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EFFECT OF SOIL AND FOLIAR POTASSIUM FERTILIZATION ON CANTALOUPE PLANT GROWTH IN SANDY SOIL

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ABSTRACT

This study was carried out on cantaloupe plants (*cv* 'Gal152') during the winter seasons of 2019-2020 and 2020-2021 to study the effect of three soil applications of K_2SO_4 rates (100%, 75%, and 50%of recommended potassium requirements) and spraying four foliar potassium sources (potassium silicate, potassium citrate, potassium acetate, potassium thiosulphate, and tap water spray as control treatment). Transplanting was done on 25th December under low plastic tunnels in sandy soil The soil 100% K + foliar potassium silicate recorded the highest cantaloupe vegetative growth traits. The highest plant fresh weight was recorded by the interaction treatment of soil application at 50% of recommended K + foliar k-acetate in the first season, while the highest values in the second season were recorded with soil 100% K +foliar K citrate without significant differences than 50% of recommended K + foliar k-Acetate. The highest plant dry weight was recorded by applying soil 75% recommended K + foliar application of K-silicate and 100 of soil K + foliar K silicate in the first season and soil 50% of recommended K + foliar K acetate without significant differences than soil application of 75% recommended K + foliar K silicate in the second season. The highest leaf pigments were recorded by the interaction of soil 100% of recommended potassium + foliar citrate potassium application in all studied traits, except chlorophyll a at 75 days after transplanting and carotenoids content at 50 and 75 days after transplanting.

INTRODUCTION

Cantaloupe (*Cucumis melo* L.) is one of the most important and popular vegetables grown in many countries including Egypt. According to statistics of Ministry of Agric, Egypt, 2018/2019, the cultivated area of cantaloupe in Egypt was 15.412 feddan with total production of 171.927 ton with an average of 11.155 ton per fed. Cantaloupe is an excellent source of vitamins, it is one of the very few fruits that has a high level of vitamin B complex, B_1 (thiamine), B_3 (niacin), B_5 (pantothenic acid), and B_6 (pyridoxine) as well as carbohydrates and minerals especially potassium (**Lester *et al.*, 2005)**. Also, it is rich in antioxidant compounds which have the ability to protect body cells against cancer. It is highly concentrated with excellent levels of beta-carotene, folic acid, potassium, dietary fiber and non-enzymatic antioxidant Phyto-chemicals such as vitamin C. In addition, it is low in fat and calories (about 17 kcal/100g) **(Shafeek *et al.*, 2015).**

Potassium has an important role in plant growth such as cell division, stomatal opening, photosynthesis, sugar translocation, protein synthesis and converting carbohydrates into fructose in fruit. Enhancing effect of potassium on plant growth may be due to the fact that potassium has essential functions in

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osmoregulation, enzyme activation, regulation of cellular pH, cellular cation-anion balance, regulation of transportation by stomata and the transport of assimilates **(Taiz and Zeiger, 1998).**

Various sources of K salts are used for plants nutrition such as potassium chloride, potassium sulfate, mono potassium phosphate (KH_2PO_4), and potassium nitrate **(Magen, 2004).** Supplementing sufficient soil potassium with additional foliar potassium applications during cantaloupe fruit development and maturation improves fruit marketable quality by increasing firmness and sugar content, and fruit human- health quality by increasing ascorbic acid, beta-carotene, and potassium levels **(Lester *et al.*, 2005 and 2010)**. So, **El-Sayed *et al*. (2017)** studied the effect of the sources of potassium fertilization such as potassium sulphate (K_2SO_4), potassium citrate (KC), potassium thiosulphate (KTS) and potassium glycerophosphate (KGP), beside control treatment (tap water) on growth, yield and fruit quality of some cantaloupe hybrids affected by spraying Galia or Gal 152 with KTS or KGP gave the highest values of dry weight of shoots and total dry weight/ plant, total acidity and Vitamin C in fruits. Foliar spray of C8 hybrid with KTS increased yield/plant, early yield, marketable yield and total yield/fad., followed by spray of Galia with KTS in both seasons with respect to marketable yield and total yield.

Fertilization program must pay a high intention for time and quantity of application specially potassium application under sandy loam soil conditions, which is very poor in potassium availability with high calcium content that reduced K uptake and then resulted in a significant reduction in fruit weight, total yield and flesh sugar contents **(Lester 2005; Jifon, *et al.*, 2009)**. However, **Merghany *et al.* (2015)** revealed significant differences between treatments for the measured traits, where the treatment of 150 and 200 kg/fad., of K_2S0_4 had the best results for the measured vegetative growth, number of fruits per plant, fruit weight per plant, and the highest crop yield for cantaloupe cultivars.

El-Drany *et al.* (2021) studied the integrative influence of sulfur, chicken manure and potassium silicate fertilization on growth and yield characters of muskmelon, and found that all treatments had a significant effect on all studied characters; *i.e.,* number of branches and leaves/plant, leaf chlorophyll (a and b) content, total soluble sugars, number of fruits/plant, average fruit weight (g), fruit yield (kg/p and ton/fad.). Application of sulphur at 150 kg feddan^{-1}, chicken manure at 6 ton feddan^{-1}, with potassium silicate at 10 or 20 cm^3/l was the best treatment for all studied attributes. Early researches demonstrated that plant growth, fruit weight, fruit diameter, total yield, flesh firmness and number of marketable fruits significantly increased with increasing K_2O doses **(Demiral and Koseoglu, 2005; Frizzone *et al.*, 2005; Kaya *et al.*, 2007).** Moreover, **Asao *et al.* (2013)** investigated the impact of reduced K concentrations in nutrient solution on plant growth, variables were not decreased greatly, except root dry weight in nutrient solution with reduced KNO_3. They found that it had not any significant effect on fruit yield. Soluble solids content of melon fruits was not decreased in plants grown with reduced by reducing KNO_3concentration compared with standard nutrient solution.

Shafeek *et al*. (2015) studied the effect of two levels of organic manure (Nile compost) at 2.4 and 3.2 ton/fed. in combination with 3 levels of NPK fertilizers, 50, 75 and 100% of recommended dose on growth, yield and fruit quality of cantaloupe plants. The highest level of NPK fertilizers (100%) application significantly gave the best growth characters, and total fruit yield. **Gouda *et al.* (2021)** indicated that grafting cantaloupe plants onto the tested rootstocks had promoted a higher vegetative growth manifested as plant length, leaf number, shoot fresh and dry weight, stem diameter, and root dry weight, as well as raising leaves content of nitrogen, phosphorus, potassium, and the greenness index (chlorophyll readings, SPAD) along with boosting the average fruit weight, and early and total yield than the control when all were fertilized by any of the applied fertilization rates. Worthy, rootstocks of Cobalt and Ferro provided the greatest superiority in all investigated growth and fruit yield characteristics of the cantaloupe plant through fertilizing by the 140% NPK fertilization rate. Keeping in view the above facts, the present investigation was undertaken with the following objectives: To find out the efficacy of different sources of potassium on growth, fruit retention, yield and quality of fruits.

