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Enhancing Yield and Fruit Quality of Barhi Date Palm (*Phoenix dactylifera* L.) through Integrated Application of Vermicompost, Micronutrients, and Amino Acids

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Abstract: Date palm is a vital fruit crop widely cultivated in developing regions, contributing significantly to food security, nutrition, and economic sustainability due to its rich content of carbohydrates, minerals, dietary fiber, and bioactive compounds. This study evaluated the combined effects of vermicompost (VC) and micronutrients with amino acids (Trace-amino, TA) on the yield and fruit quality of Barhi date palm under the agro-climatic conditions of Qena Governorate, Southern Egypt. Seven treatments were applied, including three levels of VC (50, 75, and 100 mL L^{-1}) as a soil application combined with two foliar levels of TA (2 and 4 g L^{-1}), in addition to a control treatment (water spray). The results showed that all treatments significantly improved yield components, including fruit set, fruit retention, bunch weight, and yield per palm, as well as fruit physical and chemical characteristics compared to the control. The highest yield and best fruit quality were recorded with the application of VC at 100 mL L^{-1} combined with TA at 4 g L^{-1}, followed by VC at 100 mL L^{-1} with TA at 2 g L^{-1} during both seasons.

Key words: Date palm cv. Barhi, vermicompost, micronutrients, amino acids.

1. Introduction

Date palm (*Phoenix dactylifera* L.), family Arecaceae, is one of the most important fruit trees grown in semiarid and arid-regions. In Egypt, many producers rely on date palms cultivation and exportation of fruits. According to **FAO (2025)**, Egypt ranks among the top date-producing countries worldwide, with an annual production of approximately 1.87 million tons. Barhi date palm is one of the most prominent and widely cultivated cultivars both globally and in Egypt, owing to its high productivity and superior fruit quality. Its fruits are particularly valued for their suitability for fresh consumption at the Khalal stage (full yellow maturity), which is characterized by low soluble tannin content, resulting

in reduced astringency and enhanced palatability **(Abd El- Haleem *et al*., 2020; Saeed and Abbas, 2024).**

Vermicompost is produced through the decomposition of organic materials via the interaction of earthworms and microorganisms. It is an environmentally and economically sustainable amendment that improves soil health and fertility. In contrast, the continuous use of chemical fertilizers can lead to adverse environmental and health effects, particularly through the contamination of groundwater and surface water **(Eswaran and Mariselvi, 2016).** Plant growth stimulation depends mainly on the biological properties of vermicompost, the plant used, and the cultivation conditions. The increased humus amount in soil through supplementation of vermincompost by earthworms would doubtless help favorable change in chemical, physical, and biological characteristics of soil, and in inducing the water-holding capacity **(Singh *et al.*, 2011).** In addition, the large-scale application of compost is an effective approach to increasing soil organic matter content, thereby enhancing long-term soil fertility **(Lal, 2004; Dignac *et al*., 2017).** Application of biofertilizers with worm compost tea resulted in a substantial progress in physical and chemical fruit properties of Barhi date palm. The obtained results showed that vermicompost tea and the bacterial strain *Bacillus licheniformis* (K95) improved the yield with good-quality **(Saeed and Abbas, 2024).**

Amino acids are vital cellular metabolites, it enhancing various metabolic roles and building proteins **(Akladious and Abbas, 2013).** Various studies reported that amino acids, as a biological stimulant, can improve physiological characteristics **(Xu *et al*., 2018).** According to **ElAbbasy *et al*. (2024)** on Hayany' date palm, spraying with amino-acids improved yield and fruit quality as it increased total sugars and decreased fruit content of titratable acidity. In addition, spraying bunches of Saidy Date Palm with micro-nutrients alone or in combination with amino acids was more effective in improving the yield and fruit quality **(Radwan *et al*., 2024).** On the other side, Micronutrients play a vital role in growth behavior and productivity of trees. Boron induces pollen grains to germinate and pollen tube to elongate, consequently improves fruit set and fruit yield **(Khayyat *et al*., 2007).** Zinc is an essential micronutrient that functions as a cofactor for numerous enzymes and is involved in key physiological processes, including nucleic acid metabolism, photosynthesis, and the biosynthesis of carbohydrates and proteins (**Mengel *et al*., 2001**). It also plays a role in plant growth through its involvement in the synthesis of tryptophan, a precursor of indole-3-acetic acid (IAA). Silicon, although considered a quasi-essential element, contributes to plant growth and development and requires continuous supply during different growth stages. Furthermore, silicon is associated with improved plant tolerance to abiotic stresses such as salinity and drought (**Liang *et al*., 2007**). The study of **Abo-El-Ez *et al*. (2022)** indicated that application of B at 2000 ppm + Zn at 250 ppm + Si at 1% produced high fruit quality of Seewy date palm. In addition, amino acids are among the most beneficial antioxidants that play a vital role in inducing yield by improving the nutritional status in various fruit trees and have valuable effects on growth and productivity of fruit trees **(Merwad *et al*., 2015; Khan *et al*., 2020**; **Radwan *et al*., 2024)**. Spraying bunches with 500 or 1000 ppm micro-nutrients alone or in combination with 5000 ppm amino acid was more effective in progressing yield and fruit quality of Saidy date palm **(Radwan *et al*., 2024).**

