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EFFECT OF DIFFERENT POTASSIUM SOURCES ON GROWTH, PRODUCTIVITY AND FRUIT QUALITY OF SOME CANTALOUPE HYBRIDS UNDER SANDY SOIL CONDITIONS

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ABSTRACT: Two field experiments were carried out during two successive summer seasons of 2014 and 2015 at Vegetable Private Farm located on Faqus District, Sharkia Governorate, Egypt, to study the effect of the sources of potassium fertilization such as (potassium sulphate (K_2SO_4), potassium citrate (KC), potassium thiosulphate (KTS) and potassium glysrophosphate (KGP), beside control treatment (water) on growth, yield and fruit quality of some cantaloupe hybrids (Galia, C8 and Gal 152): 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 Vitam. 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

Key words: Cantaloupe, hybrids, potassium sources, yield, fruit quality.

INTRODUCTION

Cantaloupe fruit is one of the most important and popular fruity vegetables grown in Egypt and it used mainly as a dessert and refreshing fruit. It is rich in bioactive compounds such as phenolics, flavonoids and vitamins as well as carbohydrates and minerals (especially potassium). In addition, it is low in fat and calories (about 17 cal/100g). Furthermore, it has a large amount of dietary fiber (Tamer *et al*., 2010).

There were significant differences between hybrids regarding plant growth such as main stem length, leaf number, leaf area, fresh and dry weight, yield and its components as well as fruit quality of cantaloupe (Abou El-Yazied *et al*., 2012; Merghany *et al.,* 2015; Salama, 2015). They all reported that plants of cantaloupe cultivars differ in their growth and productivity as well as fruit quality.

Potassium (K) is a key nutrient for enhancing productivity of vegetable crops and its content in vegetables has significant positive relationship with quality attributes (Bidari and Hebsur, 2011). Foliar spray is the ideal method of application of nutrients for intensive and profitable cultivation of cantaloupe crop (Oded and Uzi, 2003). 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).

Treated cantaloupe plants with different potassium sources increased plant growth, yield and its components and fruit quality (Merghany *et al*., 2015).

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Thus, the present work was designed to evaluate the effect of different sources of potassium fertilizers on growth, yield and fruit quality of some cantaloupe hybrids.

MATERIALS AND METHODS

Two field experiments were carried out during two successive summer seasons of 2014 and 2015 at Vegetable Private Farm located at Faqus District, Sharkia Governorate, Egypt. This was initiated to study the effect of some sources of potassium fertilization on growth and productivity of three hybrids (Galia, C8 and Gal 152). This experiment included 15 treatments which were the combination between three hybrids (Galia, C8 and Gal 152) and four sources of potassium, *i.e.,* potassium sulphate (K_2SO_4), potassium citrate (KC), potassium thiosulphate (KTS) and potassium glysrophosphate (KGP) as well as control (unfertilized).

The combination of treatments were distributed in split plots in a randomized complete blocks design. Cantaloupe hybrids were randomly arranged in the main plots and potassium sources randomly distributed in the sub plots.

The chemical analyses of experimental site, irrigation water and organic manure were determined in Central Laboratory, Fac. Agric. Zagazig University and presented in Table 1.

Seeds were sown (one seed/cell) on Feb. 15th, in speedling trays; *i.e.,* 209 cells (28 cm^{3}cell size) in both seasons. The trays were disinfected by dipping in Clorox 0.8%. The growing medium consisted of peatmoss and vermiculite 1:1 (*V/V*). Calcium carbonate was added to the growing medium (25 g/kg medium) to adjust pH of growing media. After seed germination, the trays were kept under plastic house condition to about 25 days. During this period transplants were sprayed 3-4 times by macro solution (Power) 20-20-20 and trace element produced by the Egyptian Co. for Development and Chemical Industries, Ismailia, Egypt at the rate of 1.5 g/l of both macro and micro nutrients, other managements for diseases and pest control during transplant production were done as followed in vegetables nurses.

After about 25 days, the transplants were planted at field at spacing of 50 cm on one side of dripper line. Transplanting was done on March 6th in summer seasons of 2015 and 2016. Plot area was 18 m^2 (2 rows with 6 m length and 1.5 m width). One of the two lines devoted for plant samples and the other line was used for yield determination.

Potassium sources were sprayed four times weekly beginning 30 days from transplanting.

All plots received fifteen units of different potassium sources which were used as foliar spray and the remaining quantity of potassium was added as fertigation.

All experimental units received equal amounts of commercial fertilizers; *i.e.,* ammonium sulfate (20.6%N), 50% P_2O_5 as calcium superphosphate (15.5%P_2O_5), 50% P_2O_5 as orthophosphoric acid (85%) and potassium sulfate (48%-52% K_2O). These commercial fertilizers were added at the recommended doses of N, P at 120 and 90 kg/ fad., respectively.

