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EFFECT OF METHODS AND SOURCES OF POTASSIUM APPLICATION ON THE PRODUCTIVITY AND FRUIT QUALITY OF SOME NEW TOMATO HYBRIDS

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Abstract

The result of this study about the response of three new tomato hybrids, i.e. Madeer as a processing type, Alex 63 as a fresh market type and Nema 1400 as a double purpose indicated a highly response to potassium fertilization treatment, i.e., soil dressing at two levels, 48 and 96 Kg K2O/fed or foliar spray with 2% potassium sulphate solution and 3% liquid potassium oxide 37% comparing with the control. The favourable treatment was soil dressing at a rate of 96 Kg K2O/fed. The results showed no-significant differences between using soil dressing method at a rate of 48 Kg K2O/fed. and foliar spray method using 2% potassium sulphate solution or 3% liquid potassium fertilizer on earliness, fruit set and fruit yield. The same treatments was superior for fruit firmness, Vit.C, TSS, fruit lycopene pigment, less acidity content and also reducing weight loss and decay percentage in fresh fruits uptil 6 days after harvesting under the room condition and then started to attenuate till 9th day.

In addition, the results pointed to the highly response of the processing hybrid than the others. Madeer hybrid was the best in earliness, yield, fruit characters and the highest in keeping quality.

Accordingly, it could be said that, using potassium fertilization at a rate of 96 Kg K2O/fed. is very important on the productivity and keeping quality of tomato hybrids, and under lack of potassium sulphate fertilizer, it can use foliar nutrition with 2% potassium sulphate solution or liquid potassium 37% at a rate of 3% under Egyptian cultivation nowadays,

INTRODUCTION

The application of potassium fertilizer nowadays to Egyptian soil is very important than before according to the decreases of this element in the Nile water, crop intensification and also to the negligence of the farmers to use it depending on the nitrogen fertilization. The role of potassium in tomato plantation is very important for fruit setting, earliness, fruit yield and keeping quality. It is considered now a limiting factor for tomato production specially after using the

tomato hybrids with its highly requirements and under lacking of potassium in the soil. Many investigators reported the stimulating effect of applying potassium fertilizer to tomato plants as soil dressing or as foliar spray, for example Jen-Tzu Chen et al. (1996) reported that for producing 40 ton tomato/ha. Using the plant and average fruit weights as an indicator, it is estimated that approximately 110 Kg N, 32 Kg P2O2, 150 kg K2O are taken up by the plants. Tomato flowering characters, i.e., earliness, number of clusters per plant and fruit set percentage were improved by potassium fertilization either as soil dressing or as foliar spray (Vasis and George, 1985; Hewedy, 1988; Agwah and Mahmoud, 1994). Tomato fruit yield and its component, i.e. fruit weight as well as number of fruits per plant were found to be increased by foliar spray with 2% potassium sulphate solution, Hewedy (1988) or by foliar nutrition with 1% potassium chloride, Agrwah and Mahmoud (1994). In addition, applying K2O as broadcast or soil dressing increased significantly tomato fruit yield and its components, i.e. fruit weight and number of fruits per plant (Hochmuth et al, 1991; Singth and Verma, 1991; Rao, 1994; Panagiotopoulos and Fordham, 1995; Lopez and Sath, 1996).

The effect of potassium fertilization on tomato yield depend on the level of this element in the soil, Hartiz (1995) reported that processing tomato fruit yield increased significantly by K2O fertilization in the two sites, but did not affect in another two sites and this due to the higher soil content of K element.

Potassium plays an important role in the keeping quality of tomato fruit and produced fruits with high amount of TSS, Vit. C, and firm fruits with less amount of titratable acidity (El-Sheikh, 1988; Zhu and Shu, 1991; Agwah and Mahmoud, 1994). Moreover, Aydin (1996) mentioned that high rates of K2O increased TSS and Vit. C contents of tomato fruits. Red color or lycopene content of tomato fruit were increased by application of K2O fertilizer (El-Sheikh, 1988 and Rao, 1994).

With respect to weight loss and decay percentage, El-Sheikh (1988), Zhu and Shu (1991) reported that adding potassium to tomato plants inhibited the weight loss and decay percentage of fruits during storage periods. They added also that Vit. C, TSS and firmness showed an increase at the beginning of storage period followed by a decrease at the end of the period, while the losses were more obvious in the fruits from the unfertilized plants with K2O.

Regarding to the response of tomato cultivares to potassium soil. Dressing, Widders and Lorenz (1979), Csizinszky and Scott (1985), Saito (1986) and Rao

(1994), reported that tomato yield response to potassium fertilization depended on cultivars. While, Agwah and Mahmoud on tomato and Hochmuth et al (1995) on pepper using foliar spray or broadcast methods, reported that the cultivars differed only in flowering characteristics and yield without any differences on fruit chemical composition according to potassium sources or methods of application.