MATERIALS AND METHODS

This study was carried out on cantaloupe plants (*Cucumis melo* L. *cv* 'Gal152') during the winter growing seasons of 2019-2020 and 2020-2021 at a private vegetable farm located at Abo El-Dahab region, Abo-Khalifa District, Ismailia Governorate, Egypt. The seedlings at age of 17 days of sowing were transplanted on 25th December in mulched low plastic tunnels under sandy soil conditions to study the combinations among three soil applications of recommended dose of K_2SO_4 rates (100%, $T_{100\%}$; 75%, $T_{75\%}$; 50%, $T_{50\%}$) and spraying four foliar potassium sources potassium silicate, (K-sili); potassium citrate, (K-cit); potassium acetate, (K-ac); Potassium Thiosulphate, (K-th.) and control treatment, (tap water spray) on cantaloupe. So, this study included fifteen treatments.

The statistical layout of this experiment was split-plot experiment in completely randomized block design with three replicates, main plots were randomly occupied by soil application rates of K_2SO_4 and the sub plots were randomly entitled to potassium foliar applications. Chemical analyses of irrigation water and initial physical and chemical properties of investigated soil of cultivated area were determined in The Central Laboratory, Faculty of Agriculture, Ismailia University (Tables 1 and 2). Drip irrigation system (GR drippers with 50 cm spaces among drippers) and soil surface mulch (black plastic) were used.

The seedlings of 17 days age were transplanted on one side of dripper lines on 25th December in winter seasons of 2019-20 and 2020-21. Plot area was 30 m^2 (2 rows, each with 10 m length and 1.5 m width), planting density was two plants/m^2. Experimental units included two drip irrigation lines one was used for samples of vegetative growth and the other line was used for determination of yield.

Soil Potassium rates were added as fertigation treatment (supply with irrigation water) during plant growth as recommended. Foliar potassium applications were sprayed first at 30 days from transplanting. Plots received units of different potassium sources by spraying several times according to their composition. All experimental units received equal amounts of commercial fertilizers; *i.e.,* ammonium sulfate (20.6% N), and ortho-phosphoric acid (85%) as recommended fertilizers for cantaloupe from nitrogen and phosphorus. Other agriculture practices (irrigation and pest control… *etc*.) were applied as recommended for cantaloupe cultivations.

Data Recorded

Vegetative growth parameters

Three plants from each experimental unite were randomly taken after 50 and 75 days from transplanting and the following data were recorded.

1. Plant length (cm),
2. Number of leaves / plant,

Table 1. Chemical analyses of irrigation water

		Soluble ions (meq. l^{-1})							
pH	**EC** (ppm)	**Cations**				**Anions**			
		K^+	Na^+	Mg^{++}	Ca^{++}	Cl^-	HCO_3^-	CO_3^{--}	SO_4^-
First season (2019-2020)									
7.12	561	0.21	18.18	17.00	20.71	46.06	2.70	-	7.34
Second season (2020-2021)									
7.32	600	0.23	18.96	19.34	21.47	48.75	2.97	-	8.28

Table 2. Initial physical and chemical properties of investigated soil of cultivated area

Physical property	**Particles size distribution (%)**	
Coarse sand (%)	62.0	61.0
Fine sand (%)	20	21.0
Silt (%)	10.5	10.0
Clay (%)	7.5	8.0
Soil texture	Loamy sand	Loamy sand
Bulk density (Mgm^{-1})	1665	1670
Chemical property	**(Soluble ions (in 1:5 soil water extract)**	
Ca^{++} (meq l^{-1})	3.10	3.89
Mg^{++} (meq l^{-1})	3.90	4.13
Na^+ (meq l^{-1})	2.44	2.89
K^+ (meq l^{-1})	0.24	0.29
CO_3^{--} (meq l^{-1})	-	-
HCO_3^- (meq l^{-1})	4.08	4.40
Cl^- (meq l^{-1})	4.20	5.35
SO_4^{--} (meq l^{-1})	1.40	1.45
EC (dS m^{-1}) in 1:5 water extract)	0.97	1.12
pH (in 1:2.5 Soil water suspension extract)	8.10	8.13
Organic matter (%)	0.153	0.171
$CaCO_3$ (%)	22.43	22.48

Table 3. Potassium fertilizer sources which were used in the experiment

Commercial name	Composition	Company and Address
Solo K Potassium sulphate	K_2O 50% And S 18%	Egypt Ferkem for Chemicals & Fertilizers. El-Saddat City, Industrial Zone 4, Al-Monofia, Governorate, Egypt.
Potassium thiosulphate (KTS)	K_2O 36% and S 25%	Egypt Ferkem for Chemicals & Fertilizers. El-Saddat City, Industrial Zone 4, Monofia, Governorate, Egypt
Pepsil (Potassium silicate)	K_2O 32% and Sil_2 60%	Mac for Agriculture Development, Al-Nozha, Cairo
Global Pota planet (Potassium citrate)	K_2O 38% and Citric acid15%	Global Green Plant for Agriculture Development - Cairo
Target potassium 47 (Potassium acetate)	K_2O 47.9% and Acetic acid 52.1%	Rawkit for Fertilizers & chemicals Industrial Zone no.78, El-Salhia El-Ggadida, Egypt

Table 4. Quantity of potassium sources/fed., and per m^2

Soil Potassium Fertilizer Level	K_2O unit	Fertilizer Dose/fed. (Kg.)	Fertilizer Dose/m^2 (g)	Foliar Spraying Fertilizer level and Source	K_2O unit	Fertilizer Dose/fed. (Kg.)	Fertilizer Dose/m^2 (g)
50% of K_2SO_4 (Potassium sulphate 48% K_2O)	40	83.3	18.83	50% K_2SO_4 Pepsil (Potassium silicate)	40	125	29.76
				50% K_2SO_4 Global Pota planet (Potassium citrate)		105.26	25.06
				50% K_2SO_4 Target potassium 47 (Potassium acetate)		83.50	19.88
				50% K_2SO_4 Potassium thiosulphate		111.11	26.45
75% of K_2SO_4 (Potassium sulphate 48% K_2O)	60	124.95	29.75	25% K_2SO_4 Pepsil (Potassium silicate)	20	62.5	14.88
				25% K_2SO_4 Global Pota planet (Potassium citrate)		52.63	12.53
				25 % K_2SO_4 Target potassium 47 (Potassium acetate)		41.75	9.94
				25% K_2SO_4 Potassium thiosulphate		55.55	13.22
100% of K_2SO_4 (Potassium sulphate 48% K_2O)	80	166.6	39.66	Tap water spray			

3. Number of branches / plant,
4. Leaf area/plant (LA/plant); It was calculated according to the following formula **(Ackley, 1964)**. LA/plant = (Leaves fresh weight/Disks fresh weight) × Leaf area of disks,
5. Fresh weight of stem, leaves and total fresh weight,
6. Dry weight of stem, leaves and total dry weight.

Different samples of cantaloupe plant organs were oven dried at 70^o C until constant weight and the dry weight of leaves and stem as well as total dry weight were estimated.

7. Leaves chlorophyll content:

Samples from 20 mature fresh leaves were taken from each experimental unit at 50 and 75 days after transplanting, washed with distilled water to remove any residue then taken for chlorophyll determination. The pigments were extracted by soaking 200 mg of fresh leaves in 5 ml of N, N-Dimethyl formamide (DMF) according to **Moran (1982**) in dark-colored glassware and left at a temperature of 4˚C for72 hours and then measured at the f wavelengths of 647 and 664 using the spectrophotometry.

