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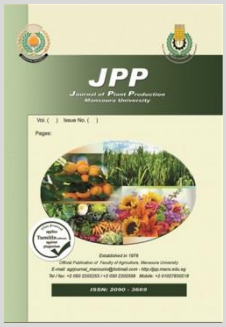
Comparative effect of some Potassium Sources on Crop and Quality Attributes of Saidy Date Palm

Sayed, M. K. [1*]; A. Y. Haleem [2]; A. M. Ali [1] and E. M. A. Radwan [1]

[1] Hort. Dept., Fac. Agric., New Valley Univ, Egypt.
[2] Desert Research Center, El-Matariya, Cairo, Egypt.



ABSTRACT

The research was carried out on Saidy date palms in the Balat region of the New Valley Governorate, Egypt, during the 2022 and 2023 seasons (latitude 25.591052° and longitude 29.276383°). To investigate how various potassium sources affect the productivity and fruit quality of saidy dates. With seven treatments and five repetitions, one lot each, the experiment was set up in a fully randomized block design. In summary, the findings of this study are as follows In comparison to spraying water (check treatment), foliar potassium citrate or potassium silicate and potassium thiosulfate considerably increased the fruit retention percentage, bunch weight, and yield per palm. No discernible differences were observed among these treatments for most of the attributes studied. In addition, compared to spraying water (check treatment), spraying potassium citrate, potassium silicate, or potassium thiosulfate at any dose under study greatly improved fruit quality in terms of a considerable increase in fruit weight, fruit dimensions, and fruit chemical contents. In general view, using potassium citrate gave the highest values of studied traits.Therefore, based on the study's findings, it is possible to draw the conclusion that, to achieve a high yield with favorable qualities and, consequently, higher market value, date bunches must be sprayed with 2 cm3/L of potassium citrate.

***Keywords*:** Date palm, potassium, Spray, fruit quality, yield.

INTRODUCTION

Date palm (*Phoenix dactylifera* L.) cultivation is expanding worldwide, particularly in regions where this crop has been recently introduced. Therefore, it is essential that proper practices are employed to ensure successful date production (Al-Yahyai *et al* 2023).

A wide range of beneficial bioactive and functional chemicals, including phenolic, flavonols, carotenoids, minerals, and vitamins, are abundant in dates. These compounds not only supply the body with a significant quantity of energy but also operate as powerful therapeutic agents against a number of ailments (Youns *et al*. 2020)

In 2020, the global production of date fruit exceeded 9.4 million tons. The major producers are those in North Africa and the Middle East. Egypt ranks among the top 10 date-producing countries, contributing over 18% of the total date production worldwide (FAO, 2022). The country has a total of 14,681,131 date palms covering 141,260 feddans, yielding 1,713,610 tons of dates. These figures are according to the Egyptian Ministry of Agriculture and Land Reclamation's statistics (MALR, 2021).

In the new Valley Governorate, the Saidy date palm is regarded as the national variety. It is the most significant semi-dry date cultivar, with a high demand in both domestic and international markets. Fertilization plays a crucial role in regulating fruit crop growth, nutritional condition, and fruiting. Practices that increase date palm yield and fruit quality are therefore crucial (Soliman and Osman, 2003; Hussein, 2008; El-Salhy *et al*., 2008 and El-Salhy *et al*., 2017).

Foliar spraying is a relatively recent technique used to address environmental challenges such as drought, salinity, high temperatures, low growth, and reduced production in date palms. While not essential for feeding date palms, foliar techniques can mitigate damage from seawater. Increasing the foliar technique's application is one contemporary way to enhance date palm culture. Furthermore, it offers fresh chances for date palm revival in regions subjected to severe weather circumstances that impede the prosperity of date palm farming. One of the most important methods for date palm agriculture that will ensure optimal development and productivity, as well as the potential to lessen abiotic stress damage, is foliar fertilization (Shareef, 2016 &Shareef, *et al.*, 2021).