The amounts of FYM, one third of both ammonium sulfate and the rest doses of potassium sulfate and 50% P_2O_5 as calcium superphosphate were added during soil preparation in the center of row and covered by sand. The rest of amounts of N, P and K fertilizers were added through irrigation water (fertigation) by 7 days intervals beginning one month after transplanting

Other agricultural practices; fertilization, irrigation and pest control were applied as recommended for cantaloupe cultivation.

Data Recorded

Plant growth traits

At flowering stage (55 days from transplanting), a sample of three plants were randomly taken from every plot to determine plant growth parameters as follows: Dry weight of root, shoot and total/plant (g).

Yield and its components

At harvesting stage, mature fruits were picked from every plot to estimate: yield/plant (kg) and early yield, marketable as well as total yield, ton/faddan.

Fruit quality

Five fruits were randomly taken as a sample from every plot to estimate some measurements:

Table 1. Chemical analyses of soil, irrigation water and organic manure

Sample	Soluble Anions				Soluble cations				EC
	CO_3^-	HCO_3^-	Cl^-	SO_4^-	Ca^{++}	Mg^{++}	Na^+	K^+	
Soil	0.0	0.23	0.18	0.47	0.08	0.24	0.39	0.06	0.47
Water	3.53	7.16	4.92	23.61	0.96	1.16	31.81	0.34	1.49
Manure	0.0	9.33	14.44	15.11	1.68	1.33	109.20	61.81	3.11

Fruit physical characteristics

Average fruit weight (g), fruit size (cm^3), fruit diameter (cm), fruit cortex (cm) and dry matter (%): It was determined at harvest using 100 g. fresh fruits oven dried at 105°C till constant weight.

Fruit chemical composition

Total soluble solids (TSS): Was determined in fruit juice by using a hand refractometer. Total titratable acidity (TA%): Was determined by using phenolphthalein indicator, according to the method described in AOAC (1995). Total soluble solids to titratable acidity ratio (TSS/ TA): Was calculated by dividing the values of TSS/total titratable acidity percent. Fruit firmness: Was determined using Chatillon Penetrometer (N,4, USA) with a needle 3mm in diameter. And ascorbic acid (Vitam. C mg/100 ml juice): A random sample of fruits were determined in fruits using 2, 6, Dichlorophenol indophenols dye (AOAC, 1995).

Statistical Analysis

Collected data were subjected to proper statistical analysis of variance according to Snedecor and Cochran (1980) and the differences among treatments were compared using Duncans' multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Dry Weight

Effect of hybrids

There were no significant differences among Galia, C8 and Gal 152 with respect to dry weight of roots, dry weight of shoots and total dry weight/plant at 55 days after transplanting (DAT) in both seasons, except dry weight of roots in the 1st season (Table 2). These results may be attributed to the different genetic factors of cantaloupe hybrids.

Theses results are in harmony with those reported by Abou El-Yazied *et al.* (2012), Merghany *et al.* (2015) and Salama (2015). All found that there were significant differences between hybrids regarding dry weight of cantaloupe.

Effect of potassium sources

Spraying potassium sources had significant effect on dry weight of roots, dry weight of shoots and total dry weight/ plant at 55 DAT in both seasons (Table 2). Spraying with K_2SO_4, KTS, KC and KGP increased, dry weight of shoots and total dry weight/plant compared to control.

Potassium citrate is potassium salt of citric acid which considered one of the most important organic acids in the respiratory pathways into plant cell. The mitochondrial citric acid cycle provides the energy for ATP synthesis which is essential for different biochemical and physiological processes (Taiz and Zeiger, 2002). Additionally, citric acid plays an important role in plant metabolism, it's as non-enzymatic antioxidant in chelating free radicals and protecting plant from injury could result in prolonging the shelf life of plant cells and improving growth characters (Sadak and Orabi, 2015).

