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Effect of Sugar Beet Compost and Effective Microorganisms (EM) on Growth and Productivity of Keitt cv. Mango Trees Under New Valley Conditions

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ABSTRACT

This study was carried out during two successive seasons (2020 and 2021) on the 5 -year- old of Keitt mango cultivar grown in a private orchard located at El-Farafrah Oasis in the New Valley Governorate, Egypt. The aim of this research was to study the effects of Four rates of sugar beet compost (control, 20%, 40% and 60%) of the trees actual nitrogen needs then we complete the actual tests of nitrogen for the tree from mineral fertilization, and Three concentration of Microorganisms (EM) (control, 75 and 100 ml/tree/year) on vegetative growth, yield and fruit quality of Keitt mango trees. The best results were recorded with Compost 40 % + 60 % mineral fertilizer level combined with 100 ml/tree microorganisms (EM) which improved vegetative growth parameters, yield and fruit quality of Keitt mango trees under heat stress conditions.

Keywords: Keitt cv. mango; Sugar beet compost; Microorganisms (EM); Mineral fertilizer; Growth; Yield; Fruit quality

1. Introduction

Mango (*Mangifera indica* L.) is one of the most important fruit in the worldwide due to its favorite fruit and the third important promising fruit crop for export. Mango trees planted under Egyptian condition production was about 240794 tons (FAOSTAT 2021).

Sugar beet compost is one of the most famous organic fertilizers which possess many environmental issues. It produces huge amounts of organic wastes with high organic loads and unstable pH values, which related to traditional technologies. Mokhtar *et al.* (2020) noticed that the effect of new microbial consortium's on the physical, chemical parameters using controlled in-vessel system for co-composting of rice straw and sugar beet agro-industrial wastes. All results of final composts indicated that it was in the range of the good matured level and can be without any restriction. Composting was known to be an effective environmentally management controlled strategy for biodegradation and mineralization of organic and agro-industrial solid wastes (Sharma *et al.,* 2014). It depends mainly on vast categories of microorganisms; mainly bacteria, actinomycetes and fungi which can effectively destroy weed seeds and pathogens (Mishra and Malik, 2014). Furthermore, it converts biodegradable solid organic matter into a stable humus like substance (Hottle, 2015). The application of organic and mineral fertilizers changes the chemical, physical, and biological soil properties. Providing soil with organic fertilizers affects its physical and chemical properties more than that with nitrogen ones. Mineral, organic, and natural fertilization also stimulates the development of microorganisms being a main source of enzymes responsible for nutrients transformations in soils (Bielinska and Mocek-Pociniak, 2012; George *et al*., 2002; Kramer and Green, 2000).

Effective microorganisms (EM), a commercial concoction of microbes that includes yeasts, fungi, bacteria and actinomycetes, have been found to be effective in enhancing crop growth by a number of scholars. The amazing thing about effective microorganisms in agriculture is that they offer an ecologically sound solution. Whether used in conventional or organic agriculture, they help to create an optimal environment in the soil and foliar surfaces. By stimulating the organisms in the soil. EM technology offers an environmentally friendly method to strengthen the natural defense system of fruit

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trees. Combined applications of EM with organic amendments improved plant N content and increased soil N content above initial levels. The application of compost resulted in soil N and P concentrations higher than those of the control presumably due to nutrients being slowly released from the compost material (Lindani Ncube, 2008).

EM contains selected species of microorganisms including three principal types of organisms namely lactic acid bacteria, yeast actinomyces and photosynthetic bacteria that are commonly found in soils (Higa and Wididana, 1991). The basic purpose of EM is the restoration of healthy ecosystem in both soil and water by using genus of microorganisms which are found in nature. Generally, EM technology has been adopted globally and is recognized as a powerful and effective tool in both agriculture and horticulture for crop and animal production systems (Chamberlain *et al.*, 1997). EM is used to improve soil fertility and plant growing conditions (Higa, 1991 and Higa and Wididana, 1991). Microorganisms in the soil are important because they maintain homeostasis environmental. They decompose organic material, recycle nutrients, remove some pollutants, stave off pathogens and release some potentially unavailable nutrients (Thies, 2008). Negi *et al*. (2011) stated that the use of plant growth promoters being cost-effective and eco-friendly is getting popular especially among the marginal and small farmers. Al-Erwy *et al.* (2016) noticed that, the application of plant growth promoters enhances the yield and nutritive value of various crops. Soil ecosystems are the most diverse compared to any other systems. Soil can contain more than 109 microbial cells per gram and harbor up to 106 different bacterial species per gram (Zhao *et al.,* 2011). Other studies estimated that there may be close to 277,000 bacterial genomes per gram of soil (Thies, 2008). It has been shown that bacterial populations found in soils are positively influenced (i.e. found in greater abundance) from management practices that include residue incorporation compared to those in soils that are left alone (Davari *et al.,* 2012).

This study aimed investigate the effect influence of Sugar beet compost, effective microorganisms (EM) and their interaction to improve yield and fruit quality characters of Keitt mango trees under heat stress conditions.

2. Material and Methods

The experiment was carried out during two successive seasons of 2020 and 2021 at a private orchard located at El-Farafrah Oasis in the New Valley Governorate, Egypt. Keitt Mango trees of Five-years- old grown in sandy soil and planted at 2.5 X 2.5 meters apart, (approximately 672 plants per feedan) under drip irrigation system. Analyses of sugar beet waste compost were shown in Table (1). Physical and chemical analyses of the experimental soil were cleared in Table (2). Meanwhile, the chemical analyses of the used irrigation water is recorded in table (3).