Consequently this study was performed to investigate and compare between the response of different types of tomato hybrids to potassium fertilization and methods of application on flowering, yield and keeping quality of fruits.

MATERIALS AND METHODS

This experiment was carried out at Kaha Vegetable research Station, Horticulture Research Institute during the summer seasons of 1995 and 1996. The soil in the farm was clay in texture with a PH of 8.0. The chemical analysis of the soil is shown in Table (1). The purpose of this study was to compare between the response of different type of tomato hybrids, i.e., Alex 63 as a fresh market type, Madeer as a processing type and Nema 1400 as a double purpose type to potassium fertilization using two methods of application, i.e., soil dressing at rates of 48 and of 96 Kg K2O per fed. or as foliar spray with 2% potassium sulphate soluation and liquid potassium fertilizer 37% at a rate cf 3% beside the control (without potassium fertilization).

Table 1. The chemical analysis of soil experiment at 1995 and 1996 seasons.

Variable	1995 Season		1996 Season	
	0-30 cm depth	30-60 cm depth	0-30 cm depth	30-60 cm depth
a) Physical properties :				
sand %	15.5	20.6	12.4	18.6
silt %	20.6	21.8	24.2	28.2
clay %	62.4	63.7	60.4	58.8
b) chemical properties :				
PH	8.2	8.0	8.0	7.8
Available N ppm	60.4	80.6	90.4	110.2
Available P ppm	4.8	4.2	6.8	6.6
Available K ppm	218.2	196.6	220.0	210.5
total CaCo 3%	2.85	2.70	2.50	2.85
Organic malter	2.24	1.08	4.2	2.6

Table 2. Effect of potassium fertilizer forms on tomato yield and its components of some tomato hybrids.

Potassium Treatments Tomato hybrids	Number of Fruits/plants						Average fruit weight (gr).						Early yield (ton/fed)						Total yield (ton/fed)					
	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	Solution K_2O at 2%	liqued K20 at 3%	Mean	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	Solution K_2O at 2%	liqued K20 at 3%	Mean	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	Solution K_2O at 2%	liqued K20 at 3%	Mean	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	Solution K_2O at 2%	liqued K20 at 3%	Mean
1995 season																								
Nema 1400	34.7	53.0	64.6	40.3	41.7	46.8	90	94.6	98.3	97.3	93.3	94.7	4.52	6.15	7.40	5.80	5.40	5.85	13.80	20.2	23.50	17.1	16.6	18.24
Alex 63	32.0	42.3	56.3	40.3	37.0	41.6	105	118	126	110	106	113.0	5.20	7.80	8.90	6.50	6.0	6.88	13.88	20.13	23.8	17.10	15.75	18.13
Madeer	1.7	57.0	69.7	50.7	46.7	53.2	94	101	110	98	98	100.2	6.50	8.2	10.18	7.20	7.50	7.92	15.50	20.7	26.6	18.4	17.3	19.13
Mean	37.6	50.7	57.5	43.7	41.8		96.3	104.5	111.4	101.7	99.1		5.40	7.38	8.82	6.5	6.3		14.39	20.34	24.63	17.53	16.55	
L.S.D. at 5% of:																								
Tomato hybrids					2.8				0.70						2.4						1.5			
Potassium treatments					3.2				1.6						2.8						1.2			
interaction					3.0				2.7						3.6						2.0			
1996 season																								
Nema 1400	48.3	65.0	76.6	65	61.6	63.3	91	93	98	96.3	94.3	94.5	5.88	7.50	9.02	7.48	6.88	7.35	18.80	28.40	32.95	24.38	21.43	25.29
Alex 63	48.3	61.6	75.0	56.6	51.5	58.6	110	122	138.3	120	118	121.7	6.30	8.27	10.30	7.13	7.15	7.83	21.07	28.30	34.88	24.72	23.70	26.53
Madeer	57.6	81.0	90.0	76.0	71.6	75.2	95.3	100	105	103	96	99.86	7.70	10.03	12.98	9.52	9.02	9.85	22.53	29.95	35.05	26.7	25.88	28.02
Mean	51.4	69.2	80.5	65.8	61.5		98.7	105	113.7	106.4	102.7		6.62	8.6	10.76	8.04	7.68		20.8	28.88	34.29	25.26	23.67	
L.S.D. at 5% of:																								
Tomato hybrids					1.53				3.4						0.47						0.86			
Potassium treatments					3.89				3.0						0.26						0.13			
interaction					6.70				5.2						0.49						0.88			

Table 3. Effect of potassium fertilizer form on tomato fruit firmness of some tomato hybrids during storage periods.