The enhancing effect of potassium on plant growth might be attributed to its association with the efficiency of leaf as an assimilator to CO_2 (Rai *et al.,* 2002), activating phyto-hormone, regulation of cellular pH, enhancing N uptake, and acting as an activator to enzymatic

Table 2. Effect of cantaloupe hybrids and potassium sources on dry weight of different plant organs at 55 days from transplanting during 2014 and 2015 summer seasons

Treatments	Dry weight of root (g)		Dry weight of shoots (g)		Total dry weight/plant (g)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
			Effect of hybrids			
Galia	2.56 a	2.41 a	55.46 a	54.76 b	58.02 a	57.18 b
C8	2.29 b	2.49 a	55.11 a	55.76 ab	57.40 a	58.26 ab
Gal 152	2.32 ab	2.50 a	56.89 a	56.52 a	59.22 a	59.02 a
			Effect of potassium sources			
K_2SO_4	2.31 ab	2.34 bc	54.61 b	54.28 b	56.92 b	56.63 b
KC	2.24 b	2.41 bc	58.75 a	54.17 b	61.00 a	56.58 b
KTS	2.51 a	2.73 a	56.62 ab	59.26 a	59.13 ab	62.00 a
KGP	2.50 a	2.26 c	58.82 a	61.03 a	61.32 a	63.30 a
Control	2.40 ab	2.58 ab	50.31 c	49.66 c	52.71 c	52.25 c

K_2SO_4 : Potassium sulphate, KC: Potassium citrate, KTS : Potassium thiosulphate , KGP: Potassium glysrophosphate and control (unsprayed)
Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance, according to Duncan's multiple range test.

systems (Marschner, 2012). In this respect, Zewail *et al.* (2011) found that foliar application of KC increased plant height, number of branches, total leaf area and dry weight of leaves and stems of faba bean plants.

Effect of the interaction

The interaction between hybrids and foliar spray with potassium sources had significant effect on dry weight of roots, dry weight of shoots and total dry weight/ plant at 55 DAT in both seasons (Table 3)

Spraying Galia with KTS gave the highest values of dry weight of roots, whereas spraying Gal 152 with KGP gave the highest values of dry weight of shoots and total dry weight/ plant in both seasons.

These results are in harmony with those reported by Merghany *et al*. (2015) and Salama (2015) on cantaloupe.

Yield and its Components

Effect of hybrids

There were significant differences among Galia, C8 and Gal 152 with respect to yield/ plant, early yield, marketable yield and total yield/fad., in both seasons (Table 4).

Respecting early yield, Gal 152 gave the highest early yield, followed by C8 and Galia. C8 hybrid gave the highest values of yield/plant, marketable yield and total yield/fad., followed by Galia and Gal 152 in both seasons. These results may be due to that C8 hybrid gave the highest value of each of average fruit weight and fruit size, followed by Galia and Gal 152 (Table 4). C8 hybrid performed agronomicaly (under these conditions) as the best tested hybrid, mostly due to producing the highest total yield followed by Galia and Gal 152.

These results are in agree with those reported by Abou El-Yazied *et al.* (2012), and Salama (2015). All found that there were significant differences between hybrids and cultivars regarding cantaloupe yield and its components.

Effect of foliar spray with potassium sources

Spraying cantaloupe plants with potassium sources had significant effect on yield/plant, early yield, marketable yield and total yield/fad., in both seasons (Table 4).

Spraying with K_2SO_4, KC, KTS and KGP increased yield/plant, early yield, marketable yield and total yield/fad., compared to control in

Table 3. Effect of interaction between cantaloupe hybrids and potassium sources on dry weight of different plant organs at 55 days from transplanting during 2014 and 2015 summer seasons

Treatments		Dry weight of root (g)		Dry weight of shoots (g)		Total dry weight/ plant (g)	
Hybrids	**Potassium sources**	**1st season**	**2nd season**	**1st season**	**2nd season**	**1st season**	**2nd season**
Galia	K_2SO_4	2.26 c	2.30 bc	53.76 de	52.76 ef	56.03 cd	55.06 ef
	KC	2.36 c	2.16 c	59.50 ab	54.20 de	61.86 ab	56.36 d-f
	KTS	2.86 a	2.90 a	57.46 a-d	58.90 ab	60.33 a-c	61.80 ab
	KGP	2.80 ab	2.33 bc	58.73 a-c	58.66 a-d	61.53 ab	61.00 a-d
	Control	2.50 a-c	2.36 abc	47.86 f	49.30 fg	50.36 e	51.66 fg
C8	K_2SO_4	2.33 c	2.36 abc	54.83 b-d	54.53 c-e	57.16 bc	56.90 de
	KC	2.20 c	2.66 abc	55.86 a-d	54.60 b-e	58.06 a-c	57.26 c-e
	KTS	2.23 c	2.46 abc	57.23 a-d	60.10 a	59.46 a-c	62.56 a
	KGP	2.40 bc	2.16 c	58.56 a-d	62.43 a	60.96 a-c	64.60 a
	Control	2.30 c	2.80 ab	49.06 ef	47.16 g	51.36 de	49.96 g
Gal 152	K_2SO_4	2.33 c	2.36 abc	55.23 b-d	55.56 b-e	57.56 bc	57.93 b-e
	KC	2.16 c	2.40 abc	60.90 a	53.73 e	63.06 a	56.13 ef
	KTS	2.43 bc	2.83 ab	55.16 b-d	58.80 a-c	57.60 bc	61.63 a-c
	KGP	2.30 c	2.30 bc	59.16 ab	62.00 a	61.46 ab	64.30 a
	Control	2.40 bc	2.60 abc	54.00 c-e	52.53 ef	56.40 cd	55.13 ef

K_2SO_4: Potassium sulphate, KC: Potassium citrate, KTS: Potassium thiosulphate, KGP: Potassium glysrophosphate and control (unsprayed)
Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance, according to Duncan's multiple range test.

