Journal of Plant Production

Journal homepage & Available online at: www.jpp.journals.ekb.eg

Potassium Nitrate and Calboro Improve Fruit Set, Productivity and Storability of Summer Squash under Aswan Conditions

Mona N. Shehata* **and K. G. Abdelrasheed**

Horticulture Department, Faculty of Agriculture and Natural Research, Aswan University, Aswan, Egypt

ABSTRACT

This study investigates the impact of foliar application of potassium nitrates of 10 and 15 mM and calboro (calcium and boron) 0.5 and 1 mg/l on the productivity and storability of summer squash Self-life also stage at 10 °C under conditions of the Aswan governorate and newly reclaimed lands during the years 2022–2023. The experiment was conducted at the Faculty of Agriculture and Natural Resources' experimental farm at Aswan uuniversity in Egypt. Three replications of a randomized complete block design were used to carry out the experiment. The highest rate of KNO_3, calboro was sprayed at a rate of 1 mg/l, and when potassium nitrate and calboro interacted, two study seasons showed superiority in the growth attributes and quality of edible crops. 15 mM potassium nitrate + 1 mg/l calboro was the treatment that resulted in the highest amounts of ascorbic acid and TSS, the least amount of weight loss, and the best pH values for fruits in the two seasons throughout the storage phase.

***Keywords*:** Squash *Cucurbita pepo,* L, potassium nitrate, calboro, storage.

INTRODUCTION

Summer squash (*Cucurbita pepo,* L.) warm season vegetable crop is a highly polymorphic vegetable and one of the most widely used vegetable crops for human nutrition. Additionally, one of the most significant income crops is squash, particularly in recently recaptured parts of Egypt Abd El-Aal *et al* (2010). It is highly susceptible to agroclimatic factors like day length and temperature Bannayan *et al* (2011). Because zucchini squash is highly perishable (Lorenz, 1951; Mencarelli *et al.*, 1982; Phillips, 1946); and it is susceptible to chilling (Mencarelli *et al.*, 1983), its storability is restricted. Because zucchini is a source of vitamins C and A, its storage is significant. According to Watt Merrill (1975), squash is grown all over the world.

Plants absorb K more than any other element, with the exception of N. Reducing the amount of soil mineral fertilizers mainly those containing nitrogen, phosphorus, and potassium has been the tendency in recent works. Because of this, potassium foliar fertilization is becoming increasingly important as a substitute for meeting plant nutrient demands during the growth season. Foliar fertilization offered several benefits, including the utilization of nutrients in sufficient quantities, much faster uptake by foliage, prompt correction of physiological disorders, assistance in overcoming various stress conditions, reduced crop production costs, ease of application, and the use of high-quality fertilizers that were readily soluble in water Haytova (2009). Despite not being a part of any organic molecule or plant structure, potassium is an essential component of many physiological and biochemical processes that affect plant growth, yield, quality, and stress. Marschner (1995) and Cakmak (2005). It is involved in enzyme activation, turgor maintenance, stress tolerance, stomatal regulation of transpiration, photosynthesis, photophosphorylation, and movement of photoassimilates from source tissues to sink tissues via the phloem Usherwood (1985), Marschner (1995) and Pettigrew (2008). Potassium influences photosynthetic translocation, which impacts post-harvest fruit and vegetable output and quality increases Mengel and Kirkby (1987). It is anticipated that effective photosynthetic translocation will also contribute to increased tomato meat thickness, allowing for the preservation of quality and post-harvest shelf life for a comparatively longer period of time. Furthermore, Tucker *et al* (1994) reported that the absence of potassium components led to thinner fruit flesh and skin and raised the possibility of fruit deterioration after harvesting too quickly, resulting in a short fruit shelf life. Potassium also plays a function in strengthening cell walls and contributing to the lignification of sclerenchyma tissue, which enhances the quality and shelf life of tomatoes after harvest Amrutha and *et al* (2007).

Calcium according to Kadir (2005) and Peter (2005) is a crucial secondary macronutrient that may not be present in sufficient amounts in plants because of low soil calcium levels, reduced calcium availability due to high soil PH, or low plant mobility, especially in the case of fruits. Thus, for leaf development, plant canopy, and robust root growth, a constant supply of calcium is necessary Del-Amor and Marcelis (2006). Puguh *et al* (2019) claims that calcium functions as a source of plant nutrients plants by creating cross connections between pectin's, mater, which hardens the cell texture. With enhanced cell wall stiffness, fruit quality should improve and physiological damage sensitivity should decrease.

Boron is another crucial micronutrient needed for crops to be of excellent quality and production as noted by Dale *et al* (1998). The following processes are influenced by boron like respiration, cell wall lignification, cell wall synthesis and integrity, glucose, phenol, RNA and IAA metabolic Parr and Loughman (1983). By encouraging pollen

* **Corresponding author.**
E-mail address: mona.nemr73@gmail.com
DOI: 10.21608/jpp.2023.241345.1273

germination and pollen tube lengthening, iron raises the proportion of fruit set Abdalla and El-Khoshiban (2007). The amount of boron in a substance affects how calcium is metabolized, and a lack of boron causes a decrease in the calcium associated with pectin components Yamaguchi *et al* (1986). Zekri and Obereza (2003) found that a lack of boric acid causes wilting and leaf drop, which has a negative impact on the quality and output of several vegetables, particularly tomatoes Imtiaz *et al* (2010). During the growing season, during the reproductive growth stage, both foliar and soil application can meet its plant requirements (Sajid, 2009).

Crop fertilization with reduced forms of nitrogen (Nitrogen-NH_2, Nitrogen-NH_4), yields with lower levels of NO_3 are generally produced when plants are nourished with N-NO3 form (Wanng *et al,* 2004; Olfati *et al.,* 2008). The effectiveness of foliage feeding is influenced by a number of parameters, including environment, type of fertilizer, and amount of nitrogen applied (Rydz, 2001; Wojciechowska *et al* 2005). Nitrate is assimilated by the leaves as well as the roots. In fully formed herbaceous plants, nitrate assimilation in the leaves usually accounts for the majority of nitrate assimilation, whereas nitrate absorption in the roots commonly plays a substantial role in these plants' early growth phases (Heldt, 2005).

Shelf life it's important to extend the fruits' and vegetables' shelf life and preserve their best quality during the post-harvest phase. Okezie (1998) states that post-harvest losses in developing nations can vary from 20 to 50% for crops. Thus, the current study's goal was to evaluate the effects of foliar spraying calboro and potassium nitrate on zucchini in the Aswan region in order to increase fruit setting and storability.

Thus, the current study's goal was to evaluate the effects of foliar spraying calboro and potassium nitrate on summer squash (*Cucurbita pepo* L.) in the Aswan governorate to increase fruit setting and storability.

MATERIALS AND METHODS

Experiment location:

This experiment was conducted in the research farm of the Faculty of Agriculture and Natural Resources' experimental farm at Aswan University in Egypt, on the 20th of March during the agricultural seasons of 2022 and 2023. An analysis of some soil samples was conducted before planting to study the components of the soil physically and chemically. The results of this analysis were presented in Table 1. Climate data for Aswan Governorate according to the National Oceanic and Atmospheric Administration are presented in Table 2.

