Effect of Spraying Moringa, Seaweed Extract and Potassium on Yield and Fruit Quality of the Winter Guava 'Maamoura' Cultivar

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ABSTRACT: This study was conducted during two successive seasons 2016 and 2017 on ten years old guava cv. Maamoura trees grown in private orchard located at Rasheed area, Beheira Governorate, Egypt.Guava trees grown at a distance of 4 x 4 m to study the effect of spraying moringa, seaweed extract and potassium on growth, yield and fruit quality of the winter guava Maamoura cultivar. The experiment was designed as randomized complete block design with five replicates. Each block contained 10 treatments as follow:control (spraying with water), foliar application of moringa leaf extract diluted to 10 times with water, foliar application of moringa leaf extract diluted to 20 times with water, foliar application of moringa leaf extract diluted to 30 times with water, foliar application of seaweed solution of a concentration at 1ml/ liter, foliar application of seaweed solution of a concentration at 2ml/ liter, foliar application of seaweed solution of a concentration at 3ml/ liter, foliar application of potassium K (1 %), foliar application of potassium K (2 %) and foliar application of potassium K (3 %). Results indicated that, moringa leaf extract diluted to 10 times with water gave the highest mean values of fruit set (%) and total soluble solid percentage, while, moringa leaf extract diluted to 10 times with water recorded the maximum (%) of fruit set and total soluble solid, also, foliar application of potassium K (3 %), gave the maximum values of fruit yield (kg/tree), yield (t/fed), fruit weight (g), fruit length (cm), fruit diameter(cm), fruit volume (cm^3), plup weight (g), juice (%), acidity (%), total sugar (%), reducing sugar (%) and non-reducing sugar (%) as compared with the control which gave the lowest mean values of the characters.

Keywords: guava, moringa, seaweed extract, potassium fertilizer, fruit set, yield, fruit quality.

INTRODUCTION

Guava (*Psidium guajava* L.) is one of the important sub-tropical fruit crop, which is also known as 'The apple of tropics' and a 'Poor man's fruit'. Guava is a rich source of ascorbic acid, pectin content and fair amount of calcium, phosphorus, iron and vitamin (Dutta *et al.,* 2009 and Lall *et al.,* 2017).

The fruits are highly nutritious, it has a rich source of vitamin 'C' after barbados cherry (1500 mg 100^{-1}g) and aonla (700 mg 100^{-1}g) and Vitamin 'C' content of fruits vary from 95.75 to 239.00 mg 100^{-1} g cultivars of guava (Singh *et al.,* 1976). Guava is the fifth important fruit crop after banana, mango, citrus and papaya with an area of 268 thousand hectares contribute to total annual production of 3668 million tons and with productivity of 13.70 tons per hectare (Anonymous, 2014). The world has become aware of environmental issue in recent years. Synthetic compounds are highly polluting, hazardous and much more costly. Researchers are working in the field of natural products extensively as they are less hazardous, low cost and easily available. The dependency on the use of inorganic fertilizers as a source of plant nutrients by farmers and their high cost is further associated with land and soil degradation and environmental pollution (Phiri, 2010).

Moringa oleifera (family: Moringaceae) is one of such alternatives, being investigated to ascertain its effect on growth and yield of crops and thus can be

promoted among farmers as a possible supplement or substitute to inorganic fertilizers (Phiri, 2010). In addition, fresh *Moringa oleifera* also content proteins, vitamins (such as A, B1, B2, B3, ascorbic acid and E), β carotene, amino acids phenolic compounds, sugars, and minerals (such as calcium, magnesium, sodium, iron, phosphorus and potassium) and several flavonoid pigments. Furthermore, ascorbic acid and foliar application have been reported to be growth and yield improving tools in various crops (Nagar *et al.,* 2006). So it is a good source of natural antioxidants (Jacob and Shenbagaraman, 2011).

