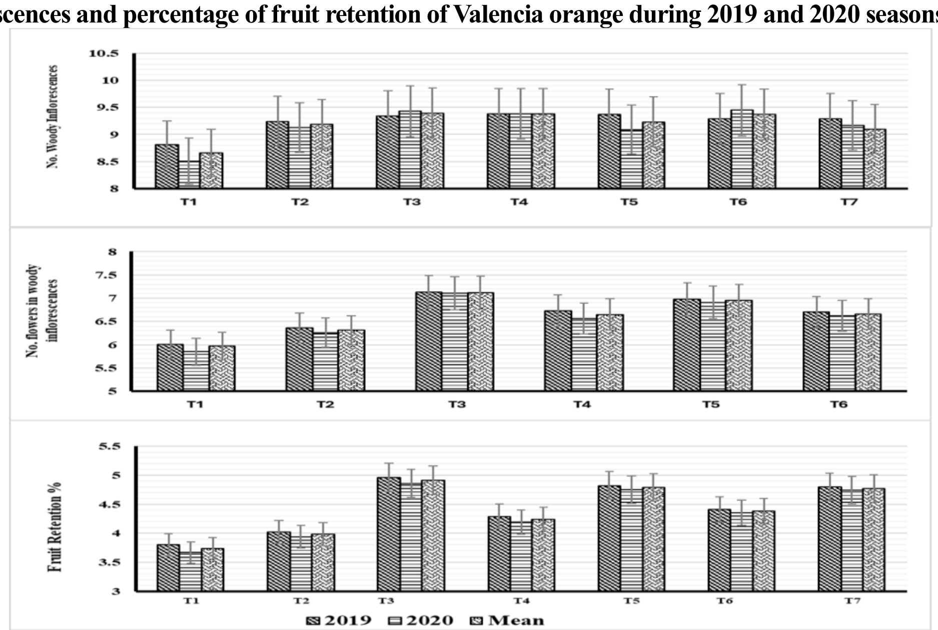
The information in figures 1&2 show the effect of yeast, Kelpak and bio-power foliar spraying at 10 or 20 g/ L on the number of leafy inflorescences, number of flowers / leafy inflorescences and percentage of fruit retention as well as number of woody inflorescences, number of flowers / woody inflorescences and percentage of fruit retention of Valencia orange trees during the 2019 and 2020 seasons. The data show that the results for both seasons followed a similar pattern.

In a general view, data cleared that foliar spraying of yeast, Kelpak or bio-power significantly stimulated the number of leafy inflorescences, number of flowers / leafy inflorescences and percentage of fruit retention as well as number of woody inflorescences, number of flowers / woody inflorescences and of percentage of fruit retention more than spraying water (control).



T1: Control T2: Spraying Yeast 10 g/L T3: Spraying Yeast 20 g/L T4: Spraying Kelpak 10 g/L T5: Spraying Kelpak 20 g/L T6: Spraying bio-power 10 g/L T7: Spraying bio-power 20 g/L

Fig 1. Effect of foliar application of yeast, Kelpak and bio-power on No. leafy inflorescences, No. flowers in leafy inflorescences and percentage of fruit retention of Valencia orange during 2019 and 2020 seasons.



T1: Control T2: Spraying Yeast 10 g/L T3: Spraying Yeast 20 g/L T4: Spraying Kelpak 10 g/L T5: Spraying Kelpak 20 g/L T6: Spraying bio-power 10 g/L T7: Spraying bio-power 20 g/L

Fig 2. Effect of foliar application of yeast, Kelpak and bio-power on No. woody inflorescences, No. flowers in woody inflorescences and percentage of fruit retention of Valencia orange during 2019 and 2020 seasons.

The highest number of leafy inflorescences, number of flowers / leafy inflorescences and percentage of fruit retention as well as number of woody inflorescences, number of flowers in woody inflorescences and percentage of fruit retention values were recorded due to spray bio-power at 20 g/L water (T7) followed by Kelpak at 20 g/L water (T5), and yeast at 20 g/ L water(T3), respectively. On other hand, the lowest values were observed due to water spray (control, T1).

