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Impact of Foliar Spray with some Nutrients on Growth, Nutritional Status and Productivity of 'Golock' Mango Trees Cultivar

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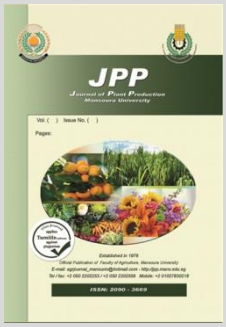

ABSTRACT

This investigation was carried out at privet farm, Abu Suwair region, Ismailia Governorate, Egypt during 2019 and 2020 seasons. Ten – year-old mango trees of 'Golock' cultivar were the plant materials used in this experiment, planted at 6 × 6 meters separated in clay soil. Forty-five fruitful mango trees were selected and devoted for this search. Those trees were similar as well as they received the same culture managements adopted in ministry of agriculture. The impact of foliar spray with some nutrients was investigated through studying their effect on some vegetative growth, leaf mineral content, yield and fruit qualities of Golock mango trees cultivar. Results indicated that, all foliar nutrients treatments resulted in a significant effect on growth, leaf mineral content, yield and fruit qualities of mango, however the spray with elemental Sulpher at 0.3% + Zinc sulphate at 0.4% + Borax at 0.1% + Magnesium sulphate at 0.4% were the most effective treatments for increasing growth, leaf mineral content, yield and fruit qualities of Golock mango trees cultivar. On the other hand, the least values were obtained from mango trees foliar spray with tap water or elemental Sulpher at 0.3% + Zinc sulphate at 0.2% during two seasons of study.

Keywords: Elemental Sulpher, Zinc, Borax, Magnesium, Golock mango.

INTRODUCTION

Mango (*Mangifera indica* L.) is a very tasty tropical fruit that belongs to the family Anacardiaceae and is considered the Queen of fruits because it is so popular all over the world. Mango fruits are rich in vitamins and minerals and are famous for their excellent taste, attractive aroma and nutritional value. It is an emerging tropical export crop, used in about 90 countries around the world, with production of over 820,877 tons (Abassi *et al.*, 2011). In Egypt, mango is considered the most popular fruit. The area of mango orchards reached 241101 feddan, producing about 712537 tons of fruits annually (Ministry of Agriculture and Land Reclamation Statistics, Egypt 2019). Golock mango cultivar grown successfully under the Egyptian conditions and its yield production comes in the late season.

Macronutrients and micronutrients improve plant pigments, DNA, RNA, amino acids, vitamins, antioxidants, sugars, and biosynthesis of plant metabolism, cell division, cell wall development, and most enzyme-related compounds. Play a role. They are involved in the biosynthesis of plant hormones such as IAA, GA3, cytokinins, ABA and ethylene. Flower, fruiting, fruit development, fruit fall, fruit ripening and fruit quality were determined by the availability of nutrients. (Mengel and Kirkpy, 1987).

Nutrients are essential in many plant metabolic processes. They play many important regulatory roles in plant development. Functions of nutrients are activating various enzymes involved in plant growth; enhancing the biosynthesis of carbohydrates, fats, proteins and natural hormone, and movement of carbohydrates. They are also responsible for stimulating cell division, cell enlargement, water and nutrient transport and the building of amino acids (Devlin and Withdam, 1983 and Nijjar, 1985).

Sulpher is important to enhance the micro and macro element availability, which may increase the growth of plants (Abbas *et al.*, 2015). The leaf length of the Mishrig Wad Laggai date palm cultivar was increased due to sulpher application (Dawoud and Rauof, 2011).

The role of sulfur in plants is to help the formation of vegetable proteins, which are essential for the formation of chlorophyll and improve root growth. Sulfur is involved in the formation of vitamins and enzymes that plants need for their biochemical processes. (Scherer *et al.*, 2008). Sulfur accumulates in plants at lower concentrations than N, but is an essential component of proteins, cysteine-containing peptides such as glutathione, or many secondary metabolites. (Abdallah *et al.*, 2010), and synthesis of vitamins and chlorophyll in the cell (Kacar and Katkat, 2007).