Table 1. Method of analyzing the soil mechanically and chemically preceding cultivation

Property of soil·	Season 2022	Season 2023
Physical characteristics		
(%) Clay	3.20	3.60
(%) Silt	0.00	0.00
(%) Sandy	95.00	93.50
type texture	Sandy	Sandy
Chemical characteristics		
1. Soluble cations in soil extract (1:1) mm/l with water		
Ca++	3.05	3.21
Mg++	1.06	1.10
K+	0.86	0.90
Na+	0.77	0.79
2. Soluble anions in soil extract at a ratio of 1:1 (mm/l)		
CO3--	0.00	0.00
HCO3-	7.40	7.25
Cl-	3.62	3.75
SO4--	0.40	0.44
pH (1:1 soil suspension)	7.51	7.68
EC (dS/cm) at 25°C	0.36	0.31
N availability (mg/kg soil)	128.42	129.12
P availability (mg/kg soil)	8.50	10.01
K availability (mg/kg soil)	178.00	181.00

- **The Department of Natural Resources at the Faculty of Agriculture and Natural Resources, Aswan University, Egypt, conducted the analyses.**

Table 2. Average precipitation, air temperature, and relative humidity for the two growing seasons at the experimental station

The months	March(Azar)	April(Nissan)	May(Ayar)	June(Hoziran)	yearly average
Maximum degree ° C	43.5	45.6	48.7	49.6	49.7
Mean Temperature Major ° C	29.5	34.9	38.9	41.4	34.6
Daily average ° C	21.8	27	31.4	33.5	24.9
Mean Lowest Temperature ° C	13.8	18.9	23	25.2	18.6
Lowest Temperature ° C	4.7	7.6	13.5	16.3	−2
Precipitation mm	0	0	0.1	0	1.5
Average No. of wet days: 0.01 mm	0.0	0.0	0.1	0.0	0.84
Relative Humidity Indicator (%)	23	20	18	17	26.2
Hours of sun exposure per month	323.6	316.3	345.8	364.2	3,861,9

Experiment Layout:

The research study employed an Alexandani variety of summer squash (*Cucurbita pepo* L.). The first step in preparing the soil was to plow, pulverize, and ridge experimental plots with an area of 12 m^2. The experimental layout had three rows, each measuring 4 meters in length and 1 meter in breadth. The plants were thinned on one plant in the hill, and the drip irrigation technique was utilized. The cultivation was done on one side of the planting rows, 40 cm apart from one another. In accordance with the advice of the Egyptian Ministry of Agriculture, 150 kg of calcium superphosphate and 50 kg of sulfur were added to the soil during preparation. During the growing season, the recommended amounts of nitrogen fertilizer and potassium fertilizer were added. This study included two experiments, i.e.

The initial experiment:

Two concentrations of nutritional solutions (10, 15 mm potassium nitrate), and two concentrations of calboro compound (0.5, 1 mg/l) were applied in the experiment. This is in addition to the distilled water-based control treatment (0.0 mm). Nutrient solutions were applied 20, 30 and 40 days after the plantation date. Nutrient solutions were made by combining nutrients and calboro with distilled water before being sprayed three times directly on the leaves. Calboro is a liquid fertilizer produced by Chema Company Egypt. Calboro is a foliar fertilizer that contains 0.2% boron and 8% calcium. Three replications of a randomized complete block design were used to carry out the experiment.

Collected measurements: -

Plant growth measurements: -

Four fully grown, rooting plants were randomly chosen from each experimental plot 45 days after the plants were first planted quantify the plant growth, such as plant length, leaf number and dry weight per plant. The leaf area per plant was measured with a planometer.

Leaf chemical contents:-

Next to 45 days from the seeding date, the plant's potassium content was determined using a flamphotometer in compliance with Jackson's (1973) method, the amount of calcium was estimated using Johnson and Urich's (1975) method, and both the phosphorus and nitrogen content was estimated using the A.O.A.C. (1992) method.

Flowering traits:

Out of every experimental plot, four plants were chosen at random to measure the number of flowers on each plant, including the total number of flowers. The percentage of fruit setting was then determined using the following formula:

$$\textbf{Fruit setting}\ (\%) = \frac{\textbf{Number of fruit/plant}}{\textbf{Total number of flowers/plant}}\ x\mathbf{100}$$

Yield characteristics and components:

Number of fruits/plant, average fruit weight (g), overall yield/plant (kg), and overall yield (ton/fad.) are all represented.

Statistical analysis system:

The MSTAT-C program developed by Bricker (1991) was used to statistically evaluate all of the collected data. The L. S. D. test at 0.05 level of probability was used to compare means after data were submitted to analysis of variance techniques, in accordance with (Snedecor and Cochroni, 1973).

The second experiment (shelf life):

In the second week of May, after spray the third dose of potassium nitrate and calboro levels, This experiment was carried out by selecting the benefits of treatments that yielded the best results in the field experiment in terms of the number and weight of fruits and the total yield for the first four collected, which represent the early yield. The fruits were collected in the period of consumption maturity of with length 12-15 cm. These transactions also showed a higher degree of flowers and vegetable characters in order to test their tolerance to storage conditions at 10 °C and to track changes in the following squash fruit characteristics (ascorbic acid % - TSS % - pH - weight loss "g") during storage every four days for 16 days and these treatments (15 mM) potassium nitrate, 1 mg/l calboro and 15 mM KNO_3 + 1mg/l calboro, samples of the fruits were collected from the perforated polyethylene bags and analyzed Fruits.

physicochemical analysis: -

Ascorbic acid (V.C %)

The amount of vitamin C in the juice was calculated as mg/100 cm^3 using the iodide potassium titration method (Ranganna, 1986).

TSS (%)

The fruits' TSS content is determined using a refractrometer. The refractrometer plate surface is wiped with a drop of fruit juice, and the reading is recorded as o Brix Padmaja *et al* (2015).

PH

The digital pH meter is used to determine the fruit pulp's pH. Initially, the pH 7 solution of buffer is used to calibrate the pH meter. After inserting the pH meter's needle into the fruit juice, a reading is received right away (Ranganna 1999).

Weight loss (g)

A precise scale was used to measure the fruits' pre- and post-storage weights in order to determine the amount of weight loss that transpired during the storage process.

$$\textbf{Weight loss} = \textbf{initial weight} - \textbf{final weight}$$

RESULTS AND DISCUSSION

Plant Growth Parameters Were Improved by Potassium Nitrate and Calboro:

Applying calboro and potassium nitrate either separately or in combination during the 2022–2023 growing season led to a notable increase in plant height, leaf area (cm^2) per plant, number of leaves per plant, and dry weight (g) per plant (Table 3).

Separately treatments:

In the first and second seasons, respectively, a concentration of 15 mM potassium nitrate produced the maximum plant growth such as plant length (42.05 and 45.86 cm), leaf number per plant (18.20 and19.75), leaf area per plant (526.2 and 549.5 cm^2) and dry weight (88.82 and 93.62 gm/plant) in 2022 and 2023 when compared to the control. These results agree with previous research on cucumber by Ahmad and Jabeen (2005), Shafeek *et al* (2013), Al-Hamzawi (2010), Hussein *et al* (2008) and Kaya *et al* (2003). The higher plant growth may be due to enhanced cell division and elongation caused by high concentrations of potassium nitrate. However, Bibi Haleema a *et al* (2018) found that tomato plants sprayed with a calcium + boron combination. In line with the findings of Asad and *et al* (2003), Dole and Wilkins (2005) and Rab and Haq (2012) the combination of calcium and boron was found to be more effective in creating taller plants with a higher leaf count. Because plant growth depends on both calcium and boron Bose and Tripathi (1996) and because boron increases the metabolism of calcium, especially in the cell wall, Blevins and Lukaszewki (1998). Due to the reality that calcium is a crucial component of plant cell walls and is important for cell division and expansion, the study features have increased by application. Ilyas *et al* (2014) and Rashid (2000). Hussain *et al* (2003) found that increased photosynthesis is directly attributed to the presence of calcium.