In plants, potassium (K) is a mobile element that greatly enhances the activity of numerous vital enzymes involved in respiration, photosynthesis, starch synthesis, and protein synthesis. It also enhances the quality of fruit and activates plant growth-related enzymes (Mengel 2001; Ahmed, 2008 and Osman, 2010). It is a crucial component of date palm tree growth and fruiting, as the variety, maturity stage, and environmental factors all affect how much sugar dates accumulate to be between 44 to 88% (Al-Shahib and Marshall, 2003 and Awad *et al*., 2011).

Although potassium (K) is a necessary element for plant growth and development, excessive amounts can disrupt various plant processes. It participates in the regulation of several important processes related to plant growth. Due to the significance index, K is thought to be second only to nitrogen in terms of overall plant growth (Johnson. *et al*. 2022).

* **Corresponding author.**
E-mail address: dr.mohammed_kamal@agr.nvu.edu.eg.
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Silicon plays a crucial antioxidant role by chelating free radicals such as OH and O3, thereby protecting plant cells from aging and senescence. It also prevents damage from reactive oxygen species (ROS) (Boukachabine *et al*., 2011).

As one of the most significant organic acids in the respiratory routes entering plant cells, potassium citrate is the potassium salt of citric acid (Ibrahim, *et al* 2015). Citric acid also has a significant impact on plant metabolism. As a non-enzymatic antioxidant, it chelates free radicals and shields plants from harm, which can extend the shelf life of plant cells and enhance growth characteristics (Wang *et al*,2013 and Sadak, and Orabi, 2015).

One source of silicon and potassium that are very soluble is potassium silicate. In addition to serving as a silica supplement in agricultural production systems, it also provides trace levels of potassium (Epstein, 1999). These days, bio-fertilization is seen as a useful technique for enhancing fruit trees' productivity and quality, and it's even being touted as a good substitute for chemical fertilizers. It is safe for people and the environment, and it has helped to produce organic crops for export while also reducing significant pollutants to our surroundings. The use of biofertilizers in fruit tree orchards is a production method that mostly eliminates or prevents such pollutants (Abdelaal *et al*., 2010).

Thus, the aim of this study was to assess the impact of applying various potassium sprays on both the quantity and quality of the fruit on these dates.

MATERIALS AND METHODS

The current study was conducted on Saidy date palms in the Balat region of the New Valley Governorate, Egypt, during the seasons of 2022 and 2023 (latitude 25° and longitude 29°). When the conjunctiva is the source of the soil. Laboratory analysis was performed at the college of agriculture's horticulture department at New Valley University in Egypt.

The trees were planted 8 by 8 meters apart and were 10 years old. Five robust palms with almost same growth vigor were chosen for the study. As usual, routine agricultural procedures were followed. At the conclusion of the blooming season, the leaf/bunch ratio was adjusted to the target of 8:1. To prevent metaxenia residues, artificial pollination was carried out consistently with regard to supply, date, and technique.

The seven spray treatments listed below were used in this experiment: -

T_1: spraying Potassium citrate 2 cm^3 / L water
T_2: spraying Potassium citrate 4 cm^3 / L water
T_3: spraying Potassium silicate 2 cm^3 / L water
T_4: spraying Potassium silicate 4 cm^3 / L water
T_5: spraying Potassium thiosulfate 2 cm^3 / L water
T_6: spraying Potassium thiosulfate 4 cm^3 / L water
T_7: spraying water (control)

The identical palm received both of these treatments. Water was added in increments of 2 or 4cm3/L to create solutions. Each item was sprayed twice on the chosen palm trees: the first time was six weeks after pollination, and the second time was a month later. Using a little hand sprayer, bunches were sprayed until run-off bunches were kept apart from one another by plastic sheets to prevent cross-contamination between treatments.

Ten treatments, each having five replications of a single bunch, were included in the experiment's randomized full block design. The impact of various treatments on yield and date quality was assessed using the following parameters.