Seaweed extracts contain a large number of organic and mineral compounds (micro- and macronutrients). They are particularly rich in phytohormones (indoleacetic acids (IAA), commonly known as auxins, gibberellic acids, cytokinins, abscisic acids (ABA) and ethylene), complex organic compounds, vitamins, simple and complex sugars (polysaccharides like alginates, laminarian and carragheenans), enzymes, N-containing compounds like betaines, proteins and amino acids, sterols (Du Jardin, 2012). Biologically active compounds in seaweed and seaweed extracts have confirmed positive effect on soil health (soil structure and moisture retention, effect on rhizosphere microbes), on plant growth and health (root development and mineral absorption, effect on shoot growth and photosynthesis, effect on crop yield, vegetative propagation) and resistance to environmental stresses (effects of seaweed concentrates in alleviating biotic and abiotic stress in crop plants) (Khan *et al*., 2009).

Potassium is a major element, which plays an important role in plants and significantly influence on many human-health related quality compounds in fruits and vegetables (Usherwood, 1985). It is involved in numerous biochemical and physiological processes vital to plant growth, yield, quality and stress (Cakmak, 2005). It resulted also in improving the fruit quality parameters i.e. total soluble solids, total sugars and coloration (Dutta, 2011). These effects might be dedicated to the potassium role in increasing tolerance to stresses and improving the formation and accumulation rates of sugars (Wahdan *et al*., 2011).Therefore, the present investigation was carried out to investigate the influence of the spraying *Moringa*, seaweed extract and potassium on fruit set, yield and fruit quality of the winter guava cv. 'Maamoura'.

MATERIALS AND METHODS

This study was carried out during two successive seasons 2016 and 2017 on ten years old guava cv. 'Maamoura' trees grown in private orchard located at Rasheed area, Beheira, Governorate, Egypt. Guava trees grown at a distance of 4 x 4 m to study the effect of spraying moringa, seaweed extract and potassium on fruit set, yield and fruit quality of the winter guava Maamoura cultivar.

Fertilizer types

All trees received the traditional and regular fertilization program, of which chemical fertilizers were potassium sulphate (50 % K_2O), as recommended dose. Potassium sulphate is added in three doses, the first at start growth season, the second dose was done at full bloom and the dose at month before the harvest (collected fruits yield).

Experimental design

The experiment was designed as randomized complete block design with five replicates. Each block contained 10 treatments.

The treatments can be illustrated as follows:

1. Control (water)
2. Foliar application of moringa leaf extract diluted to 10 times with water
3. Foliar application of moringa leaf extract diluted to 20 times with water
4. Foliar application of moringa leaf extract diluted to 30 times with water
5. Foliar application of seaweed solution of a concentration at 1ml/ liter
6. Foliar application of seaweed solution of a concentration at 2ml/ liter
7. Foliar application of seaweed solution of a concentration at 3ml/ liter
8. Foliar application of potassium K (1 %)
9. Foliar application of potassium K (2 %)
10. Foliar application of potassium K (3 %)

Preparation of moringa and seaweed extracts:

For preparation MLE, young shoots (leaves and tender branches) of moringa were brought from farm (clay soil) in Rosetta area and grinding with a pinch of water (1 L/10 kg fresh material) in a locally fabricated extraction machine. After sieving through cheese cloth the extract was centrifuged for 15 min. Various dilutions MLE10, MLE20 and MLE30 (diluted to 10, 20 and 30 times with water, respectively) of the extract were prepared with distilled water then used in experiments as foliar spray. For preparation SWE, three solutions with concentration at 1ml/ liter (SWE1), 2ml/ liter (SWE2) and 3ml/ liter (SWE3) of *Ascophyllum nodosum* composite were prepared then used in experiments as foliar spray. Foliar application of seaweed (15% concentration) was add at rate 1, 2 and 3ml/l. Potassium added as form of potassium sulphate (K_2SO_4).

Data recorded

A) Fruit set and Yield

Final fruit set (%)

Sixty days after flowering, final fruit set percentage was calculated in the same sequence mentioned above for the initial fruit set percentage according to this formula:

$$\text{Final fruit set (\%)} = \frac{No\ of\ \ fruitlets}{No\ of\ \ opened\ \ flowers} \text{X } 100$$

Yield:

At harvest time, yield of each treatment was recorded as yield weight/tree and yield weight/fed.