Table 4. Effect of cantaloupe hybrids and potassium sources on yield and its components during 2014 and 2015 summer seasons

Treatments	Yield/plant (kg)		Early yield (ton/fad.)		Marketable Yield (ton/fad.)		Total yield (ton/fad.)	
	1st season	**2nd season**	**1st season**	**2nd season**	**1st season**	**2nd season**	**1st season**	**2nd season**
				Effect of hybrids				
Galia	1.951 b	1.983 b	1.770 b	1.835 c	10.843 b	10.982 b	12.014ab	11.913 b
C8	2.021 a	2.059 a	4.492 a	4.695 b	11.353 a	12.080 a	12.246 a	12.603 a
Gal 152	2.003 ab	2.018 b	4..99 a	4.859 a	10.870 b	10.980 b	11.762 b	11.942 b
				Effect of potassium sources				
K_2SO_4	1.970 c	2.035 b	3.810 b	4.121 a	10.847 c	11.162bc	12.002 b	11.912 b
KC	1.992 bc	1.953 c	3.708 b	3.935 b	10.509 d	11.571 b	11.791 b	12.349 b
KTS	2.111 a	2.148 a	4.179 a	4.209 a	12.397 a	12.473 a	13.358 a	13.145 a
KGP	2.067 ab	2.112 a	3.660 b	3.837 b	11.229 b	11.133c	11.892 b	12.133 b
Control	1.819 d	1.852 d	2.745 c	2.878 c	10.127 e	10.397 d	10.995 c	11.223 c

K_2SO_4: Potassium sulphate, KC: Potassium citrate, KTS: Potassium thiosulphate, KGP: Potassium glysrophosphate and control (unsprayed)
Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance, according to Duncan's multiple range test.

both seasons. Spraying with KTS gave the highest value of each of yield/plant, early yield, marketable yield and total yield/fad., in both seasons.

Potassium plays a foremost role in translocation of carbohydrates, photosynthesis, water relations, resistance against insects and diseases and sustain balance between monovalent and divalent cations (Brar and Tiwari, 2004) and involved in several biochemical and physiological processes that is considered very crucial for plant growth and yield (Marschner, 1995). Additionally potassium also plays a significant role in photophosphorylation, turgor maintenance, photoassimilate transport from source tissues *via* phloem to sink tissues, stress tolerance and enzyme activation in plants (Usherwood, 2000). Potassium is considered to be a key osmoticum in plants as it provides water relations for plants making them to survive under drought stress. Potassium enhances water uptake of a plant to keep hold of cell turgor required for development and growth of a crop when it accumulates in growth of a plant (De La Guardia and Benlloch, 1980) and stomatal opening and potassium is considered to be mobile in plant and can be translocated against strong electrical and chemical gradients (Brar and Tiwari, 2004). Potassium plays a remarkable role in transpiration, stomatal opening and closing and osmoregulation (Millford and Johnson, 2002).

Jiffon and Lester (2009) foliar spray with potassium thiosulphate substantially increases yield of cantaloupe in calcareous soil as compared to control treatment and other potassium sources (KCl, KNO_3, K_2SO_4, potassium metalosate and nopotassiumphosphate).

Fruit quality, such as ascorbic acid, β-carotene, total sugars and soluble soil concentration were increased using potassium metalosate (KM) as foliar spray.

Effect of the interaction

Results in Table 5 indicate that the interaction between hybrids and foliar spray with potassium sources had significant effect on yield/plant, early yield, marketable yield and total yield/fad., in both seasons

Foliar spray of C8 hybrid with KTS gave the highest value of each of 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. KTS (K_2SO_4) is used as a source of potassium (25% K_2O) and sulpher (17.5%).

These results are in harmony with those reported with Merghany *et al.* (2015) and Salama (2015). They found that treated cantaloupe cv. Gal 152 with mono potassium phosphate gave the highest values of fruit diameter, average fruit weight and total yield/ fad.