Plant growth depends on the availability and balance of mineral nutrients in the soil, yet plants often face limitations in obtaining sufficient amounts to support essential physiological processes. Nutrient deficiencies can reduce plant vigor, yield, and fruit quality, and may also affect ecosystem stability since plants are primary producers in food webs (**Hussein *et al*., 2021**). Therefore, this study aimed to investigate the effect of vermicompost and Trace-Amino as sources of amino acids and micronutrients on yield and fruit quality of Barhi date palm.

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2. Materials and Methods

The present study was conducted on 21 uniform Barhi date palm trees (20 years old) during the 2024 and 2025 seasons at the Agricultural Mechanization Farm, Al-Marashda village, Qena Governorate, Egypt, in sandy soil whose physical and chemical properties are presented in Table 1. All trees were managed according to the recommended horticultural practices of the Ministry of Agriculture, including artificial pollination, irrigation, and fertilization. Bunch thinning was carried out to maintain 12 bunches per palm by removing excess and undesirable bunches. The experiment was arranged in a completely randomized design with three replicates (one tree per replicate). Seven treatments were applied, consisting of three levels of vermicompost (VC) as soil application combined with two levels of Trace-amino (TA), in addition to an untreated control, as follows:

1. Spraying with water (control)
2. Vermicompost at 50 mL L^{-1} + Trace-amino at 2 g L^{-1}
3. Vermicompost at 50 mL L^{-1} + Trace-amino at 4 g L^{-1}
4. Vermicompost at 75 mL L^{-1} + Trace-amino at 2 g L^{-1}
5. Vermicompost at 75 mL L^{-1} + Trace-amino at 4 g L^{-1}
6. Vermicompost at 100 mL L^{-1} + Trace-amino at 2 g L^{-1}
7. Vermicompost at 100 mL L^{-1} + Trace-amino at 4 g L^{-1}

The following measurements were recorded during the two studied seasons.

Table (1). Physical and chemical proprieties of the soil under study

Texture class Sandy	**Particle size distribution**			**$CaCO_3$%**		**EC(dSm-1) 1: 2.5**	**pH (1-5)**
	Sand %	Silt %	Clay %				
	81.3	12.5	6.2	12.40		3.02	8.00
Cation (meq L^{-1})				Anion (meq L^{-1})			
Na^+	K^+	Ca^{++}	Mg^{++}	CO_3^{--}	HCO_3^-	Cl^-	SO_4^{--}
30.03	0.89	11.11	6.21	0.00	0.72	30.21	17.31

Yield measurements

$$\text{Fruit set \%} = \frac{\text{Total number of set fruits/stand}}{\text{Total nodes number per strand}}\ x\ 100$$

$$\text{Fruit retained \%} = \frac{\text{Total number of retained fruits/stand}}{\text{Total nodes number per strand}} x100$$

-Bunch weight and yield per palm: After bunches were collected and their weight (kg) was counted, the yield per palm (kg) was calculated by multiplying the total number of bunches/palm by the average bunch weight (kg).

Fruit physical characteristics

During the two seasons, twenty fruits were randomly selected from each palm to calculate the following characteristic:

- Fruit weight: The fruit weight average was calculated and recorded in grams.

- Flesh weight % $= \frac{\text{Flesh weight}}{\text{Fresh fruit weight}} x100$

Fruit length and fruit diameter: The fruit dimensions were determined using a Vernier Caliper in centimeters.