Potassium Treatments Tomato hybrids	firmness at harvest day							firmness after 3 days							firmness after 6 days							firmness after 9 days						
	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	K_2O at 2% Solution	liqued K20 at 3%		Mean	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	K_2O at 2% Solution	liqued K20 at 3%		Mean	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	K_2O at 2% Solution	liqued K20 at 3%		Mean	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	K_2O at 2% Solution	liqued K20 at 3%		Mean
1995 season																												
Nema 1400	41	47	50	50.7	49		47.5	40.3	45.3	46.6	44	41.3		43.5	35	37.3	42.0	37.3	37.3		37.7	33.3	36.3	39.0	37.0	36.0		36.3
Alex 63	38	42	50.3	47	42		43.8	33.3	38	40	37	36.3		36.9	30.3	33.0	36.0	33.3	34.3		33.4	23.7	27.0	31.0	28.7	27.0		27.5
Madeer	46	50	51.3	48.6	48		49.0	44	47	49.3	46.0	45.3		46.3	37.3	42.0	46.7	40.0	40.3		41.3	36.0	39.3	43.0	38.8	37.7		39.0
Mean	41.6	46.3	50.5	48.7	46.3			39.2	43.4	45.3	42.3	41.0			34.2	37.4	41.5	36.8	37.3			31.0	34.2	37.7	34.8	335		
L.S.D. at 5% of:																												
Tomato hybrids					1.82					7.8							0.57							1.09				
Potassium treatments					2.35					2.8							0.84							0.56				
interaction					4.07					6.1							2.80							0.98				
1996 season																												
Nema 1400	43.3	46	50.7	50	46		47.2	42.0	44.7	47.3	43.7	43.0		44.1	36.0	42	46	41.3	40.7		41.2	28.7	33.3	36.3	32.0	31.3		32.3
Alex 63	35.3	38.3	44.3	46	39.6		40.7	31.3	35.0	37.5	34.3	33.3		34.2	27.6	31.6	34.7	30.7	30.3		31.0	22.7	27.3	32.7	26.3	26.0		27.0
Madeer	45.3	51.7	54.3	52.0	48.6		50.4	45.0	50.7	52.0	50.7	48.0		49.3	41.0	44.0	49.3	43.3	43.0		44.1	40.7	43.3	48.7	43.0	43.0		43.7
Mean	41.3	45.3	49.7	49.3	44.8			39.4	43.4	45.4	42.9	41.4			34.8	39.2	13.3	38.4	38.0			30.7	34.6	39.2	33.8	33.4		
L.S.D. at 5% of:																												
Tomato hybrids					3.4					1.2							2.1							1.9				
Potassium treatments					2.66					2.3							2.7							2.4				
interaction					3.0					2.9							3.4							2.7				

Seeds of the three tomato hybrids sown on 8th and 10th of January in the two successive seasons in seedling foam trays contained mixture of peat moss and vermiculite enriched with macro and micro nutrients.

The seedlings were transplanted on 20th and 24th of February in ridges 4 m in length and 1 m width with a distace of 40 cm between the plants. A split plot design with four replicates was adopted, which the tomato hybrids were arranged in the main plots and potassium treatments at the sub-plots where area of each was 12m2 as following:

1- Control treatment (without potassium fertilization).
2- 48 Kg K2O/fed (100 Kg potassium sulphate as a soil dressing).
3- 96 Kg K2O/fed (200 Kg potassium sulphate as a soil dressing).
4- 2% potassium sulphate solution as a foliar spray.
5- 3% liquid potassium fertilizer 37% K2O as a foliar spray.

The rates of potassium sulphate were applied in two equal portions, each of 50% from the total amount at two times, i.e. 15 days from trasplanting and at the beginning of fruit set stage, i.e. 45 days from transplanting. The other treatments of potassium sulphate solution and liquid potassium fertilize, were applied as a foliar spray three times 15, 30 and 45 days from transplanting. In addition, all treatments received nitrogen and phosphorus fertilizer as recommended.

The following data were recorded

1. Flowering characters

a) Number of days from transplanting till 25% flowering of the plants per plot.
b) Number of flowering clusters per plant.
c) Fruit set percentage : which four plants of each sub-plot were randomly chosen and number of clusters was calculated, while, average fruit set of the first 6 clusters was calculated according to the equation:

$$\text{Fruit set \%} = \frac{\text{No. of fruit / cluster}}{\text{Total No. of flowers/cluster}} \times 100$$

d) Date of maturity : number of days from transplanting till the beginning of maturity.

2. Yield and its Components

a) Early yield: The yield of the first three pickings (ton/fed.).
b) Total yield: The yield of all pickings 7 pickings (ton/fed).

c) Average fruit weight at the fourth picking (gm).
d) Total number of fruits per plant.