Fruit quality

Fruit Physical characters

Effect of hybrids

There were significant differences among Galia, C8 and Gal 152 with respect to fruit weight and fruit size, whereas there were no significant differences among hybrids with respect to fruit diameter, fruit cortex and DM (%) in both seasons, except fruit cortex in the 2^{nd} season (Table 6). C8 hybrid gave the highest values of each of average fruit weight and fruit size followed by Galia in both seasons.

Effect of foliar spray with potassium sources

Spraying cantaloupe plants with potassium sources had significant effect on fruit weight and fruit size, fruit diameter, fruit cortex and DM (%) in both seasons (Table 6). Spraying with K_2SO4, KC, KTS and KGP increased average fruit weight and fruit size, fruit cortex and DM (%) compared to control in both seasons. Spraying with KTS gave the highest value of each of fruit weight and fruit size, whereas K_2SO_4 gave the highest value of each of fruit diameter, fruit cortex and DM (%) with no significant differences with KGP.

Effect of the interaction

The interaction between hybrids and foliar spray with potassium sources had significant effect on fruit weight and fruit size, fruit cortex and DM (%), except fruit diameter in 2^{nd} season (Table 7). In general, spraying C8 hybrid with K_2SO_4 or with KTS increased fruit weight, fruit size, fruit diameter and DM (%) in the 1^{st} and 2^{nd} seasons, respectively.

Table 5. Effect of interaction between cantaloupe hybrids and potassium sources on yield and its components during 2014 and 2015 summer seasons

Treatments		Yield / plant (kg)		Early yield (ton/fad.)		Marketable Yield (ton/fad.)		Total yield (ton/fad.)	
Hybrids	Potassium sources	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Galia	K_2SO_4	1.840 e-g	1.963 ef	1.626 hi	1.777ef	10.520 de	10.223 ij	11.430 d-f	11.288e-g
	KC	1.949 d-f	1.958 f	1.736 ghi	1.840ef	10.226 e	11.762c-e	11.813 c-e	12.507 bc
	KTS	2.105 ab	2.063 cd	1.992 g	2.062 e	12.914 a	12.525 b	13.757 a	12.858 b
	KGP	2.045a-d	2.069 cd	1.910 gh	1.863ef	11.005 cd	10.724g-i	12.094b-d	11.904 c-f
	Control	1.816 fg	1.862 gh	1.586 i	1.632 f	9.548 f	9.678 j	10.976 f	11.007 g
C8	K_2SO_4	2.080 a-d	2.108 bc	5.031 bc	5.266 a	11.072 c	11.996b-d	12.738 b	12.457 bc
	KC	1.961 c-e	1.933 fg	4.231d	4.790 b	10.374 e	11.493 d-f	11.477d-f	12.293b-d
	KTS	2.134 a	2.236 a	5.330 a	5.200 a	13.097 a	13.821 a	13.943 a	14.247 a
	KGP	2.146 a	2.121 bc	4.268 d	4.496 b	11.659 b	12.279 bc	12.014b-d	12.806 b
	Control	1.787 g	1.898 fg	3.599 e	3.723 c	10.563de	10.809 f-i	11.058 ef	11.211 fg
Gal 152	K_2SO_4	1.990b-d	2.033 de	4.772 c	5.320 a	10.950 cd	11.267e-g	11.837 cd	11.990 c-e
	KC	2.066 a-d	1.968 ef	5.156 ab	5.176 a	10.927 cd	11.459 d-f	12.082b-d	12.248b-d
	KTS	2.095 a-c	2.144 b	5.216 ab	5.366 a	11.180 bc	11.074e-h	12.373 bc	12.330b-d
	KGP	2.011 a-d	2.148 b	4.801 c	5.153 a	11.023 cd	10.395 hi	11.567 d-f	11.690d-g
	Control	1.854e-g	1.796 h	3.050 f	3.280 d	10.271 e	10.703 g-i	10.951 f	11.451e-g

K_2SO_4: Potassium sulphate, KC: Potassium citrate, KTS : Potassium thiosulphate, KGP: Potassium glysrophosphate and control (unsprayed)
Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance, according to Duncan's multiple range test.