Components of yield and fruit quality:

At harvest, an estimate of the fruit retention percentage was made. From each replication, five strands per bunch were chosen at random, and the percentage was computed using the formula below.

$$\text{Fruit retained\%} = \frac{\text{Total number of retained fruits/strand}}{\text{number of retained fruit/strandand number of flower scars}} \times 100$$

The bunch weights were recorded during the harvest, which occurred before the fruit reached its maximum ripeness stage.

Physical characteristics:

The parameters evaluated included fruit weight, fruit size, and fruit flesh percentage. To determine these metrics, fifty randomly selected fruit samples were taken from each replication to calculate the fruit weight, dimensions, and flesh percentage.

Chemical characteristics:

Total soluble solids percentage (TSS %):

A hand refractometer was used to estimate the edible pulp's TSS. For every replication, three separate readings were taken, and the average was determined (AOAC, 2000).

Sugar contents: -

In accordance with Lane and Eynon's volumetric technique, which is described in AOAC (2000).

Tannins content:

The percentage of tannins in the fruits was determined using the Indigo Carmen indicator according to Balbaa (1981). Titration was carried out using 0.1 N potassium permanganate solutions. Tannins in fresh weight were calculated (as total tannins percentage) according to the following equation:

1 Ml potassium permanganate (0.1 N) = 0.00416 g. tannins.

Total phenols:

Date fruits (½ gram) were extracted by 30 ml ethanol and water (1:1 v/v). The mixture was stirred for 3hrs at room temperature and then centrifuged at 3000 rpm Permian. The supernatant was collected and filtered. Total phenols of date fruits were determined using Folin-Ciocalteu reagent according to Velioglu *et al*. (1998) with some modifications. The supernatant was decanted into 4 ml vials. A 0.1ml of the extract was mixed with 0.9 ml Folin-Ciocalteu reagent (previously diluted 10 fold with distilled water) and allowed to stand for 5 min before the addition of 0.75 ml of 7% sodium bicarbonate. After 90 min., absorbance was measured at 725 nm using a UV-vis spectrophotometer. The blank contains ethanol and water (1:1v/v) and the reagents. The calibration curve was prepared by measuring the absorbance of known concentration of Gallic acid. Total phenolic contents were expressed as Gallic acid equivalent (mg/100g) on dry weight basis (Asami *et al*., 2003).

Beta-carotene:

Estimated according to the method described by Ngkok and Solcha (1991).

Statistical Analysis:

A completely randomized design with five bunches of replicates. Every piece of information was tallied and examined in accordance with to Gomez and Gomez, (1984). Utilizing the New LSD test to identify significant variations between different treatment methods in accordance with Steel and Torrie (1980).

RESULTS AND DISSCUSION

Results

Yield Component: -

The information in Table 1 show how the treatment of potassium citrate, silicate, and potassium thiosulfate affected the yield per palm, bunch weight, and fruit retention of Saidy date palms in the 2022 and 2023 seasons. An indicator of the yield is said to be the bunch weight, yield per palm, and percentage of fruits retained. The data show that the results for both seasons followed a similar pattern.

The highest fruit retention values were recorded with the application of Potassium citrate at 2cm^3/ L water (T1), followed by spraying Potassium citrate at 4 cm^3 / L water (T2), respectively. As well as the maximum values of bunch weight and yield per palm were recorded on spraying Potassium citrate at 4 cm3/ L water (T2), followed by spraying Potassium citrate at 2cm3 / L water (T1), respectively. On the other hand, the lowest value for fruit retention, bunch weight and yield per palm was obtained in spraying water (control) trees (T7). Therefore, the corresponding increment of fruits retention over control was (7.78%), bunch weight was (21.16%) and yield per palm was (21.63%) during the two seasons studied, respectively.