Fruit chemical characteristics

- Total soluble solids (TSS %)

The fresh fruit was finely chopped with an electric blender, the past was squeezed, and total soluble solids percentage was estimated by using a hand refractometer.

- Total and reducing sugars

Total and reducing percentages were measured according to the volumetric method of Lane and Eynon that outlined in **A.O.A.C., 2000).**

- Titratable acidity (%)

Using an electric blender, twenty-five grams of fruit meat were combined with 100 ml of distilled water; the resulting extract was filtered, and 20 ml was titrated against 0.1 N sodium hydroxide using phenolphthalein as an indicator **(A.O.A.C., 2000).** The percentage of titratable acidity was calculated as g malic acid/100 g pulp.

- Total phenols

0.5 g of fruit flesh was extracted with 30 mL of ethanol and water (1:1, v/v). The mixture was stirred at room temperature for 3 h and then centrifuged at 3000 rpm. The supernatant was collected and filtered. Total phenolic content was determined using the Folin–Ciocalteu reagent according to **Velioglu *et al*. (1998)** with slight modifications. Results were expressed as gallic acid equivalents (mg/100 g dry weight) according to **Asami *et al*. (2003)**.

Statistical analysis

Data were analysis in complete randomized design with three replicates was followed according to Sendecor to Cochran (1980). The averages were compared by using the method of new least significant differences (New L. S. D.) described by Waller and Duncan (1979).

3. Results and Discussion

Yield components of Barhi date palm

Data presented in Table 2 show that fruit set, fruit retention, bunch weight, and yield per palm of Barhi date palm were significantly improved by all vermicompost (VC) and Trace-amino (TA) treatments compared with the control in both seasons. The highest fruit set percentages (48.3 and 49.1%) were recorded with VC at 100 mL L^{-1} + TA at 4 g L^{-1}, followed by VC at 100 mL L^{-1} + TA at 2 g L^{-1} (47.2 and 48.2%) in the first and second seasons, respectively. In contrast, the lowest values (38.3 and 39.2%) were observed in untreated palms. The VC 100 mL L^{-1} + TA 4 g L^{-1} treatment also resulted in the highest fruit retention (42.4 and 43.2%), bunch weight (16.0 and 16.3 kg), and yield per palm (192.0 and 196.6 kg) in both seasons. The beneficial effects of vermicompost may be attributed to its ability to supply essential nutrients, making it particularly valuable in organic production systems where synthetic fertilizers are not permitted. Vermicompost could be used to enhance and regulate plant growth and to improve stress tolerance and resilience **(Siddiqui *et al*., 2008; Saeed and Abbas, 2024)**. Several findings have revealed that vermicompost can be used as a liquid fertilizer, and the crop health, nutritive quality and yield were improved when vermicompost was used **(Pant *et al*., 2009**; **Ahmad *et al*., 2022).**

It is recognized that adding vermicompost as an organic matter to a growth medium induces soil functioning, with complex but generally beneficial effects on plant growth **(Murphy, 2014).** Our results regarding the increase in Barhi yield suggests that vermicompost is an efficient mean to improve plant yield in agriculture, confirming the reported results of **Chaudhary *et al*. (2004); Lazcano *et al*. (2011).** Vermicomposts contain combination of macro- and micro-nutrients and the uptake of nutrients has a beneficial effect on plant growth, plant nutrition, photosynthesis and chlorophyll content **(Rekha *et al*., 2018; Mahmoud and Gad, 2020**; **Abdelmawla and Al-Tamimi, 2024).** The study of **El-Salhy *et al*. (2024)** proved that using mineral-N, organic and bio fertilization induced yield and quality of Barhi fruits.