B) Physical fruit characteristics:

Sample of 10 fruits per tree from each replicate was collected randomly, i.e. 50 fruits for each of the applied treatment was picked randomly at harvest in both seasons, then transported quickly to the laboratory to determine physical and chemical fruit characteristics. Regarding the physical fruit characteristics, the following parameters were determined:

- Average fruit weight (g)
- Average fruit length (cm)
- Fruit diameter (cm)
- Fruit volume (cm^3)
- Pulp weight (g)
- Juice (%)

C) Chemical fruit characteristics:

Regarding the chemical fruit characteristics, samples of 10 fruits from each replicate tree i.e. 50 fruits for each of the applied treatment was picked randomly at harvest to determine the following parameters:

- Total soluble solids of fruit juice (TSS %): was used to determine the percentage of TSS by hand refractometer according to Chen and Mellenthin (1981).
- Total acidity (%): was determined as in fruit juice was measured according to Chen and Mellenthin (1981). Five milliliters from the obtained juice were used to determine the titratable acidity. The titratable acidity was expressed as grams citric acid/ 100 milliliters fruit juice.
- Total sugars (%): were determined in fresh fruit samples according to Malik and Singh (1980). Sugars were extracted from 5 gram fresh weight and determined by phenol sulfuric and Nelson arsenate –molybadate colorimetric methods for total and reducing sugars, respectively. The non-reducing sugars were calculated by difference between total sugars and reducing sugars.
- Vitamin C (mg/100 ml juice) the ascorbic acid content of the juice was determined by titration with 2, 6 dichloro phenol-indo-phenol (AOAC, 1985) and calculated as milli-grams per 100 ml of juice.

Statistical analysis:

Results of the measured parameters were subjected to computerized statistical analysis using MSTAT package for analysis of variance (ANOVA) and means of treatments were compared using LSD at 0.05 probability level according to Snedecor and Cochran (1990).

RESULTS AND DISCUSSION

A) Fruit set and yield

- **Fruit set (%)**

A perusal of data in Table (1) clearly indicates that significantly maximum fruit set percentage were found with moringa leaf extract diluted to 10 times with water (72.10 and 70.40 %), followed by foliar application of potassium K (3 %) (70.20 and 69.36 %), moringa leaf extract diluted to 20 times with water (70.10 and 68.30 %) and foliar application of seaweed solution of a concentration at 3ml/ liter (69.23 and 67.00 %), respectively, as compared with the control

treatment which recorded minimum fruit set percentage (55.50 and 53.06 %), during both seasons, respectively. The low fruit set in control treatment could be the result of less nutrient availability.

These results are agreement with those obtained by Reddy and Singh (2015) on mango, Thanaa *et al.* (2016) on apple, Kiran Kumar *et al*. (2017) on guava and Thanaa *et al.* (2017) on plum.

- **Yield (kg/tree)**

Data in Table (1) revealed that the fruit yield per tree ranged from 124.33 kg to 98.00 kg per tree in the first season and from 121.00 kg to 96.67 kg per tree in the second season, respectively. Significant maximum fruit yield per tree was recorded with foliar application of potassium K (3 %) (124.33 and 121.00 kg), followed by foliar application of potassium K (2 %) (120.00 and 117.67 kg), and foliar application of potassium K (1 %) (118.00 and 115.00 kg), respectively, significant minimum fruit yield per tree was obtained in control treatment (98.00 and 96.67 kg), during both experimental seasons

These results are in agreement with those obtained by Abd- El-Motty *et al.* (2010) and Sridhar and Rengasamy (2010).