Statistical Analysis

The obtained data were subjected to statistical analysis of variance according to **Snedecor and Cochran (1980**), and means separation was done according to **Duncan (1955).**

RESULTS AND DISCUSSION

Vegetative Growth

Plant length, number of leaves, and leaf area

Effect of soil potassium application

Results presented in table 5 show no significant differences among soil K applications on all studied traits, except for plant length at 50 days after transplanting in both seasons and plant leaf area at 70 days after transplanting in the second seasons, were significant. The application rate of 100% K recorded the highest value for each of plant length**,** No. leaves/plant and leaf area/ plant at 50 & 70 days after transplanting in both seasons.

Differences among tested soil application fertilizers on growth characters could be due to the effect of potassium that may be due to the fact that potassium has essential functions in osmoregulation, enzyme activation, regulation of cellular pH, cellular cation-anion balance, regulation of transportation of assimilates **(Taiz and Zeiger, 1998).** These results are in agreement with **Kaya *et al.* (2007)** and **Asao *et al.* (2013)** who reported that melon cultivars differed in their fertilizes requirements. Also, **Majed and Sadik (2010)** on Muskmelon**, Shafeek *et al.* (2015) and Salama (2015), Tantawy *et al.* (2016), Hosna and Shadia (2017),** on cantaloupe**, Sabo *et al.* (2013), Merghany *et al.* (2015), Adeyeye *et al.* (2016)** on watermelon who all reported differences in growth characters related to soil application of potassium fertilizers.

Effect of foliar potassium sources

Results in table 5 show significant effects for foliar potassium sources on most studied traits in both seasons. The highest value for each of all studied traits, *viz,* plant length, number of leaves per plant and plant leaf area was recorded with application of potassium silicate (K-sili). These results are in harmony with those reported by **El-Drany *et al.* (2021)** who indicated that increasing foliar application of potassium silicate from 10 to 20 cm^3L^{-1} caused corresponding, significant effects on number of shoots and leaves plant^{-1} of muskmelon. Also, **Wehedy *et al.* (2018)** and **El-Drany *et al.* (2021)** on muskmelon**, Jifon** and **Lester (2007)** and **Merghany *et al.* (2015)** on melon, **Majed** and **Sadik (2010),**

Table 5. Effect of soil potassium application and foliar potassium sources on plant height, number of leaves and leaf area of cantaloupe plants during (2019/2020) and (2020/2021) seasons.

Parameter	Plant length (cm)		No. Leaves/plant		leaf area/plant (cm^2)	
	Days after transplanting					
Treatment	50	75	50	75	50	75
First season (2019/2020)						
			Soil–K application			
$T_{100\%}$	35.5a	96.1a	28.0a	54.7a	928.9a	1583.3a
$T_{75\%}$	32.6ab	95.3a	27.9a	50.3a	913.1a	1546.7a
$T_{50\%}$	31.1b	95.0a	28.0a	47.9a	943.5a	1562.6a
			Foliar-K sources			
Without	29.2b	92.3b	23.2b	57.7a	771.8b	1478.5a
k-Sili	34.0a	97.7a	29.3a	53.6a	1034.5a	1641.7a
k-Citr	33.1a	97.6a	31.5a	49.7a	991.4ab	1572.8a
k-Acet	35.1a	96.2ab	28.5ab	42.9a	971.6ab	1640.1a
k-Thio	34.1a	93.2ab	27.3ab	51.0a	873.4ab	1488.0a
Second season (2020/2021)						
			Soil–K application			
$T_{100\%}$	36.5a	97.9a	29.5a	81.7a	1165.4a	1962.4a
$T_{75\%}$	30.4b	94.5b	27.3a	87.8a	920.8a	1733.5ab
$T_{50\%}$	28.8b	91.2c	26.000a	82.8a	898.3a	1673.8b
			Foliar-K sources			
Without	30.0a	91.8c	24.3b	77.9b	918.2a	1761.9a
k-Sili	33.5a	98.0a	33.7a	99.6a	1023.2a	1867.2a
k-Citr	32.1a	93.9bc	28.4ab	85.8ab	1164.4a	1956.3a
k-Acet	33.0a	95.6ab	26.3b	78.0b	991.9a	1736.8a
k-Thio	30.7a	93.5bc	25.2b	79.1b	876.4a	1627.1a

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of probability according to Duncan's multiple range test

$T_{100\%}$ Soil application (100% K_2SO4)
$T_{75\%}$ Soil application (75% K_2SO4)
$T_{50\%}$ Soil application (50% K_2SO4)

k-Sili Foliar potassium silicate
k-Citr Foliar potassium citrate
k-Acet Foliar potassium acetate
k-Thio Foliar potassium thiosulphate

Priyanka *et al.* (2016), and **Abdelaziz and Abdeldaym (2018)** on cucumber reported similar results.

Effect of soil potassium application and foliar potassium sources interaction

The obtain results in table 6 clear that the interaction between fertilizer treatments and spraying treatment had significant effect on plant length, number of leaves and leaf area at 50 and 75 days after transplanting in both seasons. The highest value of plant length was recorded by the interaction treatment of soil $T_{100\%}$ with foliar k-thio interaction treatment and soil $T_{50\%}$ K with foliar Sili, as regard to number of leaves per plant, interaction treatment of soil $T_{50\%}$ with foliar K-sili, Soil $T_{50\%}$ with foliar k-citr. Concerning leaves area per plant Soil $T_{50\%}$with foliar k-citr, and soil $T_{50\%}$ with foliar k-acet recorded the highest values at 50 and 75 days after transplanting in first and second season, respectively, as well as, the interaction treatment of soil $T_{100\%}$ with foliar k-citr recorded the highest values of all studied seven traits at 50 and 75 days after transplanting, except number of leaves which recorded the interaction of soil $T_{50\%}$ with K-sili at 50 days after transplanting in the second season. However, the lowest values were of all studied traits were with the interaction treatment of $T_{50\%}$ + without K spray at 50 days after transplanting in both seasons.

Foliar feeding potassium has great significances for plants because it includes low cost, quick response to plant. Foliar fertilization use only small quantity of nutrients and it provides compensation for lack of soil fixation. Results coincide with those reported by **Merghany *et al*. (2015)** on melon, **Salama (2015), and Adeyeye *et al.* (2016)** on watermelon, **Shafeek *et al*. (2015), Tantawy *et al*. (2016),** and **Hosna and Shadia (2017)** on cantaloupe, and **El-Drany *et al.* (2021)** on Muskmelon.

Fresh weight

Effect of potassium soil application

Results in Table 7 show no significant differences among treatments on cantaloupe plant fresh weight, *i.e.*, leaves, stem and total fresh weight at 50 and 75 days after transplanting in both seasons. The highest values were recorded by soil k fertilizer treatment ($T_{50\%}$), except stem fresh weight that was with soil k of $T_{100\%}$ at 50 days after transplanting in the first season, while the highest values in all studied traits at 50 and 75 days after transplanting in the second season were recorded with soil k 100%.

The beneficial effects of supplemental K probably resulted from a combination of improved leaf photosynthetic CO_2 assimilation, assimilate translocation from leaves to fruits, improved leaf and fruit water relations, increased enzyme activation and substrate availability for ascorbic acid and β-carotene biosynthesis all associated with adequate K nutrition as reported by many researchers among them**, Majed and Sadik (2010)** on Muskmelon; **Salama (2015), Shafeek *et al.* (2015), Tantawy *et al.* (2016), Hosna and Shadia (2017)** on cantaloupe; **Sabo *et al*. (2013), Merghany *et al.* (2015), and Adeyeye *et al*. (2016)** on watermelon, reported that soil application of potassium fertilizer increased fresh weight.

