

(Original Article)



Effect of Spraying with Amino Acids, Yeast, and Some Plant Extracts on Fruiting of Sewi Date Palm

Eslam M.A.A. Elkady; Marwa T. El-Mahdy*; Mohamed M. Elakad and Rafat A.A. Mostafa

Pomology Department, Faculty of Agriculture, Assiut University, Egypt.

*Corresponding author email: marwa.refaat@agr.aun.edu.eg

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Abstract

This study was conducted to evaluate the impact of bio-fertilization with amino acids (500 and 1000 ppm), active dry yeast (5.0 and 10.0 g/L), and plant extracts as turmeric (500 and 1000 ppm) and cinnamon (500 and 1000 ppm) on yield and fruit quality of Sewi date palm during 2019 and 2020 seasons. All treatments were foliar sprayed twice, one month after pollination at Hababouk stage and two months later in Khalal Stage. The experiment was arranged in a randomized complete block design (RCBD) including nine treatments with ten replications of one bunch each. Data showed that all treatments had a positive effect on improving all studied characteristics under the investigation. Among treatments, foliar application of active dry yeast at 5.0 or 10.0 g/L significantly induced the best results for improving the yield and fruit attributes in terms of bunch weight (kg/palm), fruit retention percentage, fruit weight, fruit volume, pulp percentage, fruit length, fruit diameter, fruit shape index, total sugar percentage, reducing sugar percentage, and non-reducing sugar percentage during the two seasons of the study. Turmeric extract also was shown to be the best second treatment followed by amino acids then cinnamon extract. Hence, it could be concluded that spraying with amino acids, yeast, turmeric extract, and cinnamon extract can be used effectively on enhancing yield and fruit value of Sewi date palm.

Keywords: amino acids, cinnamon, Date palm, turmeric, yeast.

Introduction

Date palm (*Phoenix dactylifera* L.) is an ancient fruit crop found in many places throughout the world because of the plant adaption to a wide range of environmental and soil conditions. It is one of the ancient domestic fruit trees in the Middle East and North Africa countries and their fruits play an important role in the nutrition pattern of many people as well as a strategic crop for food and biochemical industries. The fruits are rich source in carbohydrates, especially sugars and antioxidants (El-Sohaimy and Hafez, 2010). Egypt is one of the major dates producing countries in the world. The total number of females reached 14379648 palms producing about 1644417 tons, which represented around 18% of the global production (M.A.L.R., 2019).

Sewi date palm cultivar is classified as semi-dry date palm according to the moisture content. In Egypt, Sewi dates are one of the most important semi-dry varieties suitable for packaging, processing, and storage and have paramount importance for local commercial. Thus, the production of high-quality date palm cultivars both for export and domestic markets is very important.

Antioxidants such as amino acids, citric acid, ascorbic acid, and vitamins have synergistic effect on growth and productivity for most of fruit trees and may play a definite role on solving the problem of poor yield, through enhancing growth nutritional status, yield, and fruit quality in different fruit trees (Merwad *et al.*, 2015). They have a defensive role against oxidative stress, cell senescence, fungal attack, as well as enhancing cell division and growth (Moustafa-Attia, 2021). Additionally, they improve flowering and fruit setting particularly under stressful conditions (Hayat and Ahmed, 2007).

The demand of essential amino acids is well recognized as an application to boost yield and berry quality. The implementation of amino acids for foliar use is based on the necessity of crops in general and at critical development stages in specific. Numerous studies have shown the positive role of amino acids on improving fruit quality and quantity (Rai, 2002 and Abdel-Ghany, 2021).

