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Improving Mango Productivity by Spraying Some Natural Extracts and Adding Humic Under the Conditions of Newly Reclaimed Lands

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ABSTRACT

This work was carried out through 2019 and 2020 seasons on "Keitt" Mango (*Mangifera indica* L.) of 10- years old, grown in sandy soil and planted at 2x3 meters apart under drip irrigation system at private orchard located on Cairo-Alexandria desert road 58 km from Cairo, Egypt. The aim of this research is to study the effect of seven spraying treatments (T_1:Control - T_2: alga extract 2 g.l^{-1} - T_3: alga extract 4 g.l^{-1} - T_4: dry yeast 5 g.l^{-1} - T_5:dry yeast 10 g.l^{-1} – T_6: liquorice root extract 5 g.l^{-1} –T_7: liquorice root extract 10 g.l^{-1}) with three humic acid application (H_1: 0 treatment , H_2: 20 g/tree/season and H_3: 40 g/tree/season) as a soil treatments on yield and fruit quality in a factorial experiment. The obtained results cleared that all treatments led to a significant improvement in vegetative growth, yield and quality characteristics of mango fruits. Spraying algae extract 4 ml/liter gave the highest results in most of the studied characters in both seasons compared to the rest of the spraying treatments. It was also found that the addition of humic acid led to improved growth and increased fruiting as well as natural and chemical properties of fruits during the two seasons of the study, as the treatment of 40 g / tree was better than 20 g / tree in all studied traits. Moreover, T_3 with H_3 gave the highest leaf area, total chlorophyll, yield and fruit quality.

Keywords: Mango Keitt, alga extract, liquorice root extract, dry yeast, yield, fruit quality.

1. Introduction

Mango (*Mangifera indica* L.) is a very important tropical fruit, cultivated in several tropical and subtropical regions, and its distribution in world trade is expanding. It grows under a wide range of climatic and soil conditions. In Egypt, mango ranks the third after citrus and grapes. Keitt mangoes CV. is cultivated widely in the newly reclaimed area especially. The main problems of the soil in the newly reclaimed area are poor structure, low availability of water and nutrients and low fertility.

Algae extract has a positive effect on growth (Jaswant *et al.,* 1994 and Hegab *et al.,* 2005). Algae extract as a new biofertilizer containing N, P, K, Ca, Mg, and S as well as Zn, Fe, Mn, Cu, Mo, and Co, some growth regulators, polyamines and vitamins applied to improve nutritional status, vegetative growth in different orchard such as vineyards (Eman and Abd-Allah, 2008; Elham, *et al.,* 2010). Chouliaras *et al.* (2009) recommended the combination of NH_4NO_3 + borax + seaweed extract in order to improve growth and nutrition status of Koroneiki olive trees. Mansour *et al.,* (2006), investigated the impact of algae extract application to Anna apple trees and found that it was very effective in stimulating the leaf mineral content.

The dry bread yeast (*Saccharomyces cerevisiae*) is a kind of the used biofertilizers for soil or for foliar application on the shoots of vegetable crops (El-Ghamriny *et al.,* 1999) to improve growth of fruit crops (Subba Rao, 2008 and Nijjar, 1985). This is due to its content of many nutrient elements protein, large amount of vitamin B and being productive compounds of semi growth regulators compounds like auxins, gibberellins and cytokinins (Glick, 1995). Moreover, it use also as a natural bio-stimulant appeared to induce an astonished influence on growth of many crops, since it has various basic function, i.e. CO_2 production as well as formation of alcohol, acids and esters (Magoffin and Hoseney, 1974). In addition, (Idso *et al.,* 1995 and Hashem *et al.,* 2008) added that application of active dry yeast was very

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effective in releasing CO_2 which reflected on improving net photosynthesis. Active dry yeast at 0.1 % caused a striking improvement in growth of the berries for Red roomy grapes (Ahmed *et al.,* 1997). In apple, dry yeast was very effective in improving leaf area and nutritional status of the trees. (Mansour, 1998). In Valencia orange trees, spraying active dry yeast at 0.25 to 0.75% on March or / and August was favorable in improving growth, fruit weight and volume (Hegab *et al.,* 1997, 2005). However, Elham *et al.* (2010) showed that spraying mango trees with algae at 2% combined with yeast at 0.2% increased fruit length (cm), fruit width (cm), fruit weight (g), this treatment improved nitrogen and potassium contents in the leaves. On the other hand, all treatments had no effect on leaf phosphorus percentage.

Nowadays, a great attention is focused on the possibility of using natural and safe agents for promoting growth and yield of fruits trees. Licorice, (*Glycyrrhiza glabra*) family Leguminoseae, is a plant which grows in Egypt and some other countries of the world. Its roots possess some nutritive value and medicinal properties. So, widely are used as a cold beverage, and in preparing some pharmaceutical agents (Fenwick *et al.,* 1990). The licorice extract contains more than 100 various compounds, some of which accumulated in large amounts, which most important of them are triterpene saponins (including glycyrrhizin) and phenolic compounds (Shibata, 2000; Shabani *et al.,* 2009). In addition, licorice extract contain protein and amino acid (Asparagin), monosaccharide (glucose, fructose, sucrose and maltose), lignins, tannins, starch, choline, phytosterols, different types of vitamins such as B1, B2, B3, B6, C, E, biotin, folic acid, pantothenic acid, many mineral compounds (aluminum, calcium, iron, magnesium, cobalt, zinc, phosphorus, sodium, silicone, potassium and stannous) and bitter principles (Fukai *et al.,* 1998; Arystanova *et al.,* 2001). In addition, Qaraghouli and Jalal, (2005) found that spraying Anna apple trees with licorice and garlic extracts gave the highest value in yield and fruit quality. On the other hand, licorice extract is improving all growth parameters. Hussein, (2008) found that spraying date palm with licorice extract at 5g/L. increased the fruit quality.

The organic matter is crucial for maintaining soil fertility adjusting soil pH, and increasing solubility of elements. Which have positive impact on encouraging proliferation of soil microorganisms, increasing microbial population and activity of microbial enzymes i.e. dehydrogenize, urease and nitrogenase (Abou-Hussein *et al.,* 2002). Humic acid and fulvic acid are essential in soil organic matter. In addition, the nature stability of these substances affects carbon and nitrogen cycles and carbon sequestration. Moreover, it can ameliorate the negative effect of salt that would inhibit the plant growth and the uptake of nutrient elements (Casierra-Posada *et al.,* 2009).