By triggering enzymes, photosynthesis, and the metabolism of carbohydrates, calcium alone increased leaf area Bergmann (1992) and Hussain and *et al* (2003). As a result, foliar Ca treatment is likely to result in taller plants with larger leaf area. Similarly, boron is associated with the growth of plant cell walls and cell differentiation. Thus, plant height and leaves per plant jumped (Basavarajeshwari *et al* 2008; Ilyas *et al* 2014; Oyinlola, 2004) which strongly supported the current findings.

Combination treatments:

The combination between the levels of calboro and potassium nitrate appeared in table (3) on some of the characteristics of vegetative growth during the 2022 - 2023. All the characteristics of vegetative growth have shown significant moral increases due to successive increases in the calboro with levels of potassium nitrate. The study shows that, in comparison to plants that were not treated, the combination of 15 mM potassium nitrate + 1 mg/l calboro produced the highest averages of vegetable growth through both the initial and subsequent successive seasons.

Table 3. Plant growth parameters as affected by spraying potassium nitrate, calboro alone and combination during 2022 and 2023 seasons

Therapies	Plant growth							
	Plant length (cm)		Leaf number per plant		leaf area (cm^2) per plant		dry weight (gm) per plant	
	2022	2023	2022	2023	2022	2023	2022	2023
Control	32.40	34.70	11.35	14.61	378.1	458.5	61.37	70.91
10 mM KNo_3	40.01	43.45	16.65	18.38	520.6	503.1	85.10	88.11
15 mM KNO_3	42.05	45.86	18.20	19.75	526.2	549.5	88.82	93.62
0.5 mg/l calboro	37.95	40.34	16.29	17.07	525.1	556.6	80.72	81.81
1 mg/l calboro	39.28	41.89	17.00	18.04	527.2	545.5	83.54	84.95
10 mM KNO_3 + 0.5 mg/l calboro	44.50	48.28	19.25	20.79	539.9	556.3	94.65	97.92
15 mM KNO_3 + 0.5 mg/l calboro	44.81	46.28	19.72	20.23	532.7	547.9	94.32	94.85
10 mM KNO_3 + 1 mg/l calboro	55.06	60.67	23.10	26.44	673.6	687.1	118.6	123.8
15 mM KNO_3 + 1 mg/l calboro	56.82	63.97	24.75	27.72	741.5	745.3	121.5	127.7
L. S. D. at 5 %	2.26	2.96	1.16	0.66	29.74	25.04	3.38	3.39

Total Number of Flower and Fruit Setting Were Enhanced by Potassium Nitrate and Calboro:

In comparison to untreated plants, Table 4 displays the effects of calboro and potassium nitrate levels as well as their interactions on the percent of fruit set and number of flowers per plant of squash plants throughout the 2022–2023 growing season.

Separately treatments:

At 0.5 mg/l of calboro, the biggest total number of flowers per plant was seen i. e, (56.16 and 58.12). This was followed by a second treatment at 15 mM of potassium nitrate i. e. (54.74 and 55.23). In comparison to untreated plants, the treatment at 1 mg/l of calboro demonstrated greater fruit setting (51.26 and 52.07 %), which was followed by 0.5 mg/l of calboro. In comparison to other treatments and the control, Shafeek *et al* (2013) found that foliar applications of potassium nitrate at higher concentrations (15 mM) significantly increased the number of flowering plants and fruit setting % in cucumber. This could have to do with increased nutrient availability brought about by the application of potassium and calcium, which promoted plant development and increased fruit setting percentage and flower production per plant. This finding aligns with that of El-Tohamy *et al* (2006) who found that pepper plants maintained higher levels of the overall chlorophyll when sprayed using Ca or potassium chloride. The current study's cucumber's flowering time and fruit setting may then be affected by this.

Combination treatments:

In comparison to the control plants that were sprayed with distilled water alone, the data on the interaction between the concentrations of the calboro compound and the concentrations of nutrients showed that the interaction between 15 mg KNO_3 + 1 mg/l calboro was associated with the greatest number of flowers per plant and the greatest rate of fruit set, recorded at 75.74% and 77.56% in the first and second seasons, respectively.

In contrast, 0.5 mg/l calboro + 15 mM KNo_3 produced results above of 0.5 mg/l calboro + 10 mM KNo_3 in both seasons for both the overall number of flowers per plant and fruit set %. This was the case when the application of 1 mg/l calboro + 10 mM KNo_3 was recorded at the second level, 68.90 % and 71.97%, respectively.

Table 4. Total number of flower and fruit setting as affected by spraying of calboro, potassium nitrate alone and combination during 2022 and 2023 seasons

Treatments	Flower characters			
	Total No. of flower/ plant		Fruit setting %	
	2022	2023	2022	2023
Control	50.02	51.04	35.77	37.30
10 mM KNo_3	48.94	50.02	40.42	38.61
15 mM KNO_3	54.74	55.23	40.73	40.70
0.5 mg/l calboro	56.16	58.12	42.87	40.48
1 mg/l calboro	53.51	51.82	51.26	52.07
10 mM KNO_3 + 0.5 mg/l calboro	49.85	51.11	55.21	55.63
15 mM KNO_3 + 0.5 mg/l calboro	50.70	51.67	57.46	54.59
10 mM KNO_3 + 1 mg/l calboro	52.94	55.73	68.90	71.97
15 mM KNO_3 + 1 mg/l calboro	59.84	61.13	75.74	77.56
L. S. D. at 5 %	3.14	3.31	3.38	2.46

Yield and its Components Were Enhanced by Potassium Nitrate and Calboro:

Separately treatments:

According to a review of the data in Table 5, the calboro was added in steps that significantly increased the yield and its components of squash, including the No. of fruits/plant, average fruit weight (g), overall yield/plant (kg), and overall yield/plant (ton/fed.). The highest yield and its components were obtained from the sprayed 1 mg/l calboro, which outperformed the control and all other treatments, whereas 15 mM potassium nitrate outperformed 10 mM calcium nitrate in all yield characters. These outcomes are consistent with those of Bibi Haleema *et al* (2018) who discovered that plants treated with 0.25% B + 0.6% Ca had a greater rise in No. of tomato fruit /plant. Researchers, Hao *et al* (2003) Rubio *et al* (2009) and Shafeek *et al* (2013) discovered that an increase in calcium content increased the quantity of tomato fruits.

Combination treatments:

When 1 mg/l of calboro was mixed with 15 mM KNO_3, the more significant averages of the overall yield per plant and per fed., number of fruits/plant, and average fruit weight (g) were obtained in both seasons. On the other hand, as compared to squash plants that were not treated in either of the two seasons, 10 mM KNO_3 in combination with 0.5 mg/l of calboro produced the lowest mean values of yield parameters. These increases may be due to the role of potassium and calcium which spray on plants.