Micronutrients and amino acids have a crucial role for photosynthesis chlorophyll formation, hormones synthesis, metabolism, respiration, and enzyme activity for improving growth, quality and yield in plants **(Reid *et al*, 2004; Darwesh *et al*., 2015).** Boron is an important element for plant. It has a vital role in different metabolic functions that may affect tree yield **(Marschner, 1995).** If boron is present in insufficient amount, the flowers will die before the period of full bloom, and then the pear fruit is set, and the yield will be declined **(Sánchez and Righetti, 2005).** Results of **Abd-Elhaleem *et al*. (2020)** clarified that the best concentration of boron was 150 mg /L for increasing fruit set%, productivity and fruit quality of Barhi date palm. In addition, a spray application of boron to the leaves is more economical and effective in comparison with a soil application **(Hudina and Stampar, 2005; Yehia and Hassan, 2005).** Foliar fertilization can impact nutritive competition between various metabolic sinks and control the growth and reproductive activities in fruit trees **(Wojcik, 2004).** The obtained results were agreed with **Stanle and Lichtenberg (1983)** and **Yogaratnam and Johnson (1992)**, who indicated the importance of B in the contract of fruits. Boron is important in pollen tube growth and pollen germination in success full fruit setting. Boron spraying increased boron concentrations in flowers, induced pollen germination, decreased the percentage of fall of flowers and fruits, while increased the percentage of fertile fruits and thus improved yield. The positive effects of foliar application of micro-nutrients and amino acids on fruit yield was previously reported by **Lalithya *et al*. (2014); Khan *et al*. (2020)** and **Radwan *et al*. (2024)**, who proved that micro-nutrients and amino acids applications are the key to induce fruit productivity and quality in fruit trees.

Table (2). Effect of vermicompost (VC) and micronutrients with amino acids (TA) on fruit set (%), fruit retention (%), Bunch weight (kg) and Yield/palm (kg) of Barhi date palm during 2024 and 2025 seasons

Treatments	Fruit set (%)		Fruit retention (%)		Bunch weight (kg)		Yield/palm (kg)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	38.3	39.2	32.8	33.7	10.8	11.5	129.6	138.0
VC 50 ml/L+TA 2g/L	40.5	40.8	34.4	34.7	11.4	12.1	140.4	145.2
VC50 ml/L+TA 4g/L	42.8	43.4	35.2	35.6	12.7	13.0	152.4	156.0
VC 75 ml/L+TA 2g/L	44.8	45.6	36.4	37.0	13.7	14.0	164.4	168.0
VC 75 ml/L+TA 4g/L	45.7	47.0	38.2	39.1	14.3	14.9	171.6	178.8
VC 100 ml/L+TA 2g/L	47.2	48.2	39.3	40.6	15.3	15.7	183.6	188.4
VC 100 ml/L+TA 4g/L	48.3	49.1	42.4	43.2	16.0	16.3	192.0	195.6
LSD 5%	1.12	0.80	0.87	0.93	0.51	0.59	4.32	2.53

Fruit physical properties of Barhi date palm

The results in Table 3 regarding the physical properties of Barhi fruits (fruit weight, flesh percentage, and fruit length and diameter) during both seasons indicated significant differences as a result of applying the various used treatments for both seasons. It is worth noting that there is an improving in physical fruit properties with applying various feeding treatments compared to the control. It is evident that these physical fruit measurements were supported as a result of treating Barhi palms with VC 100 ml/L+TA 4g/L for both seasons when compared to the other supplementations. This treatment resulted in the highest values of fruit weight (19.1 & 19.3 g), flesh percentage (93.6 & 93.7%), fruit length (4.0 & 4.1 cm) and fruit diameter (2.8 & 2.9 cm) as compared to the other treatments in the 1st and 2nd seasons, respectively. The promoting effects of vermicompost as a valuable organic matter on the growth and nutritional status of palm trees possesses a positive relationship with enhancing the fruit quality. The obtained results are consistent with the result of **Fekry *et al*. (2020)**, who suggested that application of both micronutrients with Humic acid improved yield and fruit physical and chemical characters of Barhi date palm. These improvements in fruit quality might be attributed to its higher own content from protein, natural hormones and vitamins that are responsible for inducing the biosynthesis of most foods **(Zhang *et al*., 2019; El-Salhy *et al*., 2024).** Amino acids can function in plant cells as signaling molecules under stress conditions and normal growth conditions and as precursors to produce secondary metabolites in cells **(Rai, 2002; Khedr, 2018)**. In this connection, several findings reclaimed that amino acids have positive effects in enhancing fruit characteristics and productivity **(Al-Najjar *et al*., 2020; ElKady *et al*, 2022; Radwan *et al*., 2024).** The fruit physical properties of Barhi date palm was enhanced by spraying amino acids and micronutrients, perhaps due to improving carbohydrate metabolism and transport of proteins and sugars, which increases cell division and elongation, leading to accelerate fruit ripening and increases fruit dimensions. These findings are consistent with those reported by **Khayyat *et al*. (2007); Radwan *et al*. (2024).** The study of **Abo-El-Ez *et al*. (2022)** indicated that application of B at 2000 ppm + Zn at 250 ppm + Si at 1% treatment produced high fruit quality of Seewy date palm.