- **Yield (t/fed)**

It is apparent from the data in Table (1) that the fruit yield ranged from 32.33 to 25.48 ton/fed in the first season and from 31.46 to 25.13 tonnes per feddan in the second season, respectively. Significant maximum fruit yield/fed. was found withfoliar application of potassium K (3 %) (32.33 and 31.46 t/fed.), followed by foliar application of potassium K (2 %) (31.20 and 30.59 t/fed), and foliar application of potassium K (1 %) (30.68 and 29.90 t/fed), respectively. Significant minimum fruit yield/fed was obtained in control treatment (25.48 and 25.13 t/fed). The results are directly correlated with fruit yield per tree. Similar results are in close conformity with the finding of Dutta *et al.* (2009) on guava. These results are in agreement with those obtained by Yeshitela *et al.* (2005) and Abd- El-Motty *et al.* (2010).

Table (1). Effect of moringa, seaweed extract and potassiumon fruit set and yield of 'Maamoura' guava during two successive seasons 2016 and 2017

Treatments	Fruits set (%)		Yield (kg/tree)		Yield (ton/fed)	
	2016	2017	2016	2017	2016	2017
Control	55.50 h	53.06 j	98.00 h	96.67 h	25.48 h	25.13 h
Moringa diluted to10 times	72.10 a	70.40 a	115.00 c	112.00 d	29.90 c	29.12 d
Moringa diluted to 20 times	70.10 b	68.30 c	113.00 cd	110.33 de	29.38 cd	28.69de
Moringa diluted to 30 times	65.00 f	64.03 h	105.67 f	102.67 f	27.47 f	26.69 f
Seaweed 1ml /L	61.00 g	60.20 i	103 .00 g	100.00 g	26.78 g	26.00 g
Seaweed 2ml /L	67.30 e	65.13 f	108.00 e	105.00 f	28.08 e	27.30 f
Seaweed 3ml /L	69.23 c	67.00 d	111.00 d	108.00 e	28.86 d	28.08 e
Potassium 1%	65.43 f	64.53 g	118.00 b	115.00 c	30.68 b	29.90 c
Potassium 2%	68.13 d	66.60 e	120.00 b	117.67 b	31.20 b	30.59 b
Potassium 3%	70.20 b	69.36 b	124.33 a	121.00 a	32.33 a	31.46 a
LSD (0.05)	**0.66**	**0.40**	**1.12**	**2.41**	**0.55**	**0.63**

Means not sharing the same letter (s) with each column are significantly different at 0.05 level of probabilty

B) Physical fruit characteristics

- **Average fruit weight (g)**

It is apparent from Table (2) that significantly maximum fruit weight was recorded under the treatment of foliar application of potassium K (3 %) (165.90 and 163.20 g.), followed by foliar application of potassium K (2 %) (162.47 and 159.97 g.) and foliar application of potassium K (1 %) (159.50 and 156.73 g.), respectively. While, significantly minimum fruit weight was observed under the control treatment (134.13 and 140.10 g.), during both seasons under this study. These results are in agreement with those obtained by Bhatia *et al.* (2001), Abd El–Hamied and El-Amary (2015) and Baiea *et al.*(2015)

- **Fruit length (cm)**

Data in Table (2) showed that significantly maximum fruit length was recorded under the treatment of foliar application of potassium K (3 %) (8.83 and 8.90 cm),followed by foliar application of potassium K (2 %) (8.70 and 8.67 cm) and foliar application of foliar application of seaweed solution of a concentration at 3ml/ liter (8.60 and 8.63 cm),as compared with the control treatment which recorded significantly minimum fruit length (7.00 and 7.00 cm),during both seasons (2016 and 2017).
These results are in agreement with those obtained by Maity *et al.* (2006)

- **Fruit diameter (cm)**

It is obvious from the data in Table (2) that significantly maximum fruit diameter was observed under treatment of foliar application of potassium K (3 %) (5.70 and 5.90 cm), followed by foliar application of seaweed solution of a concentration at 3ml/ liter (5.63 and 5.77 cm),respectively, while, the minimum fruit diameter was recorded under the control treatment (4.53 and 4.60 cm), during 2016 and 2017 seasons, respectively.