The obtained fruit retention were (65.55, 65.50, 63.18, 63.65, 63.10, 63.33 and 60.45 %), punch weight were (12.71, 12.79, 11.44, 11.66, 10.93, 11.16 and 10.02 kg and yield per palm were (127.05, 127.85, 114.40, 116.60, 109.30, 111.55 and 100.20 kg as an av. of the two studied season) due to treat with spraying Potassium citrate 2 cm3 / L water, spraying Potassium citrate 4 cm3 / L water, spraying Potassium silicate 2 cm3 / L water, spraying Potassium silicate 4 cm3 / L water, spraying Potassium thiosulfate 2 cm3 / L water, spraying Potassium thiosulfate 4 cm3 / L water and spraying water (control)

Compared to the control, the fruit retention percentage, bunch weight, and yield per palm were all markedly higher under all treatments. There were no appreciable variations found in fruit retention, bunch weight, or yield per palm when potassium citrate, potassium silicate, or potassium thiosulfate were sprayed. Additionally, there were no notable variations across the groups as a result of any treatment.

Moreover, increasing the spraying solution from 2 to 4% did not result in a discernible increase in fruit retention, bunch weight, or yield per palm. As a result, it ought to use the lower concentration 2% of any component sprayed in consideration of economy.

Table 1. Effect of different sources of potassium on Yield component of Saidy date palm during 2022 and 2023 seasons.

Treatments	Fruit retention			Punch weight (kg)			Yield / palm (Kg)		
	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean
T1	64.71^{AB}	66.38^{A}	65.55^{A}	12.36^{A}	13.05^{A}	12.71^{A}	123.60^{A}	130.50^{A}	127.05^{A}
T2	64.89^{A}	66.11^{AB}	65.50^{A}	12.39^{A}	13.18^{A}	12.79^{A}	123.90^{A}	131.80^{A}	127.85^{A}
T3	62.57^{B}	63.78^{B}	63.18^{B}	11.15^{BC}	11.73^{B}	11.44^{B}	111.50^{BC}	117.30^{BC}	114.40^{B}
T4	62.81^{A}	64.48^{A}	63.65^{B}	11.34^{B}	11.98^{B}	11.66^{B}	113.40^{B}	119.80^{BC}	116.60^{B}
T5	62.35^{B}	63.85^{B}	63.10^{B}	10.61^{C}	11.25^{C}	10.93^{C}	106.10^{C}	112.50^{C}	109.30^{CC}
T6	62.66^{B}	64.00^{B}	63.33^{B}	10.87^{BC}	11.44B^{C}	11.16^{C}	108.70^{BC}	114.40^{C}	111.55^{CC}
T7	59.62^{C}	61.28^{C}	60.45^{C}	9.72^{D}	10.32^{D}	10.02^{D}	97.20^{D}	103.20^{D}	100.20^{D}
NEW LSD%	2.16	2.29	1.59	0.63	0.59	0.43	6.91	6.35	1.59

T_1: spraying Potassium citrate 2 cm^3 / L water T_2: spraying Potassium citrate 4 cm^3 / L water T_3: spraying Potassium silicate 2 cm^3 / L water T_4: spraying Potassium silicate 4 cm^3 / L water T_5: spraying Potassium thiosulfate 2 cm^3 / L water T_6: spraying Potassium thiosulfate 4 cm^3 / L water T_7: spraying water (control)

Fruit quality:

The information shown in Table (2) demonstrate how the administration of potassium citrate, silicate, and potassium thiosulfate affected the Saidy date palm's fruit diameter, weight, and length in the 2022 and 2023 growing seasons. Fruit quality is measured by three factors: fruit weight, fruit length, and fruit diameter. The acquired data makes it clear that the outcomes for the two seasons under study followed the same pattern.