Table 1: Sugar beet compost chemical analysis

pH at (1:10)	ECe (dS/m) (1/10)	C/N	N	P	K	Ca	Mg	Fe
					%			
8.67	1.43	20.66	0.12	0.23	0.68	0.14	1.06	2.06

Na	$CaCO_3$	O.M	Moisture	Zn	Cu	Mn	Co
	%					ppm	
0.29	7.85	4.26	5.40	57.90	44.16	496.70	8.89

Table 2: Analysis of experimental soil.

Soil Depth (cm)	Texture Class	pH Soil past	EC ppm	$CaCo_3$ %	Soluble cations (meq/l)				Soluble anions (meq/l)		
					Ca^{++}	K^{+}	Na^{+}	Mg^{++}	Cl^{-}	$SO_4^{=}$	Co_3+Hco_3
0-30	Sand	7.99	1910	8.05	7.6	1.3	14.0	3.6	17.1	9.8	0.3
30-60	Sand	7.85	1960	7.15	8.1	1.6	12.5	3.1	20.8	10.0	0.2

Table 3: Chemical analysis of water used for irrigation.

pH	E.C. dSm^{-1}	Soluble cations (meq/l)				Soluble anions (meq/l)		
		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Cl^{-}	CO_3^{-}	HCO_3
6.56	0.33	1.47	2.18	3.16	0.61	4.98	*	1.18

Taking into consideration that, 100% organic = 17 Kg compost / tree, 20% organic= 3.4 Kg compost / tree, 40% organic= 6.8 Kg compost / tree and 60% organic= 10.2 Kg compost / tree.

2.1. Rate and Application Method of sugar beet compos

Four rates of compost were employed in this study (control, 20 %, 40 % and 60 % of actual nitrogen / tree) at 0, 3.4, 6.8 and 10.2 Kg / tree respectively which equivalent to the same quantities delivered by using control, 80 %, 60 % and 40 % mineral N actual nitrogen /tree (205 g N / tree / year) fertilizers and added at the beginning of December in the two seasons. One trench was excavated on one side of the tree, then, the given amount of compost as a part of the soil surface were mixed together and added to the chuck hole.

2.2. Rate and Application Method of Chemical Fertilizers (N)

Four rates of chemical fertilizers N were employed in this study. The first rate was 100 % of nitrogen 205g / tree (control). The second rate was 80 % of actual nitrogen 164g / tree. The third rate was 60 % of actual nitrogen 123g / tree. The fourth rate was 40 % of actual nitrogen 82g / tree. The chemical fertilizers were added into two equal doses at the first week of February and two weeks later of fruit set through drip irrigation system during 2020 & 2021 experimental seasons.

This study was carried out to investigate the effect of soil addition of levels of sugar beet compost and effective microorganisms (EM) in soil on growth, yield and fruit quality of mango Keitt trees under heat stress conditions.

Thirty six healthy trees, nearly uniform in shape, size and productivity, received the same horticultural practices were used in this experiment.

The present study was a factorial experiment with two factors. The first factor involved four rates of sugar beet compost. The second factor consisted of three levels of effective microorganisms (EM). The experiment was designed as a randomized complete block design with three replicates for each treatment and each replicate was represented by one tree.

Response of Keitt mango trees to the tested treatments was evaluated through the following determinations.

2.3. Vegetative growth: at the end of September tree height (m), average number of new lateral/shoot, average branch length (cm), average number of leaves/branch (cm), and leaf area (cm^2) measuring according to Ahmed and Morsy, (1999) were measured. Tree height was measured by using a tape measure from the soil surface until the tip of the top of tree. Branch length was measured using a tape measure. Leaf total chlorophyll content was determined by Minolta chlorophyll meter SPAD-502.

Leaves and shoot of current season were gathered at last week of September and washed with tap water then with distilled water. The leaf and shoot samples were dried at 70 C till a constant weight ground in electric mill and digested according to Chapman and part, (1961).

2.4. Number of fruits / tree and yield Kg / tree: At harvest time at last week of October the number of fruits per each replicate was counted. Average of fruit weight was recorded. Yield Kg / tree was estimated (Number of fruits / tree x average of fruit weight).

2.5. Fruit physical and chemical properties: Five mango fruits of each replicate at maturity stage were taken at harvest time on September during two seasons. Some physical, properties, fruit length (cm), fruit diameter (cm), fruit shape index (F.L. /F.D.), fruit volume (cm^3), peel weight (g), flesh weight (g), seeds weight/fruit (g) were carried out. These measurements were carried out separating flesh and seed from the peel and the juice is extracted from the pulp by electric blender also some properties fruit total soluble solids (T.S.S.) % was determined by Hand refracto meter, total acidity percentage was determined in fruit juice according to A.O.A.C., (2000), T.S.S./Acid ratio was calculated. Ascorbic acid (vitamin C) (mg/100g f. w.) according to A.O.A.C. (2000) were determined. Total sugars (%), reducing

sugar %, and non- reducing sugar % were determined in fruit juice (100 ml juice) photo metrically as described by Dubois *et al*. (1956).

2.6. Leaf minerals content: To determine leaf macro and micro mineral content (N, P, K, Ca, Mg, Zn, Mn and Fe) leaf samples were taken during last week of October and washed with tap water then with distilled water to remove the dust. After washing, they were dried in an electric oven at 70ºc for 72 hours. The dried leaves were ground, digested and prepared for analysis using the method described by Parkinson and Allen (1975). Total nitrogen was determined by the semi-micro kjeldahl method (Bremner 1965). Phosphorus was estimated by the method of Chapman and Pratt (1961). Potassium was determined by the flame-photometer according to Jackson (1958). Calcium and magnesium were determined by titration against versant solution (Na EDTA) according to (Chapman and Pratt, 1961). Iron, Manganese and Zinc, were determined by using the Atomic Absorption Spectrophotometer "GBC 932 AA".