These results are in agreement with those obtained by Maity *et al.*(2006) and El-Tanany *et al.* (2011).

- **Fruit volume (cm^3)**

Data in Table (2) observed that significantly maximum volume of the fruit was noted in treatment of foliar application of potassium K (3 %) (163.33 and 160.40 cm^3),followed by foliar application of potassium K (2 %) (162.37 and 155.37 cm^3), respectively, while, significantly minimum fruit volume was recorded under the control treatment (139.67 and 138.30 cm^3), in the first and second seasons, respectively. The results are closely correlated with fruit weight as reported by Pereira and Mitra (1999) and Ram and Rajput (2000) on guava. These results are in agreement with those obtained by Maity *et al.* (2006) and Gill *et al.* (2012)

- **Pulp weight (g)**

Results in Table (2) revealed that application of spraying moringa, seaweed extract and potassium treatments, significantly maximum pulp weight was observed in foliar application treatmentof potassium K (3 %) (148.57 and 149.88 g), followed by foliar application of potassium K (2 %) (144.77 and 146.38 g), respectively, respectively, while, significantly minimum pulp weight was observed under the control treatment (122.13 and 122.10 g), during both seasons under this study. The results are closely correlated with fruit weight as also reported by Sharma (2004).These results are in agreement with those obtained by Maity *et al.* (2006)

- **Juice (%)**

Data in Table (2) revealed that significantly maximum juice percentage of fruit was recorded under the treatment of foliar application of potassium K (3 %) (89.55 and 91.84 %), followed by foliar application of potassium K (2 %) (89.11 and 91.51 %) and foliar application of moringa leaf extract diluted to 10 times with water(88.63 and 90.48 %), respectively, but they differed significantly as compared to control treatment which recorded the minimum juice percentage of fruit was observed under the control treatment (85.33 and 87.15 %) during both successive seasons. The results are closely correlated with fruit diameter as reported by Atom (2013) on guava. These results are in agreement with those obtained by El-Tanany *et al.* (2011).

Table (2). Effect of moringa, seaweed extract and potassiumon physical fruit characteristics of 'Maamoura' guava during two successive seasons 2016 and 2017

Treatments	Fruit weight (g)		Fruit length (cm)		Fruit diameter (cm)		Fruit volume (cm^3)	
	2016	2017	2016	2017	2016	2017	2016	2017
Control	134.13i	140.10j	7.00f	7.00e	4.53f	4.60e	139.67g	138.30i
Moringa diluted to10 times	156.10d	153.57d	8.60b	8.50bc	5.63a	5.77ab	151.17c	151.33d
Moringa diluted to 20 times	152.77e	150.60e	8.40c	8.41c	5.37bc	5.60b	149.50cd	148.10e
Moringa diluted to 30 times	145.73h	143.67h	8.00e	8.07d	4.90e	5.00d	141.33fg	140.37h
Seaweed 1ml /L	145.43h	142.10i	8.20d	8.33c	5.00de	4.90d	142.17fg	139.40hi
Seaweed 2ml /L	146.90g	144.57g	8.30cd	8.50bc	5.33bc	5.23c	144.00ef	141.93g
Seaweed 3ml /L	149.77f	147.30f	8.60b	8.63b	5.5ab	5.60b	146.33de	145.23f
Potassium 1%	159.50c	156.73c	8.30cd	8.40c	5.17cd	5.27c	155.27b	152.50c
Potassium 2%	162.47b	159.97b	8.70ab	8.67b	5.50ab	5.60b	162.37a	155.37b
Potassium 3%	165.90a	163.20a	8.83a	8.90a	5.70a	5.90a	163.33a	160.40a
L S D (0.05)	**0.53**	**0.32**	**0.15**	**0.19**	**0.21**	**0.21**	**3.20**	**1.26**

Means not sharing the same letter (s) with each column are significantly different at 0.05 level of probability

Table (3). Effect of moringa, seaweed extract and potassiumon physical fruit characteristics of 'Maamoura' guava during two successive seasons 2016 and 2017