Humic acid is a product contains many elements which improve the soil fertility and increase the availability of nutrient elements and consequently, affect positively plant growth and yield (El-Sharkawy and Abdel-Razzak, 2010). Humic acid is the most significant component of organic substances in equates system. Humic substances function to buffer the hydrogen ion concentration (pH) of the soil (Mecan and Petrovic 1995). Davis and Ghabbour (1998) indicated that humic acid improved soil structure, organic matter, nutrient uptake, root development and microbial activity. Many investigators reported that, application of humic substances led to a remarkable increment in soil organic matter which improved soil characteristics, plant growth and increase crop production (Mahmoud and Hafez, 2010). The role of these organic fertilizers is improving growth, chlorophyll content, enhancing photosynthesis and increasing tissue content of N (Hussein *et al.,* 2005). In addition, El Kheshin (2016) stated that humic acid may enhance positively the transplant's ability for nutrient uptake that led to produce healthy mango transplants which reflect increasing in leaves as a natural result for healthy transplants and improving vegetative growth and yield. Hassan (2016) cleared that application of humic acid at 20 ml/tree improved tree growth in terms of shoot length, leaves number/shoot, leaf area, and increased yield as kg/tree, number of fruits per tree, fruit quality as weight, volume and TSS content. In addition, he noticed decrease in the acidity of the Egyptian lime trees. Tahira, *et al.* (2013) mentioned that humic acid application to kinnow mandarin trees gave significant positive effect on total chlorophyll contents. Omima (2013) cleared that, applications of 60 g humic acid/ tree to the soil of Aggizy olive orchard gave the best effect on leaf area, total chlorophyll, yield, fruit quality and gave the lowest acidity percentage.

The aim of this study was to investigate the influence of spraying some extract and adding humic acid to the soil to improve the yield and fruit quality characters of mango fruits cv. Keitt".

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2. Material and Methods

This study was carried out during two successive seasons 2019 and 2020 on 63 Keitt mango trees *(Mangifera indica* L) of 10- years old, budded on mango Sukkary seedlings as rootstocks, grown in sandy soil (Table 1 a, b some physical and chemical properties) in a private farm located at desert Cairo – Alex, road. The trees in this experiment planted at 2×3m spacing and irrigated by drip irrigation system.

Table 1: Some physical and chemical properties of the experimental soil.

(a) Physical analysis

Soil Depth (cm)	Particle size distribution				Texture class	Bulk Density (g/cm)	Organic matter (%)	Moisture content (%)	
	Coarse sand	Fine sandy	Silt	Clay				Field Capacity	Wilting Point
0-30	0.00	97.50	1.50	1.00	Sand	1.52	0.20	9.21	4.44
30-60	0.00	98.00	1.40	0.60	Sand	1.56	0.19	8.88	4.49

(b) Chemical analysis

Soil Depth cm	$CaCO_3$	pH Soil past	E.Ce (dSm^{-1})	Soluble cations (meq/l^{-1})				Soluble anions (meq/l^{-1})			
				Ca^{++}	K^{+}	Na^{+}	Mg^{++}	Cl^{-}	$SO_4^{=}$	HCO_3^{-}	$CO_3^{=}$
0-30	4.1	7.1	1.74	3.1	1.5	11	1.8	9.5	6.8	1.1	-
30-60	4.2	7.1	1.57	2.8	1.4	10.2	1.3	8.5	6	1.2	-

The selected trees were uniform in vigor as possible. Fertilization program and other agricultural practices were the same for all trees. The Experiment was designed as a split plot design arranged in factorial experiment with three replicates for each treatment and each replicate was represented by one tree, seven spraying treatments was assigned in the main plot (T_1:Control - T_2: alga extract 2 $g.l^{-1}$ - T_3: alga extract 4 $g.l^{-1}$ - T_4: dry yeast 5 $g.l^{-1}$ - T_5:dry yeast 10 $g.l^{-1}$ – T_6: liquorice root extract 5 $g.l^{-1}$ –T_7: liquorice root extract 10 $g.l^{-1}$). All treatments added three times, the first added when growth started, the second was after full bloom and the last added three weeks later after setting. Humic acid application was assigned in the sub main plot with three treatments i.e. with three humic acid application (H_1: 0 treatment, H_2: 20 g/tree/season and H_3: 40 g/tree/season). Triton B at 0.1 % used as a diffuser with all treatments to spray solution including the control "tap water ".

2.1. Algae extract formulation

Algae extract (oligo-x) obtained from (union for agricultural development) company having the following composition in Table (2).

Table 2: The physicochemical properties of Algae

Oligosaccharide %	Alginic acid %	Phytin %	Menthol %	Natural growth regulators		
				Cytokinin %	Indol Acetic acid%	Pepsin %
3	5	0.003	0.001	0.001	0.0002	0.02

Minerals					
K oxide %	P oxide %	N %	Zn %	Fe %	Mn %
12	0.5	1	0.3	0.2	0.2

Yeast extract was prepared by Spencer *et al.* (1983) described to which allowed yeast cells (pure dry yeast) to grow and multiply efficiently during conducive aerobic and nutritional conditions which, in turn, allow to produce beneficial bio constituent (carbohydrates, sugars, proteins amino acids, fatty acids, hormones, etc.). Then these constituents could be released out of yeast cells in readily form by two cycles of freezing and thawing for disruption of yeast cells and releasing their contents. Extract Mahmoud, (2001) were presented in table (3).

Table 3: Chemical composition of dry yeast

Protein	47%	**Nucleic acids**	8%
Carbohydrates	33%	**Lipids**	4%
Minerals	8%		
Approximate composition of vitamins (mg/g):			
Thiamine	6-100	**Biotin**	1.3
Riboflavin	35-50	**Cholin**	4000
Niacin	300-500	**Folic acid**	5-13
Pyridoxine HCl	28	**Vit-B12**	0.001
Pantothenate		70	
Approximate composition of minerals (mg/g):			
Na	0.12	**Cu**	8.00
Ca	0.75	**Se**	0.10

The aqueous extract of licorice roots (*Glycyrrhiza glabra*) having the following composition in Table (4) were prepared by boiling (5g or 10g) in one liter of distilled water for 15 minutes. The solution filtered by wringing using a mutton cloth. The obtained extract re-filtered through Whatman No. 2 filter paper and completed by distilled water to one liter.

Triton B at 0.1 % used as wetting agents with all treatments expect with *Glycyrrhiza glabra* extract that contain saponin triterpenes.