Table 6. Effect of cantaloupe hybrids and potassium sources on some physical properties of fruits at harvest during 2014 and 2015 summer seasons

Treatments	Fruit weight (g)		Fruit size (cm^3)		Fruit diameter (cm)		Fruit cortex (cm)		DM (%)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
					Effect of hybrids					
Galia	868.3 c	888.2 c	883.2 b	879.3 b	11.36 a	11.33 a	4.80 a	4.30 ab	3.75 a	3.75 a
C8	936.0 a	959.8 a	1017.7 a	1005.9 a	10.96 a	10.56 a	4.63 a	4.06 b	3.68 ab	3.72 a
Gal 152	902.2b	922.5 b	511.0 c	540.7 c	10.90 a	10.93 a	4.70 a	4.53 a	3.61 b	3.67 a
					Effect of potassium sources					
K_2SO_4	930.6 b	949.5 a	621.1 d	644.4 c	11.83 a	11.83 a	5.05 ab	4.72 a	3.75 a	3.67 a
KC	859.4 c	896.0b	925.6 b	973.1 a	10.88 b	10.94 b	4.83 ab	3.8 b	3.72 a	3.80 a
KTS	947.8 a	972.8 a	1043.3 a	975.4 a	10.94 b	10.66 bc	4.61 b	4.44 ab	3.75 a	3.81 a
KGP	940.9ab	958.3 a	857.8 c	878.8 b	11.83 a	11.33 ab	5.16 a	4.50 ab	3.80 a	3.83 a
Control	832.0 d	841.0 c	572.0 d	571.1 d	9.88 c	9.94 c	3.88 c	3.94 b	3.38 b	3.45 b

K_2SO_4: Potassium sulphate, KC: Potassium citrate, KTS: Potassium thiosulphate, KGP: Potassium glysrophosphate and control (unsprayed)
Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance, according to Duncan's multiple range test.

Table 7. Effect of interaction between cantaloupe hybrids and potassium sources on some physical properties of fruits at harvest during 2014 and 2015 summer seasons

Treatments		Fruit weight (g)		Fruit size (cm^3)		Fruit diameter (cm)		Fruit cortex (cm)		DM (%)	
Hybrids	Potassium sources	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Galia	K_2SO_4	798.3 g	876.3 gh	646.7 ef	683.3 ef	11.83 ab	11.66a	4.83 ab	4.33 ab	3.96 a	3.88 ab
	KC	868.7 f	898.7 fg	1050.0cd	1213.3ab	11.00 b-d	12.00a	4.83 ab	3.50 b	3.90 ab	3.76 a-d
	KTS	930.0 cd	950.0 c-f	1098.3bc	936.3 d	11.50 a-c	10.66a	4.83 ab	4.33 ab	3.76 a-c	3.78 a-d
	KGP	943.0 b-d	931.3 d-g	953.3 d	916.7 d	12.16 a	11.83a	5.16 a	4.83 a	3.75 a-c	3.83 a-c
	Control	801.7 g	785.0 i	667.7 ef	646.7 f	10.33 d-f	10.50a	4.33 a-c	4.50 ab	3.38 e	3.48 de
C8	K_2SO_4	1049.3 a	1006.7ab	743.3 e	756.7 e	12.00 a	12.00a	5.33 a	5.00 a	3.58 c-e	3.58 b-e
	KC	827.0 g	881.0 gh	1116.7bc	1096.0 c	10.83 cd	10.33a	4.83 ab	4.00 ab	3.75 a-c	3.85 a-c
	KTS	950.2 b-d	1025.0 a	1371.7 a	1300.0 a	10.83 cd	10.50a	4.50 ab	4.16 ab	3.73 b-d	3.80 a-d
	KGP	958.6 bc	989.0 a-c	1166.7 b	1203.3 b	11.66 a-c	10.66a	5.00 ab	3.83 ab	3.96 a	3.91 a
	Control	895.0 ef	897.7 fg	690.0 ef	673.3 ef	9.50 f	9.33a	3.50 c	3.33 b	3.36 e	3.48 de
Gal 152	K_2SO_4	944.3 b-d	965.7 b-d	473.3 g	493.3 g	11.66 a-c	11.83a	5.00 ab	4.83 a	3.71 b-d	3.55 c-e
	KC	882.7 f	908.3 e-g	610.0 f	610.0 f	10.83 cd	10.50a	4.83 ab	4.16 ab	3.51 de	3.80 a-d
	KTS	963.3 b	943.7 c-f	660.0 ef	690.0 ef	10.50 de	10.83a	4.50 a-c	4.83 a	3.75 a-c	3.85 a-c
	KGP	921.3 de	954.7 b-e	453.3 gh	516.7 g	11.66 a-c	11.50a	5.33 a	4.83 a	3.70 b-d	3.76 a-d
	Control	799.3 g	840.3 hi	358.3 h	393.3 h	9.83 ef	10.00a	3.83 bc	4.00 ab	3.40 e	3.38 e

K_2SO_4: Potassium sulphate, KC: Potassium citrate, KTS: Potassium thiosulphate, KGP: Potassium glysrophosphate and control (unsprayed)

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

Fruit chemical characters

Effect of hybrids

Galia hybrid recorded maximum value of each of total acidity and Vitam. C, whereas, Gal 152 recorded maximum firmness (Table 8). There were no significant differences among Galia, C8 and Gal 152 with respect to TSS in both seasons and TSS/acid ratio in the 1st season. Results are in harmony with those reported by Abou El-Yazied *et al.* (2012) on cantaloupe.