The obtained number of leafy inflorescences were 10.15, 11.27, 12.68, 11.74, 12.81,11.95 and 12.98, number of flowers / leafy inflorescences were (7.70, 8.02, 8.84, 8.27, 8.86,8.51 and 8.89), and fruit retention were 9.21, 9.97, 11.18, 10.57, 11.21, 10.67 and 11.32% as well as number of woody inflorescences (8.66, 9.19, 9.38, 9.39, 9.23, 9.37 and 9.10),number of flowers / woody inflorescences (5.97, 6.31, 7.11, 6.65, 6.95, 6.66 and 7.12) and fruitretention (3.74, 3.98, 4.91, 4.24, 4.69, 4.38 and 4.77 %) as an av. of the two studied season) due to spray water (control), yeast 10 g/L water, yeast 20 g/L water, Kelpak 10 g/L water, Kelpak 20 g/L water, bio-power 10 g/L water and bio-power 20 g/L water. Therefore, the corresponding increment of the number of leafy inflorescences over control was (27.88%), number of flowers / leafy inflorescences (15.45%) and percentage of fruit retention was (22.91%) due to spray bio-power at 20 g/ L water (T7) compared to water spray (T1) as average of the two studied seasons, respectively. On the other hand, the corresponding increment of the number of woody inflorescences was (8.43%), the number of flowers /woody inflorescences was (19.26%), and the percentage of fruit retention was (31.28%) due to spray yeast at 20 g/ L water (T3) compared to water spray (T1) as average of the two studied seasons, respectively. No significant differences were found in flowering characteristics due to spraying with biopower at 20 g/L or Kelpak at 20 g/L or Yeast at 20 g/L.

Also, data in Table (1) demonstrates how the administration of yeast, Kelpak and bio- power at 10 or 20 g/ L had positively affected the percentage of NPK in 'Valencia' orange leaves, compared to the control in the 2019 and 2020 growing seasons. It appears that the results followed the same trend during the two studied seasons.

In general, data cleared that yeast, Kelpak or bio-power spraying significantly increased the percentage of leaf nitrogen, phosphor and potassium more than spraying water (control).

The obtained leaf of nitrogen % were (2.37, 2.42, 2.47, 2.44, 2.50, 2.46 and 2.49 %), of

Phosphor % were (0.150, 0.181, 0.201, 0.172, 0.181, 0.175 and 0.186 %), and potassium % were(1.28, 1.48, 1.52, 1.50, 1.49, 1.54 and 1.50 %) as an av. of the two studied season) due to spray water (control), yeast 10 g/L water, yeast 20 g/ L water, Kelpak 10 g/ L water, Kelpak 20 g/ L water, Bio-power 10 g/ L water and spraying Bio-power 20 g/ L water respectively .

The highest leaf nitrogen, phosphor and potassium % were recorded due to spray bio- power at 20 g/ L water(T7) followed by Kelpak at 20 g/L water(T5), and yeast at 20 g/L water(T3), respectively. On other hand, the lowest values were observed in the control treatment (T1). Therefore, the corresponding increment of the nitrogen over control was (5.49%), phosphor was (34.00%) and potassium was (18.75%) during the two studied seasons, respectively. No significant differences were found in percentage N, P and K due to spray with bio-power at 20 g/L or Kelpak at 20 g/L or yeast at 20 g/L.

Therefore, spraying of yeast, Kelpak and bio-power significantly improved the number of leafy inflorescences, number of flowers / leafy inflorescences and percentage of fruit retention as well as number of woody inflorescences, number of flowers / woody inflorescences and of percentage of fruit retention and nutritional status of trees.

Table 1. Effect of foliar application of yeast, Kelpak and bio-power on percentage of NPK content of Valencia orange leaves during 2019 and 2020 seasons.