Yeast as a bio-fertilizer is characterized by containing different nutrients, vitamins and cytokinin as a natural plant hormone and photosynthesis stimulator (Subba Rao, 1984). The positive effect of yeast application could be due to its effect on activating photosynthesis process as well as its higher own content from natural growth regulators, amino acids, and B-vitamins. Also, yeast is responsible for encouraging the uptake of different nutrients (Barnett *et al.*, 1990). In this respect, many investigators emphasized the importance of yeast application to improve the fruiting of date palm (Osman, 2003; Gobara, 2004; Gobara and Ahmed, 2004; Gadalla *et al.*, 2011; Osman *et al.*, 2011; El-Khayat and El-Noam, 2013; Ahmed *et al.*, 2014; Mostafa, 2015, El-Salhy *et al.*, 2017; El-Salhy *et al.*, 2018).

The use of natural compounds as plant extracts in alternative to the industrial chemical fertilizers is highly recommended to conserve the environment and avoid the residual effect of synthetic fertilizers (Sadeq *et al.*, 2002). Using natural plant extracts are effective in improving yield and quality of fruit orchards as safety agents for human and environment and cost effective (Dimitri and Oberholtzer, 2006).

Turmeric is the dried rhizome of the plant *Curcuma longa* L. It contains 0.5% volatile oil. This oil contains about 60% turmeric, 25% zingiberene and small quantities d-a-phellandrene, d-sabienene, cineole and forneol. Curcumin which gives turmeric a yellow color, along with nutritional ingredients such as potassium. The extracts are characterized by their higher content of organosulfur compounds, volatile components, fats, proteins, nutrients, tannins, vitamins, and antioxidants (Peter, 1999).

Cinnamon (*Cinnamo mumverum*) is a rich source of proteins, carbohydrates, vitamins (A, C, E and B3), and minerals like Ca, Fe, Mg, Mn, P and Zn (Vangalapati *et al.*, 2012). Moreover, it has essential oils, cinnamic acid, cinnamaldehyde and cinnamate. Cinnamon also has high antioxidant and antibacterial activity (Jakhetia *et al.*, 2010).

The purpose of this study was to shed more light on the benefits of amino acids, yeast, and some plant extracts (Turmeric & Cinnamon) on fruiting of Sewi date palm cultivar under Assiut climatic conditions, Egypt.

Materials and Methods

This investigation was executed through two successive seasons of 2019 and 2020 on Sewi date palms (*Phoenix dactylifera* L.) to evaluate the effect of amino acids, yeast, and some plant extracts (Turmeric & Cinnamon) on fruiting of Sewi date palm cultivar under Assiut climatic conditions, Egypt.

The date palms were grown in the experimental orchard of Pomology Department, Faculty of Agriculture, Assiut University, Egypt, where the soil is clay loam. Ten healthy palms selected randomly and at the same age of 35 years-old, uniform in vigor, healthy in good physical conditions, and free from insects and diseases. The palms were planted at 10x10 meters apart. They were subjected to the same management, and cultural practices such as artificial pollination, pruning, irrigation, fertilization, and manuring. Artificial pollination was uniform for source, date, and method. Also, the bunch/leaf ratio has been adjusted to be 1:8 during the pollination process. Bunches were thinned to nine per palm by removing excess earliest, latest, and smallest ones.

The experiment including nine treatments with ten replications of one bunch each and they were arranged as follow:

- T1- Spraying with amino acids (500 ppm)
- T2- Spraying with amino acids (1000 ppm)
- T3- Spraying with active dry yeast (5.0 g/L)
- T4- Spraying with active dry yeast (10.0 g/L)
- T5- Spraying with turmeric extract (500 ppm)
- T6- Spraying with turmeric extract (1000 ppm)
- T7- Spraying with cinnamon extract (500 ppm)
- T8- Spraying with cinnamon extract (1000 ppm)
- T9- Spraying with water (control).

The applied amino acid is: Super Viga Max^R (Commercial product produced by: Union for Agricultural Development Co. (UAD), Egypt), containing 17.5 % amino acid W\V)

Active dry yeast was dissolved in water and activated before application by using sugar solution at 5% in warm water (38°C) for 24 hours (Barnett *et al.*, 1990).