Effect of foliar spray with potassium sources

Spraying with K_2SO_4, KC, KTS and KGP increased firmness and Vitam. compared to control in both seasons and KC increased TSS/ acid ratio and Vitam. C, whereas KGP increased firmness in both seasons (Table 8).

This effect probably resulted from a combination of improved leaf photosynthetic CO_2, assimilation translocation from leaves to fruits, improved leaf and fruit water relations, increased enzyme activation and substrate availability for ascorbic acid and beta- carotene biosyntheses (Hopkins, 1963; Gross, 1991).

Lester (2005) found that supplementing sufficient soil K with additional foliar K 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.

Spraying cantaloupe with potassium chloride, potassium nitrate, mono potassium phosphate, potassium sulphate, potassium thiosulphate and potassium metalosate increased TSS and total sugars in fruits compared to control (Jiffon and Lester, 2011).

These Effects could be attributed to the importance of potassium in improving the translocation of carbohydrates from sources to the tubers. Additionally, potassium ion transport across chloroplast and mitochondrial membranes

Table 8. Effect of cantaloupe hybrids on TSS, acidity, firmness and Vitam. C contents in fruits at harvest during 2014 and 2015 summer seasons

Treatments	TSS (Brix)		Acidity (%)		TSS/acid ratio		Firmness (g/cm^2)		Vitam. C (mg/100 ml juice)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
					Effect of hybrids					
Galia	5.18 a	5.09 a	0.162 a	0.164 a	32.85 a	31.65 b	362.53 b	373.27 b	36.17 a	35.38 a
C8	5.04 a	5.02 a	0.142 b	0.142 b	35.68 a	35.64 a	374.93ab	378.13 b	27.08 c	27.20 c
Gal 152	5.05 a	5.06 a	0.151 ab	0.152 ab	33.64 a	33.61 ab	383.07 a	392.87 a	32.50 b	31.87 b
					Effect of potassium sources					
K_2SO_4	5.11 a	5.08 a	0.167 a	0.163 a	30.93 c	31.97 b	392.78 b	393.56 b	34.11 a	32.45 b
KC	5.13 a	5.11 a	0.142 b	0.142 b	36.52 a	36.35 a	377.22 c	394.44ab	34.54 a	33.48 a
KTS	5.17 a	5.04ab	0.149 b	0.152 ab	35.00 ab	33.50 ab	368.89 c	390.56 b	31.13 b	30.75 c
KGP	5.17 a	5.20 a	0.163 a	0.163 a	32.32 bc	32.23 b	422.44 a	405.89 a	32.24 b	33.16 ab
Control	4.86 b	4.86 b	0.138 b	0.144 b	35.52 ab	34.12 ab	306.22 d	322.67 c	27.56 c	27.57 d

K_2SO_4: Potassium sulphate, KC:Potassium citrate, KTS: Potassium thiosulphate, KGP:Potassium glysrophosphate and control (unsprayed)

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

is related closely to the energy status of plants, aid in protein synthesis in the ribosomes (Barker and Pilbeam, 2007) and has favorable effect on CO_2 assimilation. In addition, the enzyme responsible for synthesis of starch, starch synthetase, is also activated by potassium (Malvi, 2011).

Fruit firmness, a good indicator of shipping quality, texture and shelf life of horticultural produce (Harker *et al.,* 1997), was increased by foliar K feeding. They may be related to increased fruit texture pressure potential (Lester *et al*., 2006) as well as enhanced phloem transport of Ca to fruits following K applications.

Foliar K application treatments resulted in higher plant tissue K concentration, higher soluble solids concentrations, total sugars and bioactive compounds (ascorbic acid and B-carotene (Jifon and Lester, 2011)

Effect of the interaction

The interaction between hybrids and foliar spray with potassium sources had significant effect on TSS, total acidity, TSS/acid ratio, firmness and Vitam. C in fruits in both seasons, except TSS in the 2nd season (Table 9).

Spraying Galia with KGP increased total acidity and Vitam. C in fruits, whereas spraying Gal 152 with KGP increased firmness in both seasons. These results are in harmony with Tang *et al.* (2012) and Salama (2015) on cantaloupe.