Treatments	N%			P%			K%		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
T1	2.38B	2.36B	2.37C	0.133C	0.167C	0.150D	1.27C	1.29C	1.28C
T2	2.43AB	2.41AB	2.42BC	0.155AB	0.206B	0.181BC	1.41B	1.54A	1.48B
T3	2.47A	2.47A	2.47AB	0.166A	0.235A	0.201A	1.51A	1.52B	1.52AB
T4	2.45AB	2.43AB	2.44B	0.149B	0.195B	0.172C	1.44B	1.56AB	1.50AB
T5	2.50A	2.49A	2.50A	0.159AB	0.203B	0.181BC	1.48A	1.50B	1.49B
T6	2.46AB	2.45A	2.46AB	0.152AB	0.193B	0.175BC	1.47A	1.60A	1.54A
T7	2.49A	2.48A	2.49A	0.159AB	0.213B	0.186B	1.49A	1.51B	1.50A
LSD 5 %	0.08	0.08	0.05	0.015	0.018	0.012	0.05	0.06	0.04

Means in each column with the same letters are not significantly different at 5%level.T1: Control T2: Spraying Yeast 10 g/L T3: Spraying Yeast 20 g/L T4: Spraying Kelpak 10 g/L T5: Spraying Kelpak 20 g/L T6: Spraying bio-power 10 g/L T7: Spraying bio-power 20 g/L

Yield components and fruit characters: -

The information shown in Table (2) demonstrates that yeast, Kelpak or bio-power at 10 or 20 g/ L spraying had positively increased yield per tree, fruit weight(g), fruit volume andpercentage of Pulp of 'Valencia' oranges, compared to the control in the 2019 and 2020 growing seasons. It appears that the results followed the same trend during the two studied seasons.

In a general view, the data presented cleared that yeast, Kelpak or bio-power significantly stimulated yield per tree, fruit weight(g), fruit volume and percentage of pulp more than spraying water (control).

Table 2. Effect of foliar application of yeast, Kelpak and bio-power on yield and fruit weight, fruit volume and percentage of Pulp of Valencia orange during 2019 and 2020 seasons.

Treatments	Yield / tree (Kg)			Fruit weight (g)			Fruit volume			Pulp %		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
T1	23.24C	27.51C	25.38C	155.72B	159.38B	157.55B	180.18B	187.83B	184.16 B	75.15B	73.93B	74.54B
T2	24.72B	29.45B	27.09B	156.13A	159.69A	157.91A	188.97A	199.32A	194.15 A	76.61AB	75.34AB	75.98AB
T3	26.26A	30.54AB	28.40AB	157.24A	161.28A	159.26A	190.61A	200.55A	195.58 A	77.54A	75.91A	76.73A
T4	25.22AB	29.94AB	27.58B	157.41A	160.65A	159.03A	188.40A	198.95A	193.68 A	77.07AB	75.28AB	76.18A
T5	26.27A	31.49A	28.88A	161.97B	164.27B	163.12B	192.58A	201.17A	196.88 A	77.49A	76.02A	76.76A
T6	25.46AB	30.44AB	27.95AB	157.43A	160.51A	158.97A	190.27A	200.28A	195.28 A	76.94AB	75.53AB	76.24A
T7	26.28A	30.59AB	28.44AB	158.7A	161.52A	160.11A	190.79A	201.09A	195.94 A	77.56A	75.90A	76.73A
LSD 5 %	1.41	1.63	1.11	6.53	7.91	5.29	8.12	8.33	6.05	2.11	1.81	1.45

Means in each column with the same letters are not significantly different at 5%level. T1: Control T2: Spraying Yeast 10 g/L T3: Spraying Yeast 20 g/L T4: Spraying Kelpak 10 g/L T5: Spraying Kelpak 20 g/LT6: Spraying bio-power 10 g/LT7: Spraying bio-power 20 g/L

The obtained yield per tree were (25.38, 27.09, 28.40, 27.58, 28.88, 27.95 and 28.44 kg), fruit weight were (157.55, 157.91, 159.26, 159.03, 163.12, 158.97 and 160.1g), fruit volumewere (184.16, 194.15, 195.58, 193.68, 196.88, 195.28

and 195.94cm3) and pulp % were (74.54, 75.98, 76.73, 76.18, 76.76, 76.24 and 76.73%) as an av. of the two studied season) due to spray water (control), yeast 10 g/L water, yeast 20 g/L water, Kelpak 10 g/L water, Kelpak 20 g/L water, Bio-power 10 g/L water and Bio-power 20 g/L water respectively.