Treatments	Pulp weight (g)		Juice (%)	
	2016	2017	2016	2017
Control	122.13j	122.10 j	85.33 g	87.15 g
Moringa diluted to 10 times	138.35d	138.95 d	88.63bc	90.48 d
Moringa diluted to 20 times	134.67e	136.08 e	88.15cd	90.36 d
Moringa diluted to 30 times	126.47h	128.30 h	86.78 ef	89.30 e
Seaweed 1ml /L	125.60 i	125.73 i	86.36 f	88.48 f
Seaweed 2ml /L	128.07 g	130.90 g	87.18 e	90.55 cd
Seaweed 3ml /L	132.70 f	133.65 f	88.60bc	90.73 c
Potassium 1%	140.07 c	141.80 c	87.82 d	90.47 d
Potassium 2%	144.77 b	146.38 b	89.11ab	91.51 b
Potassium 3%	148.57 a	149.88 a	89.55 a	91.84 a
LSD (0.05)	**0.71**	**0.40**	**0.48**	**0.23**

Means not sharing the same letter (s) with each column are significantly different at 0.05 level of probabilty

C) Chemical fruit characteristics

- **Total Soluble solids (TSS %)**

It is apparent from the Table (4) that significantly maximum total soluble solid percentage was observed in treatment of foliar application of moringa leaf extract diluted to 10 times with water (13.03 and 12.63 %), followed by foliar application of potassium K (3 %)(11.70 and 12.10 %) andfoliar application of seaweed solution of a concentration at 3ml/ liter (11.07 and 11.40 %), respectively, whereas significantly minimum TSS was observed under the control treatment (7.23 and 7.50 %), during both seasons, respectively. The increase in TSS might be due to accumulation of sugars and other soluble components from hydrolysis of protein and oxidation of ascorbic acid as reported by Pandey *et al.* (1990) on ber. These results are in agreement with those obtained by Abd El Moniem and Abd-Allah (2008) and Gill *et al.* (2012).

- **Acidity (%)**

It is obvious from the data in Table (4) that acidity percentage was found significantly minimum under the treatment of foliar application of potassium K (3 %)(0.24 and 0.22 %) followed by foliar application of potassium K (2 %)(0.26 and 0.28 %) and foliar application of potassium K (1 %)(0.28 and 0.30 %), respectively, while significantly maximum acidity percentage was noted under the control treatment (0.49 and 0.55 %), respectively, during 2016 and 2017 seasons under this stuudy. The application of inorganic fertilizers resulted in an overall increase in plant growth, fruit yield which reasonably can be explained with the fact that the application of organic and inorganic fertilizers might have helped in improving the soil physical, chemical and biological condition thereby, making the efficient and balanced nutrient availability for the fundamental processes of the plants. The present findings are in accordance with the report of Sharma (2004) in papaya and Atom (2013) in guava. These results are agreement with those obtained by Abd El-Fatah *et al.* (2008) and Khan *et al.* (2012).

- **Vitamin C (mg/ 100 ml juice)**

Data in Table (4) revealed that the ascorbic acid was significantly maximum under the treatment of foliar application of seaweed solution of a concentration at 3ml/ liter (207.07 and 196.13 mg/100 g f.w.) followed by foliar application of moringa leaf extract diluted to 10 times with water (203.03 and 193.13 mg/100 g f.w.), respectively, while, significantly minimum ascorbic acid was noted under control treatment T0 (170.10 and 168.63 mg/100 g f.w.). Enhancement in ascorbic acid might be ascribed due to optimum availability of nutrients in T2. The results are in close conformity with the report of Ram and Rajput (2000) in guava. These results are agreement with those obtained by Maity *et al.* (2006), Abd El-Fatah *et al.* (2008), Abd El Moniem and Abd-Allah (2008) and Khan *et al.* (2012).