Statistical Analysis

The obtained data in 2020 and 2021 seasons were subjected to analysis of variance according to Clarke and Kempson (1997). Means were differentiated using Range test at the 0.05 level Duncan, (1955).

3. Results and Discussion

3.1. Vegetative growth

Data in table (4) show the effect of sugar beet compost, effective Microorganisms (EM) and their interaction on tree height, average No. of new lateral shoot / branch and average number of branch length of keitt cv. mango under heat stress conditions during 2020 & 2021 seasons.

Tree height: Regarding to soil application with sugar beet compost rates, compost 40% with mineral fertilizer 60% treatment recorded the highest significant tree height in both seasons. On the other hand, control (farm treatment) recorded was the lowest significant value. Concerning effect of Microorganisms (EM) treatments, soil application with 100 ml EM show the highest significant value of tree height, which was observed in both seasons. The interaction of the two studied factors revealed that compost 40% + mineral fertilizer 60% with 75 and 100 ml EM treatment gave highest tree height in both seasons.

Average number of new lateral shoot/ branch: Regarding to soil application with sugar beet compost, compost 40% + mineral fertilizer 60% treatment showed the highest significant Average No. of new lateral shoot/ branch in both seasons. On the other hand, control (farm treatment) was the lowest significant value. Concerning effect of Microorganisms (EM) treatments, soil application with 75 ml EM show the highest significant value of average No. of new lateral shoot/ branch, which was observed in both seasons. The interaction of the two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment gave highest average No. of new lateral shoot / branch in both seasons.

Average Branch length: Regarding to soil application with sugar beet compost rates, compost 20% + mineral fertilizer 80% and compost 40% + mineral fertilizer 60% treatments showed the highest significant average branch length in both seasons. On the other hand, control (farm treatment) was the lowest significant values. Concerning effect of Microorganisms (EM) treatments, control (farm treatment) in first season, 100 ml EM treatment in second season show the highest significant value of average branch length. The interaction between two studied factors recorded that compost 40% + mineral fertilizer 60% with control treatment in first season and compost 20% + mineral fertilizer 80% with control in second season gave highest average branch length.

Data in table (5) Show the effect of sugar beet compost, effective Microorganisms (EM) and their interaction on average no. of leaves/branch, leaf area and Leaf total chlorophyll content of Keitt cv. mango under heat stress conditions during 2020 &2021 seasons.

Table 4: Effect of sugar beet compost, effective microorganisms (EM) and their interaction on tree height, average number of new lateral shoot/ branch and average branch length of Keitt cv. mango under heat stress conditions during 2020 & 2021 seasons.

Parameters / Treatments	Tree height (m)				Average No. of new lateral shoot/branch				Average Branch length			
	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean
						First season 2020						
Control	2.88e	2.58f	2.90e	2.79D	5.00i	15.00ef	14.f	11.44D	21.00i	25.33h	20.00f	21.10 C
Compost 20 % + 80 % M.F.	2.60f	3.25c	3.32bc	3.06B	13.33g	18.00b	15.67de	15.67B	29.33e	31.50cd	32.33bc	31.05A
Compost 40 % + 60 % M.F.	2.97de	3.48a	3.42ab	3.29A	16.00de	17.33bc	19.67a	17.67A	40.00a	24.33h	30.50d	31.61A
Compost 60 % + 40 % M.F.	2.58f	3.02d	2.98de	2.86C	9.33h	16.67cd	16.00de	14.00C	33.17b	25.33h	26.67g	28.39B
Mean	2.76C	3.08B	3.16A		10.92B	16.75A	16.42A		30.88A	26.62C	29.38B	
						Second season 2021						
Control	2.94e	2.70f	2.95e	2.86D	7.00i	17.00e	16.00f	13.33D	22.00f	24.67e	26.00d	24.22B
Compost 20 % + 80 % M.F.	2.72f	3.30c	3.45b	3.16B	15.00g	19.33b	17.67de	17.33B	32.33a	23.67e	30.67b	28.89A
Compost 40 % + 60 % M.F.	3.15d	3.62a	3.57ab	3.45A	18.67bc	19.33b	21.00a	19.67A	28.00c	29.00c	30.33b	29.11A
Compost 60 % + 40 % M.F.	2.68f	3.10d	3.17d	2.98C	11.67h	18.67bc	18.00cd	16.11C	22.05f	24.67e	26.02d	24.25B
Mean	2.87C	3.18B	3.29A		13.09C	18.58A	18.17B		26.10B	25.50C	28.26A	

Means having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

Table 5: Effect of sugar beet compost, effective microorganisms (EM) and their interaction on average number of leaves/branch, leaf area and leaf total chlorophyll content of Keitt cv. mango under heat stress conditions during 2020 and2021 seasons.

Treatments \ Parameters	Average No. of leaves/branch				Leaf area (cm2)				Leaf T. chlorophyll content			
	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean
						First season 2020						
Control	12.33i	12.33i	15.33g	13.33D	53.37j	56.75i	64.42g	58.18D	35.40i	41.80h	48.50g	41.90D
Compost 20 % + 80 % M.F.	13.33h	20.75c	26.65b	20.24B	65.15f	70.65c	74.43a	70.08B	51.50d-f	52.90d	57.33b	53.91B
Compost 40 % + 60 % M.F.	18.35e	21.00c	26.67a	23.01A	68.26e	70.69c	74.95a	71.30A	52.13de	55.27f	60.03a	55.81A
Compost 60 % + 40 % M.F.	16.67f	19.45d	18.67e	18.26C	63.84h	69.77d	73.08b	68.90C	50.27f	51.13ef	52.00de	51.13C
Mean	15.17C	18.38B	22.58A		62.66C	66.97B	71.72A		47.33C	50.28B	54.47A	
						Second season 2021						
Control	11.33j	12.70i	14.33fg	12.79C	62.99j	63.67i	64.27h	63.64D	30.20g	47.87f	48.53f	42.20D
Compost 20 % + 80 % M.F.	12.68i	17.50e	21.00b	17.06B	65.55f	68.79d	74.77ab	69.70B	54.13cd	54.83c	58.90a	55.95B
Compost 40 % + 60 % M.F.	13.59gh	19.00d	23.67a	18.75A	67.77e	70.51c	75.56a	71.28A	54.67c	56.33b	59.87a	56.96A
Compost 60 % + 40 % M.F.	15.00f	15.85	20.00c	16.95B	64.85g	65.52f	65.49f	65.29C	50.50e	51.70e	52.97d	51.72C
Mean	13.15C	16.26B	19.75A		65.29C	67.12B	70.02A		47.38C	52.68B	55.07A	