3. Keeping quality

Ten Kg of tomato fruits were radomly chosen from each sub-plot at the fourth picking and stored in carton boxes under room condition and the following data were recorded at the same harvest day and after 3 days, 6 days, 9 days from harvesting:

a) Fruit firmness: measured in 1a/inch2 by using Magness and Ballauf pressure tester equipped with 3/16 inch plunger and adjusted in Newton (as recommended by ASHS Postharvest Working Group)

b) Fruit chemical composition: Total soluble solids (TSS) was determined by using Able refractometer, while Vit. C, actidity and Lycobene fruit contents were determined by using the methods described by A.O.A.C. (1970).

c) Weight loss and decay- loss percentage.

RESULTS AND DISCUSSION

1. Flowering characters

Data in Table 2 revealed that Madeer hybrid was the earliest in flowering and maturity and produced the highest number of clusters per plant followed by Nema 1400, however, Alex 63 hybrid was the lowest. On the other hand tomato hybrids did not reflect any differences in fruit set percentage. The variability in tomato cultivates in flowering characters were reported by several investigators (Saito, 1986; Hewedy 1988 and Rao, 1994).

Concerning the potassium effect, data in Table 2 showed that all potassium fertilization treatments either as soil dressing or as foliar spray affected significantly on the earliness or on number of cluusters per plant as well as fruit set percentage. whereas, adding potassium sulphate at 96 Kg K2O/fed being the best treatment. These results are in harmony with those reported by Varis and George (1985), Hewedy (1988), Agwah and Mahmoud (1994) on tomato.

The interaction between Madeer hybrid and K2O at a rate of 96 Kg/fed as soil dressing being the most effective treatment on earliness as well as number of flow-

ering clusters per plant.

2. Yield and its Components

It is clear from Table 3 that Madeer hybrid produced the highest number of fruits per plant and was the best in early and total fruit yield, in spite of, that Alex 63 hybrid gave the heaviest fruit weight.

The early and total Tomato fruit yields as well as number of fruits per plant and average fruit weight were siginficantly increased by potassium fertilization at all levels using soil dressing at 48 or 96 Kg K2O/fed foliar nutrition by 2% K2O solution or 3% liquid potassium fertilizer 37%. In this regard, the highest increments in all previously mentioned yield components were obtained from applying K2O at a rate of 96 Kg/fed., several investigators came to similer result on tomato using some potassium sources and methods of application (Hochmuth et al, 1991; Singh and Verma, 1991 Rao, 1994; Panagiotopoulos and Fordham, 1995; Lopez and Sath, 1996).

The interaction between tomato hybrids and potassium treatments had a significant effect on fruit yield and its components as shown in Table (3). Madeer hybrid and potassium fertilization at 96 Kg K2O/fed produced the highest values in number of fruits per plant as well as early and total yield. While the heaviest fruit weight was obtained from the interaction between Nema 1400 hybrid and K2O at 96 Kg/fed.

It is obvious from data in Table 3 that applying potassium fertilizer as a soil dressing specially at the rate of 96 Kg K2O/fed. was better than using it as a foliar spray in tomato yield production. These resuts are in agreement with those reported by Roa (1994), Agwah and Mahmoud (1994) on tomato and by Hochmauth et al (995) on pepper using potassium fertilization in soluble or broadcasting methods.

3. Keeping quality of fruits

3-a) Fruit firmness

Madeer hybrid as a processing type has the most firm fruits followed by Nema 1400, while Alex 63 as a fresh market type was inferior in fruit firmness as shown in table (4).

Potassium application produced high firm fruit as shown in Table (4) the highest firm fruits were obtained from plant received 96 Kg K2/fed. Moreover, data in Table (4) showed that potassium treatments increased the fruit firmness during storage periods comparatively to the unfertilized plants. The obtained results are in agreement with those of El-Sheikh (1988), Zhu and Shu (1991), Agwah and Mahmoud (1994) on tomato.

The interaction between Madeer hybrid and K2O at 96 Kg/fed. resulted in very firm fruits, while fruits from Alex 63 without potassium fertilization were the lowest in firmness as shown in Table 4.

3-b) Fruit chemical composition:

The concentration of total soluble solids (TSS), Vit. C and lycopene pigment in tomato fruits of Madeer hybrid was higher significantly than those of Alex 63, and non significance than those in fruits of Nema 1400 as shown in Table (5,6,8).

It is obvious from Table 5 that total soluble solids in tomato fruits of different hybrids was not affected throughout 9 days after harvesting. While, Vit. C content tomato fruits of different hybrids attenuated gradually at the same period as shown in Table 6. On the contraty, lycopene pigment in tomato fruits of the hybrids increased with increasing the period after harvesting as shown in Table 8.