Table (3). Effect of vermicompost (VC*) and micronutrients with amino acids (TA) on fruit physical characteristics of Barhi date palm during 2024 and 2025 seasons**

Treatments	Fruit weight (g)		Flesh (%)		Fruit length (cm)		Fruit diameter (cm)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	12.4	12.9	88.7	89.1	3.1	3.1	2.3	2.4
VC 50 ml/L+TA 2g/L	13.4	13.8	89.6	89.9	3.2	3.3	2.4	2.5
VC50 ml/L+TA 4g/L	14.6	15.1	90.5	90.5	3.5	3.5	2.4	2.5
VC 75 ml/L+TA 2g/L	15.6	16.4	91.5	91.8	3.7	3.7	2.5	2.7
VC 75 ml/L+TA 4g/L	17.3	17.7	92.2	92.9	3.8	3.8	2.5	2.7
VC 100 ml/L+TA 2g/L	18.4	18.5	93.1	93.6	3.9	3.9	2.6	2.7
VC 100 ml/L+TA 4g/L	19.1	19.3	93.6	93.7	4.0	4.1	2.8	2.9
LSD 5%	0.62	0.69	0.55	0.52	0.08	0.07	0.05	0.03

Fruit chemical properties of Barhi dates

Vermicompost combined with Trace-amino significantly influenced the chemical properties of Barhi fruits, including total soluble solids (TSS%), total sugars, reducing sugars, total acidity, and total phenols (Table 4 and Figs. 1 & 2). Overall, all nutritional treatments increased TSS, total and reducing

sugars, while decreasing total acidity and total phenols compared with untreated palms. The highest values of TSS (40.1 and 40.2%), total sugars (35.5 and 35.8%), and reducing sugars (24.5 and 24.6%), along with the lowest total acidity (0.162 and 0.158%) and total phenols (0.152 and 0.151 mg/100 g gallic acid), were recorded in palms treated with VC at 100 mL L^{-1} + TA at 4 g L^{-1} in both seasons, compared with the other treatments. Our results regarding the positive effect of vermicompost on Barhi dates are parallel to the findings of **AbdulBasser and Abd EL-all (2025)**, who revealed that applying vermicompost in sandy soils can significantly enhance the productivity and quality of Sewy date palm. This enhancement may be relating to the fact that vermicompost increases microbial activity, humification, and enzyme production, which improves soil structure and aeration **(Ansari, 2008.).** Also, vermicompost is widely acted as an excellent soil amendment and bio control agent, making it an eco-friendly alternative to chemical fertilizer **(Alneyadi *et al*., 2024).** It increases plant growth and yield, while decreasing environmental pollution **(Joshi *et al*., 2014)**. The beneficial effects of vermicompost, also may be related to the production of different plant growth regulators, like auxins, and cytokinins by microorganisms present in vermicompost **(Tomati *et al*., 1987)**. In this respect, **Krishnamoorthy and Vajrabhiah (1986)** indicated that organic waste processed by earthworms leads to produce of essential plant hormones, which promoting the plant growth and productivity. In addition, vermicomposts contain various plant nutrients such as phosphates, nitrates, soluble potassium and exchangeable calcium in readily available forms **(Orozco *et al*., 1996).**

The progressing in fruit quality of Barhi date palm was assured **ElAbbasy *et al.* (2024)**, who clarified that spraying Hayany'date palm with amino acids decreasing fruit contents of anthocyanins, and titratable acidity, and led to maintain fruit quality. The positive effects of amino acids in improving Barhi date palm may be attributed to its vital role in building proteins and act as crucial cellular metabolites, as well as playing various metabolic roles **(Akladious and Abbas, 2013).** Different studies proved that amino acids function as biological stimulants to improve physiological characteristics **(Xu *et al*., 2018; ElAbbasy *et al*., 2024).** Moreover, our results belonging the positive effects of micronutrients were in good line with the findings of **Khayyat *et al.* (2007)**, who showed that mineral nutrients especially boron, improved fruit yield and quality in 'Shahany' date palm. Zinc is applied to increase fruit number, size and quality. Also, application of zinc is effective in enhancing the yield, fruit quality parameters and decreasing fruit drop of citrus fruit **(Yasin *et al*., 2012**) and Hayany date palm **(Merwad *et al*., 2014).**