Table 4: The physicochemical properties of Licorice extracted

Reducing sugar	**Non-Reducing sugar**	**Humidity**	**Starch**	**Ash**	**Glycyrrhizic acid**		
3.23%	10.27%	5.88%	4.76%	10.55%	26%		
GA_3	**Na**	**P**	**K**	**Ca**	**Mg**	**Fe**	**Zn**
	mg/g						
0.63%	600	540	1235	560	280	33	3.6

The following parameters were measured for both seasons:

2.2. Leaf area (cm^2): was measured using leaf area meter.

2.3. Average total chlorophyll content: leaves were tested at the end of August in field using Minolta meter SPAD-502.

2.4. Productivity

2.4.1. No. of fruits/tree and yield kg/tree

At harvest date, mid-October of each season, number of full, matured fruits per tree was counted to determine total yield per tree as follow fruit yield kg/tree = number of fruit/tree X fruit weight per g/1000.

2.4.2. Fruit quality

A sample of three fruits from each replicate was taken for measuring the following fruit quality parameters.

2.4.3. Fruit physical and chemical properties

Average fruit weight (g), fruit length (cm), fruit diameter (cm), fruit volume (cm^3) were recorded. Fruit shape index, fruit pulp percentage, peel percentage, seed percentage and pulp seed ratio were calculated.

Furthermore, total sugar (%), reducing sugar (%), total soluble solids (T.S.S.) was determined by hand refractometer, total acidity in fruit juice (expressed as citric acid per 100 ml juice) was determined by titrating with 0.1 N sodium hydroxide in the presence of phenolphthalein and ascorbic acid (mg ascorbic acid/100 ml juice) according to A.O.A.C. (1995). TSS/ Acid ratio was calculated by divided TSS on acidity. The obtained data were statistically analyzed according to Snedecor and Cochran (1990). Duncan's Multiple Range test effect was used to compare treatment means Duncan (1955).

3. Results and Discussion

3.1. Leaf area and total chlorophylls

Data presented in Table (5) reveal that leaf area (cm^2) and total chlorophyll were significantly affected by spraying treatments in both seasons. T_3 recorded the highest significant leaf area (cm^2) and total chlorophyll in both seasons.

On the other hand, the three humic level significantly affected the leaf area (cm^2) and total chlorophyll in both seasons. H_3 had the highest significant effect to increase leaf area (cm^2) and total chlorophyll compared with other two level used.

Furthermore, leaf area (cm^2) and total chlorophyll were varied significantly as influenced by the interaction between different spraying extracts and humic acid treatments. T_3 with H_3 gave the highest leaf area (cm^2) and total chlorophyll comparing with other interactions under study. On the other hand, the tree without spraying and humic acid gave the lowest significant leaf area (cm^2) and total chlorophyll.

This result may be due to that alga extract as a new biofertilizer containing more of chemical elements, some growth regulators, polyamines and vitamins applied to improve nutritional status, vegetative growth in different orchard such as vineyards (Eman, & Abd-Allah, 2008, Elham, *et al.,* 2010). Humic acid is a product contains many elements which improve the soil fertility and increase the availability of nutrient elements and consequently, affect positively cabbage plant growth (El-Sharkawy and Abdel-Razzak, 2010).

These results are parallel with those of Chouliaras *et al.,* (2009) recommended the combination of NH_4NO_3 + borax + seaweed extract in order to improve olive trees growth and nutrition status. Jaswant *et al.,* (1994) and Hegab *et al.,* (2005) Sayed that algae extract has a positive effect on growth. In addition, Sheren (2014a) found that spraying mango with algae and yeast gave the best leaf area, leaf chlorophyll of Sukkary mango trees.

Table 5: Effect of spraying some natural extracts and addition humic acid to the soil on leaf area (cm^2) and total chlorophyll of Keitt mango trees in 2019 and 2020 seasons.

Treatment*	1st Season				2nd Season			
	H_1	**H_2**	**H_3**	**Mean**	**H_1**	**H_2**	**H_3**	**Mean**
				Leaf area (cm^2)				
T_1	64.1 f	64.6 f	66.5 f	**65.1 F**	65.1 l	71.3 k	74.4 j	**70.3 F**
T_2	76.5 b-d	76.7 b-d	77.5 b-d	**76.9 BC**	80.4 g-i	85.3 b-e	87.8 b	**84.5 B**
T_3	77.4 b-d	78.8 b	82.9 a	**79.7 A**	82.3 e-i	87.5 bc	90.2 a	**86.7 A**
T_4	70.2 e	74.9 b-d	76.5 b-d	**73.9 E**	79.8 hi	81.0 f-i	82.2 e-i	**81.0 E**
T_5	73.4 d	75.5 b-d	76.5 b-d	**75.1 D**	81.4 f-i	83.3 d-h	83.7 d-g	**82.8 CD**
T_6	74.4 cd	75.1 b-d	77.5 b-d	**75.7 CD**	79.2 i	81.9 e-i	84.5 c-f	**81.9 DE**
T_7	75.9 b-d	77.9 bc	78.8 b	**77.5 B**	81.2 f-i	83.1 d-h	86.3 b-d	**83.5 BC**
Mean	**73.1 C**	**74.8 B**	**76.6 A**		**78.5 C**	**81.9 B**	**84.2 A**	
				Leaf total chlorophyll				
T_1	45.2 h	46.0 h	47.4 h	**46.2 F**	44.5 j	49.5 i	51.1 hi	**48.3 E**
T_2	56.9 c-f	57.1 c-f	61.1 bc	**58.4 B**	61.0 c-e	62.6 b-d	64.3 bc	**62.7 B**
T_3	60.3 b-d	62.9 b	65.9 a	**63.1 A**	62.4 b-d	66.2 b	70.3 a	**66.3 A**
T_4	51.2 g	52.8 fg	54.3 e-g	**52.8 E**	52.6 g-i	56.0 e-g	58.5 d-f	**55.7 D**
T_5	52.5 fg	53.6 fg	56.5 c-f	**54.2 DE**	54.8 f-h	57.4 d-f	59.6 c-e	**57.3 D**
T_6	52.9 fg	55.6 d-g	57.4 c-f	**55.3 CD**	56.9 ef	60.9 c-e	62.3 b-d	**60.0 C**
T_7	55.1 e-g	55.7 d-g	59.0 b-e	**56.6 C**	60.2 c-e	62.3 b-d	66.5 b	**63.0 B**
Mean	**53.5 C**	**54.8 B**	**57.4 A**		**56.1 C**	**59.3 B**	**61.8 A**	

Means followed by the same letter (s) within each row, column or interaction are not significantly different at 5% level.
*(T_1: Control - T_2: alga extract 2 $g.l^{-1}$ - T_3: alga extract 4 $g.l^{-1}$ - T_4: dry yeast 5 $g.l^{-1}$ - T_5:dry yeast 10 $g.l^{-1}$ – T_6: liquorice root extract 5 $g.l^{-1}$ –T_7: liquorice root extract 10 $g.l^{-1}$) and Humic acid application (H_1: 0, H_2: 20 g/tree/season and H_3: 40 g/tree/season).