Table 5. Yield and its Components as affected by spraying potassium nitrate, calboro alone and combination during 2022 and 2023 seasons

Treatments	Yield characters							
	Number of fruit /plant		Average fruit weight (g) /plant		Overall yield /plant (kg)		Overall yield (ton/fed.)	
	2022	2023	2022	2023	2022	2023	2022	2023
Control	4.50	6.84	108.0	106.6	0.701	0.728	7.01	7.28
10 mM KNo_3	7.31	7.51	118.2	119.6	0.865	0.901	8.65	9.01
15 mM KNO_3	8.15	9.02	125.8	120.5	1.024	1.087	10.24	10.87
0.5 mg/l calboro	9.51	10.31	113.2	112.3	1.076	1.159	10.76	11.58
1 mg/l calboro	11.19	11.46	117.1	116.8	1.310	1.338	13.11	13.38
10 mM KNO_3 + 0.5 mg/l calboro	10.95	12.50	120.1	115.4	1.315	1.443	13.15	14.43
15 mM KNO_3 + 0.5 mg/l calboro	12.94	14.39	125.4	120.2	1.623	1.731	16.23	17.30
10 mM KNO_3 + 1 mg/l calboro	16.66	17.71	118.7	120.8	1.977	2.139	19.77	21.39
15 mM KNO_3 + 1 mg/l calboro	17.29	19.57	127.5	122.8	2.204	2.280	22.04	22.80
L. S. D. at (5 %)	0.696	0.434	3.36	5.74	0.078	0.090	0.826	0.878

Chemical Compositions of Leaf Were Improved by Potassium Nitrate Calboro:

The information in table 6 demonstrated the impacts of spraying calboro and potassium nitrate, and their interactions in comparison to the regulation of leaf chemical compositions such as (N, P, K, Ca % on plant).

Separately treatments:

By looking at the leaf chemical compositions, it was found that the content of leaf NPK and Ca % increased morally by spraying each of (10 and 15 mM potassium nitrate) and 0.5 and 1 mg/l calboro compound. The results showed the highest concentration of NPK % when plant treated with 15 mM potassium nitrate compared to the plants that were sprayed with the different concentrations of calboro and also control plants on both seasons, but1 mg/l calboro gave the highest result in leaf Ca %. According to Shafeek *et al* (2013), foliar spraying with 15 mM KNo3 produced the highest N percentage, p value, and K (mg/g fresh weight of cucumber fruit tissues). The tendencies in the results are consistent with the findings of other studies, such as Jiang *et al* (1998), Gue *et al* (1999), Sing and Mohanty (2002) Abd El-Al *et al* (2005) and Al-Hamzawi (2010).

Combination treatments:

In comparison to the control over the two seasons, the interaction between 15 mM potassium nitrate + 1 mg/l calboro demonstrated significantly higher leaf NPK and Ca levels. According to Shafeek *et al* (2013) levels of nitrogen, potassium, and calcium in fruit tissues showed that the contents of both calcium and potassium nitrate in cucumber fruit tissues improved to reach the greatest values as these levels increased.

Table 6. Chemical compositions leaf as affected by spraying potassium nitrate, calboro alone and combination during 2022 and 2023 seasons

Treatments	Leaf Chemical Constituents							
	N Leaf (%)		P Leaf (%)		K Leaf (%)		Ca Leaf (%)	
	2022	2023	2022	2023	2022	2023	2022	2023
Control	1.799	1.731	0.104	0.108	1.736	1.776	0.120	0.152
10 mM KNo_3	2.920	3.054	0.152	0.164	2.223	2.374	0.241	0.218
15 mM KNO_3	2.974	3.122	0.247	0.243	2.323	2.466	0.273	0.222
0.5 mg/l calboro	2.386	2.744	0.143	0.147	1.838	1.706	0.318	0.353
1 mg/l calboro	2.676	2.884	0.172	0.183	2.002	1.624	0.338	0.371
10 mM KNO_3 + 0.5 mg/l calboro	2.948	3.173	0.257	0.261	2.722	2.879	0.493	0.509
15 mM KNO_3 + 0.5 mg/l calboro	3.484	3.672	0.277	0.301	2.85	3.151	0.419	0.455
10 mM KNO_3 + 1 mg/l calboro	4.244	4.367	0.278	0.31	2.758	3.105	0.445	0.500
15 mM KNO_3 + 1 mg/l calboro	4.432	4.749	0.288	0.32	2.935	3.39	0.529	0.557
L. S. D. at (5 %)	0.142	0.155	0.014	0.015	0.395	0.155	0.0142	0.0141

Shelf Life Were Enhanced by Potassium Nitrate and Calboro:

(Figure A) illustrates how storage temperature affects the percentage of fruit recovered from plants sprayed with different amounts of KNO_3 and calboro. V.C % was considerably raised with the addition of 15 mM KNO_3 + 1 mg/l of calboro compared to control in the start of storage at 10 °C from 4.66 to 15.84 in the first season and from 4.98 to 15.00 % in second season. Conversely, V.C % with 16 days of stored squash fruits at 10°C and treated with the same treatment decreased over storage time but to a lesser degree than with those that occurred with the treatment of the control. These findings are consistent with those of Puguh Catur Wicaksana *et al* (2019) who found that treatment 3% Ca (30 g $CaCl_2$ / l aqueduct), or 48.14 mg / 100g, is the optimal calcium concentration that can give tomatoes the highest vitamin C content. Furthermore, although food is no longer transferred from the parent plant to the fruit, harvested fruit still undergoes life processes and must rely on food stores to remain fresh. Food reserves, including vitamin C, will eventually run out along with the duration of storage, which leads to aging and degradation Ullah (2009). Ca^{2+} content that binds to pectin cellulose micro fibrils from the cell wall can be added exogenously to $CaCl_2$ by sterilization reaction. Pectin and Ca^{2+} form a connection that makes the cell wall stiff. By maintaining membrane integrity, the administration of Ca^{2+} can create crosslinks between Ca^{2+} and other polysaccharides, such as pectic acid, which can restrict the action of respiration-related softening enzymes like polygalcturonase Kramer *et al* (1989).

The respiration rate lowers as the fruit membrane integrity is stabilized with $CaCl_2$, which can further slowdown the pace at which vitamin C is degraded. the research of Puguh Catur *et al* (2019) using a dose of 150 kg / ha of potassium chloride can yield noteworthy outcomes regarding the varying content of vitamin C in tomatoes. Vitamin C's characteristics will deteriorate during the maturation and storage phase, as demonstrated by Amrutha *et al* (2007). However, potassium plays a crucial role in slowing down this decline by strengthening the cell wall and aiding in the lignification of sclerenchyma tissue. Tomatoes with robust and thick cell walls are less likely to be damaged and lose their vitamin C content. In addition to slowing down the rate at which vitamin C depletes, potassium can also work to raise the amount of vitamin C present in the fruit. Potassium's role is closely linked to an agricultural product's nutritional value, which is defined as the amount of specific elements like protein, fat, and vitamin and mineral components. Positive interactions between potassium and nitrogen in a number of physiological processes can also indirectly contribute to potassium's function in quality Usherwood (1985). In the process of moving through xylem, potassium and nitrate (NO_3) both act as reverse ions. When K is present, N can be absorbed in higher concentrations and turned to protein more quickly. Plants will first convert nitrates to amines, which will next be converted to amino acids, which will finally produce proteins. Low K supplies tend to restrict nitrate transport and prevent the synthesis of proteins IPI (2013). Because vitamin C is a byproduct of protein synthesis, fruit with higher protein content will also have higher vitamin C concentration the Rosyidah (2017).