Effect of foliar spray with potassium sources

Results in Table 7 show significant effects for foliar application sources on all treatments on fresh weight traits; *viz,* leaves, stem and total fresh weight at 50 and 75 days after transplanting in both seasons Except stem and total fresh weight at 50 days after transplanting in the first season the highest values were recorded by foliar application of K citrate in both seasons, without significant differences than other K applications. Control treatment recorded the lowest values in both seasons.

These results are of great interest because at this early stage of growth great simulative positive differences existed with various applied treatments, that could be

Table 6. Effect of soil potassium application and foliar potassium sources interaction on plant length, number of leaf, and leaf area of cantaloupe plant during 2019/ 2020 and 2020/2021 season

Parameter	Plant length (cm)		No. Leaves/plant		Leaf area/ plant (cm^2)	
	Days after transplanting					
Treatments	50	75	50	75	50	75
First season (2019/2020)						
$T_{100\%}$*without	32.0bc	89.5bc	24.0bc	67.5a	763.1ab	1416.0ab
$T_{100\%}$*K-Sili	37.0ab	97.8a	30.6ab	54.0abc	1018.5ab	1642.2ab
$T_{100\%}$*k-Citr	35.3abc	99.6a	30.0ab	52.8abc	960.6ab	1635.7ab
$T_{100\%}$*k-Acet	36.0abc	96.1abc	27.6abc	46.8abc	896.6 ab	1564.9ab
$T_{100\%}$*k-Thio	37.5a	97.3ab	28.0abc	52.6abc	1005.9ab	1657.6ab
$T_{75\%}$*without	30.3cd	94.5abc	27.0abc	48.0abc	942.0ab	1639.3ab
$T_{75\%}$*K-Sili	34.8abc	95.1abc	27.3abc	47.0abc	1023.7ab	1631.1ab
$T_{75\%}$*k-Citr	33.8abc	94.1abc	27.3abc	55.3abc	848.6ab	1443.2ab
$T_{75\%}$*k-Acet	33.8abc	99.3a	27.3abc	48.5abc	914.6ab	1603.3ab
$T_{75\%}$*k-Thio	30.5cd	93.3abc	30.6ab	53.0abc	836.9ab	1410.1ab
$T_{50\%}$*without	25.3d	93.0abc	18.6 c	57.6abc	610.4 b	1416.8ab
$T_{50\%}$*K-Sili	30.1cd	100.3a	30.0ab	59.8ab	1061.4a	1651.9ab
$T_{50\%}$*k-Citr	30.1cd	99.1a	37.3a	41.1bc	1164.9a	1639.4ab
$T_{50\%}$*k-Acet	35.6abc	93.3abc	30.6ab	33.5c	1103.7a	1752.0a
$T_{50\%}$*k-Thio	34.5abc	89.1c	23.3bc	47.5abc	777.4ab	1359.6b
Second season (2020/2021)						
T100%*without	37.6ab	95.0bcd	30.8abcd	82.8abcde	1159.1ab	1978.6ab
T100%*K-Sili	36.3ab	102.0a	32.0abcd	90.0abcd	1068.5ab	1956.3ab
T100%*k-Citr	39.0a	100.5ab	36.8a	101.3ab	1725.9a	2450.0a
T100%*k-Acet	36.1ab	95.0bcd	22.5de	58.6e	815.8b	1556.4b
T100%*k-Thio	33.3abc	97.3abc	25.6bcde	75.8bcde	1057.6ab	1870.4ab
T75%*without	27.1c	93.5cde	24.6cde	87.8abcd	848.8b	1869.2ab
T75%*K-Sili	32.8abc	97.5abc	33.8abc	101.5ab	1077.0ab	1828.0b
T75%*k-Citr	30.5abc	93.5cde	26.0bcde	81.6abcde	961.5b	1754.2b
T75%*k-Acet	31.6abc	95.3bcd	24.0cde	75.5bcde	885.0b	1664.8b
T75%*k-Thio	29.8bc	93.0cdef	28.0abcd	92.5abc	831.8b	1555.9b
T50%*without	25.3c	87.0f	17.5e	63.1de	739.8b	1438.0b
T50%*K-Sili	31.5abc	94.6bcd	35.3ab	107.3a	924.2b	1817.3b
T50%*k-Citr	26.833c	87.8ef	22.5de	74.5bcde	805.9b	1664.8b
T50%*k-Acet	31.1abc	96.6abc	32.5abcd	100.0ab	1274.9ab	1993.6ab
T50%*k-Thio	29.1bc	90.1def	22.1de	69.1cde	746.5b	1455.1b

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of probability according to Duncan's multiple range test.

Table 7. Effect of soil potassium application and foliar potassium sources on fresh weight of cantaloupe plants during 2019/2020 and 2020/2021 seasons

Parameter	Leaf fresh weight (g)		Stem fresh weight (g)		Total fresh weight (g)	
	Days after transplanting					
Treatment	50	75	50	75	50	75
First season (2019/2020)						
Soil–K application						
T100%	36.2a	73.1a	24.9a	53.2a	73.7a	151.0c
T75%	38.3a	76.4a	23.9a	55.4a	75.1a	157.0b
T50%	40.9a	78.2a	22.1a	57.1a	78.9a	164.3a
Foliar-K sources						
Without	26.2b	62.8b	19.1b	44.7b	53.5b	126.5b
k-Sili	42.6a	80.3a	29.4a	60.6a	88.8a	171.8a
k-Citr	40.8a	78.7a	24.0ab	55.8a	77.5a	158.5a
k-Acet	43.3a	80.7a	24.3ab	61.1a	85.4a	173.3a
k-Thio	39.3a	77.0a	21.3b	54.0a	74.3ab	157.1a
Second season (2020/2021)						
Soil–K application						
$T_{100\%}$	43.9a	78.5a	33.2a	60.2a	94.7a	170.9a
$T_{75\%}$	39.0a	77.6a	22.3b	56.1a	74.4ab	158.8a
$T_{50\%}$	38.9a	75.7a	18.6b	56.9a	72.3b	161.3a
Foliar-K sources						
Without	33.1b	66.4b	21.6a	47.3b	65.2a	133.7b
k-Sili	42.5ab	81.6a	28.1a	62.2a	87.7a	175.9a
k-Citr	46.7a	81.9a	29.7a	66.2a	97.3a	188.2a
k-Acet	41.7ab	79.3a	23.6a	57.9ab	80.1a	164.6ab
k-Thio	39.0ab	77.0ab	20.5a	55.0ab	72.0a	155.8ab

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of probability according to Duncan's multiple range test

$T_{100\%}$	Soil application (100% K_2SO4)	k-Sili	Foliar potassium silicate
$T_{75\%}$	Soil application (75% K_2SO4)	k-Citr	Foliar potassium citrate
$T_{50\%}$	Soil application (50% K_2SO4)	k-Acet	Foliar potassium acetate
		k-Thio	Foliar potassium thiosulphate

prolonged to the advanced growth stages including flowering and the final fruit yield as well as the high quality of fruits yield and increment of leaf area is of great interest because that could be reflected upon the efficiency of photosynthesis by accumulating more assimilates and high rates of their translocation specially toward formed fruits. This result is in harmony with those reported by **Wehedy *et al.* (2018)** and **El-Drany *et al.* (2021)** on muskmelon, **Jifon and Lester (2007)** and **Merghany *et al.* (2015)** on melon, **Majed and Sadik (2010), Priyanka *et al.* (2016),** and **Abdelaziz and Abdeldaym (2018)** on cucumber.