- **Total sugars (%)**

It is evident from the data in Table (5) that significantly maximum total sugar percentage was recorded under the treatment of foliar application of potassium K (3 %)(7.73 and7.93 %) followed by foliar application of potassium K (2 %)(7.47 and7.43 %) and foliar application of moringa leaf extract diluted to

10 times with water (7.17 and 7.13 %), respectively, as compared to control treatment (7.47 and 7.43 %), which recorded the minimum total sugar percentage (5.13 and 5.27 %), during both seasons under this study. These results are in agreement with the findings of Sharma *et al.* (2009) and Atom (2013) in guava. These results are agreement with those obtained by Bhatia *et al.* (2001), Maity *et al.* (2006), Abd El Moniem and Abd-Allah (2008), Kassem *et al.* (2010), Gill *et al.* (2012) and Khan *et al.* (2012).

- **Reducing sugars (%)**

Data presented in Table (5) revealed that significantly maximum reducing sugar percentage was recorded under the treatment of foliar application of potassium K (3 %) (4.57 and 4.90 %) followed by foliar application of potassium K (2 %)(4.50 and 4.73 %) and foliar application of moringa leaf extract diluted to 10 times with water (4.40 and 4.70 %), respectively, as compared to control treatment which recorded minimum reducing sugar percentage (3.00 and 2.87 %), during both seasons, respectively. In view of the present findings, similar results have been obtained by Ram and Rajput (2000) on guava.
These results are in agreement with those obtained by Maity *et al.* (2006) and Khan *et al.* (2012).

- **Non-Reducing sugars (%)**

It is clear from the data in Table (5) that significantly maximum non-reducing sugar percentage was recorded under the treatment of foliar application of potassium K (3 %) (3.17 and 3.07 %) followed by foliar application of potassium K (2 %) (2.97 and 2.70 %) and foliar application of moringa leaf extract diluted to 10 times with water (2.77 and 2.53 %), respectively, as compared to control treatment which recorded minimum non-reducing sugar percentage (2.13 and 2.40 %), during 2016 and 2017 seasons, respectively.
These results are agreement with those obtained by Abd- El-Motty *et al.* (2010), Khan *et al.* (2012) and Baiea *et al.* (2015).

Table (4). Effect of moringa, seaweed extract and potassiumon chemical fruit characteristics of 'Maamoura' guava during two successive seasons 2016 and 2017

Treatments	T.S.S (%)		Total acidity (%)		Vitamin C (mg/ 100 ml juice)	
	2016	2017	2016	2017	2016	2017
Control	7.23j	7.50j	0.49a	o.55a	170.10j	168.63h
Moringa diluted to 10 times	13.03a	12.63a	0.32de	0.36d	207.07a	196.13a
Moringa diluted to 20 times	9.53e	10.80d	0.34cd	0.38cd	180.13e	178.17e
Moringa diluted to 30 times	8.20h	9.13g	0.36c	0.40c	175.47h	171.00g
Seaweed 1ml /L	7.90i	7.90i	0.47a	0.50b	178.23g	171.13g
Seaweed 2ml /L	9.13f	9.73f	0.41b	0.48b	183.53d	180.23d
Seaweed 3ml /L	11.07c	11.40c	0.30ef	0.33e	203.03b	193.13b
Potassium 1%	8.67g	8.77h	0.28fg	0.30f	178.53f	171.10g
Potassium 2%	10.10d	10.27e	0.26gh	0.28f	173.57i	175.13f
Potassium 3%	11.70b	12.10b	0.24h	0.22g	193.00c	183.57c
LSD (0.05)	**0.26**	**0.23**	**0.03**	**0.03**	**0.24**	**0.26**

Means not sharing the same letter (s) with each column are significantly different at 0.05 level of probability

Table (5). Effect of moringa, seaweed extract and potassiumon chemical fruit characteristics of 'Maamoura' guava during two successive seasons 2016 and 2017