3.2. No. of fruits/tree, fruit weight (g) and yield kg/tree

Table, 6 show that spraying treatments were significantly affected to improve number of fruits /tree, fruit weight (g) and yield kg/tree. Meanwhile, the highest number of fruits /tree, fruit weight (g) and yield kg/tree were achieved by T3 followed by T2 and T7 in both seasons.

Elham, *et al.,* (2010) found that the increment in yield either as number of fruits may explained due to the positive effect of spraying algae extract on fruit yield. Also these results was in an agreement with Abada (2002) and Fornes *et al.,* (2002) who reported that yield of grape and orange were increased by yeast and algae extracts. In addition, the effect of spraying alga extract and liquorice root extract may be attributed to hormone production Mohamed and El- Sehrawy (2013), Shakir and Al-Rawi 2017) and Sheren (2014a,b) found that spraying mango with algae and yeast gave the best umber of fruits, weight and yield. Also, Gattass *et al.,* (2018) reported that spraying Keitt mango trees with NAA, GA3, CPPU increasing fruit retention and tree yield.

Table 6: Effect of spraying some natural extracts and addition humic acid to the soil on number of fruits/ tree, fruit weight (g), and yield/tree (kg) of Keitt mango trees in 2019 and 2020 seasons.

Treatment	1st Season				2nd Season			
	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean
				No. of fruits/ tree				
T_1	29.0 i	30.7 hi	31.0 hi	**30.2 E**	27.3 j	29.3 i	31.0 hi	**29.2 E**
T_2	34.0 fg	42.7 bc	44.0 ab	**40.2 B**	38.0 ef	45.7 c	48.3 b	**44.0 B**
T_3	39.0 de	44.0 ab	46.3 a	**43.1 A**	43.0 d	49.7 b	52.0 a	**48.2 A**
T_4	32.0 gh	35.3 f	38.3 e	**35.2 D**	31.7 gh	36.0 f	41.0 d	**36.2 D**
T_5	32.7 gh	35.3 f	40.7 cd	**36.2 C**	33.7 g	37.0 ef	43.3 d	**38.0 C**
T_6	32.3 gh	35.7 f	42.3 bc	**36.8 C**	33.0 gh	39.0 e	43.3 d	**38.4 C**
T_7	33.3 f-h	42.7 bc	44.3 ab	**40.1 B**	34.0 g	46.3 c	49.7 b	**43.3 B**
Mean	**33.2 C**	**38.0 B**	**41.0 A**		**34.4 C**	**40.4 B**	**44.1 A**	
				Fruit weight (g)				
T_1	337.7 h	431.2 g	450.5 g	**406.5 E**	375.8 f	425.9 e	430.6 e	**410.7 D**
T_2	484.5 ef	536.2 bc	553.0 b	**524.6 B**	475.1 b-e	507.6 b-d	517.2 b	**500.0 B**
T_3	528.4 b-d	546.8 bc	581.7 a	**552.3 A**	499.9 b-d	516.8 b	566.4 a	**527.7 A**
T_4	450.5 g	499.3 de	528.1 b-d	**492.6 D**	444.0 de	477.8 b-e	485.7 b-e	**469.1 C**
T_5	460.4 fg	510.4 c-e	530.7 b-d	**500.5 CD**	471.8 b-e	478.6 b-e	500.9 b-d	**483.8 BC**
T_6	455.8 fg	522.4 b-d	535.3 bc	**504.5 B-D**	447.1 c-e	479.2 b-e	505.4 b-d	**477.2 C**
T_7	463.9 fg	537.5 bc	560.1 ab	**520.5 BC**	474.6 b-e	513.2 bc	528.8 b	**505.5 B**
Mean	**454.5 C**	**512.0 B**	**534.2 A**		**455.5 C**	**485.6 B**	**505.0 A**	
				Yield/tree (kg)				
T_1	9.8 k	13.2 j	14.0 ij	**12.3 E**	10.3 k	12.5 j	13.4 ij	**12.0 E**
T_2	16.5 f-i	22.9 b-d	24.3 bc	**21.2 B**	18.0 fg	23.2 cd	25.0 bc	**22.1 B**
T_3	20.6 de	24.0 bc	27.0 a	**23.9 A**	21.5 de	25.7 bc	29.5 a	**25.5 A**
T_4	14.4 ij	17.6 f-h	20.3 de	**17.4 D**	14.1 ij	17.2 f-h	19.9 ef	**17.1 D**
T_5	15.1 h-j	18.0 e-g	21.6 cd	**18.2 CD**	15.9 g-i	17.7 f-h	21.7 de	**18.4 C**
T_6	14.7 ij	18.6 ef	22.7 b-d	**18.7 C**	14.8 h-j	18.7 fg	21.9 de	**18.5 C**
T_7	15.5 g-j	22.9 b-d	24.8 b	**21.1 B**	16.2 g-i	23.8 b-d	26.2 b	**22.1 B**
Mean	**15.2 C**	**19.6 B**	**22.1 A**		**15.8 C**	**19.8 B**	**22.5 A**	

Means followed by the same letter (s) within each row, column or interaction are not significantly different at 5% level. *(T_1: Control - T_2: alga extract 2 g.l^{-1} - T_3: alga extract 4 g.l^{-1} - T_4: dry yeast 5 g.l^{-1} - T_5:dry yeast 10 g.l^{-1} – T_6: liquorice root extract 5 g.l^{-1} –T_7: liquorice root extract 10 g.l^{-1}) and Humic acid application (H_1: 0, H_2: 20 g/tree/season and H_3: 40 g/tree/season).

Moreover, humic acid improved fruit number/tree, fruit weight (g) and yield kg/tree as compared with untreated trees in both seasons. Generally H_3 soil application recorded the most influenced treatment in this respect.

The obtained data go in line with those reported by Patel *et al.,* (2019) who mentioned that humic acid 1.5% was found beneficial to increases number of fruits/tree and fruit yield in mango CV. Amrapali. This result may be due to that humic acid is a product contains many elements which improve the soil fertility and increase the availability of nutrient elements and consequently, affect positively on yield of cabbage plants (El-Sharkawy and Abdel-Razzak, 2010).