The highest values of fruit weight and fruit diameter were recorded by spraying Potassium citrate at 4 cm3/ L water (T2), followed by spraying Potassium citrate at 2 cm3 / L water (T1), respectively. On the other hand, the lowest value for fruit weight and fruit diameter was obtained by spraying water (control) trees (T7). Therefore, the corresponding increment of fruit retention over control was (15.66%), bunch weight was (8.24%) and yield per palm was (11.61%) during the two seasons studied, respectively.

The obtained fruit weight were (11.51, 11.62, 10.74, 10.87, 10.32, 10.44 and 9.80 g), Fruit length were (3.68, 3.73, 3.61,3.62,3.56, 3.58 and 3.45 cm and Fruit diameter were (2.34, 2.41, 2.28, 2.29, 2.23, 2.28 and 2.13 cm as an av. of the two studied season) due to treat with spraying Potassium citrate 2 cm3 / L water, spraying Potassium citrate at 4 cm3 / L water, spraying Potassium silicate at 2 cm3 / L water, spraying Potassium silicate at 4 cm3 / L water, spraying Potassium thiosulfate at 2 cm3 / L water, spraying Potassium thiosulfate at 4 cm3 / L water and spraying water (control).

All treatments, as compared to the control, greatly increased the fruit's weight, length, and diameter overall. Fruit weight, length, and diameter did not significantly alter when treated with potassium citrate, potassium silicate, or potassium thiosulfate. Furthermore, no appreciable variations were noted across the groups as a result of any treatment.

Moreover, an increase in the spraying solution from 2 to 4% did not result in a discernible increase in fruit weight, length, or diameter. As a result, it ought to use the lower concentration 2% of any component sprayed in consideration of economy.

Table 2. Effect of different sources of potassium on Fruit quality of Saidy date palm during 2022 and 2023 seasons.

Treatments	Fruit weight (g)			Fruit length (cm)			Fruit diameter (cm)		
	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean
T1	11.38^{A}	11.63^{A}	11.51^{A}	3.66^{AB}	3.70^{AB}	3.68^{AB}	2.31^{B}	2.37^{A}	2.34^{B}
T2	11.46^{A}	11.78^{A}	11.62^{A}	3.70^{A}	3.76^{A}	3.76^{A}	3.40^{A}	2.42^{A}	2.41^{A}
T3	10.61^{B}	10.86^{B}	10.74^{B}	3.59^{B}	3.63^{B}	3.61^{B}	2.26^{B}	2.30^{B}	2.28^{C}
T4	10.75^{B}	10.98B	10.87^{B}	3.60^{B}	3.64^{B}	3.62^{B}	2.28^{B}	2.30^{B}	2.29^{C}
T5	10.16^{C}	10.48^{C}	10.32^{C}	3.53^{B}	3.58^{B}	3.56^{B}	2.22^{C}	2.24^{B}	2.23^{D}
T6	10.31^{C}	10.57^{C}	10.44^{C}	3.56^{B}	3.60^{B}	3.58^{B}	2.27^{B}	2.29^{B}	2.28^{C}
T7	9.66^{D}	9.93^{D}	9.80^{D}	3.44^{C}	3.46^{C}	3.45^{C}	2.11^{D}	2.15^{C}	2.13^{E}
NEW LSD%	0.38	0.41	0.29	0.08	0.09	0.06	0.06	0.08	0.05

Fruit chemical constituents: -

The information shown in Tables (3&4) indicate how the application of potassium citrate, silicate, and potassium thiosulfate affected the chemical composition of the Saidy date palm's fruit in the 2022 and 2023 growing seasons. Sugar content and total soluble solids are regarded as indicators of fruit chemical quality. The data show that the results for both seasons followed a consistent pattern.

The highest values of total soluble solids and sugar contents were recorded by spraying Potassium citrate at 4 cm^3/ L water (T2), followed by spraying Potassium citrate at 2 cm^3 / L water (T1), respectively. On the other hand, the lowest value for total soluble solids and sugar contents was obtained by spraying water (control) trees (T7). Therefore, the corresponding increment of TSS over control was (11.56%), total sugar was (15.53%), reducing sugar was (14.11%) and non-reducing sugars was (23.11%) during the two seasons studied, respectively.