Boron is an essential micronutrient for all fruit crop species development. It is very important for all reproductive tissues. During flowering and fruit setting, boron deficiency can result in dropping of flowers and poor fruit set, since it plays a main role in early seasons shoot growth; pollen growth, and tube germination, since it is needed for fertilization process and fruit setting (Marschner, 2012).

Boron has a significant impact on fruit crop fruiting through its important role in improving cell division, sugar and hormone biosynthesis and translocation, root development, pollen germination, water, and nutrient uptake and flowering. However, the formation and reduction of flower drops Fruits and the frequency of disability (Fraguas and Silva, 1998).

Abdel-Fattah *et al.*, (2008) on "Costate" persimmon spraying boric acid on the leaves showed an increase in fruit weight. Boron is involved in processes such as protein synthesis, sugar transport, and carbohydrate metabolism. (Hansch and Mendel, 2009).

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Boron and zinc deficiencies are more likely to occur at the beginning of the season, as element transfer from the roots to the above-ground part before leaf swelling may be inadequate. (Nelson *et al.*, 2004).

Zinc and boron have a promising effects on plant metabolism. They are involved in the production of the natural hormone IAA, activation of several enzymes, chlorophyll biosynthesis, promotion of pollen germination, and regulation of water absorption by plants. (Nijjar, 1985).

Foliar fertilization with nutrients, especially boron and zinc, was essential for the production of healthy mango trees and the production of highly productive trees. In addition, they are responsible for improving the physical and chemical parameters of the fruit (Banik *et al.*, 1997 and Bahadur *et al.*, 1998).

Zinc is a cofactor for over 300 enzymes and proteins with early targeting effects on cell division, nucleic acid metabolism, and protein synthesis. (Marschner, 2012). It is an essential trace element for plants that is involved in many enzymatic reactions and is required for their good growth and development. Zinc is also involved in the regulation of protein and carbohydrate metabolism (Swietilk, 1999). Moreover, zinc uptake rate was faster in mango trees when zinc sulfate was foliar applied as compared with its soil application (Bahadur *et al.*, 1998). The positive effect of zinc foliar application on increasing mango productivity was cited by improving fruit quality in terms of TSS and total sugar (Rashmi and Singh, 2007).

Magnesium is essential for the construction of chlorophyll, sugar, DNA, RNA, proteins, fats and amino acids. It also helps improve P uptake and sugar translocation (Nijjar, 1985).

The positive effects of magnesium on the fruiting of Ewise Mango tree are increased activity of various enzymes, biosynthesis and translocation of carbohydrates, fats, proteins and natural hormones, cell division, cell expansion, water and nutrients, structure. Is due to chlorophyll, amino acids and seed formation (Mengel and Kirkby, 1987).

The main target from this study investigate the impact of spraying Golock mango trees cultivar with some nutritive solution on growth, leaf mineral content, yield, and fruit qualities.

MATERIALS DND METHODS

This investigation was carried out at privet farm, Abu Suwair region, Ismailia Governorate, Egypt during two successive 2019 and 2020 experimental seasons. Ten years old mango trees of 'Golock' cultivar were the plant materials used in this experiment, planted at 6 × 6 meters separated in clay. Forty-five fruitful mango trees were selected and devoted for this search. Those trees were similar as well as they received the same culture management adopted in ministry of agriculture. All trees are fertilized with NPK (205, 50 and 145g per tree, respectively (program recommended by the Ministry of Agriculture).

Physical and chemical analyses of orchard soil was performed according to the method in the first season after Piper (1947) and Jackson (1973) as shown in Table (1).

The experiment involved the following fifteen treatments of Sulpher, Zinc, Boron and Magnesium:

T1- Control (spraying water only).
T2- Elemental Sulpher at 0.3% + Zinc sulphate at 0.2%.
T3- Elemental Sulpher at 0.3% + Zinc sulphate at 0.4%.
T4 - Elemental Sulpher at 0.3% + Borax at 0.05%.
T5- Elemental Sulpher at 0.3% + Borax at 0.1%.
T6- Elemental Sulpher at 0.3% + Magnesium sulphate at 0.2%.
T7- Elemental Sulpher at 0.3% + Magnesium sulphate at 0.4%.
T8- Elemental Sulpher at 0.3% + Zinc sulphate at 0.2% + Borax at 0.05%.
T9- Elemental Sulpher at 0.3% + Zinc sulphate at 0.2% + Magnesium sulphate at 0.2%.
T10- Elemental Sulpher at 0.3% + Borax at 0.05% + Magnesium sulphate at 0.2%.
T11- Elemental Sulpher at 0.3% + Borax at 0.1% + Magnesium sulphate at 0.4%.
T12- Elemental Sulpher at 0.3% + Borax at 0.1% + Zinc sulphate at 0.4%.
T13- Elemental Sulpher at 0.3% + Zinc sulphate at 0.4% + Magnesium sulphate at 0.4%.
T14- Elemental Sulpher at 0.3% + Zinc sulphate at 0.2% + Borax at 0.05% + Magnesium sulphate at 0.2%.
T15- Elemental Sulpher at 0.3% + Zinc sulphate at 0.4% + Borax at 0.1%. + Magnesium sulphate at 0.4%.

Table 1. Analysis of the soil at trial location at Abu Suwair district, Ismailia Governorate, Egypt.

Constituents	Values
Sand %	6.56
Silt %	15.28
Clay %	78.16
Texture	Clay
Organic matter (O.M. %)	2.14
pH (1:2.5 extract)	8.11
Electric Conductivity (E.C.) (1:2.5extract) (mmhos/1cm/25C°)	0.95
Calcium Carbonate ($CaCO_3$ %)	1.32
Available macronutrients	
Nitrogen%	0.11
Potassium ppm	450
Phosphorus ppm	32
Magnesium ppm	140
Sulpher ppm	6.95
Available micronutrients	
Boron ppm	0.30
Iron ppm	18.65
Zinc ppm	1.30
Manganese ppm	14.70
Cupper ppm	2.00

Trees spray with treatments twice, after pruning in late September and first week of February during each season. Each tree was sprayed with five liter from solution, beside tap water as control.

The Complete randomized block design was used for arranging the abovementioned spraying treatments, whereas each treatment was replicated three times and each replicate was represented by one mango trees.

The Methodology which has been followed in this study is being determined as follows:

1- Some vegetative growth measurements:

At last week of August vegetative growth measurements of mango trees "Golock cv." as affected by the differential investigated fifteen spray treatments were evaluated through determining the response of the following parameters: shoot length, shoot diameter, number of leaves per shoot and average leaf area were measured according to (Ahmed and Morsy,1999).

2- Leaf mineral contents:

Leaf samples were taken on the last week of August from the middle portion of currant season shoots. The leaves were thourghly washed with distilled water, oven dried at 70 °C till constant weight, then weighed and ground with porcelain mortar and pestle, after being ground, the leaf dried samples were stored in small paper bags until using for the determination of N, P, K, Ca, Mg, Fe, Zn and Mn after the following procedures:

a. Total Nitrogen :

Total nitrogen content of dried leaves samples was determined by the following standard method Black (1965).

b. Total phosphorus :

Total leaf phosphorus content was determined using a Spekol spectrophotometer at 882.0 UV according to the method described by Murphy and Riely (1962).

c. Leaf K, Ca, Mg, Fe, Zn and Mn contents:

Were determined by using the Atomic Absorption Spectrophotometer (3300) according to Jackson (1973) and Wild et al. (1985). Leaf nutrient elements contents were expressed as a ratio of the leaf dry weight, i.e., percentage for the macro-elements (N, P, K, Ca and Mg) and part per million (ppm) with micro-nutrient elements (Fe, Zn and Mn).

3- Flowering measurements:

At full bloom in the 2nd week of April for both seasons number of panicles per tree, panicle length, numbers of flowers per panicle were measured.

4- Yield indicators:

At harvesting time (which was extended to late August during both seasons of study), fruits of each individual tree were counted and weighed in Kg.

5- Fruit quality:

Samples of ten mature fruits at harvesting time from each tree were randomly collected and the physical and chemical properties were determined:

5. a. Fruit physical characteristics: The average of fruit weight (g), fruit volume (cm^3), fruit length, fruit diameter, fruit shape index and fruit thickness were measured and estimated.