Turmeric extract: Acetone was used as the solvent for the preparation of turmeric extract from turmeric powder (Jayaweera *et al.*, 2108).

Cinnamon extract: 250g of grounded bark of cinnamon plant were suspended in water 48h then filtered to obtain stock solution extract. Slim, (2014)

All treatments were applied two times, on month after pollination at Hababouk stage and two months later at Khalal Stage. Bunches were foliar sprayed using a small hand sprayer until run-off. Bunches were separated from each side with plastic sheets to avoid any contamination between the treatments. The laboratory work of this study was conducted in Pomology Department Faculty of Agriculture Assiut University, Egypt.

Generally, the following measurements were determined during the two investigated seasons. The harvest took place at the peak of full color stage (before it's quite ripe), the third week of September in both studied seasons.

- **Yield components**

1- Fruit retention (%).

2- Bunch weight (kg).

- **Fruit characteristics**

1- Fruit physical properties:

2- Fruit weight (g).

3- Flesh weight: The average flesh weight, in grams after removing the seeds, was calculated and flesh (%) was calculated by: $\text{flesh weight} / \text{fruit weight} \times 100$

4- Fruit Length and Fruit diameter (cm).

5- Fruit shape: It was calculated by dividing fruit length by fruit diameter.

6- Fruit volume (cm³).

- **Fruit chemical properties**

1- Total soluble solids (TSS %).

2- Titratable acidity (%).

3- Total, reducing and non-reducing sugars: according to the protocol of A.O.A.C. (1985).

Statistical analysis

Consequently, the obtained data during the two seasons were collected, tabulated, and subjected to the proper statistical analysis of variance method reported by Gomez and Gomez (1984) and Mead *et al.* (1993). The differences between treatment means were compared by using LSD values at 5% level of the probability.

Results

Bunch weight and fruit retention%

Data in Table (1) show the effect of foliar spray with amino acids, dry yeast, and plant extracts (turmeric and cinnamon) on bunch weight and fruit retention percentage of Sewi date palm. Bunch weight was improved by all treatments under the current investigation for the two seasons of study compared to the control. Dry yeast application (5.0 and 10.0 g/L) induced the highest significant values for bunch weight (23.18 and 23.65 kg) during the 1st season and (23.65 and 23.58 kg) during the 2nd season, respectively followed by turmeric extract (500 and 1000 ppm) which recorded (22.75 and 23.22 kg) in the 1st season and (22.83 and 23.11 kg) in the 2nd season, respectively. Cinnamon extract caused the lowest significant increase in bunch weight in both seasons of study. On the other hand, fruit retention percentage increased by different treatments, however the differences were insignificant between the treatments and control. Foliar spray with cinnamon extract at 500 ppm caused the maximum fruit retention (70.26%) in 2019, while dry yeast at 5.0 g/L produced the best fruit retention (65.19%) in 2020 compared to the control.

Table 1. Effect of spraying with amino acids, yeast and some plant extracts on Bunch weight and Fruit retention% of Sewi date palm during 2019 and 2020 seasons

Property Treat.	Bunch weight (kg)			Fruit retention%		
	2019	2020	Mean	2019	2020	Mean
T1	22.36B	22.60A	22.48	68.91	64.26	66.59
T2	22.81B	22.71A	22.76	68.68	63.31	66.00
T3	23.18AB	23.65A	23.42	69.38	65.19	67.29
T4	23.65A	23.58A	23.62	69.85	64.48	67.17
T5	22.75AB	22.83A	22.79	68.68	63.78	66.23
T6	23.22AB	23.11A	23.17	68.75	63.11	65.93
T7	21.13C	21.18B	21.16	70.26	63.85	67.06
T8	21.40BC	22.00B	21.70	67.65	64.71	66.18
T9	19.65D	19.86C	19.76	68.11	63.75	65.93
New L.S.D.	1.18	1.11		N.S.	N.S.	