Because vitamin C is very labile and provides a sensitive indicator of nutritional quality, analysis of vitamin C (does not constitute a comprehensive nutritional evaluation. PERRIN and GAYE (1986). Due to its extreme liability, ascorbic acid (AA) provides a sensitive indicator of the relative nutritional quality Toivonen *et al* (1994). In general, the AA content of fruits and vegetables gradually decreases as storage temperature or duration rises LEE and KADER (2000). According to Izumi *et al* (1984), winter squash's AA content didn't begin to drop until chilling harm occurred during storage at 1C. The temperature in storage was kept at 10 ± 2C consistently. The ripening of the goods may be connected to the increase in AA content for whole squash that was seen during storage. Within minutes, the physical harm or wounding brought on by preparation speeds up the rates of several biochemical reactions that result in alterations in color, flavor, texture, and nutritional value (such as vitamin loss). It also increases respiration and ethylene generation Kader (1992).

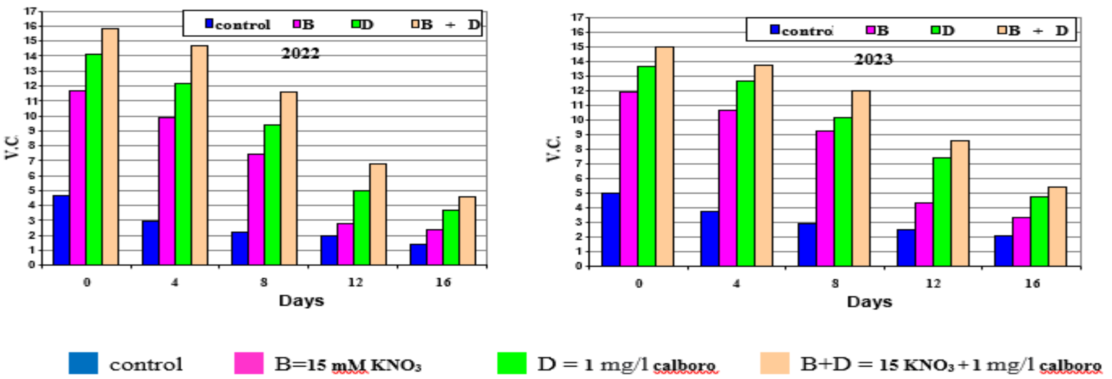

Figure A. V.C % (ascorbic acid) in squash fruits which taken from plants were sprayed by potassium nitrate, calboro alone and combination when storage at 10 °C during 2022 and 2023 seasons

The (Figure B) shows the relationship between storage days "16 days" and total soluble solids (TSS) in the case of squash fruit, where individual transactions showed a significant increase in TSS which sprayed with1 mg/l calboro then followed by 15 mM potassium nitrate. The interaction of 15 mM nitrate potassium + 1 mg/l calboro showed a moral balance on individual transactions and showing a significant increase in the concentration of TSS in fruits at the beginning of the storage period but gradually decreased as storage days increased by 16 days at 10°C compared to the control that deteriorated at the end of the storage period. This result is in line with those obtained by Homin and Kuenwoo (1999) and Majeed Kadhem Abbas (2010) and which determined that storage cucumber of the coefficient option during cultivation at 15 Mm of potassium nitrate at 10 °C led to a slight reduction of TSS over that stored at 27 °C for 18 days. According to Sara Ines Roura *et al* (2003), both diced and whole squash showed a rise in soluble solids content over storage. According to Peyvast *et al* (2009), when 4 mmolL-1 potassium phosphate was sprayed on TSS plants, the fruits increased. On tomatoes, combinations of 6 and 4 mmolL-1 nitrogen and potassium, respectively, were found to produce the highest levels of TSS (2.5 Brix). In contrast to other treatments and the control, Shafeek *et al* (2013) clearly demonstrate that foliar spraying potassium nitrate at both concentrations (10 and 15 mM) produced the greatest values of TSS in cucumber fruit tissues.

The differences in calcium and potassium nitrate between distinct foliar sprays were substantial, with the exception of TSS. It is feasible to conclude that increasing the potassium nitrate content in foliar spray improved the nutrients' availability and absorption, which in turn raised the concentration of potassium nitrate in fruits. The results obtained exhibit patterns that are consistent with those of previous studies conducted by Sing (2000), AbdEl-Al *et al* (2005) and Al-Hamzawi (2010). According to Sara Ines Roura *et al* (2003) a rise in the soluble solids content may be a sign of modifications in the carbohydrates, such as the conversion of squash starch to sugar.

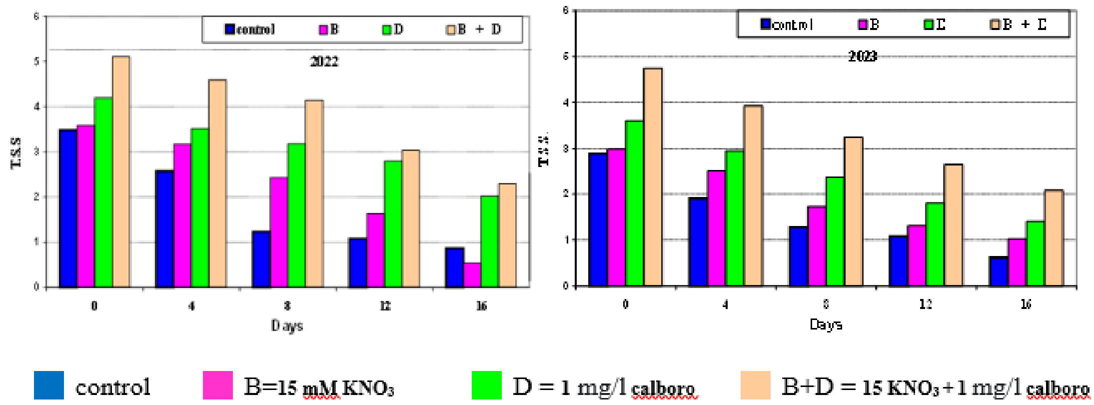

Figure B. TSS in squash fruits which taken from plants were sprayed by potassium nitrate, calboro alone and combination when storage at 10 °C during 2022 and 2023 seasons

(Figure C) showed the relationship between storage days at 16 days and pH of squash fruits on 10 °C, and there was a moral increase with the addition of transactions. 15 Mm potassium nitrate + 1 mg/l calboro gave the highest pH %. As well as the slowly increase of pH in fruit with storage days passing through to the eighth day and then decreasing with the passage of time. According to Sara Ines Roura *et al* (2003) after squash was stored the pH readings increased from 6 to 6.8 (P > 0.01) (P > 0.01).

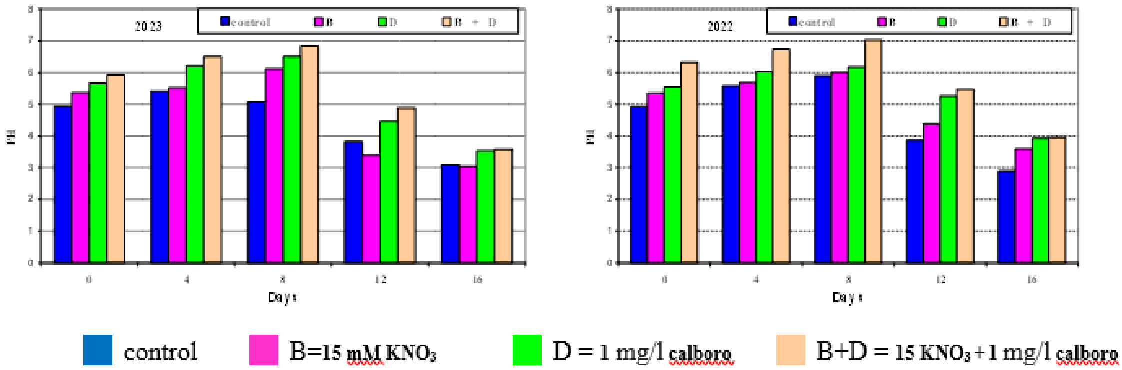

Figure C. pH in squash fruits which taken from plants were sprayed by potassium nitrate, calboro alone and combination when storage at 10 °C during 2022 and 2023 seasons