Effect of soil potassium application and foliar potassium sources interaction

Results in Table 8 show significant effects for the interaction of soil and foliar application sources on all fresh weight traits treatments at 50 and 75 days after transplanting in both seasons. The best results were recorded by the interaction treatment of soil application at 50% of recommended K + foliar k-Acet in the first season, while in the second season were recorded with application of 100% K +foliar K citrate without significant differences than 50% of recommended K + foliar k-Acet. On the other hand, The lowest values of fresh weight of leaves, stem and total fresh weight were recorded by 50 % of recommended k without foliar potassium at 50 and 75 days after transplanting in both seasons.

These results demonstrate that the benefit of supplemental foliar K application depends on other prevailing environmental conditions controlling available soil K and plant development. Such factors can either intensify or mask the beneficial effects of supplemental foliar K applications. These results coincide with those reported by **Merghany *et al.* (2015)** on melon, **Salama (2015), Shafeek *et al.* (2015), Tantawy *et al.* (2016),** and **Hosna and Shadia (2017)** on cantaloupe, **Majed** and **Sadik (2010), Adeyeye *et al.* (2016)** on watermelon, **and El-Drany *et al.* (2021)** on Muskmelon.

Dry weight

Effect of soil potassium application

Results in Table 9 show no significant differences among treatments on cantaloupe plant dry weight, *i.e.*, leaves, stem and total fresh weight at 50 and 75 days after transplanting in both seasons, except at 50 days leaves and total dry weight in the first season, as well as, stem and total dry weight in the second season. The highest values were recorded by soil k fertilizer treatment of 100% 0f recommended dose.

Potassium helps in the transport of water and nutrients through the xylem, influencing various biochemical and physiological parameters like photosynthesis, respiration, protein synthesis cell extension. These results are in agreement with **Merghany *et al.* (2015)** on melon**, Salama (2015), Shafeek *et al.* (2015),** and **Tantawy *et al.* (2016)** on cantaloupe.

Effect of foliar spray with potassium sources

Results in Table 9 show that in both seasons, the highest values were recorded by foliar application of K silicate in both seasons, without significant differences than other foliar K applications. While, control treatment recorded the lowest values. However, little significant differences were detected among foliar spray application treatments for studied dry weight traits in both seasons.

The enhancement of dry weight of cantaloupe plants at 50, 75 days after transplanting may be attributed to the improvement of photosynthesis process that let to accumulation of more dry matter in leaves. Potassium silicates participate in plant growth and development indirectly by enhancing the endogenous levels of various growth factors, so obtained results could be

Table 8. Effect of soil potassium application and foliar potassium sources interaction on fresh weight of cantaloupe plants during 2019/2020 and 2020/2021 seasons

Parameter / Treatment	Leaf fresh weight (g)		Stem fresh weight (g)		Total fresh weight (g)	
	Days after transplanting					
	50	75	50	75	50	75
			First season (2019/2020)			
$T_{100\%}$*without	28.5cd	64.0de	17.8bc	45.1cd	54.6cd	127.5cd
$T_{100\%}$* K-Sili	37.8bc	76.0abcd	32.1a	55.8bc	83.8abc	158.3bc
$T_{100\%}$* k-Citr	37.5bc	75.0bcd	26.3abc	52.8bcd	74.8abcd	150.1bc
$T_{100\%}$* k-Acet	37.5bc	73.8bcd	21.0abc	53.3bcd	71.6abcd	151.0bc
$T_{100\%}$* k-Thio	39.6abc	77.0abcd	29.5ab	59.1abc	83.8abc	168.1bc
$T_{75\%}$* without	29.8cd	68.0cde	23.3abc	49.8bcd	63.5bcd	141.0bcd
$T_{75\%}$* K-Sili	47.1ab	85.3ab	26.6abc	63.0ab	90.5ab	178.3ab
$T_{75\%}$* k-Citr	36.3bc	74.5bcd	20.8abc	51.6bcd	67.3bcd	146.6bcd
$T_{75\%}$* k-Acet	39.0abc	76.8abcd	27.0abc	57.1bc	80.5abc	162.0bc
$T_{75\%}$* k-Thio	39.5abc	77.3abcd	21.8abc	55.5bc	74.0abcd	157.1bc
$T_{50\%}$* without	20.5d	56.5e	15.0c	39.1d	42.5d	111.0d
$T_{50\%}$* K-Sili	43.0abc	79.6abc	29.5ab	63.1ab	92.3ab	178.8ab
$T_{50\%}$* k-Citr	48.6ab	86.6ab	25.0abc	63.1ab	90.3ab	178.6ab
$T_{50\%}$* k-Acet	53.6a	91.5a	25.0abc	73.0a	104.1a	207.1a
$T_{50\%}$* k-Thio	38.8abc	76.6abcd	16.3c	47.3bcd	65.1bcd	146.1bcd
			Second season (2020/2021)			
$T_{100\%}$*without	44.0abcd	79.8abc	38.1ab	60.3abc	100.0ab	170.6abc
$T_{100\%}$* K-Sili	40.8abcd	78.1bc	32.8abc	58.8abc	89.6abc	166.0abc
$T_{100\%}$* k-Citr	61.3a	89.6ab	51.5a	78.0a	142.5a	222.5a
$T_{100\%}$* k-Acet	32.3cd	67.0cd	18.1bcd	46.0cd	59.5bc	131.3cd
$T_{100\%}$* k-Thio	41.1abcd	77.8bc	25.5bcd	58.0abc	82.1bc	164.1abc
$T_{75\%}$* without	29.1cd	66.8cd	17.0cd	46.8cd	54.5bc	132.0cd
$T_{75\%}$* K-Sili	48.3abc	89.0ab	27.1bcd	67.1abc	94.3abc	190.0abc
$T_{75\%}$* k-Citr	42.1abcd	80.1abc	23.0bcd	58.1abc	79.5bc	165.0abc
$T_{75\%}$* k-Acet	35.6bcd	74.0bc	22.6bcd	54.5bcd	71.1bc	154.6bcd
$T_{75\%}$* k-Thio	39.6abcd	78.0bc	21.8bcd	53.8bcd	72.5bc	152.33bcd
$T_{50\%}$* without	26.1d	52.6d	9.8d	35.0d	41.3c	98.6d
$T_{50\%}$* K-Sili	38.3bcd	77.8bc	24.3bcd	60.6abc	79.1bc	171.8abc
$T_{50\%}$* k-Citr	36.8bcd	76.0bc	14.8cd	62.5abc	70.0bc	177.3abc
$T_{50\%}$* k-Acet	57.1ab	97.0a	30.0bcd	73.3ab	109.6ab	208.0ab
$T_{50\%}$* k-Thio	36.1bcd	75.1bc	14.1cd	53.3bcd	61.5bc	151.0bcd

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of probability according to Duncan's multiple range test.