T1: Spraying with amino acids (500 ppm), T2: Spraying with amino acids (1000 ppm), T3: Spraying with active dry yeast (5.0 g/L), T4: Spraying with active dry yeast (10.0 g/L), T5: Spraying with turmeric extract (500 ppm), T6: Spraying with turmeric extract (1000 ppm), T7: Spraying with cinnamon extract (500 ppm), T8: Spraying with cinnamon extract (1000 ppm) and T9: Spraying with water (control). N.S.: not significant. Means marked by the same letter are not significantly different at 5% level.

Fruit weight, fruit volume and flesh percentage

Analysis of data from all the field trials indicated that foliar supplementation of different treatments significantly increased fruit weight, fruit volume and pulp % during the 2019 and 2020 experimental seasons (Table 2). In the first season, the highest fruit weight measurements (16.53 g), fruit volume (17.13 ml), and flesh (88.90%) was achieved by the application of dry yeast at 10.0 g/L. Similarly, such a trend was noted in the second season, the top most records of fruit weight (16.28 g), and fruit volume (16.75 ml) was observed after the addition of dry yeast (10.0 g/L), while flesh (89.39%) reached the maximum when the lower level of dry yeast

(5.0 g/L) was added. In addition, turmeric extract as well as yeast expressed positive influence in the studied traits followed by amino acids then cinnamon extract.

Table 2. Effect of spraying with amino acids, yeast and some plant extracts on fruit weight, fruit volume and flesh percentage of Sewi dates during 2019 and 2020 seasons

Property Treat.	Fruit weight (g)			Fruit volume (ml)			Flesh %		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
T1	15.60AB	15.31B	15.46	16.25B	15.86B	16.06	87.89A	88.58A	88.24
T2	15.81AB	15.38B	15.60	16.41B	16.10B	16.26	87.95A	88.55A	88.25
T3	16.14A	15.72AB	15.93	16.79AB	16.45AB	16.62	88.66A	89.39A	89.03
T4	16.53A	16.28A	16.41	17.13A	16.75A	16.94	88.90A	89.19A	89.05
T5	15.96AB	15.54AB	15.75	16.52AB	16.22AB	16.37	87.86A	88.39A	88.13
T6	16.10A	15.60AB	15.85	16.70B	16.41A	16.56	88.21A	89.11A	88.66
T7	14.78B	14.53C	14.66	15.34C	15.05C	15.20	87.42AB	88.16AB	87.79
T8	15.21B	14.94C	15.08	15.66C	15.41BC	15.54	87.38AB	88.11AB	87.75
T9	13.84C	15.53D	14.69	14.36D	14.15C	14.26	85.22B	85.91B	85.57
New LS.D.	0.85	0.76		0.68	0.71		2.36	2.44	

T1: Spraying with amino acids (500 ppm), T2: Spraying with amino acids (1000 ppm), T3: Spraying with active dry yeast (5.0 g/L), T4: Spraying with active dry yeast (10.0 g/L), T5: Spraying with turmeric extract (500 ppm), T6: Spraying with turmeric extract (1000 ppm), T7: Spraying with cinnamon extract (500 ppm), T8: Spraying with cinnamon extract (1000 ppm) and T9: Spraying with water (control). N.S.: not significant. Means marked by the same letter are not significantly different at 5% level.

Fruit length, fruit diameter and fruit shape index

The different investigated treatments significantly influenced the fruit length and fruit diameter and insignificantly affected fruit shape index during the two seasons of the study, however the magnitude of the response depended on the specific treatment (Table 3). Yeast application (5.0 and 10.0 g/L) was the best treatment to enhance fruit length and fruit diameter, but the dose of 10.0 g/L induced the maximum fruit length (4.16 and 4.20 cm) and fruit diameter (2.57 and 2.61cm) in 2019 and 2020, respectively, when compared with untreated trees. Conversely, fruit shape index did not show significant changes. Turmeric extract (500 ppm) ranked the second-best treatment for enhancing fruit length and fruit diameter, recording (4.10 and 4.13 cm) for fruit length and (2.53 and 2.55 cm) for fruit diameter during the first and second season, respectively. Whereas cinnamon extract achieved the lowest significant result.