Regarding to titratable acidity in tomato fruits of different hybrids data in Table (7) showed that Madeer fruits were significantly the lowest than the other two hybrids, while the highest acidity content was recorded in the fruits of Alex 63 hybrid. Also, data revealed that fruit acidity of different hybrids decreased with the prolongation of storage.

With respect to the influence of potassium application on fruit chemical composition, data in Table (5, 6, 8) indicated that all potassium treatments enhanced significantly fruit contents of TSS, Vit.C and lycopene pigment. Moreover, the high rate of potassium fertilizer, i.e. 96 Kg K2O/fed gave the highest values of total soluble solids, Vit. C and lycopene pigment. While, the unfertilized plants with K2O gave fruit with the lowest contents of these chemical compounds. It is obvious also that potassium positively affected the keeping quality of tomato fruits, where the TSS, Vit. C and lycopene of tomato fruits were more stable during the 6 days from harvesting under room condition comparatively to the untreated plants.

Concerning fruit acidity data in Table (7) showed that the potassium fertilization had a converse trend, where the unfertilized treatment was higher in fruit acidity than those fertilized ones. The same trend prolonged after harvesting. Adding K2O fertilizer at 96 Kg/fed. as soil dressing was the favourable treatment to decrease fruit acidity content. Several investigators came to similar results of fruit chemical composition (El-Sheikh, 1988; Zhu and Shu, 1991; Agwah and Mahmoud, 1994 and Aydin, 1996).

Concerning the interaction effect between tomato hybrids and potassium treatments on fruit chemical composition, data in Table (5, 6, 7, and 8) indicated that, Madeer hybrids with K2O at 96 Kg/fed. as soil dressing gave the greatest amount of TSS, Vit. C and lycopene pigment in tomato fruits and the lowest concentration of acidity in the fruits and also it was the best treatments during the periods after harvesting.

3-c Weight loss and decay percentage in tomato fruits:

Data in Table (9) showed difference weight loss among tomato hybrids during three days intervals under room condition. The results cleary indicated that the least weight loss was observed in the processing hybrid Madeer followed by Alex 63, While Alex 63 was the highest in weight loss character. The same trend was observed during the three storage periods, which increased with increasing these periods.

Concerning the effect of potassium fertilizer treatment, it was found from data in Table 9 that all potassium fertilizer treatments significantly inhibited the weight loss percentage in tomato fruits. It is obviously also that adding potassium at rate of 96 Kg K2O/fed. significantly reduced weight loss than those of foliar spraying with 2% potassium sulphate solution or 3% liquid potassium fertilizer. These results were in agreement with those reported by El-Sheikh (1988), Zhu and Shu (1991) on tomato.

The interaction between Madeer hybrid and K2O at 96 Kg/fed. as a soil dressing gave the lowest value in weight loss during all storage periods. It is obvious that decay loss % showed the same trend of weight loss speciaally after 9 days from harvesting. But it observed that decay loss did not happened during the first three days, and for this reason. data were neglected to be tabulated. The behavior of decay loss % during the 6 days show that there was no any decay in the fruits obtained from plants fertilized with K_2O at 96 Kg/fed. or foliar spray treatments as

shown in Table 9. Accordingly, the highest values of decay at the end of 9 days from harvesting were observed in the unfertilized plants fruits. These results are also in agreement with those reported by El-Sheikh (1988), Zhu and Shu (1991) on some tomato cultivars.

Table 4. Effect of potassium fertilizer forms on tomato fruit TSS% of some tomato hybrids during storage.