Means having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

Average number of leaves/branch: Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment recorded the highest significant average No. of leaves/branch in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment show the highest significant value of average No. of leaves/branch. The interaction between two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment gave highest significant values Average No. of leaves/branch in both seasons.

Leaf area (cm^2): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment recorded the highest significant Leaf area (cm^2) in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment show the highest significant value of Leaf area (cm^2). The interaction between two studied factors recorded that compost 20% + mineral fertilizer 80% and compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant values Leaf area (cm2) in both seasons.

Yield

Data in table (6) show the effect of sugar beet compost, effective Microorganisms (EM) and their interaction on No. of fruits/tree, fruit weight, and yield of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Number of fruits/tree: Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment showed the highest significant number of fruits/tree in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the highest significant value of number of fruits/tree. The interaction between two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant number of fruits/tree in both seasons.

Fruit weight (g): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment recorded the highest significant values fruit weight (g) in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the highest significant value of fruit weight (g). The interaction between two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant values fruit weight (g) in both seasons.

Yield (kg/tee): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment gave the highest significant yield (kg/tee) in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the highest significant value of yield (kg/tee). The interaction between two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant yield (kg/tee) in both seasons.

Fruit physical properties

Data in table (7) show the effect of compost, effective of Microorganisms (EM) and their interaction on fruit length, fruit diameter and fruit shape index of mango Keitt cv. under heat stress conditions during 2020 and 2021 seasons.

Fruit length (cm): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment showed the highest significant fruit length in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the highest significant value of fruit length. The interaction between two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant values fruit length in both seasons.

Table 6: Effect of sugar beet compost, effective microorganisms (EM) and their interaction on number of fruits/tree, fruit weight and yield of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Parameters / Treatments	No. of fruits/tree				Fruit weight (g)				Yield (kg/tee)			
	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean
						First season 2020						
Control	49.00i	55.33h	64.67g	56.33D	208.7k	345.0j	351.3i	301.6D	10.22k	19.09h	22.72j	17.34D
Compost 20 % + 80 % M.F.	78.67e	84.33d	92.00b	85.00B	455.9e	483.8c	508.6b	482.8B	35.87f	40.80d	46.79b	41.15B
Compost 40 % + 60 % M.F.	84.00d	87.33c	97.33a	89.55A	472.9d	483.3c	631.6a	529.3A	39.72e	42.20c	61.48a	47.80A
Compost 60 % + 40 % M.F.	73.33e	74.00f	77.33e	74.89C	361.9h	376.0g	434.2f	390.7C	26.54i	27.82h	33.58g	29.31C
Mean	71.25C	75.25B	82.83A		374.8C	422.0B	481.4A		28.09C	32.48B	41.14A	
						Second season 2021						
Control	62.00g	65.00f	65.00f	64.00D	219.9l	351.2k	361.7j	310.9D	13.63l	22.83jk	23.51j	19.99D
Compost 20 % + 80 % M.F.	74.00d	78.00c	82.00ab	78.00B	463.9f	492.2d	515.3b	490.5B	34.33f	38.29d	42.25b	38.32B
Compost 40 % + 60 % M.F.	75.00d	80.00bc	83.00a	79.33A	485.1e	505.3b	637.4a	542.6A	36.38e	40.42c	52.90a	43.32A
Compost 60 % + 40 % M.F.	66.00f	67.00f	71.00e	68.00C	376.5i	381.9h	439.7g	399.4C	24.85i	25.59h	31.22g	27.22C
Mean	69.25C	72.50B	75.25A		386.3C	432.6B	488.5A		27.30C	31.81B	37.47A	

Means having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

Table 7: Effect of sugar beet compost, effective microorganisms (EM) and their interaction on fruit length, fruit diameter and fruit shape index of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Treatments \ Parameters	Fruit length (cm)				Fruit diameter (cm)				Fruit shape index			
	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean
						First season 2020.						
Control	10.80i	11.33h	11.67g	11.00D	8.27f	8.37f	8.50f	8.38C	1.21a	1.35a	1.37a	1.31A
Compost 20 % + 80 % M.F.	13.10d	13.97b	14.25b	13.77B	9.77cd	10.11bc	10.90a	10.26B	1.34a	1.38a	1.31a	1.34A
Compost 40 % + 60 % M.F.	13.52c	14.23b	14.73a	14.16A	10.03bc	10.18b	11.18a	10.47A	1.35a	1.40a	1.32a	1.35A
Compost 60 % + 40 % M.F.	12.10f	12.70e	12.87de	12.56C	8.93e	9.00e	9.67d	9.20C	1.35a	1.41a	1.33a	1.37A
Mean	12.18C	13.06B	13.38A		9.25C	9.42B	10.06A		1.31A	1.39A	1.33A	
						Second season 2021						
Control	10.90h	11.48g	11.72g	11.37D	8.04f	8.43e	8.56e	8.34D	1.36a	1.36a	1.37a	1.36A
Compost 20 % + 80 % M.F.	13.16e	14.01c	14.35b	13.84B	9.77bc	10.09b	10.62a	10.16B	1.35a	1.39a	1.35a	1.36A
Compost 40 % + 60 % M.F.	13.63d	14.29bc	14.79a	14.24A	10.07b	10.10b	10.90a	10.36A	1.35a	1.41a	1.36a	1.38A
Compost 60 % + 40 % M.F.	12.18f	12.83e	12.99e	12.67C	9.00d	9.07d	9.51c	9.19C	1.35a	1.41a	1.37a	1.38A
Mean	12.47C	13.15B	13.46A		9.22C	9.42B	9.90A		1.35A	1.39A	1.36A	