TSS and Acidity percentage

The results in Table 4 revealed that in both studied seasons, significant increase in TSS% and decrease in acidity% was observed in treated palms compared to their controls. Turmeric extract and dry yeast were superior in stimulating the investigated parameters over the control. In the first season, the most effective

Table 3. Effect of spraying with amino acids, yeast and some plant extracts on fruit dimension and shape index of Sewi dates during 2019 and 2020 seasons

Property Treat.	Fruit length (cm)			Fruit diameter (cm)			Fruit shape index (L/D)		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
T1	4.07AB	4.09AB	4.08	2.49AB	2.51AB	2.5	1.63	1.63	1.63
T2	4.08AB	4.10AB	4.09	2.51AB	2.53AB	2.52	1.63	1.62	1.625
T3	4.11AB	4.14AB	4.125	2.55A	2.58A	2.565	1.61	1.60	1.605
T4	4.16A	4.20A	4.18	2.57A	2.61A	2.59	1.62	1.61	1.615
T5	4.10AB	4.13AB	4.115	2.53B	2.55AB	2.54	1.62	1.62	1.62
T6	4.10AB	4.12AB	4.11	2.54B	2.54AB	2.54	1.61	1.62	1.615
T7	3.98B	4.01B	3.995	2.46B	2.48BC	2.47	1.62	1.62	1.62
T8	4.02AB	4.02B	4.02	2.48AB	2.51AB	2.495	1.62	1.60	1.61
T9	3.82C	3.80C	3.81	2.35C	2.38C	2.365	1.63	1.60	1.615
New L.S.D.	0.15	0.13		0.09	0.10		N.S.	N.S.	

T1: Spraying with amino acids (500 ppm), T2: Spraying with amino acids (1000 ppm), T3: Spraying with active dry yeast (5.0 g/L), T4: Spraying with active dry yeast (10.0 g/L), T5: Spraying with turmeric extract (500 ppm), T6: Spraying with turmeric extract (1000 ppm), T7: Spraying with cinnamon extract (500 ppm), T8: Spraying with cinnamon extract (1000 ppm) and T9: Spraying with water (control). N.S.: not significant. Means marked by the same letter are not significantly different at 5% level.

Treatment was turmeric extract (1000 ppm) which recorded 73.31% for TSS and 0.238% for acidity. While, in the second season, dry yeast (5.0 g/L) achieved the highest values for TSS (74.16%), and turmeric acid (1000 ppm) achieved 0.214% for acidity. On the other hand, dry yeast application had the same positive behavior as turmeric treatment with insignificant differences between them, while cinnamon extract treatment showed the least effects.

Table 4. Effect of spraying with amino acids, yeast, and some plant extracts on TSS and acidity percentage of Sewi dates during 2019 and 2020 seasons

Property Treat.	TSS %			Acidity %		
	2019	2020	Mean	2019	2020	Mean
T1	72.68A	73.48A	73.08	0.253AB	0.224B	0.24
T2	72.80A	73.39A	73.10	0.250B	0.226AB	0.24
T3	73.31A	74.16A	73.74	0.245B	0.218B	0.23
T4	73.25A	74.08A	73.67	0.241B	0.220B	0.23
T5	73.15A	74.11A	73.63	0.240B	0.216B	0.23
T6	73.31A	74.15A	73.73	0.238B	0.214B	0.23
T7	71.43AB	72.22AB	71.83	0.256AB	0.230AB	0.24
T8	71.58AB	72.38AB	71.98	0.254AB	0.230AB	0.24
T9	68.93B	69.76B	69.35	0.264A	0.235A	0.25
New L.S.D.	2.68	2.85		0.012	0.010	