However, the interaction between different spraying extracts and humic acid treatments proved that T_3 with H_3 gave the highest significant effect on fruit number/tree, fruit weight (g) and yield kg/tree. Meanwhile, the other treatments gave intermediate values of number of fruits/tree and yield kg/tree.

3.3. Fruit length (cm), fruit diameter (cm), fruit volume (cm^3) and fruit shape index

The results presented in (Table 7) showed that the enhancement in fruit length, fruit diameter, fruit volume and fruit shape index related with all spraying treatments as compared with control in both seasons.

Furthermore, it seems from our results that the humic acid treatments increased the fruit length, fruit diameter, fruit volume and fruit shape index significantly.

Moreover, the combination between spraying treatments and humic acid application caused a significant positive increase in fruit length, fruit diameter, fruit volume and fruit shape index in both seasons. T_3 with H_3 exceeded other combinations in this respect.

These results are in harmony with those reported by Elham, *et al.* (2010) who showed that spraying Keitte mango trees once at full bloom with algae at 2% alone or combined with yeast at 0.2% was very effective in increased fruit length (cm) and fruit width (cm). Sheren (2014a) found that spraying mango trees CV. "Sukkary" with algae and yeast gave the best results of fruit length, diameter and volume. In addition, El-Kosary *et al.* (2011) who found that fruit width of Keitt and Ewais mango cultivars was significantly affected by treatment by humic acid. Also, Patel *et al.* (2019) found the same result in mango (*Mangifera indica* L.) cv. Amrapali".

3.4. TSS, Acidity and TSS/acidity ratio

Data in Table (8) showed that fruit flesh TSS content, fruit flesh acidity and TSS/acidity ratio significantly affected by all treatments compared to the control. In this respect, T_3 increased TSS (11.9% &11.8%), TSS/acid ratio (23.4, 22.0) and decrease the fruit acidity (0.51% & 0.54%) in the first and the second seasons, respectively.

In addition, T.S.S. and TSS/acidity ratio were enhanced by humic acid treatment as compared with control trees in both seasons. Presently, H_3 in both seasons recorded the best significant values in contradiction of untreated trees treatment that exhibited the lowest values during the two studied seasons. Furthermore, humic acid treatments succeed in lessening fruits acidity content which reached the minimum value with H_3 when compared with control trees in both seasons.

Regarding, the highest values and superiority fruit T.S.S. and TSS/acid ratio and the lowest values of fruit acidity were obtained by T_3 with H_3. These results are in harmony with those reported by Mohamed and El- Sehrawy (2013) found that spraying alga extract and liquorice root extract improved "Hindy Bisinnara" Mango and decreasing total acidity % in relative to the check treatment. The obtained data are go in line with those reported by Sheren (2014b) on mango.

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Table 7: Effect of spraying some natural extracts and addition humic acid to the soil on fruit length (cm), fruit diameter (cm), fruit shape index and fruit volume (cm^3) of Keitt mango trees in 2019 and 2020 seasons.

Treatment	1st Season				2nd Season			
	H_1	**H_2**	**H_3**	**Mean**	**H_1**	**H_2**	**H_3**	**Mean**
				Fruit length (cm)				
T_1	9.53 g	10.93 f	10.97 f	**10.48 E**	9.73 g	11.20 f	11.47 ef	**10.80 D**
T_2	11.73 e	12.67 b-d	12.90 b	**12.43 B**	12.00 c-e	12.33 bc	12.83 b	**12.39 B**
T_3	12.20 c-e	12.80 bc	13.40 a	**12.80 A**	12.13 c-e	12.50 bc	13.80 a	**12.81 A**
T_4	11.00 f	11.87 e	12.17 c-e	**11.68 D**	11.47 ef	12.00 c-e	12.13 c-e	**11.87 C**
T_5	11.67 e	11.90 e	12.27 b-e	**11.94 C**	11.83 c-e	12.00 c-e	12.13 c-e	**11.99 C**
T_6	11.07 f	12.07 de	12.53 b-d	**11.89 CD**	11.63 d-f	12.07 c-e	12.23 cd	**11.98 C**
T_7	11.70 e	12.73 bc	12.90 b	**12.44 B**	12.00 c-e	12.40 bc	12.83 b	**12.41 B**
Mean	**11.27 C**	**12.14 B**	**12.45 A**		**11.54 C**	**12.07 B**	**12.49 A**	
				Fruit diameter (cm)				
T_1	7.67 i	8.33 h	8.40 gh	**8.13 D**	7.67 i	8.40 h	8.37 h	**8.14 D**
T_2	8.77 e-g	9.40 a-c	9.50 a-c	**9.22 B**	9.00 c-f	9.13 b-e	9.47 b	**9.20 B**
T_3	9.10 c-e	9.47 a-c	9.73 a	**9.43 A**	9.10 b-e	9.30 b-d	9.87 a	**9.42 A**
T_4	8.60 f-h	8.80 e-g	9.00 d-f	**8.80 C**	8.50 gh	8.83 d-g	8.90 d-g	**8.74 C**
T_5	8.77 e-g	8.83 ef	9.10 c-e	**8.90 C**	8.70 e-h	8.83 d-g	8.90 d-g	**8.81 C**
T_6	8.67 e-h	9.00 d-f	9.30 b-d	**8.99 C**	8.60 f-h	8.90 d-g	9.00 c-f	**8.83 C**
T_7	8.77 e-g	9.50 a-c	9.60 ab	**9.29 AB**	9.10 b-e	9.10 b-e	9.40 bc	**9.20 B**
Mean	**8.62 C**	**9.05 B**	**9.23 A**		**8.67 C**	**8.93 B**	**9.13 A**	
				Fruit shape index				
T_1	1.24 b	1.31 ab	1.31 ab	**1.29 B**	1.27 a	1.33 a	1.37 a	**1.32 A**
T_2	1.34 ab	1.35 ab	1.36 ab	**1.35 A**	1.33 a	1.35 a	1.36 a	**1.35 A**
T_3	1.34 ab	1.35 ab	1.38 a	**1.36 A**	1.33 a	1.34 a	1.40 a	**1.36 A**
T_4	1.28 ab	1.35 ab	1.35 ab	**1.33 A**	1.35 a	1.36 a	1.36 a	**1.36 A**
T_5	1.33 ab	1.35 ab	1.35 ab	**1.34 A**	1.36 a	1.36 a	1.36 a	**1.36 A**
T_6	1.28 ab	1.34 ab	1.35 ab	**1.32 A**	1.35 a	1.36 a	1.36 a	**1.36 A**
T_7	1.34 ab	1.34 ab	1.34 ab	**1.34 A**	1.32 a	1.36 a	1.37 a	**1.35 A**
Mean	**1.31 B**	**1.34 A**	**1.35 A**		**1.33 B**	**1.35 AB**	**1.37 A**	
				Fruit volume (cm^3)				
T_1	346.7 h	440.0 g	446.7 fg	**411.1 E**	380.0 e	430.0 d	436.7d	**415.6 D**
T_2	503.3 de	550.0 b	555.0 b	**536.1 B**	476.7 b-d	506.7 bc	530.0 b	**504.4 B**
T_3	543.3 bc	560.0 b	590.0 a	**564.4 A**	500.0 bc	523.3 b	583.3 a	**535.6 A**
T_4	450.0 fg	510.0 cd	536.7 b-d	**498.9 D**	453.3 cd	483.3 b-d	490.0 b-d	**475.6 C**
T_5	466.7 fg	503.3 de	533.3 b-d	**501.1 D**	453.3cd	483.3	503.3 bc	**480.0 C**
T_6	463.3 fg	536.7 b-d	540.0 bc	**513.3 CD**	456.7 cd	480.0 b-d	506.7 bc	**481.1 C**
T_7	476.7 ef	543.3 bc	563.3 b	**527.8 BC**	480.0 b-d	516.7 bc	536.7 b	**511.1 B**
Mean	**464.3 C**	**520.5 B**	**537.9 A**		**457.1 C**	**489.0 B**	**512.4 A**	