Table 9. Effect of soil potassium application and foliar potassium sources on dry weight and total dry weight of cantaloupe plants during 2019/2020 and 2020/2021 seasons

Parameter	leaf dry weight		stem dry weight		Total dry weight	
	Days after transplanting					
Treatment	50	75	50	75	50	75
First season (2019/2020)						
Soil–K application						
T100%	10.783a	21.2a	5.7a	13.249a	16.5ab	34.545a
T75%	12.603a	18.3b	5.6a	14.447a	18.2a	32.801a
T50%	6.222b	18.7ab	6.07a	11.928a	12.2b	30.703a
Foliar-K sources						
Without	6.859b	12.2c	2.6c	9.9b	9.5b	22.141b
k-Sili	11.514a	22.6ab	8.8a	15.8a	20.3a	38.457a
k-Citr	9.234ab	24.8a	5.8abc	12.7ab	15.1ab	37.636a
k-Acet	11.389ab	20.5ab	6.6ab	13.0ab	18.0a	33.689a
k-Thio	10.351ab	17.0bc	5.1bc	14.4a	15.4ab	31.493ab
Second season (2020/2021)						
Soil–K application						
$\mathbf{T_{100\%}}$	17.0a	46.0a	10.6a	33.6a	27.7a	79.1a
$\mathbf{T_{75\%}}$	17.4a	46.1a	6.7b	33.1a	24.2ab	79.1a
$\mathbf{T_{50\%}}$	16.8a	45.4a	3.8c	32.1a	20.6b	78.3a
Foliar-K sources						
Without	13.1b	42.9b	8.1a	27.0b	21.2a	70.0b
k-Sili	19.5a	48.9a	7.8a	36.1a	27.3a	85.0a
k-Citr	17.8ab	45.3ab	6.5a	32.4ab	24.3a	77.7ab
k-Acet	17.8ab	47.2ab	6.7a	34.4ab	24.5a	81.6ab
k-Thio	17.1ab	45.0ab	6.3a	35.0a	23.4a	80.1ab

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of probability according to Duncan's multiple range test

$T_{100\%}$	Soil application (100% K_2SO4)	k-Sili	Foliar potassium silicate
$T_{75\%}$	Soil application (75% K_2SO4)	k-Citr	Foliar potassium citrate
$T_{50\%}$	Soil application (50% K_2SO4)	k-Acet	Foliar potassium acetate
		k-Thio	Foliar potassium thiosulphate

expected, since used treatments enhanced the formation of chlorophylls and hence might activate the pathway of photo assimilation that is in tight relation with the accumulation of dry matter. Moreover, these results are of great interest, because at this early stage of growth great simulative effects existed with various applied treatments, so that the results are in harmony with the results of potassium citrate, where potassium salt of citric acid is very important in the respiratory pathways into plant cell.

Effect of soil application and foliar potassium sources interaction

Results in Table 10 indicate that no relationship was detected between soil potassium application + foliar potassium spray and dry weight traits in both seasons , since the treatment which showed high values in some traits recorded low values in other ones . Generally , the soil application of 75% of k recommended + foliar k-silicate considered the best treatment in the first season since recorded the highest values for leaves and total dry weight (at 50 days) , as well as, stem dry weight (at 75 days) and accepted values for the remaining traits . Meanwhile , in the second seasons , the soil application of 50% of k recommended + foliar spray k-acetate was considered the best one , since recorded the highest values for studied dry weight traits after 75 days from transplanting .

Obtained results are in accordance with those reported by **Merghany *et al.* (2015), Salama (2015), Shafeek *et al.* (2015**), **Tantawy *et al.* (2016), Hosna and Shadia (2017) and El-Sayed *et al.* (2017)** on cantaloupe, **Majed and Sadik (2010)** on muskmelon.

Leaf photosynthetic pigments content

Effect of potassium soil application

Results in Table 11 show significant effects for potassium soil applications on all photosynthetic pigment's traits at 50 and 75 days after transplanting in both seasons. potassium soil application of 100 K recorded the highest values, while the level of 50% recorded the lowest values of leaf photosynthetic pigments content.

These results are due to the positive action of potassium on enhancing cell division, the biosynthesis of sugars, plant pigments and natural growth regulators as well as enhancing the resistance of plants to all unfavorable environments. Results are in harmony with **Lester (2005)** who found that supplementing sufficient soil K with additional foliar K applications during cantaloupe fruit development and maturation improves fruit marketable quality and fruit human health quality by increasing beta carotene. Also, similar results were reported by **Salama (2015), Tantawy *et al.* (2016) Hosna and Shadia (2017)** and **Anouschka *et al.* (2021)** on cantaloupe, and **Nassar *et al.* (2019)** on squash.

Effect of foliar spray with potassium sources

Results in Table 11 indicate that foliar potassium sources had significant effects on all studied traits of leaf photosynthetic pigments content at 50 and 75 days after transplanting in both seasons. The highest values were recorded by spraying foliar application of k-acetate followed by k-silicate with insignificant differences between of them for most studied traits in both seasons. The highest content of carotene content in potassium treated fruit might be due to combination of improved leaf photosynthetic CO_2 assimilation, assimilate translocation from leaves to fruits, improved leaf and fruit water relation, increased enzyme activation and substrate availability for carotene biosynthesis. This is in accordance with the findings of **Lester (2005)** on melon, **Salama (2015)**, **Tantawy *et al.* (2016)** and **El-Sayed *et al.* (2017)** on cantaloupe **Priyanka *et al.* (2016), El-Drany *et al.* (2021) and Sindhuja *et al.* (2017)** on muskmelon.

Effect of soil application and foliar potassium sources interaction

Results in Table 12 indicate that interaction of soil application and foliar potassium

Table 10. Effect of soil potassium application and foliar potassium sources interaction on dry weight and total dry weight of cantaloupe plants during 2019/2020 and 2020/2021 seasons