Table 3. Effect of different sources of potassium on TSS and sugar contents of Saidy date palm during 2022 and 2023 seasons.

Treatments	TSS%			Total Sugar %			Reducing sugars %			Non-reducing sugars %		
	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean
T1	74.62^{A}	74.87^{A}	74.75^{A}	64.55^{A}	65.21^{A}	64.88^{A}	54.55^{A}	54.82^{A}	54.69^{A}	10.00^{A}	10.39^{A}	10.20^{A}
T2	75.37^{A}	75.62^{A}	75.50^{A}	64.90^{A}	65.43^{A}	65.17^{A}	54.73^{A}	55.01^{A}	54.87^{A}	10.17^{A}	10.42^{A}	10.30^{A}
T3	69.90^{B}	70.39^{B}	70.15^{B}	58.70^{B}	59.62^{B}	59.16^{B}	49.28^{BC}	50.35^{B}	49.82^{B}	9.50^{B}	9.39^{B}	9.45^{B}
T4	70.25^{B}	71.14^{B}	70.70^{B}	59.19^{B}	60.12^{B}	59.76^{B}	49.78^{B}	50.55^{BC}	49.98^{B}	9.32^{B}	9.57^{B}	9.45^{B}
T5	68.41^{C}	69.32^{C}	68.87^{C}	56.61^{C}	58.72^{C}	57.67^{C}	47.90^{C}	49.21^{C}	48.56^{C}	8.71^{C}	9.51^{C}	9.11^{C}
T6	68.73^{C}	69.61^{C}	69.17^{C}	56.73^{C}	58.49^{C}	57.61^{C}	48.23^{C}	49.16^{C}	48.70^{C}	8.50^{C}	9.33^{C}	8.92^{C}
T7	66.71^{D}	66.83^{D}	66.77^{D}	54.81^{D}	55.28^{D}	55.05^{D}	46.91^{D}	47.34^{D}	47.13^{D}	7.90^{D}	7.94^{D}	7.92^{D}
NEW LSD%	1.41	1.32	0.98	1.22	1.13	0.84	1.10	1.13	0.79	0.24	0.26	0.22

Table 4. Effect of different sources of potassium on some fruit chemical constituents of Saidy date palm during 2022 and 2023 seasons.

Treatments	Acidity (%)			Carotene (mg/100gDW)			Phenols (mg/100g)			Tannins (%)		
	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean
T1	0.186^{D}	0.189^{C}	0.188^{E}	0.88^{A}	0.90^{A}	0.89^{A}	933^{A}	941^{A}	937^{B}	0.446^{D}	0.451^{D}	0.449^{E}
T2	0.180^{E}	0.184^{C}	0.182^{F}	0.90^{A}	0.92^{A}	0.91^{A}	956^{A}	965^{A}	960.5^{A}	0.438^{D}	0.442^{E}	0.440^{E}
T3	0.194^{C}	0.201^{B}	0.198^{D}	0.83^{B}	0.84^{B}	0.84^{B}	868^{B}	877^{B}	872.5^{C}	0.460^{C}	0.464^{D}	0.462^{D}
T4	0.203^{B}	0.205^{B}	0.204^{C}	0.81^{B}	0.83^{B}	0.82^{B}	850^{B}	861^{B}	855.5^{D}	0.485^{B}	0.491^{B}	0.488^{B}
T5	0.206^{A}	0.209^{A}	0.208^{B}	0.78^{C}	0.79^{C}	0.79^{C}	822^{C}	831^{C}	826.5^{E}	0.493^{A}	0.498^{B}	0.496^{B}
T6	0.201^{B}	0.206^{B}	0.204^{C}	0.80^{B}	0.81^{B}	0.81^{C}	854^{B}	865^{B}	859.5^{D}	0.475^{C}	0.481^{C}	0.478^{C}
T7	0.211	0.215^{A}	0.213^{A}	0.73^{D}	0.74^{D}	0.74^{D}	721^{D}	733^{D}	727^{F}	0.521^{A}	0.528^{A}	0.525^{A}
NEW LSD 5%	0.005	0.006	0.003	0.02	0.03	0.02	23.81	25.19	14.33	0.015	0.018	0.010