Potassium Treatments Tomato hybrids	TSS at harvest day						TSS after 3 days						TSS after 6 days						TSS after 3 days					
	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	K_2O Solution 2%	liqued K20 at 3%	Mean	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	K_2O Solution 2%	liqued K20 at 3%	Mean	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	K_2O Solution 2%	liqued K20 at 3%	Mean	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	K_2O Solution 2%	liqued K20 at 3%	Mean
1995 season																								
Nema 1400	4.0	4.13	4.2	4.13	4.06	4.1	4.0	4.1	4.1	4.1	4.2	4.1	4.0	4.1	4.2	4.1	4.1	4.1	3.8	3.9	4.1	4.1	4.1	4.0
Alex 63	3.7	3.9	3.9	4.1	3.7	3.86	3.8	3.9	4.1	4.1	4.0	3.98	3.7	3.9	4.1	4.1	4.1	3.98	3.5	3.8	4.0	3.9	3.9	3.82
Madeer	4.1	4.2	4.2	4.1	4.1	4.14	4.1	4.3	4.3	4.1	4.2	4.2	4.0	4.1	4.3	4.3	4.1	4.16	3.8	4.0	4.1	4.1	4.1	4.02
Mean	3.93	4.07	4.1	4.11	3.95		3.96	4.1	4.16	4.1	4.13		3.9	4.03	4.2	4.16	4.1		3.7	3.93	4.06	4.03	4.03	
L.S.D. at 5% of:																								
Tomato hybrids	0.17						0.12						0.11						0.14					
Potassium treatments	0.11						0.14						0.13						0.19					
interaction	0.35						0.39						0.24						0.21					
1996 season																								
Nema 1400	4.3	4.4	4.7	4.3	4.4	4.42	4.1	4.3	4.5	4.4	4.3	4.32	4.0	4.1	4.3	4.3	4.2	4.0	4.0	4.2	4.3	4.2	4.3	4.2
Alex 63	3.9	4.2	4.2	4.1	4.1	4.10	4.0	4.3	4.3	4.1	4.2	4.14	3.9	4.1	4.2	4.1	4.1	4.05	3.8	4.1	4.1	4.2	4.1	4.08
Madeer	4.3	4.4	4.8	4.4	4.3	4.44	4.1	4.8	4.8	4.4	4.3	4.38	4.2	4.3	4.4	4.2	4.3	4.28	4.1	4.3	4.2	4.3	4.3	4.24
Mean	4.16	4.33	4.56	4.26	4.23		4.06	4.53	4.53	4.3	4.36		4.03	4.16	4.3	4.2	4.2		3.96	4.2	4.2	4.23	4.23	
L.S.D. at 5% of:																								
Tomato hybrids	0.19						0.14						0.13						0.11					
Potassium treatments	0.16						0.117						0.13						0.12					
interaction	0.37						0.36						0.26						0.23					

Table 5. Effect of potassium fertilizer forms on tomato fruits Vit. C (mg/100 grm fresh weight) of some tomato hybrids during storage periods.

Potassium Treatments Tomato hybrids	TSS at harvest day						TSS after 3 days						TSS after 6 days						TSS after 3 days					
	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	K_2O at 2% Solution	liqued K20 at 3%	Mean	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	K_2O at 2% Solution	liqued K20 at 3%	Mean	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	K_2O at 2% Solution	liqued K20 at 3%	Mean	Control	K_2O at 48 kg/fed	K_2O at 96 kg/fed	K_2O at 2% Solution	liqued K20 at 3%	. Mean
1995 season																								
Nema 1400	18.5	19.4	21.1	20.1	20.3	19.88	18.0	19.0	21.0	20.0	20.2	19.40	17.0	19.0	20.0	19.0	19.0	18.8	13.0	13.3	15.0	18.0	16.0	15.06
Alex 63	16.5	18.5	19.6	19.5	19.2	18.66	15.3	17.3	19.0	19.3	18.3	17.84	14.6	17.3	18.6	17.3	18.3	17.22	12.0	13.6	15.3	14.3	15.0	14.04
Madeer	20.0	21.01	22.3	20.4	20.6	20.86	19.3	21.0	22.3	20.0	20.0	20.52	18.6	20.3	21.6	20.3	21.0	20.36	16.6	18.0	18.6	18.0	19.3	18.1
Mean	18.33	19.63	21.0	20.06	20.03		17.53	19.1	20.76	19.76	19.43		16.73	18.86	20.06	18.86	19.43		13.86	14.96	16.3	16.76	16.76	
L.S.D. at 5% of:																								
Tomato hybrids					0.87				1.02						1.08						0.92			
Potassium treatments					1.18				0.86						1.19						1.18			
interaction					2.05				1.5						1.62						1.36			
1996 season																								
Nema 1400	16.0	18.3	20.3	18.7	18.2	18.3	15.3	16.6	19.3	18.6	18.2	17.6	15.0	16.0	18.0	18.0	18.0	17.0	13.0	14.0	15.0	16.0	16.0	14.8
Alex 63	14.4	15.9	18.4	17.3	16.7	16.54	14.3	16.0	17.0	16.6	16.3	16.04	13.0	15.0	17.0	16.3	15.6	15.38	11.3	13.0	14.0	14.3	14.3	13.38
Madeer	18.1	20.3	22.0	20.3	19.5	20.04	17.0	18.6	18.3	19.0	18.3	18.24	17.6	18.0	19.0	19.0	18.0	18.32	13.3	15.3	16.0	16.3	16.3	15.44
Mean	16.16	18.16	20.23	18.76	18.13		15.53	17.06	18.2	18.06	17.6		15.2	16.33	18.0	18.0	17.76		12.53	14.1	15.0	15.53	15.53	
L.S.D. at 5% of:																								
Tomato hybrids					1.10				0.98						1.04						1.03			
Potassium treatments					1.4				1.02						1.20						1.24			
interaction					2.19				1.65						1.44						1.64			

Table 6. Effect of potassium fertilizer forms on tomato fruit acidity (mg/100 grm fresh weight) of some tomato hybrids during storage periods.