Means followed by the same letter (s) within each row, column or interaction are not significantly different at 5% level.
*(T_1: Control - T_2: alga extract 2 $g.l^{-1}$ - T_3: alga extract 4 $g.l^{-1}$ - T_4: dry yeast 5 $g.l^{-1}$ - T_5:dry yeast 10 $g.l^{-1}$ – T_6: liquorice root extract 5 $g.l^{-1}$ –T_7: liquorice root extract 10 $g.l^{-1}$) and Humic acid application (H_1: 0, H_2: 20 g/tree/season and H_3: 40 g/tree/season).

Table 8: Effect of spraying some natural extracts and addition humic acid to the soil on fruit flesh TSS%, total acidity % and TSS/acid ratio of Keitt mango trees in 2019 and 2020 seasons.

Treatment	1st Season				2nd Season			
	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean
				TSS%				
T_1	8.2 j	8.3 j	8.7 j	**8.4 E**	9.4 g	9.8 fg	10.2 d-f	**9.8 F**
T_2	10.0 e-i	11.2 c	12.2 b	**11.1 B**	10.5 c-e	11.1 c	12.0 b	**11.2 C**
T_3	10.6 c-f	12.0 b	13.1 a	**11.9 A**	10.9 cd	11.8 b	12.6 a	**11.8 A**
T_4	9.4 i	10.2 e-h	10.5 d-g	**10.0 D**	10.0 ef	10.5 c-e	10.8 cd	**10.4 E**
T_5	9.8 g-i	10.3 d-g	10.7 c-e	**10.3 CD**	10.3 d-f	10.7 cd	11.0 c	**10.7 D**
T_6	9.5 hi	10.4 d-g	11.0 cd	**10.3 C**	10.5 c-e	10.8 cd	11.0 c	**10.8 D**
T_7	9.9 f-i	11.7 b	12.2 b	**11.3 B**	10.8 cd	11.6 b	12.1 b	**11.5 B**
Mean	**9.6 C**	**10.6 B**	**11.2 A**		**10.3 C**	**10.9 B**	**11.4 A**	
				Total acidity %				
T_1	0.75 a	0.74 ab	0.72 bc	**0.74 A**	0.76 a	0.74 b	0.71 cd	**0.74 A**
T_2	0.59 ij	0.57 jk	0.55 kl	**0.57 F**	0.62 gh	0.61 h	0.58 i	**0.61 F**
T_3	0.54 l	0.51 m	0.48 n	**0.51 G**	0.54 j	0.55 j	0.52 k	**0.54 G**
T_4	0.71 c	0.70 c	0.66 de	**0.69 B**	0.73 bc	0.70 de	0.68 e	**0.70 B**
T_5	0.67 d	0.64 ef	0.62 gh	**0.64 C**	0.72 c	0.68 e	0.64 g	**0.68 C**
T_6	0.66 de	0.63 fg	0.60 hi	**0.63 D**	0.70 de	0.65 f	0.60 h	**0.65 D**
T_7	0.63 fg	0.59 ij	0.56 k	**0.60 E**	0.69 de	0.61 h	0.59 i	**0.63 E**
Mean	**0.65 A**	**0.63 B**	**0.60 C**		**0.68 A**	**0.65 B**	**0.62 C**	
				TSS/acid ratio				
T_1	10.9 l	11.3 kl	12.0 k	**11.4 F**	12.4 m	13.2 lm	14.3 jk	**13.3 F**
T_2	17.0 fg	19.5 d	22.1 c	**19.5 B**	16.9 fg	18.1 de	20.6 c	**18.5 B**
T_3	19.6 d	23.5 b	27.2 a	**23.4 A**	20.0 c	21.6 b	24.4 a	**22.0 A**
T_4	13.3 j	14.5 i	15.9 gh	**14.6 E**	13.8 kl	15.0 ij	15.9 g-i	**14.9 E**
T_5	14.6 i	16.2 gh	17.4 f	**16.0 D**	14.3 jk	15.8 g-i	17.3 ef	**15.8 D**
T_6	14.5 i	16.5 f-h	18.3 e	**16.4 D**	15.1 ij	16.5 f-h	18.3 de	**16.6 C**
T_7	15.6 hi	19.9 d	21.7 c	**19.1 C**	15.6 hi	18.9 d	20.7 c	**18.4 B**
Mean	**15.1 C**	**17.3 B**	**19.2 A**		**15.4 C**	**17.0 B**	**18.8 A**	

Means followed by the same letter (s) within each row, column or interaction are not significantly different at 5% level.
*(T_1: Control - T_2: alga extract 2 g.l^{-1} - T_3: alga extract 4 g.l^{-1} - T_4: dry yeast 5 g.l^{-1} - T_5: dry yeast 10 g.l^{-1} – T_6: liquorice root extract 5 g.l^{-1} –T_7: liquorice root extract 10 g.l^{-1}) and Humic acid application (H_1: 0, H_2: 20 g/tree/season and H_3: 40 g/tree/season).

3.5. Vitamin (C), total sugar and reducing sugar

Data presented in Table (9) reveal that vitamin (C), total sugar and reducing sugar were significantly affected by spraying treatments in both seasons. T_3 recorded the highest significant vitamin (C), total sugar and reducing sugar followed in descending order by T_7 in both seasons.