The obtained TSS were (74.75, 75.50, 70.15, 70.70, 68.87, 69.17 and 66.77 %), total sugar were (64.88, 65.17, 59.16, 59.76, 57.67, 57.61 and 55.05 %), reducing sugar were (54.69, 54.87, 49.82, 49.98, 48.56, 48.70 and 47.13 %) and non-reducing sugars were (10.20, 10.30, 9.45, 9.45, 9.11, 8.92 and 7.92 % as an av. of the two studied season) due to treat with spraying Potassium citrate 2 cm^3 / L water, spraying Potassium citrate 4 cm^3 / L water, spraying Potassium silicate 2 cm^3 / L water, spraying Potassium silicate 4 cm^3 / L water, spraying Potassium thiosulfate 2 cm^3 / L water, spraying Potassium thiosulfate 4 cm^3 / L water and spraying water (control).

The best values of acidity, carotene, phenols and tannins were recorded by spraying Potassium citrate at 4 cm^3/ L water (T2), followed by spraying Potassium citrate at 2 cm^3 / L water (T1), respectively. On the other hand, the Worse value for acidity, carotene, phenols and tannins was obtained by spraying water (control) trees (T7). Therefore, the corresponding increment of acidity over control was (14.55%), carotene was (18.68%), phenols was (24.31%) and tannins was (16.19%) during the two seasons studied, respectively.

The obtained acidity were (0.188, 0.182, 0.198, 0.204, 0.208, 0.204 and 0.213 %), carotene were (0.89, 0.91, 0.84, 0.82, 0.79, 0.81 and 0.74 mg/100gDW), phenols were (937, 960.5, 872.5, 855.5, 826.5, 859.5 and 727 mg/100g) and tannins were (0.449, 0.440, 0.462, 0.488, 0.496, 0.478 and 0.525 % as an av. of the two studied season) due to treat with spraying Potassium citrate 2 cm^3 / L water, spraying Potassium citrate 4 cm^3 / L water, spraying Potassium silicate 2 cm^3 / L water, spraying Potassium silicate 4 cm^3 / L water, spraying Potassium thiosulfate 2 cm^3 / L water, spraying Potassium thiosulfate 4 cm^3 / L water and spraying water (control).

Overall, all treatments considerably reduced the chemical contents of the fruit compared to the control. There

were no discernible variations in the chemical composition of the fruit when potassium citrate, potassium silicate, or potassium thiosulfate were sprayed. Furthermore, no appreciable variations were noted across the groups as a result of any treatment.

Furthermore, no appreciable variations were seen between the two amounts of potassium citrate, silicate, or potassium thiosulfate that were utilized (2 cm3 or 4 cm3). As a result, it ought to use the lower concentration 2% of any component sprayed in consideration of economy.

Discussion

Potassium is necessary for the synthesis and operation of proteins, lipids, carbohydrates, and chlorophyll as well as for maintaining the balance of salts and water within plant cells. It triggers numerous physiological functions that are present in plants, including permeability, hydration, and cell organization (Nijjar, 1985, Marschner, 1995 and Abdel-Rahman, 2010).

Potassium is a crucial and necessary component for date palm tree growth and fruiting. Additionally, potassium silicate is particularly good at boosting yield and enhancing the majority of the physical and chemical properties of fruit (Al-Shahib and Marshall, 2003, Awad *et al*., 2011 and Al-Falahy and Hasan 2020 and Ahmed , 2023) .