Means having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

Fruit diameter (cm): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment found the highest significant values fruit diameter in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the highest significant value of fruit diameter. The interaction between two studied factors recorded that compost 20% + mineral fertilizer 80% treatment, compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant values fruit diameter in both seasons.

Fruit shape index: Insignificant differences could be noticed among sugar beet compost treatments, microorganism treatments and their interaction treatments in both seasons.

Data in table (8 & 9) show the effect of compost, effective of Microorganisms (EM) and their interaction on fruit volume, peel weight, flesh weight and seed weight fruits of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Fruit volume (cm^3): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment had the highest significant fruit volume in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the highest significant value of fruit volume. The interaction between two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant values fruit volume in both seasons.

Peel weight (g): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment found the lowest significant peel weight in both seasons. On the other hand, control (farm treatment) was the highest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the lowest significant value of peel weight. The interaction between two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment in first season and compost 40% + mineral fertilizer 60% with 75 ml EM treatment in second season showed lowest significant values peel weight.

Flesh weight (g): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment had the highest significant flesh weight in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the highest significant flesh weight. The interaction between two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant values flesh weight in both seasons.

Seed weight (g): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment had the lowest significant values seed weight/fruit in both seasons. On the other hand, control (farm treatment) was the highest significant values in both
seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the lowest significant value of seed weight/fruit. The interaction between two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant values seed weight/fruit in both seasons.

Fruit chemical properties

Data in table (10) show the effect of compost, effective microorganisms (EM) and their interaction on TSS acidity, TSS / acid ratio and ascorbic acid content of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

TSS (%): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment showed the highest significant TSS in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the highest significant value of TSS. The interaction

Table 8: Effect of sugar beet compost, effective microorganisms (EM) and their interaction on fruit volume and peel weight of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Treatments \ Parameters	Fruit volume (cm^3)				Peel weight (g)			
	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean
				First season 2020				
Control	218.3j	384.4i	403.8h	335.5D	78.03a	64.33e	60.73f	67.70A
Compost 20 % + 80 % M.F.	493.6e	515.0c	540.0b	516.2B	70.50b	60.65f	49.30j	60.15B
Compost 40 % + 60 % M.F.	505.0d	518.4c	666.7a	563.4A	67.73c	57.50g	47.17k	57.47CD
Compost 60 % + 40 % M.F.	407.1h	416.8g	473.5f	432.5C	65.77d	55.03h	53.70i	58.17C
Mean	406.0C	458.7B	521.0A		70.51A	59.38B	52.73C	
				Second season 2021				
Control	236.7 j	391.9i	411.3h	346.6D	79.16a	65.46e	61.78f	68.80A
Compost 20 % + 80 % M.F.	501.1e	522.5c	547.5b	523.7B	71.63b	56.16h	54.83i	60.87B
Compost 40 % + 60 % M.F.	512.5d	525.9c	674.2a	570.9A	68.86c	48.30k	50.43j	55.86D
Compost 60 % + 40 % M.F.	414.6h	424.3g	481.0f	440.0C	66.90d	61.80f	58.63g	62.44C
Mean	416.2C	466.2D	528.5E		71.64A	57.93B	56.42C	

Means having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

Table 9: Effect of sugar beet compost, effective microorganisms (EM) and their interaction on flesh weight and seed weight of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Treatments \ Parameters	Flesh weight (g)				Seed weight (g)			
	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean
				First season 2020				
Control	108.3j	206.2i	249.6h	188.0D	66.35c	72.37ab	63.45d	67.39A
Compost 20 % + 80 % M.F.	319.1e	350.8d	395.8b	355.2B	55.11f	61.01de	54.68f	56.93C
Compost 40 % + 60 % M.F.	350.1d	364.8c	529.8a	414.9A	22.38h	74.42a	41.00g	45.93D
Compost 60 % + 40 % M.F.	253.7g	254.1g	304.9f	270.9C	42.37g	66.91c	75.59a	61.62B
Mean	257.8C	294.0B	370.0A		46.55C	68.68A	58.68B	
				Second season 2021				
Control	109.3k	210.3j	253.2i	190.9D	59.77e	86.07a	53.68f	66.51A
Compost 20 % + 80 % M.F.	329.0e	369.8c	400.3b	366.4B	47.77g	53.67f	74.92c	58.12C
Compost 40 % + 60 % M.F.	356.5d	370.9c	533.3a	420.2A	31.45h	75.47b	46.67g	51.20D
Compost 60 % + 40 % M.F.	261.8h	266.4g	308.2f	278.8C	63.22f	66.25d	60.18e	63.22B
Mean	264.2C	304.3B	373.7A		50.55C	70.37A	58.36B	