By observing (Figure D) this shows the relationship between storage days and weight loss of squash fruit. It also turns out that with storage days of 10 °C, there was a slight loss in the weight of the fruit, and the best transactions, which led to a lower loss of weight over time, were 15 potassium nitrate + 1 mg/l calboro, compared to individual transactions and control plants in both seasons, respectively. According to Luna-Guzam *et al* (1999) and Roura *et al* (2000) who explained that storage of the fresh-cut cantaloupe at 10°C within polyethylene bags had achieved the highest storage life of storage, these results corroborate Majeed adhem Abbas (2010) suggestion regarding the cucumber, which states that weight loss increased with the increase in storage time at 27 °C times as compared to storage at 10°C.

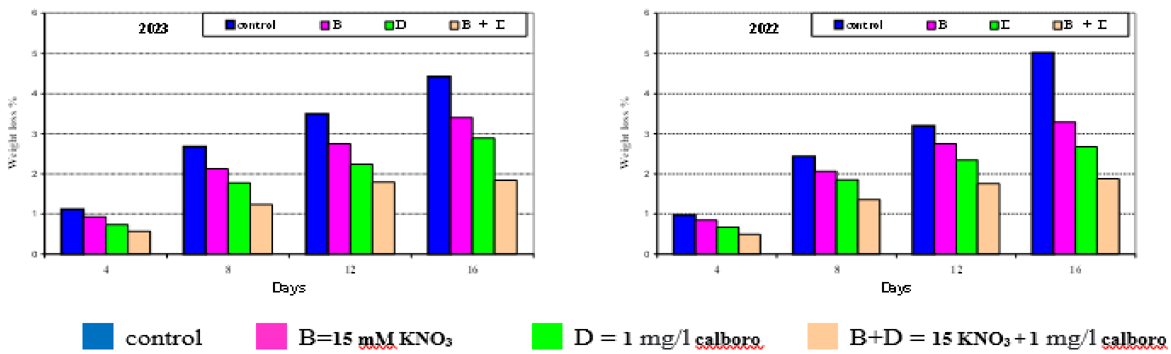

Figure D. Weight loss % in squash fruits which taken from plants were sprayed by potassium nitrate, calboro alone and combination when storage at 10 °C during 2022 and 2023 seasons

CONCLUSION

In conclusion, the present study suggests positive impacts between potassium nitrate and calboro on the yield and storage of summer squash. The results of this research have shown that the spraying of calboro and potassium separately or in combination has led to a significant increase in the vegetative growth, number of flowers/plant, fruit set %, yield and its components, leaf chemical composition and shelf life. The best treatment was 15 mM potassium nitrate + 1 mg/l calboro, since this combination has demonstrated highly substantial good benefits as example the yield was increased by 47.0 and 46.9 % compared to control in the first and second seasons respectively, and therefore recommended that this treatment be applied to the cultivation of squash in Aswan governorate and similar conditions.

REFERENCES

Abdalla, M.M. and N.H. El-Khoshiban (2007). The influence of water stress on growth, relative water content, photosynthetic pigments, some metabolic and hormonal contents of two *Triticium aestivum* cultivars. J. App. Sci. Res. 3(12): 2062-2074.

Abd El-Aal, F.S., A.M. Shaheen, A.A. Ahmed and R.A. Mahmoud (2010). Effect of foliar application of urea and amino acids mixtures as antioxidants on growth, yield and characteristics of squash. Research Journal of Agriculture and Biological Sciences, 6(5): 583-588.

AbdEl-Al, Faten, S., M.R. Shafeek, A.A. Ahmed and A.M. Shaheen (2005). Response of growth and yield of onion plants to potassium fertilizer and humic acid. J. Agric. Sci. Mansoura Univ., 30(1): 441-452.

Ahmad, R. and R. Jabeen, (2005). Foliar spray of mineral elements antagonistic to sodium a technique to induce salt tolerance in plants growing under saline conditions. Pak. J. Bot., 37: 913-920.

Al-Hamzawi, M.K., (2010). Effect of calcium nitrate, potassium nitrate and Anfaton on growth and storability of plastic houses cucumber (*Cucumis sativus* L.). Ameri. J. of Plant Physi., 5(5): 278-290.

Amrutha N.R, Nataraj S, and Rajeev K,. (2007). Genome-wide analysis and identification of genes related to potassium transporter families in rice (*Oryza Sativa* L.). Plant Science. Vol 172 Page 708-721. Science Direct

A.O.A.C., (1992). Official methods of analysis of the Association official Analytical Chemists, 1sth Ed. Published by The Association of Analytical Chemists 111. North Nineteenth suite 210 Arlington Virginia 2220/U.S.A. Macmillan Publishing Company, New York.

Asad, A., E.P.C. Blamey and D.G. Edward (2003). Effects of boron foliar applications on vegetative and reproductive growth of sunflower. Ann. Bot. 92: 565–570. https://doi.org/10.1093/aob/mcg179

Bannayan, M., E.E . Rezaei and A. Alizadeh (2011). Climatic suitability of growing summer squash (*Cucurbita pepo* L.) as a medicinal plant in Iran. *Notulae Scientia Biologicae*, 3 (2) :39-46

Basavarajeshwari, C.P., R.M. Hosamani, P.S. Ajjappalavara,B.H. Naik, R.P. Smitha and K.C. Ukkund. (2008). Effect of foliar application of micronutrients on growth and yield components of tomato (*Lycopersicon esculentum*). Karnataka J. Agric. Sci. 21(3): 428-430.

Bergmann, W. (1992). Nutritional disorders of plants. Development, visual and analytical diagnosis. Gustav Fisher Verlag, Jena Germany.

Bibi Haleema, Abdur Rab and Syed Asghar Hussain (2018): Effect of Calcium, Boron and Zinc Foliar Application on Growth and Fruit Production of Tomato. *Sarhad Journal of Agriculture*, 34(1): 19-30. http://dx.doi. org/ 10.17582/journal.sja/2018/34.1.19.30

Blevins, D.G. and K.M. Lukaszewski. 1998. Boron in plant structure and function. Ann. Rev. Plant Physiol. Mol. Biol. 49: 481–500. https://doi. org/10.1146/annurev. arplant.49.1.481

Bose, U.S. and S.K. Tripathi. 1996. Effect of micro nutrients on growth, yield and quality of tomato Cv. Pusa Ruby in M.P. Crop Res. Hissar. 12 (1): 61-64.

Bricker, B. (1991). MSTATC: A Micro Computer Program from the Design Management and Analysis of Agronomic Research Experiments. Michigan State University, USA.

Cakmak, I. (2005). The role of potassium in alleviating detrimental effects of abiotic stress in plants. *J. Plant. Nutr. Soil Sci.* ,168:521-530.