Potassium Treatments Tomato hybrids	fruit acidity at harvest day						fruit acidity after 3 days						fruit acidity after 6 days						fruit acidity after 9 days					
	Control	K_2O at 48 Kg/fed	K_2O at 96 Kg/fed	K_2O at 2% solution	liqued K2O at 3%	Mean	control	K_2O at 48 Kg/fed	K_2O at 96 Kg/fed	K_2O at 2% solution	liqued K_2O at 3%	Mean	control	K_2O at 48 Kg/fed	K_2O at 96 Kg/fed	K_2O at 2% solution	liqued K2O at 3%	Mean	control	K_2O at 48 Kg/fed	K_2O at 96 Kg/fed	K_2O at 2% solution	liqued K_2O at 3%	Mean
1995 season																								
Nema1400	0.45	0.39	0.36	0.39	0.38	0.394	0.43	0.39	0.36	0.36	0.38	0.384	0.37	0.35	0.34	0.34	0.34	0.348	0.31	0.29	0.28	0.29	0.29	0.290
Alex 63	0.49	0.46	0.43	0.44	0.41	0.446	0.46	0.42	0.39	0.41	0.41	0.418	0.38	0.35	0.34	0.38	0.340 .32	0.358	0.34	0.32	0.30	0.30	0.31	0.314
Madeer	0.41	0.38	0.35	0.36	0.38	0.376	0.38	0.37	0.35	0.37	0.37	0.368	0.35	0.31	0.30	0.33		0.322	0.31	0.29	0.28	0.28	0.28	0.288
Mean	0.45	0.41	0.38	0.40	0.39		0.423	0.393	0.366	0.38	0.386		0.366	0.336	0.326	0.350	0.333		0.320	0.30	0.280	0.290	0.293	
L.S.D. at 5% of: Tomato hybrids					0.016				0.018						0.016						0 04			
Potassium treatments					0.027				0.021						0.019						0.018			
interaction					0.071				0.082						0.078						0.044			
1996 season																								
Nema1400	0.47	0.45	0.39	0.44	0.44	0.438	0.44	0.41	0.40	0.43	0.41	0.418	0.39	0.37	0.34	0.36	0.34	0.360	0.34	0.30	0.27	0.33	0.29	0.306
Alex 63	0.49	0.46	0.43	0.43	0.45	0.452	0.43	0.42	0.39	0.41	0.41	0.412	0.38	0.36	0.33	0.33	0.32	0.344	0.34	0.32	0.28	0.27	0.29	0.30
Madeer	0.45	0.43	0.40	0.41	0.42	0.422	0.42	0.38	0.37	0.35	0.38	0.380	0.34	0.31	0.28	0.29	0.28	0.30	0.31	0.30	0.26	0.27	0.29	0.286
Mean	0.47	0.446	0.406	0.426	0.436		0.433	0.403	0.386	0.396	0.40		0.370	0.346	0.316	0.322	0.313		0.330	0.306	0.27	0.29	0.29	
L.S.D. at 5% of: Tomato hybrids					0.019				0.019						0.017						0.019			
Potassium treatments					0.029				0.023						0.021						0.03			
Interaction					0.082				0.088						0.068						0 059			

Table 7. The combined means of the pod length (cm) as influenced by year, location, genotypes of pea and their interactions.