Means having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

Table 10: Effect of sugar beet compost, effective microorganisms (EM) and their interaction on TSS (%), acidity (%),TSS/acid ratio and ascorbic acid (vitamin C) of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Treatments \ Parameters	TSS (%)				Acidity (%)				TSS/acid ratio				Ascorbic acid (vitamin C)			
	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean
First season 2020																
Control	11.93g	12.77f	13.73e	12.81D	6.70a	5.80c	5.60cd	6.03A	1.78h	2.20g	2.45e	2.14C	0.70f	0.70f	0.80f	0.73D
Compost 20 % + 80 % M.F.	14.33de	14.97c	15.37ab	14.89B	6.20b	4.70f	2.70i	4.53C	2.31f	3.19d	5.69a	3.73A	1.00d	1.10c	1.20b	1.10B
Compost 40 % + 60 % M.F.	14.60cd	15.33ab	15.82a	15.25A	6.50b	3.75g	3.10h	4.45C	2.25f	4.09c	5.10b	3.81A	1.10c	1.20b	1.40a	1.23A
Compost 60 % + 40 % M.F.	13.83e	14.00de	14.17de	14.00C	5.90c	5.20e	4.80f	5.30B	2.34f	2.69e	2.95	2.66B	0.80f	0.90e	0.90e	0.87C
Mean	13.67C	14.27B	14.77A		6.33A	4.86B	4.05C		2.17C	3.04B	4.05A		0.90B	0.98AB	1.08A	
Second season 2021																
Control	12.00g	12.84f	13.85e	12.90D	7.20a	5.70d	5.30e	6.07A	1.67h	2.25f	2.61e	2.18C	0.60e	0.60e	0.70d	0.63D
Compost 20 % + 80 % M.F.	14.43ce	14.75cd	15.38ab	14.85B	6.90ab	4.40f	4.10fg	5.13C	2.09g	3.35bc	3.75ab	3.06A	0.80c	0.80c	0.90b	0.83B
Compost 40 % + 60 % M.F.	14.58cd	15.02bc	15.83a	15.14A	7.05a	4.30f	3.95h	5.10C	2.07g	3.49b	4.01a	3.19A	0.80c	0.90b	1.10a	0.93A
Compost 60 % + 40 % M.F.	13.87e	14.28de	14.33de	14.16C	6.65c	5.05e	4.95e	5.55B	2.09g	2.83d	2.89	2.60B	0.70d	0.70d	0.80c	0.73C
Mean	13.72C	14.22B	14.85A		6.95A	4.86B	4.58C		1.98C	2.98B	3.32A		0.73B	0.75B	0.88A	

Means having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

between two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant values TSS in both seasons.

Acidity (%): Regarding to soil application with sugar beet compost, compost 20% + mineral fertilizer 80% and compost 40% + mineral fertilizer 60% treatment found the lowest significant acidity (%) in both seasons. On the other hand, control (farm treatment) was the highest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the lowest significant acidity (%). The interaction between two studied factors recorded that compost 20% + mineral fertilizer 80% treatment and compost 40% + mineral fertilizer 60% treatment with 100 ml EM treatment showed lowest significant values acidity (%) in both seasons.

TSS/acid ratio: Regarding to soil application with sugar beet waste compost rates, compost 20% + mineral fertilizer 80% treatment, compost 40% + mineral fertilizer 60% found the highest significant values TSS/acid ratio in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the highest significant TSS/acid ratio. The interaction between two studied factors recorded that compost 20% + mineral fertilizer 80% treatment in first season, compost 20% + mineral fertilizer 80% treatment, compost 40% + mineral fertilizer 60% treatment with 100 ml EM treatment showed highest significant values TSS/acid ratio in both seasons.

Ascorbic acid (vitamin C): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment had the highest values ascorbic acid (vitamin C) in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the highest significant value of ascorbic acid (vitamin C). The interaction between two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant ascorbic acid (vitamin C) in both seasons.

Data in table (11) show the effect of sugar beet compost, effective Microorganisms (EM) and their interaction on total sugars, reducing sugars and non-reducing sugars and of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Total sugars (%) and reducing sugars (%): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment showed the highest significant total sugars and reducing sugars in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the highest significant value of total sugars and reducing sugars. The interaction between two studied factors recorded that compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant values total sugars and reducing sugars in both seasons.

Non-reducing sugars (%): Regarding to soil application with sugar beet compost rates, compost 60% + mineral fertilizer 40% treatment showed the lowest significant non reducing sugars in both seasons. Concerning effect of Microorganisms (EM) treatments, 75,100 ml EM treatment recorded lower significant value of non-reducing sugars than control in both season. The interaction between two studied factors recorded that compost 60% + mineral fertilizer 40% with 100 ml EM treatment showed lowest significant values non-reducing sugars in both seasons.

Leaf mineral content

Data in table (12) show the effect of compost, effective microorganisms (EM) and their interaction on nitrogen, phosphors and potassium of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Nitrogen (%): Regarding to soil application with sugar beet compost rates, compost 40% + mineral fertilizer 60% treatment found the highest significant leaf Nitrogen percentage in both seasons. On the other hand, control (farm treatment) was the lowest significant values in both seasons. Concerning effect of Microorganisms (EM) treatments, 100 ml EM treatment recorded the highest significant value of