The highest percentage of affected yield per tree, fruit weight(g), fruit volume and percentage of pulp were recorded with the application of spraying Kelpak at 20 g/L water(T 5) followed by spraying bio-power at 20 g/L water(T7), and spraying yeast at 20 g/L water(T3), respectively. On other hand, the lowest values were observed in the control treatment (T1). Therefore, the corresponding increment of yield per tree over control was (13.79%), fruit weight was (3.54%), fruit volume was (6.91%) and Pulp was (2.98%) during the two seasons studied, respectively.

Fruit chemical quality: -

Table 3 shows the chemical components of fruit juice and their impact on the spraying yeast, Kelpak and bio-power during the 2019 and 2020 seasons. The data showed that all treatments led to a significant improvement in the chemical ingredients of fruit juice in terms of high values, total soluble solids and ascorbic acid, a significant decrease in total acidity compared to the control. The highest percentage of total soluble solids, fruit juice and ascorbic acid as well as the lowest total acidity were obtained in trees that spray with Kelpak at 20 g/L water(T5) followed by spraying with yeast at 20 g/L water(T3). Therefore, the corresponding increment of TSS over control was (14.65%), fruit juice was (6.11%), ascorbic acid was (6.54%) and total acidity was (21.88%) during the two seasons studied, respectively.

The recorded TSS were (10.92, 11.40, 12.48, 11.34, 12.52, 11.86 &12.33%), fruit juice were (48.10, 49.57, 51.04, 49.77, 50.97, 50.14 & 50.87%), ascorbic acid were (43.74, 45.13, 46.45, 45.25, 46.60, 45.73& 46.45mlg/g), and total acidity were (1.17, 1.04, 0.96, 1.02, 0.96, 0.99& 0.97% as an average of two studied season) due to spray water (control), yeast 10 g/L water, yeast 20 g/L water, Kelpak 10 g/L water, Kelpak 20 g/L water, Bio-power 10 g/L water and Bio-power 20 g/L water, respectively.

Therefore, from a general perspective, spraying with yeast, Kelpak, and bio power at a concentration of 20 g/L of water appears to be more effective in enhancing the quality of Valencia oranges.

Table 3. Effect of foliar application of yeast, Kelpak and bio-power on some fruit chemical quality of Valencia orange during 2019 and 2020 seasons.

Treatments	TSS%			Juice %			Ascorbic acid (mg/ 100 ml Juice)			Acidity %		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
T1	10.94C	10.98D	10.92D	47.95B	48.25B	48.10 C	43.61C	43.87C	43.74C	1.16A	1.18A	1.17A
T2	11.45B	11.35C	11.40C	49.33AB	49.81B	49.57B	44.96B	45.30B	45.13B	1.04B	1.03B	1.04B
T3	12.27A	12.69A	12.48A	50.71A	51.37A	51.04 A	46.27A	46.63A	46.45A	0.97BC	0.95B	0.96C
T4	11.47B	11.20B	11.34C	49.56A	49.98A	49.77 B	45.13A	45.37B	45.25B	1.02BC	1.01B	1.02BC
T5	12.26A	12.78A	12.52A	50.63A	51.31A	50.97 A	46.38A	46.81A	46.60A	0.96C	0.95B	0.96C
T6	11.71B	12.00B	11.86B	49.87A	50.40A	50.14 A	45.61A	45.85A	45.73A	0.99BC	0.98B	0.99BC
T7	12.27A	12.38A	12.33A	50.60A	51.14A	50.87 A	46.18A	46.71A	46.45A	0.97BC	0.96B	0.97C
LSD 5 %	0.38	0.43	0.30	1.39	1.46	1.03	1.28	1.25	0.93	0.07	0.09	0.06

Means in each column with the same letters are not significantly different at 5%level. T1: Control T2: Spraying Yeast 10 g/L T3: Spraying Yeast 20 g/L T4: Spraying Kelpak 10 g/L T5: Spraying Kelpak 20 g/LT6: Spraying bio-power 10 g/LT7: Spraying bio-power 20 g/L

Discussion

The application of a biogen-enriched formulation containing 100 g of *Azotobacter* to *Citrus reticulata* trees grafted on sour orange rootstock significantly improved vegetative growth traits, leaf area, and the carbohydrate-to-nitrogen ratio in shoots, outperforming conventional artificial fertilizers. Similarly, a biofertilizer blend comprising *Bacillus megaterium*, *Bacillus cereus*, and *Azotobacter chroococcum* enhanced the growth of Valencia orange trees. Compared to untreated control trees, this combination significantly improved all measured vegetative growth parameters (El-Salhy et al., 2010; El-Khawaga and Maklad, 2013).