Table 9. Effect of interaction between cantaloupe hybrids and potassium sources on TSS, acidity, firmness and Vitam. C contents in fruits at harvest during 2014 and 2015 summer seasons

Treatments		TSS (Brix)		Acidity (%)		TSS/acid ratio		Firmness (g/cm^2)		Vitam. C (mg/100 ml Juice)	
Hybrids	**Potassium sources**	**1st season**	**2nd season**	**1st season**	**2nd season**	**1st season**	**2nd season**	**1st season**	**2nd season**	**1st season**	**2nd season**
Galia	K_2SO_4	5.33 a	5.20a	0.192a	0.181 a	27.79 cd	29.40 d	368.33 ef	392.33 bc	35.83 b	30.90 g
	KC	5.20 ab	5.06a	0.138 bc	0.149a-c	38.02 ab	34.27 a-d	424.00 b	406.67 ab	39.36 a	37.13 b
	KTS	5.33 a	5.06a	0.160 b	0.170 ab	33.33 a-c	29.79 cd	333.33 g	378.33 c	35.36 bc	36.03 bc
	KGP	5.20 ab	5.26a	0.192 a	0.181 a	27.08 d	29.30 d	396.33 cd	397.33 bc	38.50 a	40.16 a
	Control	4.86 b	4.86a	0.128 c	0.138 bc	38.02 ab	35.52 a-d	290.67 h	291.67f	31.80 e-g	32.70 ef
C8	K_2SO_4	4.93 b	4.93a	0.149 bc	0.149 a-c	33.33 b-d	33.54 a-d	426.67 b	386.67 bc	34.03 b-d	34.46 cd
	KC	5.13 ab	5.20a	0.138 bc	0.138 bc	37.29 ab	37.91ab	333.00 g	391.67 bc	29.133 h	29.10 h
	KTS	5.06 ab	5.00a	0.128 c	0.128 c	39.59 a	39.06 a	413.33bc	390.00 bc	24.46 j	22.90 j
	KGP	5.20 ab	5.20a	0.149 bc	0.149 a-c	35.21 ab	35.31 a-d	408.67 bc	396.67 bc	26.90 i	27.33 i
	Control	4.86 b	4.80a	0.149 bc	0.149 a-c	33.02 b-d	32.39 a-d	293.00 h	325.67 e	20.900	22.23 j
Gal 152	K_2SO_4	5.06 ab	5.13a	0.160 b	0.160 a-c	31.67 b-d	32.98 a-d	383.33 de	401.67 b	32.46 d-f	32.00 fg
	KC	5.06 ab	5.06a	0.149 bc	0.138 bc	34.270a-c	36.87 a-c	374.67d-f	385.00 bc	35.13 bc	34.23 de
	KTS	5.13 ab	5.06a	0.160 b	0.160 a-c	32.08 b-d	31.66 b-d	360.00 f	403.33 ab	33.56 c-e	33.33 d-f
	KGP	5.13 ab	5.13a	0.149 bc	0.160 a-c	34.68 ab	32.08 a-d	462.33 a	423.67 a	31.33 fg	32.00 fg
	Control	4.86 b	4.93a	0.138 bc	0.145 bc	35.52 ab	34.44 a-d	335.00 g	350.67 d	30.00 gh	27.80 hi

K_2SO_4: Potassium sulphate, KC: Potassium citrate, KTS: Potassium thiosulphate, KGP: Potassium glysrophosphate and control (unsprayed)

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

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تأثير بعض مصادر البوتاسيوم على نمو وإنتاجية وجودة ثمار بعض هجن الكانتلوب تحت ظروف الأرض الرملية

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أُجريت تجربتان حقليتان خلال موسمى صيف ٢٠١٤، ٢٠١٥ بمزرعة خضر خاصة بمركز فاقوس، محافظة الشرقية، مصر بهدف دراسة تأثير مصادر التسميد البوتاسى (سلفات البوتاسيوم، سترات البوتاسيوم، ثيوسلفات البوتاسيوم، جليسروفوسفات البوتاسيوم) بجانب معاملة الكنترول (الرش بالماء) على النمو، المحصول وجودة ثمار بعض هجن الكانتلوب (جاليا، سى ٨، جال ١٥٢)، أعطى رش الهجين جاليا أو الهجين جال ١٥٢ بثيوسلفات البوتاسيوم أو جليسروفوسفات البوتاسيوم أعلى القيم لكل من الوزن الجاف للعرش، الوزن الجاف الكلى للنبات محتوى الثمار من الحموضة الكلية، فيتامين ج، أدى رش الهجين سى ٨ بثيوسلفات البوتاسيوم الى زيادة كل من محصول النبات والمحصول المبكر والقابل للتسويق وكذلك المحصول الكلى للفدان يليه رش الهجين جاليا بثيوسلفات البوتاسيوم فى كلا الموسمين بخصوص المحصول القابل للتسويق والمحصول الكلى للفدان.

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