Table 11: Effect of sugar beet compost, effective microorganisms (EM) and their interaction on total sugars, reducing sugars and non-reducing sugars of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Treatments \ Parameters	Total sugars (%)				Reducing sugars (%)				Non-reducing sugars (%)			
	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean
						First season 2020						
Control	9.82h	10.57g	11.18f	10.52D	8.05f	8.90e	9.70d	8.88D	1.77a	1.67a	1.48ab	1.64A
Compost 20 % + 80 % M.F.	12.76d	13.28bc	13.57b	13.20B	11.05bc	11.85ab	12.18a	11.69B	1.71a	1.43b	1.39b	1.51B
Compost 40 % + 60 % M.F.	13.18c	13.51b	14.18a	13.62A	11.65ab	12.10a	12.47a	12.07A	1.53ab	1.41b	1.71a	1.55B
Compost 60 % + 40 % M.F.	11.41ef	11.62e	11.70e	11.58C	10.25cd	10.37cd	10.52cd	10.38C	1.16c	1.25c	1.18c	1.20C
Mean	11.79C	12.25B	12.66A		10.25C	10.81B	11.22A		1.54A	1.44B	1.44B	
						Second season 2021						
Control	9.96g	10.35f	11.21e	10.47D	8.20f	9.05e	9.85d	9.03D	1.66a	1.30c	1.36c	1.44B
Compost 20 % + 80 % M.F.	12.96c	13.43b	13.66b	13.35B	11.20bc	12.00ab	12.33a	11.84B	1.76a	1.43b	1.33	1.51A
Compost 40 % + 60 % M.F.	13.32b	13.61b	14.32a	13.75A	11.80ab	12.25a	12.62a	12.22A	1.52b	1.36c	1.70a	1.53A
Compost 60 % + 40 % M.F.	11.55de	11.66d	11.82d	11.68C	10.40cd	10.52cd	10.67cd	10.53C	1.15d	1.14d	1.15d	1.15C
Mean	11.92C	12.26B	12.75A		10.40C	10.96B	11.37A		1.52A	1.31B	1.39B	

Means having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

Table 12: Effect of sugar beet compost, effective microorganisms (EM) and their interaction on nitrogen, phosphors and potassium of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Parameters / Treatments	Nitrogen (%)				Phosphors (%)				Potassium (%)			
	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean
First season 2020												
Control	1.590e	1.600de	1.627c-e	1.606D	0.163a	0.157a-c	0.123f	0.148AB	2.80e	2.83e	2.90de	2.84B
Compost 20 % + 80 % M.F.	1.683b	1.697b	1.750a	1.710B	0.140c-f	0.150a-d	0.150a-d	0.147AB	3.10ab	3.16ab	3.17ab	3.14A
Compost 40 % + 60 % M.F.	1.687b	1.743a	1.770a	1.733A	0.150a-d	0.130ef	0.150a-d	0.138B	3.12ab	3.16ab	3.25a	3.18A
Compost 60 % + 40 % M.F.	1.637cd	1.653bc	1.670bc	1.653C	0.160ab	0.143b-e	0.150a-d	0.151A	2.92c-e	3.05b-d	3.08a-c	3.02B
Mean	1.649C	1.673B	1.704A		0.153A	0.145B	0.139B		2.99B	3.05A	3.10A	
Second season 2021												
Control	1.583g	1.607fg	1.623fg	1.604D	0.150ab	0.150ab	0.143bc	0.148A	2.85e	2.88e	2.95de	2.89B
Compost 20 % + 80 % M.F.	1.670de	1.690cd	1.750ab	1.703B	0.143bc	0.140bc	0.157ab	0.147A	3.15ab	3.19ab	3.22ab	3.19A
Compost 40 % + 60 % M.F.	1.683c-e	1.713bc	1.770a	1.722A	0.123cd	0.150ab	0.157ab	0.143A	3.17ab	3.31ab	3.30a	3.23A
Compost 60 % + 40 % M.F.	1.623fg	1.623fg	1.647ef	1.631C	0.167a	0.120d	0.153ab	0.147A	2.97c-e	3.10b-d	3.13a-c	3.07A
Mean	1.640C	1.658B	1.698A		0.146B	0.140B	0.153A		3.04B	3.10A	3.15A	

Means having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

Nitrogen percentage. The interaction between two studied factors recorded that compost 20% + mineral fertilizer 80% treatment, compost 40% + mineral fertilizer 60% with 100 ml EM treatment showed highest significant values Nitrogen percentage in both seasons.

Phosphors (%): Inconstant trend of leaf phosphors content among all treatments could be found in both the two studied seasons.

Potassium (%): Regarding to sugar beet compost treatments, compost 20% + mineral fertilizer 80% treatment and compost 40% + mineral fertilizer 60% treatment showed higher significant values compared with control. Concerning EM treatment, both treatments of EM showed higher leaf potassium than control. The interaction between two studied factors, recorded that compost 20% + mineral fertilizer 80% treatment, compost 40% + mineral fertilizer 60% treatment with both of EM treatments recorded highest values in both seasons.

Data in table (13) show the effect of compost, effective of Microorganisms (EM) and their interaction on calcium and magnesium of mango Keitt cv. under heat stress conditions during 2020 and 2021 seasons.

Calcium (%): Regarding to sugar beet compost treatments, compost 20% + mineral fertilizer 80% recorded highest leaf calcium content. Concerning EM treatment, 75ml EM treatment had highest significant values. The interaction between the two studied seasons, inconstant trend could be noticed between both seasons.

Magnesium (%): Regarding to sugar beet compost treatments, the treatment compost 20% + mineral fertilizer 80% had highest significant value of leaf magnesium content in both seasons. Concerning to EM treatment insignificant differences could be noticed among treatments. The interaction between the two studied factors, the treatment of compost 20% + mineral fertilizer 80% with all EM treatments had highest leaf magnesium.

Data in table (14) show the effect of compost, effective of Microorganisms (EM) and their interaction on iron, manganese and zinc of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Iron and Zinc (ppm): Micro nutrients: leaf iron and zinc content were affected significantly by all treatments. Compost 20% + mineral fertilizer 80% recorded highest iron and zinc compost in both seasons. EM treatment at 75ml gave highest values in both seasons. The interaction between compost and EM it could be noticed that 20% compost + 80% mineral fertilizer had highest values in both seasons.

Manganese (ppm): Regarding to compost treatment 60% compost + 40% mineral fertilizer had highest significant content. Concerning EM treatment, 100ml EM treatment showed highest significant value. The interaction between compost and EM 60% compost + 40% mineral fertilizer + 100ml EM showed highest significant leaf manganese content.