On the other hand, the two humic levels significantly affected on vitamin (C), total sugar and reducing sugar in both seasons. H_3 gave the highest significant effect to increase vitamin (C), total sugar and reducing sugar compared with other two level used.

Furthermore, vitamin (C), total sugar and reducing sugar were varied significantly as influenced by the interaction between different spraying extracts and the three level of humic acid. T_3 with H_3 gave the highest vitamin (C), total sugar and reducing sugar comparing with other interactions under study. On the other hand, T_1 with H_1 gave the lowest significant vitamin (C), total sugar and reducing sugar.

These results are in harmony with those obtained by Elham, *et al.,* (2010) who showed that spraying alga and yeast extracts on Keitte mango trees increased total, reducing sugars and vitamin C. Also, Mohamed and El- Sehrawy (2013) found that treating the trees with seaweed extract significantly improved chemical characteristics of the fruits of "Hindy Bisinnara" mango in terms of increasing total and reducing sugars % and vitamin C content. The promotion on fruit quality was associated with increasing concentration of spraying seaweed extracts. Furthermore, Sheren and Eman, (2015) found that spraying pear with licorice extract at (4g/ l.) increased productivity. In addition, Sheren (2014b) found that spraying mango trees with algae combined with yeast improving vitamin C and total sugar.

Table 9: Effect of spraying some natural extracts and addition humic acid to the soil on fruit flesh vitamin (C), total sugar and reducing sugar of Keitt mango trees in 2019 and 2020 seasons.

Treatment	1st Season				2nd Season			
	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean
				Vitamin (C)				
T_1	38.0 j	42.2 h	44.3 gh	**41.5 E**	40.4 i	41.9 hi	43.6 gh	**42.0 E**
T_2	43.1 h	48.2 c-e	50.5 b	**47.3 B**	46.3 ef	49.9 bc	51.8 b	**49.3 B**
T_3	47.9 c-e	50.1 bc	53.3 a	**50.4 A**	47.2 de	52.0 b	53.6 a	**51.0 A**
T_4	39.9 i	42.5 h	44.8 f-h	**42.4 D**	41.9 hi	44.6 fg	47.9 c-e	**44.8 D**
T_5	42.5 h	45.7 fg	46.7 d-f	**45.0 C**	44.3 fg	44.6 fg	48.4 cd	**45.8 D**
T_6	42.6 h	46.5 ef	48.3 c-e	**45.8 C**	45.0 fg	49.3 cd	49.4 cd	**47.9 C**
T_7	43.9 gh	48.9 b-d	50.6 b	**47.8 B**	45.9 ef	49.9 bc	50.2 bc	**48.7 BC**
Mean	**42.6 C**	**46.3 B**	**48.4 A**		**44.4 C**	**47.5 B**	**49.3 A**	
				Total sugar				
T_1	4.87 h	6.02 g	6.13 g	**5.67 F**	4.79 m	5.00 l	5.43 k	**5.08 G**
T_2	6.46 ef	7.04 c	7.30 b	**6.93 C**	6.16 gh	7.14 d	7.44 c	**6.92 C**
T_3	6.60 e	7.25 b	7.56 a	**7.14 A**	6.89 e	7.41 c	8.44 a	**7.58 A**
T_4	6.06 g	6.46 ef	6.57 ef	**6.36 E**	5.70 j	6.27 g	6.85 e	**6.28 F**
T_5	6.40 f	6.52 ef	6.64 e	**6.52 D**	6.14 h	6.41 f	7.07 d	**6.54 E**
T_6	6.12 g	6.52 ef	6.86 d	**6.50 D**	5.98 i	6.78 e	7.12 d	**6.63 D**
T_7	6.46 ef	7.25 b	7.33 b	**7.01 B**	6.16 gh	7.34 c	8.17 b	**7.22 B**
Mean	**6.14 C**	**6.72 B**	**6.91 A**		**5.98 C**	**6.62 B**	**7.22 A**	
				Reducing sugar				
T_1	3.61 j	4.01 i	4.13 i	**3.92 E**	3.21 j	3.26 j	4.20 i	**3.55 F**
T_2	4.81 f	5.28 bc	5.42 b	**5.17 B**	4.73 g	5.22 e	5.90 c	**5.29 C**
T_3	5.12 cd	5.41 b	5.68 a	**5.41 A**	5.13 e	5.43 d	6.95 a	**5.84 A**
T_4	4.16 i	4.93 ef	5.07 de	**4.72 D**	4.23 i	4.87 f	4.97 f	**4.69 E**
T_5	4.56 gh	4.96 d-f	5.12 cd	**4.88 C**	4.35 i	4.93 f	5.17 e	**4.81 D**
T_6	4.44 h	4.99 de	5.28 bc	**4.91 C**	4.31 i	4.91 f	5.15 e	**4.79 D**
T_7	4.61 g	5.37 b	5.45 b	**5.14 B**	4.51 h	5.26 e	6.55 b	**5.44 B**
Mean	**4.47 C**	**4.99 B**	**5.16 A**		**4.35 C**	**4.84 B**	**5.56 A**	

Means followed by the same letter (s) within each row, column or interaction are not significantly different at 5% level.
*(T_1: Control - T_2: alga extract 2 g.l^{-1} - T_3: alga extract 4 g.l^{-1} - T_4: dry yeast 5 g.l^{-1} - T_5:dry yeast 10 g.l^{-1} – T_6: liquorice root extract 5 g.l^{-1} –T_7: liquorice root extract 10 g.l^{-1}) and Humic acid application (H_1: 0, H_2: 20 g/tree/season and H_3: 40 g/tree/season).

3.6. Pulp percentage, peel percentage, seed percentage and pulp seed ratio

Data presented in Table (10) reveal that pulp percentage, peel percentage, seed percentage and pulp seed ratio were significantly affected by spraying treatments in both seasons. T_3 recorded the highest pulp percentage (82.6 in both season) and pulp seed ratio (12.82 & 11.06) in the first and second seasons but gave the lowest peel percentage (10.7 & 9.7) and seed percentage (6.65 & 7.72) in both seasons.

Table 10: Effect of spraying some natural extracts and addition humic acid to the soil on fruit pulp percentage, peel percentage, seed percentage and pulp seed ratio of Keitt mango trees in 2019 and 2020 seasons.