Yeasts are not only a rich source of carbohydrates, vitamins, enzymes, amino acids, minerals, and phytohormones - particularly cytokinins - but also serve as a natural and safe biofertilizer. They have been shown to enhance chlorophyll biosynthesis, stimulate protein and nucleic acid synthesis, and promote cell division and expansion, thereby improving plant growth and productivity. Dry yeast, in particular, is valued as a natural biostimulant due to its high content of proteins, amino acids, and B-complex vitamins, including thiamine (B_1), riboflavin (B_2), and pyridoxine (B_6). Yeasts also produce significant amounts of growth-promoting substances such as vitamins, hormones, and cytokinins. Foliar application of 0.2% dry yeast extract has been reported to improve the physical characteristics of Valencia orange fruits. Moreover, the most effective treatment for enhancing fruit length and diameter was found to be a spray mixture containing 40 ppm benzyladenine (BA), 0.4% yeast, and 0.4% potassium, which significantly increased final fruit size—especially in trees grafted onto sour orange rootstock—while also improving key chemical quality attributes (Mahmoud, 2001; Abou El-Yazied and Mady, 2012; El-Tanany and Shaimaa, 2016).–Studies by Bakry (2007) on Balady mandarin, Mohamed (2008) on Jaffa orange, and Khafagy *et al.* (2010) on Navel orange trees demonstrated that foliar application of 0.4% yeast extract significantly increased fruit weight and number, as well as improved fruit physical characteristics, compared to the control treatment.

CONCLUSION

The results of this study indicate that foliar application of yeast, Kelpak, or Bio-power at a concentration of 20 g/L effectively enhances yield, fruit quality, and nutritional status of Valencia orange trees, contributing to improved marketability under the tested conditions.

REFERENCES

Abd El-Motty, E. Z. and S. A. Orabi (2013). The beneficial effects of using zinc, yeast and selenium on yield, fruit quality and antioxidant defense systems in Navel orange trees grown under newly reclaimed sandy soil. J. of Applied Sciences Research, 9(10): 6487-6497.

Abdel-Moniem, E.A.A; A.A. Fouad; F.H. Khalil and A.E.M. Mansour (2003). Response of Fagri kalan and Alphonse mango trees to some bio-fertilizers treatments. Minia J. Agric. Res. & Develop., 23 (3): 547-564.

Abou El-Yazied, A. and M.A. Mady (2012). Effect of boron and yeast extract foliar application on growth, pod setting and both green pod and seed yield of broad bean (*Vicia faba* L.). J. Appl. Sci. Res., 8(2): 1240-1251.

Alalaf, A. H. (2020). The role of biofertilization in improving fruit productivity: a review. Int J Agricult. Stat Sci., 16(1): 107-12.

Bakry, K.H.A. (2007). Response of Jafa orange trees to spray with yeast extract and promalin. Egypt. J. Appl. Sci., 22 (10A): 195-210.

Barnett, J.A., R.W. Payne and D. Yarrow, (1990). Yeasts, characteristics and Identification. Cambridge University Press, London, 999pp.

Calvo, P.; L. Nelson and J.W. Klooper (2014). Agricultural uses of biostimulants. Plant Soil, 383: 3-41.

Deepali, G. K., and K.Gangwar, (2010). Biofertilizers: An ecofriendly way to replace chemical fertilizers. Biofertilizers for sustainable agriculture, 1-13.

El-Boray, M. S., M. F. M.Mostafa, , S. E.Salem, , and O. A. O. El-Sawwah, (2015). Improving yield and fruit quality of Washington Navel orange using foliar applications of some natural biostimulants. J. of Plant Production, 6(8): 1317-1332.