Parameter	Dry w. of leaves (g)		Dry w. of stems (g)		Total dry weight (g)	
	Days after transplanting					
Treatment	50	75	50	75	50	75
First season (2019/2020)						
$T_{100\%}$*without	9.5bcd	21.9abcde	2.9c	11.9bc	12.4bc	33.8abc
$T_{100\%}$* K-Sili	12.8abc	27.9ab	7.5abc	13.1abc	20.4ab	41.0ab
$T_{100\%}$* k-Citr	11.9abc	25.9abcd	6.8abc	12.0bc	18.8ab	37.9ab
$T_{100\%}$* k-Acet	12.8abc	13.5defg	2.8c	12.2bc	15.6abc	25.8bcd
$T_{100\%}$* k-Thio	6.6cd	17.1bcdefg	8.7abc	16.9ab	15.4bc	34.0abc
$T_{75\%}$*without	8.1bcd	9.21fg	2.6c	11.7bc	10.8bc	20.9cd
$T_{75\%}$* K-Sili	18.6a	20.2bcdef	8.2abc	20.3a	26.9a	40.6ab
$T_{75\%}$* k-Citr	9.8bcd	26.1abc	4.5abc	10.7bc	14.3bc	36.8abc
$T_{75\%}$* k-Acet	11.7abc	15.3cdefg	9.8ab	15.0ab	21.5ab	30.4abc
$T_{75\%}$* k-Thio	14.6ab	20.7bcdef	3.0c	14.2ab	17.6ab	35.0abc
$T_{50\%}$*without	2.9d	5.5g	2.4c	6.0c	5.3c	11.5d
$T_{50\%}$* K-Sili	2.9d	19.7bcdef	10.7a	13.9ab	13.7bc	33.6abc
$T_{50\%}$* k-Citr	5.8cd	22.5abcde	6.2abc	15.5ab	12.1bc	38.1ab
$T_{50\%}$* k-Acet	9.5bcd	32.8a	7.2abc	11.9bc	16.8ab	44.8a
$T_{50\%}$* k-Thio	9.7bcd	13.2efg	3.5bc	12.1bc	13.2bc	25.3bcd
Second season (2020/2021)						
$T_{100\%}$*without	15.8bcd	47.4abc	19.6a	35.2b	35.4a	82.6b
$T_{100\%}$* K-Sili	16.4abcd	46.4abc	8.9b	34.5b	25.4abcd	80.9b
$T_{100\%}$* k-Citr	21.7abc	48.8ab	10.0b	36.6ab	31.7abc	85.5ab
$T_{100\%}$* k-Acet	14.2bcd	42.3bc	6.4b	27.9bc	20.6cd	70.3bc
$T_{100\%}$* k-Thio	16.9abcd	42.4bc	8.4b	33.9b	25.3abcd	76.4b
$T_{75\%}$*without	12.2cd	43.5abc	2.6b	27.4bc	14.8d	71.0bc
$T_{75\%}$* K-Sili	26.1a	47.6abc	8.9b	37.9ab	35.1ab	85.5ab
$T_{75\%}$* k-Citr	16.4abcd	43.8abc	5.9b	32.0b	22.3abcd	75.8b
$T_{75\%}$* k-Acet	15.8bcd	46.2abc	8.0b	26.6bc	23.8abcd	72.94c
$T_{75\%}$* k-Thio	16.6abcd	49.6ab	8.2b	36.7ab	24.8abcd	86.3ab
$T_{50\%}$*without	11.3d	38.0c	2.1b	18.2c	13.4d	56.3c
$T_{50\%}$* K-Sili	16.1abcd	52.6a	5.4b	36.0ab	21.6bcd	88.7ab
$T_{50\%}$* k-Citr	15.4bcd	43.2abc	3.5b	28.5bc	18.9cd	71.8bc
$T_{50\%}$* k-Acet	23.5ab	52.9a	5.6b	48.5a	29.1abc	101.5a
$T_{50\%}$* k-Thio	17.7abcd	43.1abc	2.4b	34.3b	20.2cd	77.4b

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of probability according to Duncan's multiple range test.

Table 11. Effect of soil potassium application and foliar potassium sources on photosynthetic pigments content in cantaloupe leaves during 2019/2020 and 2020/2021 seasons

Parameter	Chl.a (mg/g fw)		Chl.b (mg/g fw)		Chl.a+b (mg/g fw)		Carotenoid (mg/g fw)	
Treatment	Days after transplanting							
	50	75	50	75	50	75	50	75
First season (2019/2020)								
Soil–K application								
$T_{100\%}$	0.254a	0.184a	0.404a	0.480a	0.359a	0.664a	0.555a	0.436a
$T_{75\%}$	0.235b	0.168b	0.384b	0.460ab	0.339a	0.628b	0.514a	0.416b
$T_{50\%}$	0.219c	0.157c	0.374b	0.443b	0.283b	0.600c	0.448b	0.412b
Foliar-K sources								
Without	0.225b	0.170ab	0.368b	0.418b	0.338a	0.603b	0.517ab	0.410b
k-Sili	0.232ab	0.184a	0.392a	0.461ab	0.341a	0.631ab	0.532a	0.426ab
k-Citr	0.231b	0.166b	0.381ab	0.454ab	0.314a	0.621ab	0.486ab	0.411b
k-Acet	0.251a	0.158b	0.398a	0.493a	0.310a	0.652a	0.481b	0.436a
k-Thio	0.240ab	0.169ab	0.396a	0.478a	0.332a	0.647a	0.511ab	0.423ab
Second season (2020/2021)								
Soil–K application								
T100%	0.265a	0.169b	0.390a	0.326b	0.637a	0.495b	0.414b	0.361b
T75%	0.263ab	0.212a	0.417a	0.370a	0.686a	0.582a	0.450a	0.408a
T50%	0.265a	0.182ab	0.411a	0.339ab	0.683a	0.521b	0.436ab	0.420a
Foliar-K sources								
Without	0.237b	0.175b	0.382b	0.322b	0.627b	0.498b	0.417b	0.390a
k-Sili	0.250ab	0.168b	0.399ab	0.327b	0.653ab	0.496b	0.431ab	0.388a
k-Citr	0.278a	0.194ab	0.435a	0.404a	0.720a	0.598a	0.445a	0.397a
k-Acet	0.262ab	0.213a	0.398ab	0.342b	0.667ab	0.555ab	0.437ab	0.405a
k-Thio	0.254ab	0.186ab	0.415ab	0.328b	0.675ab	0.515b	0.435ab	0.402a

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of probability according to Duncan's multiple range test

$T_{100\%}$	Soil application (100% K_2SO4)	k-Sili	Foliar potassium silicate
$T_{75\%}$	Soil application (75% K_2SO4)	k-Citr	Foliar potassium citrate
$T_{50\%}$	Soil application (50% K_2SO4)	k-Acet	Foliar potassium acetate
		k-Thio	Foliar potassium thiosulphate

Table 12. Effect of soil potassium application and foliar potassium sources interaction on photosynthetic pigments content in cantaloupe leaves during 2019/2020 and 2020/2021 seasons