Treatments	Total sugars (%)		Reducing sugars (%)		Non- reducing sugars (%)	
	2016	2017	2016	2017	2016	2017
Control	5.13i	5.27 h	3.00d	2.87f	2.13g	2.40bcd
Moringa diluted to 10 times	7.17c	7.13c	4.40a	4.60bc	2.77bc	2.53bc
Moringa diluted to 20 times	6.63d	6.80d	4.13b	4.47c	2.50de	2.33cde
Moringa diluted to 30 times	5.40h	5.53g	3.30c	3.43e	2.10g	2.10de
Seaweed 1ml /L	5.23hi	5.77g	3.00d	3.70d	2.23fg	2.07e
Seaweed 2ml /L	6.07f	6.10f	3.37c	3.70d	2.70cd	2.40bcd
Seaweed 3ml /L	6.33e	6.47e	3.20cd	3.80d	3.13a	2.67b
Potassium 1%	5.70g	5.67	3.30c	3.50e	2.40ef	2.17de
Potassium 2%	7.47b	7.43b	4.50a	4.73ab	2.97ab	2.70b
Potassium 3%	7.73a	7.93a	4.57a	4.90a	3.17a	3.03a
L S D (0.05)	**0.25**	**0.24**	**0.20**	**0.17**	**0.25**	**0.28**

Means not sharing the same letter (s) with each column are significantly different at 0.05 level of probabilty

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الملخص العربي

تاثير رش مستخلص المورينجا وأعشاب البحر والبوتاسيوم علي المحصول وجودة ثمار الجوافة الشتوي صنف "معمورة"

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***طالب دراسات عليا

أجريت هذه الدراسة خلال موسمين متتاليين ٢٠١٦ و٢٠١٧ على أشجار جوافة عمرها عشر سنوات صنف المعمورة النامية في منطقة – رشيد (محافظة البحيرة) ، مصر. أشجار الجوافة مزروعة على مسافة ٤ × ٤ متر لدراسة تأثير رش مستخلص المورينجا وأعشاب البحروالبوتاسيوم علي نمو ومحصول وجودة ثمار الجوافة الشتوي صنف معمورة. تم تصميم التجربة على أنها تصميم القطاعات العشوائية الكاملة بخمس مكررات. يحتوي كل قطاع على ١٠ معاملات الكنترول (الرش بماء الصنبور)، الرش بمستخلص اوراق المورينجا عند تخفيف ١٠ مرات (بطريقةحجم/حجم كنسبة مئوية)، الرش بمستخلص اوراق المورينجا عند تخفيف ٢٠ مرة (بطريقة حجم/حجم كنسبة مئوية)، الرش بمستخلص اوراق المورينجا عند تخفيف ٣٠ مرة (بطريقة حجم/ حجم كنسبة مئوية)، الرش بمستخلص الأعشاب البحرية بتركيز ١ملل/ لتر، الرش بمستخلص الاعشاب البحرية بتركيز ٢ ملل/ لتر، الرش بمستخلص الاعشاب البحرية بتركيز ٣ ملل/ لتر، الرش بالبوتاسيوم بتركيز١%، الرش بالبوتاسيوم بتركيز٢ %، الرش بالبوتاسيوم بتركيز٣%.أظهرت النتائج أن مستخلص أوراق المورينجا عند تخفيف ١٠ مرات أعطي أعلى متوسط قيم للنسبة المئوية لكل من العقد و نسبة المواد الصلبة الذائبة الكلية مقارنة ببقية المعاملات الآخري والكنترول، أيضاً أعطي الرش بمستخلص الأعشاب البحرية بتركيز ٣ملل/ لتر أعلي القيم لمحتوي فيتامين سي ومن ناحية أخرى، وجد ان الرش بالبوتاسيوم بتركيز٣% أعطي أعلي القيم لكل من المحصول/شجرة (كجم)،المحصول الكلي (طن/فدان)، أقصي قيم للصفات الطبيعية للثمار (وزن ، طول، قطر، حجم الثمرة، وزن اللحم، النسبة المئوية لكل من العصير، الحموضة الكلية ،السكريات الكلية والمختزلة وغير المختزلة) مقارنة بالكنترول وغيرها من المعاملات الأخرى خلال كلا الموسمين ٢٠١٦، ٢٠١٧، على التوالي.