Dale, G.B. and M.L. Krystyna. 1998. Boron in plant structure and function. Annu. Rev. Plant Physiol. Plant Mol. Biol. 49: 481-500. https:// doi.org/10.1146/ annurev. arplant.49.1.481

Del-Amor, F.M. and L.F.M Marcelis. 2006. Differential effect of transpiration and Ca supply on growth and Ca concentration of tomato plants.Sci. Hort. 111:17-23. https://doi.org/10.1016/j. scienta.2006.07.032

Dole, J.M. and H.F. Wilkins (2005). Floriculture: Principles and Species.2nd ed. Prentice Hall, New Jersey.

Ranganna, S. (1999). Hand book of analysis and quality control for fruits and vegetable products. 3rd ed., Tata Mc GrawHill publishing Co.Ltd, New Delhi,.

El-Tohamy, W.A., A.A. Ghoname and S.D. Abou-Hussein, (2006). Improvement of pepper growth and productivity in sandy soil by different fertilization treatments under protected cultivation. J. Applied Sci. Res., 2(1): 8-12.

Gue, X.G., L.G. Aiju and W.J. Wang, (1999). The effect of K fertilizer on the yield, quality and nutrient uptake of onion. China Vegt., 2: 12-14.

Hao, X. and A.P. Papadopoulos. (2003). Effects of calcium and magnesium on growth, fruit yield March 2018 | Volume 34 | Issue 1 | Page 29 and quality in a fall greenhouse tomato crop grown on rockwool. Can. J. Plant Sci. 83: 903–912. https://doi.org/10.4141/P02-140

Haytova, D. (2013). A review of foliar fertilization of some vegetable's crops. Ann. Rev & Resear. in Bio., 3(4):455-465.

Heldt HW (2005). Plant biochemistry. Elsevier academic press. California. USA.

Homin, Kand P.Kuenwoo, (1999). Effect of packaging methods and temperatures on post-harvest quality during storage of cucumber J. Kor. Soc. Hort., 40: 9-12.

Hussein, M.M., M.M. Shaaban and A.K. El-Saady, (2008). Response of cowpea plants grown under salinity stress to PK-foliar applications. AM. J. Plant Physiol., 3: 81-88.

Hussain, N., A. Ali, G. Sarwar, F. Mujeeb and M. Tahir (2003). Mechanism of salt tolerance in rice. Pedosphere. 13: 233-238.

Ilyas, M., G. Ayub, Z. Hussain, M. Ahmad, B. Bibi, A. Rashid and Luqman (2014). Response of tomato to different levels of calcium and magnesium concentration. World Appl. Sci. J. 31 (9): 1560-1564.

International Potash Institute (2013). Potassium The Quality Element in Crop Production. ipipotash.org.

Imtiaz, M., A. Rashid, P. Khan, M.Y. Memon and M. Aslam. (2010). The role of micronutrients in crop production and human health. Pak. J. Bot. 42(4): 2565-2578.

IZUMI, H., TATSUMI, Y. and MURATA, T. (1984). Effect of storage temperature on changes of ascorbic acid content of cucumber, winter squash, sweet potato and potato. Nippon Shokuhin Kogyo Gakkaishi 31, 47-49.

Jackson, A., (1973). Soil Chemical Analysis. Prentice- Hall. India Private Limited, New Delhi.

Jiang, J., Z. Huilin and J. Gltui, (1998). Application of potassium fertilizer on onion production. China Vegt., 4: 38-41.

Johnson, J.M. and Urich, (1975). Analytical Methods for Use in Plant Analysis. University of California, Agricultural Experiment Station, Berkeley, pp:26-78.

KADER, A.A. (1992). Postharvest Technology of Horticultural *Crops.* pp. 21-28, Division of Agriculture and Natural resources, University of California, Davis, CA.

Kadir, S.A. (2005). Influence of pre harvest calcium application on storage quality of Jonathan apple in Kansas. Kansas Acad. Sci. 118: 129-36. https://doi.org/10.1660/0022-8443(2005)108 [0129:IOPCAO] 2.0.CO;2

Kramer, G.F. and C.Y. Wang. (1989). Correlation of reduced chilling injury and oxidative damage with increased polyamine levels in zucchini squash. Physiol Plant 76:479-484.

Kaya, C., B.A. Ak and D. Higgs, (2003). Response of salt stressed strawberry plants to supplementary calcium nitrate and / or potassium nitrate. J. Plant Nutr., 26: 543-560.

LEE, S.K. and KADER, A.A. (2000). Preharvest and postharvest factors influencing vitamin C content of horticultural crops. Postharvest Biol. Techn~l. 20, 207-220.

Lorenz, D.A. (1951). Chemical changes in early prolific summer squash during storage. Proc. Amer. Soc. Hort. Sci. 57:288-294.

Luna-Guzam, M. C. Cantwall and D. M. Barrett, (1999). Fresh-cut cantaloupe: Effect of CaCl2 dips and heat treatments on firmness and metabolic activity. Postharvest Biol. Technol., 17:201-213.

Majeed Kadhem Abbas (2010): Effect of Calcium Nitrate, Potassium Nitrate and Anfaton on Growth and Storability of Plastic Houses Cucumber (*Cucumis sativus* L. cv. Al-Hytham). American Journal of Plant Physiology DOI:10.3923/ajpp.2010.278.290.

Marschner, H. (1995). Functions of mineral nutrients: Macronutrients, p.299-312. In: H. Marschner (ed). Mineral nutrition of higher plants 2 nd ed. Academic Press, N.Y.

Mencarelli, F., G. Anelli, and R. Tesi. (1982). Idoneità alla conservazione di alcune cultivars di carciofo e di zucca da zucchine. Frutticoltura 8:47-50.

Mencarelli, F., W.J. Lipton, and S.P. Peterson (1983). Responses of Zucchini squash to storage in low-02 atmospheres at chilling and non-chilling temperatures. J. Amer. Soc. Hort. Sci. 108:884- 890.

Mengel V.A, and Kirkby E.A, 1987. Principles of Plant Nutrient. International Potash Institute. Switzerland.

Okezie, B.O. (1998). World food security: The role of post – harvest technology. Food Technol., 52:64-69.

Olfati JA, Babalar M, Kashi AK, Dadashipoor A, and Shahmoradi KH (2008). The effect of ammonium and molybdenum on nitrate concentration in two cultivars of greenhouse tomatos. Agric. Sci. technol. j. 22(1):69-77.

Oyinlola, E.Y. (2004). Response of irrigated tomatoes (Lycopersicon lycopersicum Karst) to boron fertilizer: 00Growth and nutrient concentration. Nigeria. J. Soil Res. (2004) 5: 62-69.

Padmaja, N., Don, Bosco, S. J., and Rao, J. S. (2015). Physico chemical analysis of sapota (*Manilkara Zapota*) coated by edible aloe vera gel. Int. J. Appl. Sci. Biotechnol., 3(1):20-25.

Parr, A.J. and B.C. Loughman. (1983). Boron and membrane function in plants. In: Metals and Micronutrients: Uptake and Utilization by Plants, D.A. Robb and W.S. Pierpoint (Eds.). Academic Press, New York. pp. 87-107. https://doi.org/ 10.1016/ B978-0-12-589580-4.500122

PERRIN, P.W. and GAYE, M.M. (1986). Effects of simulated retail display and overnight storage treatments on quality maintenance in fresh broccoli. J.Food Sci. *51,* 146-149.

Peter, K.H. (2005). Calcium: A central regulator of plant growth and development. The Plant Cell, 17:2142-2155. https://doi.org/10.1105/ tpc.105.032508

Pettigrew, W.T. (2008). Potassium influences on yield and quality production for maize, wheat, soybean and cotton. *Physiol. Plant.*,133:670-681.