El-Haddad, M.E.; Y.Z. Ishac and M.L. Mostafa (1993). The role of bio-fertilizers in reducing agricultural costs, decreasing environmental pollution and raising crop yield. Arab Univ. J. Agric. Sci., 1 (1): 147-195.

El-Khawaga, A.S. and M.F. Maklad (2013). Effect of combination between bio and chemical fertilization on vegetative growth, yield and quality of Valencia orange fruits. Hortscience J. of Suez Canal University, 1: 269-279.

El-Salhy, A.M., H.A. Abd El-Galil, A.H. Abd El-Aal and M. M. Ali (2010). Effect of different Nitrogen fertilizer sources on vegetative growth, nutrient status and fruiting of Balady Mandarin trees. Scientists Fac. of Agric. Assiut Univ., 27: 153-170.

El-Salhy, A.M.; H.M. Mazrouk and M.M. El-Akkad. (2006). Biofertilization and elemental sulphur effects on growth and fruiting of King's Ruby and Roomy grapevines. Egyptian J. of Horti., 33: 29- 44.

El-Salhy, A.M.; K.I.A. Amen; A.A.B. Masoud and A.A. Eman Abozed (2011). Response of Ruby seedless and Red Roomy grapevines to application of some bio-fertilizers. Assiut J. Agric. Sci., 41 (5): 125- 142.El-Tanany, M. M., and A. M.Shaimaa (2016). Effect of foliar application of cytokinin, active dry yeast and potassium on fruit size, yield, fruit quality and leaf mineral composition of Valencia orange trees. Egypt. J. Hort., 43(2): 389-414.

Hegab, M.Y.; A.M.A. Sharawy and S.A.g. El-Saida (2005): Effect of algae extract and mono potassium phosphate on growth and fruiting of Balady orange trees. Bull. Fac. Agric., Cairo Univ., 56: 107-120.

Jankowski, K. and B. Dubis, (2008) Biostimulators in Plant Field Production. Mat. Conf. Biostimulators in Modern Plant Breeding. Plant Press, Warsaw, 24-25

Kannaiyan, S. (2002): Biotechnology of Biofertilizers. Alpha Sci. In ter. Ltd B. O. Bpx 4067 Pang Boorne. 68 U.K. pp. 1-275.

Kasahara, H. (2016). Current aspects of auxin biosynthesis in plants. Bioscience, biotechnology, and biochemistry, 80(1): 34-42.

Kawalekar, J. S. (2013). Role of biofertilizers and biopesticides for sustainable agriculture. J Bio Innov, 2(3), 73-78.

Khafagy, S.A.A., N.S Zaied, , M.M Nageib,., M.A. Saleh, and , A.A. Fouad (2010) The beneficial effects of yeast and zinc sulphate on yield and fruit quality. Agricultural Sciences, 6 (6): 635-638.

M.A.L.R. (2023). Ministry of Agriculture and Land Reclamation. Bulletin of Agricultural Statistics. Part (2). Summer and Nili crops.

Ma, G.; Zhang, L.; Sugiura, M.; Kato, (2020). Citrus and health. In The Genus Citrus; Talón, M., Caruso, M., Gmitter, F., Eds.; Woodhead Publishing: Cambridge, UK, 2020; pp. 495–511.

Mahmoud, T.R. (2001): Botanical studies on growth and germination of Magnolia "Magnolia grandiflora L." plants. Ph.D. Thesis, Fac. Agric. Moshtohor, Zagazig Univ.

Mohamed, O.A.F. (2008) Response of Balady mandarin trees to foliar application with active yeast and some microelements. M.Sc. Thesis, Faculty of Agric., Moshtohor, Benha Univ. Egypt.

Mustafa, N. S., and S. M. El-Shazly (2013). Impact of some biostimulant substances on growth parameters of Washington Navel orange trees. Middle East J. of Applied Sciences, *3*(4): 156-160.

Nutaratat, P., N.Srisuk, , P.Arunrattiyakorn, , and S.Limtong (2016). Indole-3-acetic acid biosynthetic pathways in the basidiomycetous yeast *Rhodosporidium paludigenum*. Archives of microbiology, 198: 429-437.