Treatment	1st Season				2nd Season			
	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean
				Pulp percentage				
T_1	73.7 k	77.1 j	77.1 j	**76.0 E**	71.7 m	74.2 l	75.7 k	**73.8 G**
T_2	78.4 h	81.2 e	83.5 b	**81.0 B**	78.5 hi	82.2 de	84.1 b	**81.6 B**
T_3	80.2 f	82.8 c	85.0 a	**82.6 A**	79.8 g	82.9 cd	85.1 a	**82.6 A**
T_4	77.4 ij	78.4 h	79.4 g	**78.4 D**	76.3 k	78.8 g-i	79.6 gh	**78.2 F**
T_5	78.2 h	79.1 g	80.4 f	**79.2 C**	78.3 i	78.9 g-i	81.5 ef	**79.6 D**
T_6	77.9 hi	79.3 g	81.1 e	**79.4 C**	77.2 j	79.5 gh	80.9 f	**79.2 E**
T_7	78.3 h	81.6 d	83.7 b	**81.2 B**	78.3 i	81.7 ef	83.3 c	**81.1 C**
Mean	**77.7 C**	**79.9 B**	**81.5 A**		**77.2 C**	**79.8 B**	**81.5 A**	
				Peel percentage				
T_1	16.4 a	13.9 b	13.4 b-d	**14.6 A**	17.9 a	16.3 b	14.9 c	**16.3 A**
T_2	13.1 c-e	10.2 ij	11.3 h	**11.5 C**	12.8 e	8.8 hi	8.7 i	**10.1 E**
T_3	11.9 g	10.5 i	9.7 j	**10.7 E**	11.0 fg	9.2 hi	8.8 hi	**9.7 F**
T_4	13.5 b-d	12.9 de	12.6 ef	**13.0 B**	15.2 c	12.9 e	12.4 e	**13.5 B**
T_5	13.8 b	13.4 b-d	11.1 h	**12.8 B**	12.9 e	11.6 f	11.2 fg	**11.9 C**
T_6	13.7 bc	12.8 e	12.1 fg	**12.9 B**	13.8 d	11.2 fg	11.1 fg	**12.0 C**
T_7	12.1 fg	11.8 g	9.7 j	**11.2 D**	12.4 e	10.5 g	9.6 h	**10.8 D**
Mean	**13.5 A**	**12.2 B**	**11.4 C**		**13.7 A**	**11.5 B**	**10.9 C**	
				Seed percentage				
T_1	9.89 a	9.00 c	9.46 b	**9.45 A**	10.42 a	9.58 b	9.42 bc	**9.80 A**
T_2	8.50 de	8.69 cd	5.20 h	**7.46 E**	8.69 e-g	8.94 c-f	7.20 j	**8.28 D**
T_3	7.95 ef	6.67 g	5.32 h	**6.65 F**	9.20 b-e	7.87 hi	6.10 k	**7.72 F**
T_4	9.06 c	8.69 cd	7.98 ef	**8.58 B**	8.51 fg	8.28 gh	8.04 hi	**8.27 D**
T_5	8.02 ef	7.53 f	8.44 de	**8.00 C**	8.80 d-f	9.48 bc	7.30 j	**8.52 C**
T_6	8.42 de	7.96 ef	6.85 g	**7.74 D**	9.07 b-e	9.31 b-d	7.98 hi	**8.79 B**
T_7	9.63 ab	6.62 g	6.55 g	**7.60 DE**	9.28 b-d	7.76 i	7.08 j	**8.04 E**
Mean	**8.78 A**	**7.88 B**	**7.12 C**		**9.14 A**	**8.74 B**	**7.59 C**	
				Pulp Seed ratio				
T_1	7.46 i	8.57 gh	8.16 h	**8.06 G**	6.88 l	7.75 k	8.04 jk	**7.56 F**
T_2	9.23 e-g	9.35 e-g	16.07 a	**11.55 B**	9.03 g-i	9.20 gh	11.68 b	**9.97 C**
T_3	10.08 de	12.43 bc	15.97 a	**12.82 A**	8.68 h-j	10.54 d	13.97 a	**11.06 A**
T_4	8.55 gh	9.02 fg	9.96 de	**9.18 E**	8.98 g-i	9.52 fg	9.90 ef	**9.47 D**
T_5	9.75 d-f	10.52 d	9.53 ef	**9.93 F**	8.91 g-i	8.33 ij	11.18 c	**9.47 D**
T_6	9.25 e-g	9.96 de	11.83 c	**10.35 D**	8.51 ij	8.55 h-j	10.14 de	**9.07 E**
T_7	8.13 h	12.35 bc	12.78 b	**11.09 C**	8.45 ij	10.54 d	11.78 b	**10.25 B**
Mean	**8.92 C**	**10.31 B**	**12.04 A**		**8.49 C**	**9.20 B**	**10.96 A**	

Means followed by the same letter (s) within each row, column or interaction are not significantly different at 5% level.
*(T_1: Control - T_2: alga extract 2 g.l^{-1} - T_3: alga extract 4 g.l^{-1} - T_4: dry yeast 5 g.l^{-1} - T_5: dry yeast 10 g.l^{-1} – T_6: liquorice root extract 5 g.l^{-1} –T_7: liquorice root extract 10 g.l^{-1}) and Humic acid application (H_1: 0, H_2: 20 g/tree/season and H_3: 40 g/tree/season).

On the other hand, the two humic levels significantly affected the pulp percentage and pulp seed ratio in both seasons. H_3 gave the highest significant effect to increase pulp percentage and pulp seed ratio and gave the lowest significant effect to decrease peel percentage and increased pulp seed ratio compared with other two level used.

Furthermore, pulp percentage peel percentage, seed percentage and pulp seed ratio were varied significantly as influenced by the interaction between different spraying extracts and added to the soil the three level of humic acid. T_3 with H_3 gave the highest pulp percentage and pulp seed ratio and gave the lowest peel percentage, seed percentage comparing with other interactions under study. On the other hand, T_1 with H_1 gave the lowest significant pulp percentage and pulp seed ratio.

The obtained data go in line with those reported by Elham *et al.,* (2010) who reported that spraying Keitte mango trees with algae extract reduced weight of peel and seed (g) comparing with the control. In addition, Abd El-Razek *et al.,* (2017) who reported that spraying Ewais mango trees with yeast extract (2, 3%) had a positive effect on pulp weight but did not effect on pulp/seed ratio. In addition, Alebidi *et al.,* (2021) recommended spraying inflorescences of Barhee date palms with algae extract and/or potassium nitrate had a significant effect on the yield and on the physical and chemical properties of the fruit as fruit shape index when compared with the untreated palms. The increase in yield and qualitative properties was associated with increasing concentrations of both materials (algae extract and potassium nitrate).

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