The ability of fruit crops to withstand biotic and abiotic challenges, photosynthesis, nutrition and water intake, plant pigments, and all cell division are all enhanced and increased by silicon (Epstein, 1999 and Ma, 2004).

As one of the most significant organic acids in the respiratory routes entering plant cells, potassium citrate is the potassium salt of citric acid (Ibrahim, *et al.*, 2015). Plant metabolism is significantly impacted by citric acid, which acts as a non-enzymatic antioxidant to chelate free radicals and shield plants from harm. This can extend the shelf life of plant cells and enhance their development characteristics (Wang, 2013 and Sadak, and Orabi, 2015).

The most effective times for applying potassium fertilizer were in May and December with two equal doses or in March, May, and December with three equal doses. The optimal rate of potassium fertilization for date palms growing in sandy soil is 600 g K2O/palm/season. Applying 2 kg of potassium sulfate per palm to the soil improved the fruit's physical and chemical characteristics and enhanced yield and bunch weight (Abdel-Nasser and El-Shazly 2001, Salama, 2007, Osman, 2010 and Zagzog and Salem, 2016).

Furthermore, the best outcomes in terms of fruit quality and yield were achieved by spraying date palm fruits with a concentration of either 1% or 2% of potassium citrate or potassium silicate(Mohamed and Saleh,2013and Haikal, 2017).

CONCLUSIONS

Based on the current findings, it is possible to draw the conclusion that foliar treatments of potassium silicate or citrate can help to increase the quality and productivity of saidy date palm.

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الأثر المقارن لبعض مصادر البوتاسيوم علي المحصول وجودة ثمار نخيل البلح الصعيدي

محمد كمال محمد سيد [1] ، عاطف يعقوب حليم[2] ، أحمد محمود علي [1] وعصام محمد عبد الظاهر رضوان[1]

[1] قسم البساتين – كلية الزراعة - جامعة الوادي الجديد– مصر

[2] مركز بحوث الصحراء – المطرية - القاهرة – مصر

الملخص

أجريت هذه الدراسة خلال موسمي 2022 ، 2023 لدراسة تأثير الرش ببعض مصادر البوتاسيوم المختلفة علي محصول وخصائص ثمار نخيل البلح الصعيدي النامية بمزرعة خاصة بمنطقة بلاط محافظة الوادي الجديد – مصر. حيث تضمنت الدراسة رش السباطات بسليكات البوتاسيوم – ثيوسلفات البوتاسيوم – سترات البوتاسيوم بتركيز 2و4 سم^3 لكل لتر ماء مقارنة برش السباطات بالماء.وقد صممت التجربة بنظام القطاعات كاملة العشوائية.ويمكن تلخيص النتائج كالتالي:أدي الرش بسترات البوتاسيوم أو سليكات البوتاسيوم أو ثيوسلفات البوتاسيوم إلي زيادة مؤكدة في نسبة الثمار الباقيه وبالتالي زيادة وزن السباطات ووزن المحصول لكل نخلة مقارنة برش المياه (معاملة الكنترول).سبب استخدام المعاملات السابقة زيادة وزن وأبعاد الثمار والمواد الصلبة الذائبة الكلية ومحتوي الثمار من السكريات مقارنة برش المياه (معاملة الكنترول).أدت جميع المعاملات السابقة إلي نقص مؤكد لكل من الحموضة والفينولات والتانينات وزيادة الكاروتينات مقارنة برش المياه (معاملة الكنترول).أظهرت النتائج تفوق الرش بسترات البوتاسيوم مقارنة برش سليكات أو ثيوسلفات البوتاسيوم.من نتائج هذه الدراسة يمكن التوصية بأهمية رش سترات البوتاسيوم مرتين وذلك لتحسين انتاجية وجودة ثمار البلح الصعيدي مع الحماية من الاجهادات البيئية والحيوية .

الكلمات الدالة : البوتاسيوم – الرش – جودة الثمار – المحصول – نخيل البلح.