Ram Rao, D.M.; J. Kodandaramaiah; M.P. Reddy; R.S. Katiyar and V.K. Rahmathulla (2007). Effect of AM fungi and bacterial biofertilizers on mulberry leaf quality and silkworm cocoon characters under semiarid conditions. Caspian J. Env. Sci., 5 (2): 111-117.

Snedecor, G. W. and W. G. Cochran (1990). Statistical Methods 7th ed. Iowa State Univ. Press. Ames.

Sprent, J. I. (1999). Nitrogen fixation and growth of non-crop legume species in diverse environments. Perspectives in Plant Ecology, Evolution and Systematics, 2(2): 149-162.

Talón, M., G.A. Wu, F.G. Gmitter and D.S. Rokhsar (2020). The origin of citrus. In: Talón, M., M. Caruso and F.G. Gmitter (eds.) The genus citrus, Elsevier, Duxford, UK, pp. 9–31.

Thomas, L. and I.Singh, (2019). Microbial bio-fertilizers: types and applications. In: Bio-fertilizers for Sustainable Agriculture and Environment, Springer. p. 1-19.

Verna, L.N. (1999). Role of biotechnology in supplying plant nutrients in the vineties. Fertilizer news., 35: 87- 97.

Wilde, S.A., B.B. Gorey, J.G. Layer and J.K. Voigt (1985): Soils and Plant Analysis for tree culture. Published by Mohan primlani, Oxford and IBH publishing Co., New Delhi, p. 1- 142.

Zhong, G., and E.Nicolosi (2020). Citrus origin, diffusion, and economic importance. The citrus genome: 5-21.

تأثير بعض المستخلصات الطبيعية على إنتاجية وجودة البرتقال الفالنشيا تحت ظروف الوادى الجديد

عاطف يعقوب حليم ،وائل موسى غيث وأحمد عبد الفتاح حسن حجازي

قسم الإنتاج النباتي ، مركز بحوث الصحراء، القاهرة ، مصر

الملخص

أجريت هذه الدراسة خلال موسمي ٢٠١٩ و٢٠٢٠ على أشجار البرتقال الفالنشيا المنزرعة في مزرعة آفاق بمنطقة بلاط محافظة الوادي الجديد– مصر بهدف دراسة تأثير رش بعض المستخلصات الطبيعية على النمو الخضري و الحالة الغذائية وإنتاجية وخصائص الثمار. اشتملت الدراسة على رش الخميرة والكلباك والمنشط الحيوي بيوبلور بتركيزين هما ١٠ و ٢٠ جم لكل لتر ماء ، مقارنة بمعاملة الرش بالماء(معاملة الكنترول). وقد صممت التجربة بنظام القطاعات كاملة العشوائية. ويمكن تلخيص النتائج كالتالي:- أدي رش الخميرة والكلباك والمنشط الحيوي بيوبلور إلي زيادة معنوية في عدد الأوراق وعدد الأزهار في النورات الورقية و الخشبية للأشجار وبالتالي زيادة نسبة العقد بها وأيضاً زيادة محتوي الأوراق من عناصر النيتروجين والفوسفور والبوتاسيوم مقارنة برش الماء (معاملة الكنترول). سبب الرش بالمعاملات السابقة إلى زيادة وزن الثمار وبالتالي زيادة محصول كل شجرة وأيضاً حجم الثمرة وزيادة نسبة اللحم للثمرة مقارنة برش المياه(معاملة الكنترول). أدي الرش بالخميرة والكلباك والمنشط الحيوي بيوبلور إلي زيادة مؤكدة في المواد الصلبة الذائبة الكلية ونسبة العصير وحمض الاسكوربيك بالثمار ونقص مؤكد في نسبة الحموضة في العصير مقارنة برش الماء (معاملة الكنترول).من نتائج هذه الدراسة يمكن التوصية بأهمية رش أشجار البرتقال الفالنشيا بالخميرة أو الكلباك أو المنشط الحيوي بيوبلور مرتين وذلك لتحسين النمو الخضري والحالة الغذائية و الإنتاجية وانتاج محصول ذو خصائص ثمرية جيدة.

الكلمات الدالة : المستخلصات الطبيعية –جودة الثمار – المحصول – البرتقال الفالنشيا.