These results are agree with those found by Mishra, and Malik, (2014) showed that effect of sugar beet compost depends mainly on vast categories of microorganisms; mainly bacteria, actinomycetes and fungi which can effectively destroy weed seeds and pathogens. Hottle, (2015) recorded that biodegradable solid organic matter into a stable humus like substance. Also, (Higa, 1991; Higa and Wididana, 1991) noticed that (EM) on lowering soil pH, and increasing the uptake of water and nutrients and enhancing soil fertility (Formowitz *et al*., 2007 and Ibrahim, 2012). Furthermore, (Higa, 1991) found that EM application increased number of the soil microflora i.e. total bacteria, total actinomyces and total fungi which are the producers of indole acetic acid and gibberellins leads to improvement growth of root system that reflected on enhanced the uptake of nutrients. Briefly, from the obtained results and under similar conditions it is preferable to add sugar beet compost 40% + mineral fertilizer 60% with EM at 100 ml / mango tree/ year treatment as soil application to improve growth and fruit quality under heat stress condition.

Table 13: Effect of sugar beet compost, effective microorganisms (EM) and their interaction on calcium and magnesium of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Treatments \ Parameters	Calcium (%)				Magnesium (%)			
	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean
				First season 2020				
Control	1.44f	1.88e	1.86e	1.73B	0.184d	0.196b	0.188c	0.189C
Compost 20 % + 80 % M.F.	2.21c	2.20c	2.34b	2.25A	0.219a	0.221a	0.228a	0.223A
Compost 40 % + 60 % M.F.	1.86e	2.06d	1.32g	1.75B	0.209b	0.194	0.210ab	0.204B
Compost 60 % + 40 % M.F.	2.15c	2.41a	2.17c	2.24A	0.206b	0.189c	0.199b	0.198B
Mean	1.92B	2.14A	1.92B		0.205A	0.200A	0.206A	
				Second season 2021				
Control	1.47g	1.91f	1.89f	1.76C	0.182e	0.199cd	0.191d	0.191C
Compost 20 % + 80 % M.F.	2.24c	2.23c	2.37b	2.28A	0.222ab	0.224ab	0.231a	0.226A
Compost 40 % + 60 % M.F.	2.02e	2.10d	1.35h	1.82C	0.212b	0.197d	0.213b	0.207B
Compost 60 % + 40 % M.F.	1.89f	2.44a	2.20c	2.18B	0.209b	0.192d	0.202bc	0.201B
Mean	1.91B	2.17A	1.95B		0.206A	0.203A	0.209A	

Means having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

Table 14: Effect of sugar beet compost, effective microorganisms (EM) and their interaction on iron, manganese and zinc of Keitt cv. mango under heat stress conditions during 2020 and 2021 seasons.

Parameters / Treatments	Iron (ppm)				Manganese (ppm)				Zinc (ppm)			
	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean	Control	75 ml EM	100 ml EM	Mean
						First season 2020						
Control	292.1l	427.1g	419.6h	379.6D	129.8k	183.5c	133.5j	148.9D	73.43k	94.70j	104.7i	90.90D
Compost 20 % + 80 % M.F.	388.4j	507.1a	487.1c	460.9A	128.5k	168.5e	179.8d	159.0C	152.2f	174.7a	148.4d	158.4A
Compost 40 % + 60 % M.F.	414.6i	462.1e	500.9b	459.2B	139.8i	156.0g	204.8b	166.8B	122.2f	114.7g	144.7e	127.2C
Compost 60 % + 40 % M.F.	368.4k	465.9d	437.1f	423.8C	162.3f	143.5h	207.3a	171.0A	107.2h	157.2b	147.2d	137.2B
Mean	365.9C	465.5A	461.2B		140.1C	162.9B	181.3A		113.7B	135.3A	136.2A	
						Second season 2021						
Control	297.1l	392.4k	404.6j	364.7D	139.8h	180.5c	135.5j	151.9D	77.73k	107.7i	105.4j	96.90D
Compost 20 % + 80 % M.F.	474.9d	509.6a	467.4e	483.9A	128.0k	168.0d	179.8c	158.6C	141.7cd	167.2a	142.7c	150.5A
Compost 40 % + 60 % M.F.	427.1h	495.4b	487.1c	469.9B	137.3i	155.8f	206.8b	166.6B	134.2f	125.2g	140.2d	133.2C
Compost 60 % + 40 % M.F.	412.1i	429.6g	457.1f	432.9C	160.3e	142.5g	215.3a	172.7A	112.2h	164.7b	137.2e	138.0B
Mean	402.8C	456.7A	454.0B		112.3C	161.7B	184.3A		116.4C	141.2A	131.4B	

Means having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

Conclusions

Finally, adding sugar beet compost at 40% + mineral fertilizer 60% also effective micro-organisms (EM) at 100 ml / tree could be recommended as the most appropriate treatment in Kiett cv. mango trees under heat stress conditions. This treatment improved soil properties, vegetative growth (plant height, number of new lateral/shoot, branch length, number of leaves/branch, leaf area, total chlorophyll in leaf, dry matter % of leaves, dry matter % of shoot, as well as leaf mineral content of N, P, K, Ca, Mg, Fe, Mn and Zn in leaves. On the other hand, this treatment enhanced fruit volume, fruit weight, number of fruit/tree, yield kg/ tree, flesh weight, fruit length, fruit diameter, fruit shape index, as well as, improve T.S.S. T.S.S./acid ratio, ascorbic acid (vitamin C), total sugar, reducing sugar and reduced peel weight, seed weight, acidity percentage, non- reducing sugar. This treatment was proven to be the most efficient in enhancing growth and mineral content.

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