Peyvast, G., J. A. Olfati, P. Ramezani-Kharazi and S. Kamari-Shahmaleki (2009). Uptake of calcium nitrate and potassium phosphate from foliar fertilization by tomato. iJournal of Horticulture and Forestry Vol. 1(1) pp. 007-013 March, 2009. Available online http:// www. academicjournals. org/ jhf .©2009 Academic Journals.

Phillips, T.G. (1946). Changes in the composition of squash during storage. Plant Physiol. 21:533-541.

Puguh, C. W., K. A. Wijaya and S. Soeparjono (2019): Role of potassium and calcium in improving the quality and shelf life of tomato *(Lycopersicum escolentum* var. servo). El-Hayah Vol. 7, No.2 (2019) 84-93. Journal Homepage: http://ejournal.uin-malang.ac.id/ index.php/bio/index e-ISSN: 2460-7207, p-ISSN: 2086-0064.

Rab, A. and I. Haq (2012). Foliar application of calcium chloride and borax influences plant growth, yield, and quality of tomato (*Lycopersicon esculentum* Mill.) fruit. Tur. J. Agric. Fores. 36: 695-701.

Ranganna, S. (1986). Handbook of Analysis and Quality Control for Fruit and Vegetable Products.2nd Edition.Tata McGraw-Hill Publ. Comp. Ltd., New Delhi, India. 1112p.

Rashid, M. (2000). Secondary and micronutrients. In: Soil Science. National Book Foundation, Is lamabad. pp. 342-343.

Rosyidah, A. (2017). Hasil Dan Kualitas Tomat (*Lycopersicum esculentum* L.) Pada Berbagai Pemberian Pupuk Kalium. Seminar Nasional Hasil Penelitian. Universitas Islam Malang.

Rubio, J.S., F. Garcia-Sanchez and R.F. Martinez. (2009). Yield, blossom-end rot incidence, and fruit quality in pepper plants under moderate salinity are affected by K+ and Ca2+ fertilization. Sci. Hort. 119: 79–87. https://doi. org/10.1016/j.scienta.2008.07.009

Rydz A (2001). The effect of foliar nutrition urea on yield quality of broccoli cv Lord F1. Veg. Crops Res. Bull. 54 (1): 61–64.

Sajid, M. (2009). Effect of micronutrients (Zn and B) as foliar spray on growth and yield of sweet orange (*Citrus sinensis* L.) cv. Blood red. Ph.D. Dissertation. Department of Horticulture, The University of Agriculture Peshawar.

Sara Ines Roura, Maria Del Rosario Moreira'and Carlos Enrique Del Valle (2033): Shelf – life of fresh like ready to use diced squash. Journal of Food Quality 27 (2004) 91-101. All Rights Reserved. Copyright 2004 by Food & Nutrition Press, Inc., Trumbull. Connecticut.

Roura, S. T., L. A. Davidovich and C. E. Valle (2000). Quality loss in processed Swiss chard related to amount of damaged area. Lebensmittel Wissenscaft Technol., 33:53-59.

Shafeek, M.R., Y.I. Helmy, W.A. El-Tohamy and H.M. El-Abagy (2013): Changes in growth, yield and fruit quality of cucumber (*Cucumis sativus L.*) in response to foliar application of calcium and potassium nitrate under plastic house conditions. Research Journal of Agriculture and Biological Sciences, 9(3): 114-118, ISSN 1816-1561.

Sing, S.P. and C.R. Mohanty, (2002). A note on the effect of nitrogen and potassium on the growth and yield of onion. Orissa J. Hort., 26(2): 70-71.

Snedecor, G.W. and W.G. Cochroni (1973). Statistical methods (sixthed.) Iowa state Univ.press, U.S.A.

TOIVONEN, P., ZEBARTH, B. and BOWEN P. (1994). Effect of nitrogen fertilization on head size, vitamin C content and storage life of broccoli *(Brasica oleracea* var. Italica). Can. J. Plant. Sci. *74,* 607-610.

Tucker, D.P.H., L.G. Abrigo, T.A. Wheaton and J.R. Parsons (1994). *Tree And Fruit Disorders*. Fact Sheet HS-140. Institute of Food & Agriculture Science University Of Florida. Physiologia plantarum, Wiley Online Library.

Ullah, J. (2009). Storage of fresh tomatoes to determine the level of calcium chloride coating and optimum temperature for extending shelf life. A post Doctorate Fellowship Report submitted to Professor Athapol Athapol Noomhorm.

Usherwood, N.R. (1985). The role of potassium in crop quality In: *Potassium in Agriculture*, Munson, R.D. (Ed.). ASA-CSSA-SSSA, Madison, W.I., pp:489-513.

Wanng Z, and Li S (2004). Effects of nitrogen and phosphorus fertilization on plant growth and nitrate accumulation in vegetables. J. Plant Nutr. 27: 539–556.

Watt, B.K. and A.L. Merrill. (1975). Composition of foods. USD A Hdbk. 8.

Wojciechowska R, Roz˙ EkS, and Rydz A (2005). Broccoli yield and its quality in spring growing cycle as dependent on nitrogen fertilization. Folia Hort. 17 (2):141–152.

Yamaguchi, T., T. Hara and Y. Sonoda. (1986). Distribution of calcium and boron in the pectin fraction of tomato leaf cell wall. Plant Cell Physiol. 27:729-732.

Zekri, M. and T.A. Obereza. (2003). Micronutrient deficiencies in citrus: Iron, zinc and manganese. Institute of Food and agricultural Services, University of Florida, USA.

نترات البوتاسيوم والكالبورو تحسن الانتاجية وعقد الثمار والقدرة التخزينية للكوسة الصيفية تحت ظروف أسوان

منى نمر شحاته بساتين و خالد جمال عبد الرشيد

قسم بساتين – خضر - كلية الزراعة والموارد الطبيعية – جامعة اسوان

الملخص

تهدف هذه الدراسة الى مقارنة تاثير رش نباتات الكوسة بمعدل (10 ، 15 ملليمول من نترات البوتاسيوم) و بمعدل (0.5 ، 1 مل/لتر) من مركب كالبورو (الكالسيوم والبورون) مع رش نباتات الكنترول بالماء المقطر، وتتبع هذه الآثار خلال مرحلة تخزين النباتات عند 10 درجة مئوية تحت ظروف محافظة أسوان والأراضي المستصلحة حديثاً خلال السنوات 2022 - 2023 بالمزرعة البحثية لكلية الزراعة والموارد الطبيعية، جامعة أسوان، مصر. تم إستخدام تصميم القطاعات كاملة العشوائية مع ثلاثة مكررات لإجراء التجربة. موسيمى الدراسة اظهرا تفوقا في خصائص النمو الخضرى والمحصول الصالح للاكل والصفات الزهرية والنسبة المئوية لعقد الثمار والتركيب الكيميائى للبناتات وكانت افضل المعاملات الفردية هى الرُشّ بمركب نترات البوتاسيوم بمعدل 15 ملليمول، والرُشّ مركب كالبورو بمعدل 1 مل/لتر، بينما كانت أفضل معاملات التفاعلات هي 15ملليمول نترات البوتاسيوم + 1 مل/لتر مركب كالبورو. و أظهرت المعاملة بمعدل 15 ملليمول نترات بوتاسيوم + 1 مل/لتر كالبورو أعلى مستويات لحمض الاسكوربك وTSS، وأقل معدل للفقد فى الوزن، وأفضل قيم pH % للثمار في الموسمين أثناء مرحلة التخزين.