T1: Spraying with amino acids (500 ppm), T2: Spraying with amino acids (1000 ppm), T3: Spraying with active dry yeast (5.0 g/L), T4: Spraying with active dry yeast (10.0 g/L), T5: Spraying with turmeric extract (500 ppm), T6: Spraying with turmeric extract (1000 ppm), T7: Spraying with cinnamon extract (500 ppm), T8: Spraying with cinnamon extract (1000 ppm) and T9: Spraying with water (control). N.S.: not significant. Means marked by the same letter are not significantly different at 5% level.

Total sugar, reducing sugar and non-reducing sugar percentage

The exogenous foliar spray of amino acids, dry yeast, turmeric extract, and cinnamon extract significantly raised total sugars, reducing sugars and non-

reducing sugars ratios as displayed in Table (5). In comparison to the control, the most remarkable total sugar percentage (64.62 and 65.25%) was resulted from the application of dry yeast at 10.0 g/L during the first and second seasons, respectively. Moreover, reducing sugars and non-reducing sugars accumulation significantly increased by all treatments in both seasons. Reducing sugar content reached the peak (52.98 and 52.56%) after the addition of dry yeast (5.0 g/L) in 2019 and 2020, respectively. However, the highest level of non-reducing sugar (11.81%) was obtained after the exposure to dry yeast (10.0 g/L) in the first year then (12.89%) after turmeric treatment (1000 ppm) in the second year.

Table 5. Effect of spraying with amino acids, yeast, and some plant extracts on sugars contents of Sewi dates during 2019 and 2020 seasons

Property Treat.	Total sugar %			Reducing sugars %			Non-reducing sugars %		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
T1	64.16A	64.88A	64.52	52.53A	52.10A	52.315	11.63AB	12.78A	12.205
T1	63.98A	64.63A	64.305	52.46A	51.93A	52.195	11.52AB	12.70A	12.11
T2	64.51A	65.19A	64.85	52.98A	52.56A	52.77	11.53AB	12.63A	12.08
T3	64.62A	65.25A	64.935	52.81A	52.44A	52.625	11.81A	12.81A	12.31
T4	64.38A	65.11A	64.745	52.80A	52.43A	52.615	11.58AB	12.68A	12.13
T5	64.55A	65.25A	64.9	52.86A	52.36A	52.61	11.69A	12.89A	12.29
T6	62.71A	63.41A	63.06	51.49A	51.41A	51.45	11.22B	12.00B	11.61
T7	62.80A	63.81A	63.305	51.56A	51.22A	51.39	11.24B	12.59A	11.915
T8	59.29B	59.36B	59.325	48.38B	47.83B	48.105	10.91B	11.53C	11.22
New L.S.D.	2.11	1.99		1.68	1.82		0.43	0.38	

T1: Spraying with amino acids (500 ppm), T2: Spraying with amino acids (1000 ppm), T3: Spraying with active dry yeast (5.0 g/L), T4: Spraying with active dry yeast (10.0 g/L), T5: Spraying with turmeric extract (500 ppm), T6: Spraying with turmeric extract (1000 ppm), T7: Spraying with cinnamon extract (500 ppm), T8: Spraying with cinnamon extract (1000 ppm) and T9: Spraying with water (control). N.S.: not significant. Means marked by the same letter are not significantly different at 5% level.

Discussion

In the present study natural products such as yeast, amino acids, turmeric extract, and cinnamon extract were utilized to enhance fruit characteristics and yield of Sewi date palm. Amino acids are one of the most widely applied biostimulants in agriculture field. They are substances that promote plant growth, increase nutrient availability, and enhance quality attributes. Moreover, amino acids can act as precursors to produce secondary metabolites and signaling molecules in plant cell under stressed and non-stressed conditions (Rai *et al.*, 2002; Tegedera and Rentsch, 2010; Khedr, 2018). In this regard, several studies reported the positive effect of amino acids on improving fruit attributes and yield (El-Salhy *et al.*, 2017 Alnajjar *et al.*, 2020).