Table (4). Effect of vermicompost (VC) and micronutrients with amino acids (TA) on fruit chemical characteristics of Barhi date palm during 2024 and 2025 seasons

Treatments	TSS (%)		Total sugars (%)		Reducing sugar (%)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	36.2	36.7	31.3	31.5	22.3	22.4
VC 50 ml/L+TA 2g/L	37.3	37.5	31.7	31.8	22.7	22.8
VC50 ml/L+TA 4g/L	37.6	37.8	32.3	32.5	23.2	23.3
VC 75 ml/L+TA 2g/L	38.4	38.7	32.6	32.8	23.4	23.5
VC 75 ml/L+TA 4g/L	39.1	39.3	33.6	33.7	23.7	23.8
VC 100 ml/L+TA 2g/L	39.7	39.6	34.6	34.7	24.2	24.3
VC 100 ml/L+TA 4g/L	40.1	40.2	35.5	35.8	24.5	24.6
LSD 5%	0.31	0.46	0.22	0.28	0.08	0.07

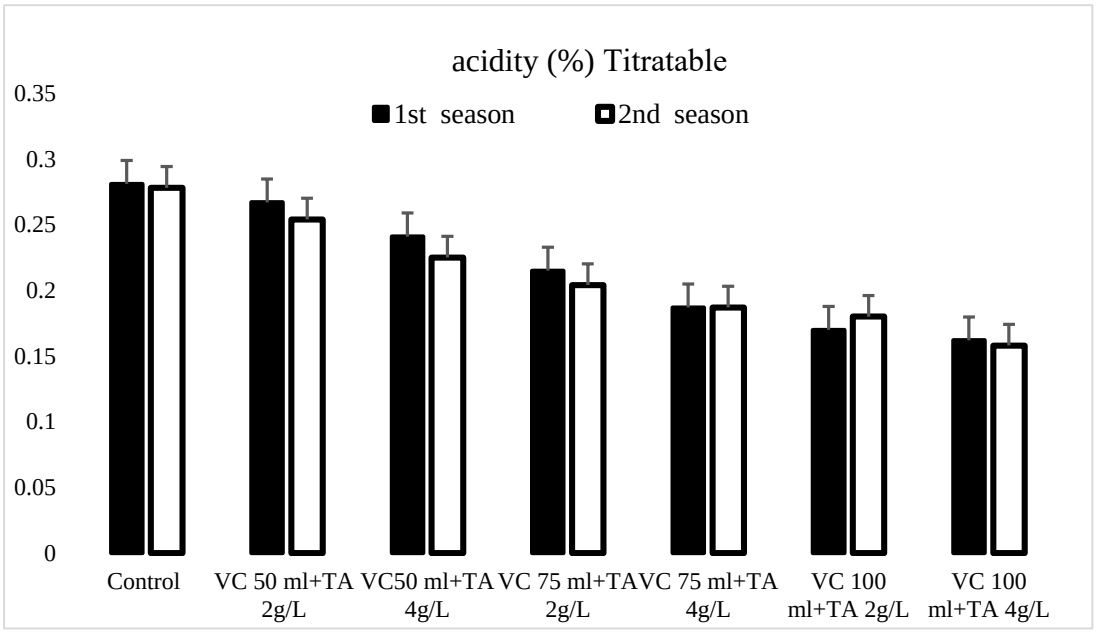

Fig. (1). Effect of vermicompost (VC) and micronutrients with amino acids (TA) on total acidity (%) of Barhi date palm during 2024 and 2025 seasons.