Potassium Treatments Tomato hybrids	fruit lycopene pigment at harvest day						fruit lycopene pigment after 3 days						fruit lycopene pigment after 6 days						fruit lycopene pigment after 9 days					
	Control	K_2O at 48 Kg/fed	K_2O at 96 Kg/fed	K_2O at 2% solution	liqued K2O at 3%	Mean	control	K_2O at 48 Kg/fed	K_2O at 96 Kg/fed	K_2O at 2% solution	liqued K_2O at 3%	Mean	control	K_2O at 48 Kg/fed	K_2O at 96 Kg/fed	K_2O at 2% solution	liqued K2O at 3%	Mean	control	K_2O at 48 Kg/fed	K_2O at 96 Kg/fed	K_2O at 2% solution	liqued K_2O at 3%	Mean
1995 season																								
Nema1400	0.50	0.52	0.55	0.53	0.51	0.522	0.54	0.56	0.61	0.57	0.55	0.566	0.58	0.61	0.64	0.61	0.60	0.608	0.62	0.65	0.68	0.65	0.65	0.650
Alex 63	0.47	0.53	0.56	0.54	0.52	0.524	0.51	0.53	0.58	0.53	0.52	0.536	0.55	0.57	0.63	0.57	0.57	0.578	0.59	0.63	0.67	0.61	0.62	0.624
Madeer	0.54	0.57	0.59	0.57	0.55	0.564	0.57	0.58	0.62	0.58	0.58	0.586	0.59	0.61	0.64	0.59	0.58	0.602	0.65	0.68	0.69	0.68	0.66	6.72
Mean	0.503	0.54	0.566	0.546	0.526		0.54	0.556	0.603	0.560	0.55		0.573	0.596	0.636	0.59	0.583		0.620	0.653	0.680	0.646	0.643	
L.S.D at 5% of: Tomato hybrids					0.02				0.016						0.011						0.016			
Potassium treatments					0.04				0.009						0.015						0.009			
interaction					0.07				0.015						0.017						0.016			
1996 season																								
Nema1400	0.47	0.51	0.52	0.51	0.50	0.502	0.52	0.55	0.58	0.53	0.54	0.544	0.56	0.59	0.63	0.58	0.58	0.586	0.59	0.63	0.66	0.62	0.61	0.622
Alex 63	0.49	0.53	0.54	0.51	0.50	0.514	0.51	0.53	0.57	0.53	0.52	0.532	0.52	0.56	0.60	0.54	0.53	0.548	0.56	0.59	0.62	0.58	0.58	0.586
Madeer	0.49	0.53	0.59	0.51	0.51	0.526	0.55	0.57	0.61	0.54	0.57	0.572	0.58	0.60	0.63	0.60	0.59	0.60	0.63	0.64	0.67	0.64	0.64	0.644
Mean	0.483	0.523	0.55	0.51	0.503		0.526	0.550	0.586	0.540	0.543		0.55	0.580	0.620	0.573	0.566		0.593	0.620	0.650	0.613	0.610	
L.S.D. at 5% of: Tomato hybrids					0.03				0.019						0.014						0.0118			
Potassium treatments					0.07				0.012						0.013						0.014			
Interaction					0 08				0.022						0.019						0.019			

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تأثير مصادر وطرق التسميد البوتاسي علي الإنتاجية وصفات الثمار لبعض هجن الطماطم الجديدة

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أوضحت نتائج دراسة إستجابة ثلاثة من هجن الطماطم الجديدة وهي مادير الذي يمثل مجموعة التصنيع وألكس ٦٣ الذي يمثل مجموعة الإستهلاك الطازج وهجين نيما ١٤٠٠ ثنائي الغرض علي الإستجابة العالية لمعاملات التسميد البوتاسي وهي الإضافة للتربية بمستويين وهما ٤٨ و ٩٦ كيلو جرام بو٢أ للفدان ، الرش علي المجموع الخضري بإستخدام محلول ٢٪ من سلفات البوتاسيوم وسماد البوتاسيوم السائل "أكسيد البوتاسيوم" ٣٧٪ بنسبة ٣٪ مقارنة بالكنترول. وكانت أفضل المعاملات هي الإضافة الأرضية بمعدل ٩٦ كيلو جرام / للفدان.

وأوضحت الدراسة أنه لم توجد فروق معنوية بين إستخدام الإضافة الأرضية لسماد سلفات البوتاسيوم بمعدل ٤٨ كليو جرام بو٢أ للفدان والرش علي المجموع الخضري بإستخدام محلول سلفات البوتاسيوم ٢٪ أو البوتاسيوم السائل بتركيز ٣٪ وذلك علي التبكير وعقد الثمار ومحصول الثمار مباشرة بدون فاصل، وكانت نفس المعاملات هي الأفضل بالنسبة لصلابة الثمار ومحتواها من فيتامين ج والمواد الصلبة الذائبة الكلية وصبغة الليكوبين مع محتوي أقل من الحموضة والفقد في الوزن والتلف وذلك في الثمار الطازجة حتي ٦ أيام بعد الحصاد تحت ظروف الغرفة ثم بدأت في الإنخفاض بعد ذلك حتي اليوم التاسع.

بالإضافة إلي ذلك أوضحت النتائج الاستجابة العالية لهجين التصنيع عن الآخرين وكان هجين مادير الأفضل في التبكير والمحصول ومواصفات الثمار وأعلي صفات للحفظ.

وعليه يمكن القول بأن استخدام التسميد البوتاسي بمعدل ٩٦ كيلو جرام بو٢أ للفدان هام جداً للإنتاجية وصفات الحفظ لهجن الطماطم ويمكن تحت ظروف عدم توفره استخدام محلول سلفات البوتاسيوم بنسبة ٢٪ أو البوتاسيوم السائل "أكسيد البوتاسيوم ٣٧٪" بنسبة ٣٪ تحت ظروف الزراعة المصرية في الوقت الحاضر.