On the other hand, yeast was proven to be a promotive additive for vegetables and fruits production. Yeast is a cost-effective source of nutrients, cytokinins and vitamins, which add value for crops production (Wanas, 2007). In parallel with our results, several previous studies documented the beneficial roles of yeast addition to improve quality and yield for fruit crops (Gobara, 2004; Osman *et al.*, 2011; Mostafa 2015; Xi *et al.*, 2019).

Plant extracts as turmeric and cinnamon also were recently shown as an effective improver for plant growth and maturity. Turmeric is natural material with high content of cytokinin that stimulates cell division and expansions as well as the formation of protein, nucleic acid, and chlorophyll synthesise (Pons, 2003).

Similarly, cinnamon is a rich source of many important components such as proteins, carbohydrates, vitamins, and minerals (Vangalapati *et al.*, 2012) hence, considered as a stimulator for plant growth and development. Mohammadi *et al.* (2019) emphasized the activist role of cinnamon essential oil on Halilehei date palm cultivar fruits.

Conclusion

The accomplished results under our investigation showed that yeast, amino acids, turmeric extract, and cinnamon extract can be used efficiently on Sewi date palms to enhance productivity and fruit quality. They can be safely applied in replacement of synthetic fertilizers as natural products harmless for human health and the environment. Among treatments, the best results for improving yield and fruit attributes turned out to be through foliar application of active dry yeast at 5.0 or 10.0 g/L. From an economic point of view, 5.0 g/L would be preferable.

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تأثير الرش بالأحماض الأمينية والخميرة وبعض المستخلصات النباتية على إثمار نخيل البلح السيوي

اسلام محمود عبد العزيز عبد العال القاضي، مروة طلعت المهدي، محمد مجدي العقاد، رأفت أحمد على مصطفى

قسم الفاكهة – كلية الزراعة – جامعة أسيوط - مصر

الملخص

أجريت هذه الدراسة خلال موسمي 2019 و2020 على نخيل البلح السيوي المزروع بمزرعة كلية الزراعة جامعة أسيوط بهدف دراسة تأثير رش الأحماض الأمينية والخميرة الجافة ومستخلص القرفة والكرم على المحصول وخصائص الثمار. وقد تم الرش مرتين خلال موسم النمو. وتوضح النتائج الآتي: -

أدت جميع المعاملات إلي زيادة جوهريّة في وزن السباطة ونسبة العقد النهائي ووزن المحصول وخصائص الثمار مقارنة بأشجار الغير مرشوشة (الكنترول).

تم الحصول علي أعلى نسبة في العقد النهائي وزن للسباطة وبالتالي أعلى وزن للمحصول عند الرش بالخميرة الجافة بتركيزي 10.5 جم/ لتر و يليه الرش بمستخلص الكرم بتركيز 500 ppm.

أدت جميع المعاملات إلي زيادة معنوية في وزن الثمرة وحجم الثمرة والنسبة المئوية للحم وطول وعرض الثمرة وسجلت أعلى القيم عند الرش بالخميرة الجافة بتركيز 10 جم/ لتر.

أدت جميع المعاملات تحسناً ملحوظاً في الصفات الكيميائية للثمار حيث زادت نسبة المواد الصلبة الذائبة الكلية والسكريات في الثمار وتقل النسبة المئوية للحموضة الكلية والتانينات بالثمار وكانت أفضل المعاملات هي الرش بالحمض الأميني بتركيز 5 جم/لتر.

من نتائج هذه الدراسة يمكن التوصية برش أغاريض نخيل البلح السيوي مرتين أثناء موسم النمو بالخميرة الجافة أو مستخلص الكرم وذلك للحصول على محصول عال ذو خصائص ثمريه جيد.