Parameter / Treatment	Chl.a (mg/g fw)		Chl.b (mg/g fw)		Chl. a+b (mg/g fw)		Carotenoid (mg/g fw)	
	Days after transplanting							
	50	75	50	75	50	75	50	75
First season (2019/2020)								
$T_{100\%}$* without	0.266ab	0.216a	0.403ab	0.460b	0.363a	0.676abcd	0.590a	0.453ab
$T_{100\%}$* K-Sili	0.226cd	0.160def	0.413a	0.486ab	0.386a	0.646abcde	0.556abc	0.420cdef
$T_{100\%}$* k-Citr	0.276a	0.170cdef	0.426a	0.540a	0.333abc	0.710a	0.516abcd	0.430bcd
$T_{100\%}$* k-Acet	0.230cd	0.170cdef	0.373bc	0.440b	0.350ab	0.610def	0.530abcd	0.413cdef
$T_{100\%}$* k-Thio	0.270a	0.206ab	0.403ab	0.473ab	0.363a	0.680abc	0.583ab	0.463a
$T_{75\%}$* without	0.203de	0.186bcd	0.336c	0.366c	0.333abc	0.553fg	0.528abcd	0.400ef
$T_{75\%}$* K-Sili	0.236bcd	0.190abc	0.396ab	0.450b	0.360a	0.640bcde	0.556abc	0.403def
$T_{75\%}$* k-Citr	0.233cd	0.146f	0.373bc	0.466ab	0.343ab	0.613cdef	0.496bcde	0.406def
$T_{75\%}$* k-Acet	0.270ab	0.160def	0.423a	0.540a	0.333abc	0.700ab	0.496bcde	0.440abc
$T_{75\%}$* k-Thio	0.233cd	0.156ef	0.393ab	0.480ab	0.326abc	0.636bcde	0.493bcde	0.430bcde
$T_{50\%}$* without	0.206de	0.150f	0.366bc	0.430bc	0.320abc	0.580efg	0.480cde	0.426bcdef
$T_{50\%}$* K-Sili	0.233cd	0.160def	0.366bc	0.446b	0.276bc	0.606efg	0.440de	0.406def
$T_{50\%}$* k-Citr	0.183e	0.183bcde	0.343c	0.3567c	0.253c	0.540g	0.446de	0.396f
$T_{50\%}$* k-Acet	0.253abc	0.146f	0.393ab	0.500ab	0.260c	0.646abcde	0.416e	0.416cdef
$T_{50\%}$* k-Thio	0.218d	0.145f	0.400ab	0.481ab	0.306abc	0.626cde	0.456de	0.416cdef
Second season (2020/2021)								
$T_{100\%}$* without	0.226cd	0.166cd	0.373d	0.320bcde	0.610cd	0.48cde	0.413cde	0.356cd
$T_{100\%}$* K-Sili	0.243bcd	0.150d	0.376cd	0.273e	0.620bcd	0.42e	0.413cde	0.340d
$T_{100\%}$* k-Citr	0.240bcd	0.183bcd	0.406bcd	0.356bcde	0.650bcd	0.54bcd	0.403de	0.390abcd
$T_{100\%}$* k-Acet	0.243bcd	0.176cd	0.386bcd	0.340bcde	0.636bcd	0.51cde	0.410de	0.356cd
$T_{100\%}$* k-Thio	0.253bcd	0.170cd	0.410bcd	0.340bcde	0.670bcd	0.51cde	0.430bcde	0.363bcd
$T_{75\%}$* without	0.200d	0.160d	0.356d	0.273e	0.603cd	0.43de	0.400e	0.393abcd
$T_{75\%}$* K-Sili	0.276abc	0.196abcd	0.455ab	0.383bc	0.736ab	0.58bc	0.473ab	0.413abcd
$T_{75\%}$* k-Citr	0.320a	0.236ab	0.483a	0.493a	0.806a	0.73a	0.490a	0.396abcd
$T_{75\%}$* k-Acet	0.270abc	0.246a	0.400bcd	0.400b	0.676bcd	0.64ab	0.456abc	0.420abc
$T_{75\%}$* k-Thio	0.250bcd	0.220abc	0.390bcd	0.300cde	0.643bcd	0.52cde	0.433bcde	0.420abc
$T_{50\%}$* without	0.286ab	0.200abcd	0.416abcd	0.373bcd	0.706abc	0.57bc	0.440bcde	0.436ab
$T_{50\%}$* K-Sili	0.230bcd	0.160d	0.366d	0.326bcde	0.566d	0.48cde	0.406de	0.396abcd
$T_{50\%}$* k-Citr	0.276abc	0.163d	0.416abcd	0.363bcde	0.703abc	0.52cde	0.443bcde	0.406abcd
$T_{50\%}$* k-Acet	0.273abc	0.216abc	0.410bcd	0.286de	0.690abc	0.50cde	0.446abcd	0.440a
$T_{50\%}$* k-Thio	0.260bc	0.170cd	0.446abc	0.346bcde	0.713abc	0.51cde	0.443bcde	0.423abc

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of probability according to Duncan's multiple range test.

sources had significant effects on all studied leaf photosynthetic pigments content traits, *viz,* chlorophyll a, (chlorophyll b, chl. a+b and carotenoids content at 50 and 75 days after transplanting in both seasons. Generally in the first season, the highest values were recorded by the interaction treatment of application of 100% of recommended potassium + foliar citrate potassium application in all studied leaf photosynthetic pigments content, except chlorophyll a and carotenoids content, followed by application of 75% from potassium recommended + foliar spray of k-acetate with insignificant differences between of them for most studied traits at 75 days after transplanting. Meanwhile, application of 75% of potassium recommended + foliar spray of k-citrate recorded the highest values for photosynthetic pigments content in the second season.

These results are due to the positive action of potassium sources on enhancing cell division, the biosynthesis of sugars, plant pigments and natural growth regulators as well as enhancing the resistance of plants to all unfavorable environments. These results are in harmony with those of **Hosna and Shadia (2017) and Gouda *et al.* (2021)** on cantaloupe, **El-Drany *et al.* (2021)** on muskmelon.

Conclusion

It could be concluded that soil application of 50% or 100% recommended potassium with foliar application with K-Silicate or K-Acetate or K-Citrate gave the best vegetative growth of cantaloupe plant under sandy soil condition. Therefore , to obtained the best vegetative growth of cantaloupe plant under sandy soil condition with little cost of potassium could be used soil application of 50% recommended potassium with foliar spray application with silicate - acetate – or citrate – potassium.

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الملخص العربي

تأثير تسميد البوتاسيوم الأرضي وبالرش على نمو نبات الكنتالوب بالأراضي الرملية

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أجريت دراسة حقلية على محصول الكنتالوب هجين **"Gal 152 F1"** خلال الموسم الشتوي 2019-2020، و2020-2021 لدراسة تأثير ثلاث معدلات للتسميد الأرضي بالبوتاسيوم (100%، 75%، 50% من المعدل الموصي به)، والرش بأربعة مصادر للبوتاسيوم (سلكيات البوتاسيوم، سترات البوتاسيوم، أسيتات البوتاسيوم، ثيوسلفات البوتاسيوم)، وكنترول (الرش بماء الصنبور) تحت نظام الري بالتنقيط وعلى مسافة 50 سم بين النقاطات. تم الشتلات في 25 ديسمبر تحت الانفاق البلاستيكية المنخفضة. أدى الإضافة الأرضية 100% + الرش بسلكيات البوتاسيوم إلى أعلى القيم لمعظم صفات النمو الخضري. ونتج عن التفاعل بين البوتاسيوم الأرضي 50% من المعدل الموصي به + الرش بأسيتات البوتاسيوم إلى تحقيق أفضل قيم لصفات النمو الخضري (ارتفاع النبات، وعدد الاوراق، والمساحة الورقية، والوزن الطازج للنبات) في الموسم الأول، في حين سجلت معامله الإضافة الأرضية 100% من الموصي به + الرش بسترات البوتاسيوم أعلى القيم بالموسم الثاني دون اختلاف معنوي مع معامله 50% المضافة ارضياً + الرش بأسيتات البوتاسيوم. وتم الحصول على اعلى القيم للوزن الجاف بإضافة 75% بوتاسيوم أرضي + الرش بسيليكات البوتاسيوم، و100% بوتاسيوم أرضي + سلكيات البوتاسيوم بالموسم الأول، في حين نتج عن المعاملة 50% بوتاسيوم أرضي + الرش بأسيتات البوتاسيوم، و75% بوتاسيوم أرضي+ الرش بسلكيات البوتاسيوم أفضل القيم بالموسم الثاني. وتحقق أفضل القيم لصبغات التمثيل الضوئي بإضافة 100 % بوتاسيوم أرضي + الرش بسترات البوتاسيوم، عدا كلوروفيل أ بعد 75 يوم من الزراعة، ومحتوى الكاروتينات بعد 50 و75 يوم من الزراعة. و100% بوتاسيوم أرضي+ سلكيات البوتاسيوم بالموسم الأول، في حين كانت أفضل القيم بالموسم الثاني مع المعاملة 50% بوتاسيوم أرضي+ الرش بأسيتات البوتاسيوم، و75% بوتاسيوم أرضي+ الرش بسلكيات البوتاسيوم.

الكلمات الاسترشادية: الكنتالوب، مصادر البوتاسيوم، التسميد، الانفاق البلاستيكية المنخفضة.

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