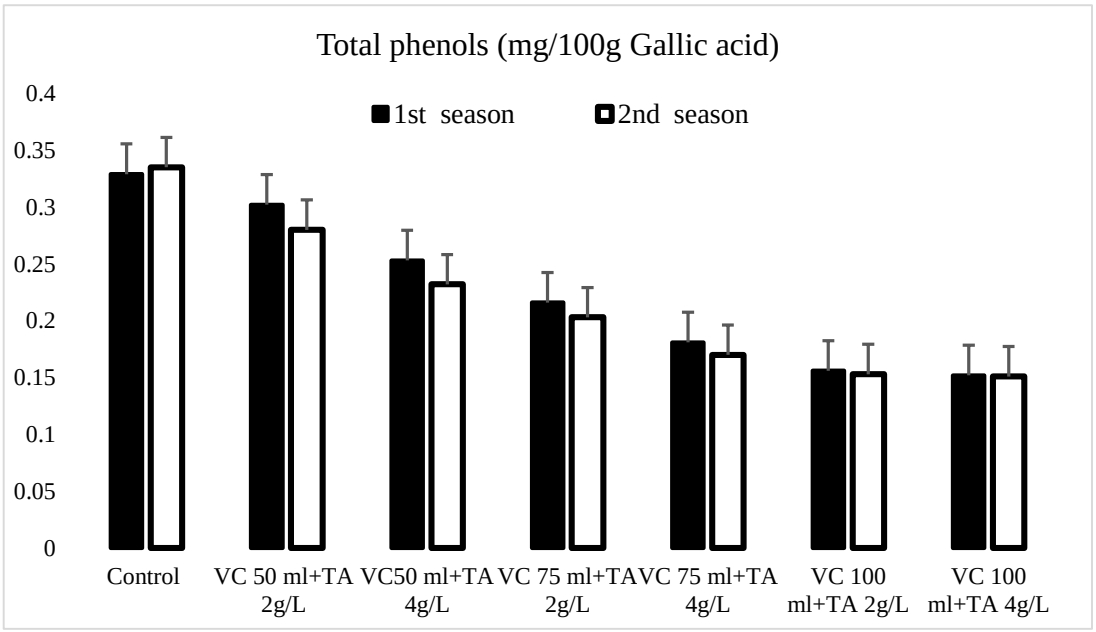

Fig. (2). Effect of vermicompost (VC) and micronutrients with amino acids (TA) on total phenols (mg/100 g Gallic acid) of Barhi date palm during 2024 and 2025 seasons.

4. Conclusions

The present study demonstrated differences in fruit yield and in the physical and chemical quality attributes of Barhi date palm in response to vermicompost and micronutrients combined with amino acids. The results showed a promising response of Barhi under the application of vermicompost as a soil drench at 100 mL L^{-1} combined with foliar spraying of micronutrients and amino acids at 4 g L^{-1}, which enhanced fruit productivity and improved fruit physical and chemical characteristics.

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تأثير اضافة الفيرميكمبوست والعناصر الصغري مع الأحماض الأمينية علي انتاج وجودة الثمار لنخيل البلح البارحي

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الملخص العربي

يُعد نخيل البلح من محاصيل الفاكهة الأساسية التي تُزرع في المناطق النامية، ويؤدي دورًا مهمًا في تعزيز الأمن الغذائي العالمي من خلال مساهمته في التغذية وسبل العيش والاقتصاد. وتتميز ثمار البلح بقيمتها الغذائية العالية لاحتوائها على الكربوهيدرات والمعادن والألياف الغذائية ومجموعة من المركبات الحيوية النشطة. لذلك هدفت هذه الدراسة إلى تقييم التأثير المتداخل للفيرميكمبوست مع العناصر الصغرى والأحماض الأمينية على إنتاجية وجودة ثمار نخيل البلح صنف البارحي تحت الظروف المناخية لمحافظة قنا جنوب مصر. ولتحقيق ذلك تم استخدام سبع معاملات تضمنت ثلاث مستويات من الفيرميكمبوست ومستويين من خليط العناصر الصغرى مع الأحماض الأمينية، بالإضافة إلى الكنترول، وكانت كالتالي: (1) الرش بالماء (كنترول)، (2) فيرميكمبوست 50 مل/لتر + رش 2 جم/لتر، (3) 50 مل/لتر + 3 جم/لتر، (4) 75 مل/لتر + 2 جم/لتر، (5) 75 مل/لتر + 4 جم/لتر، (6) 100 مل/لتر + 2 جم/لتر، (7) 100 مل/لتر + 4 جم/لتر. وأظهرت النتائج حدوث تحسن معنوي في صفات الإنتاج مثل نسبة العقد، ونسبة الثمار المتبقية، ووزن السوباطة، والإنتاج لكل نخلة، بالإضافة إلى الصفات الفيزيائية والكيميائية للثمار مقارنة بالكنترول. وسُجلت أفضل النتائج في الإنتاج والجودة عند استخدام فيرميكمبوست بمعدل 100 مل/لتر مع الرش بخليط العناصر الصغرى والأحماض الأمينية بمعدل 4 جم/لتر، يليها المعاملة بمعدل 100 مل/لتر مع 2 جم/لتر.