5. b. Fruit chemical characteristics: The fruit juice chemical properties of mature fruits were determined according to Hussein and Youssef (1972) as follows:

Total soluble solids percentage (TSS %): Fruit juice total soluble solids percentage was determined using a Carl Zeiss hand refractometer.

Total titratable acidity percentage: Fruit juice total acidity was estimated as a percentage of anhydrous citric and malic acids according to the method described by A.O.A.C., 1995.

TSS/acid ratio: TSS/acid ratio was estimated by dividing the total soluble solids (TSS) percentage over total acidity percentage

Total sugars content: total sugar of fruit pulp was determined calorimetrically as g/ 100g flesh weight according to the method described by Dubaist *et al.* (1956).

Statistical Analysis:

All data in two seasons of study were statistically analyzed using the analysis of variance method according to Snedecor and Cochran (1980). However, means were distinguished by the Duncan's multiple range test (Panse and Sukhatme, 1978).

RESULTS AND DISCUSSION

Data obtained during both 2019 and 2020 experimental seasons could be summarized as follow:

1-Vegetative growth measurements:

Regarding the influence of foliar spray with some nutrients treatments on some vegetative growth measurements i. e., shoot length, shoot diameter (cm), number of leaves per shoot and leaf area of 'Golock' mango trees. Data presented in Table (2) indicated that, elemental Sulpher at 0.3% + Zinc sulphate at 0.4% + Borax at 0.1%. + Magnesium sulphate at 0.4% (T15) gave highest values from some vegetative growth measurements during two seasons. On the other hand, the least values of vegetative growth measurements were obtained from Control (spray water only) during 2019 and 2020 seasons. The other treatments were in between during both seasons.

The present results are in general accordance with those previously found by Dawoud and Rauof (2011) and Abbas *et al.*, (2015).

Table 2. Effect of spraying with some nutrients on vegetative growth measurements of Golock mango trees cultivar during 2019 and 2020 seasons.

Treatments	Shoots length (cm)		Number of leaves		Shoot thickness (cm)		Leaf area(cm^2)	
	2019	2020	2019	2020	2019	2020	2019	2020
T1	15.50	15.69	12.67	13.06	0.59	0.61	77.76	82.12
T2	16.42	16.63	14.44	14.89	0.62	0.63	81.82	86.40
T3	16.48	16.69	14.56	15.01	0.61	0.63	82.32	86.92
T4	16.51	16.70	14.61	15.06	0.61	0.63	82.56	87.18
T5	16.58	16.78	14.33	14.78	0.61	0.63	82.84	87.48
T6	16.59	16.79	14.42	14.86	0.61	0.63	83.00	87.64
T7	16.63	16.83	14.67	15.12	0.62	0.63	82.66	87.28
T8	16.91	17.11	14.75	15.21	0.62	0.63	84.56	89.29
T9	17.04	17.24	14.83	15.29	0.62	0.64	85.09	89.85
T10	17.16	17.36	14.78	15.24	0.62	0.63	85.91	90.71
T11	17.17	17.38	14.93	15.39	0.62	0.64	86.25	91.07
T12	17.29	17.50	15.00	15.47	0.63	0.64	86.62	91.46
T13	17.31	17.52	14.89	15.35	0.63	0.64	87.41	92.30
T14	17.94	18.16	15.44	15.92	0.63	0.65	89.41	94.40
T15	18.20	18.42	15.33	15.81	0.64	0.65	91.44	96.55
L.S.D.at 5%	0.30*	0.30*	0.74*	0.77*	0.02*	N.S.	2.03*	2.14*

2- Leaf mineral content:

Concerning the impact of foliar spray with some nutrients treatments on the leaf N, P, K, Ca, Mg, Fe, Zn and Mn content. Data tabulated in Tables (3 and 4) indicated that, different applied treatments i.e., elemental Sulpher at 0.3% + Zinc sulphate at 0.4% + Borax at 0.1%. + Magnesium sulphate at 0.4% (T15), elemental Sulpher at 0.3% + Zinc sulphate at 0.2% + Borax at 0.05% + Magnesium sulphate at 0.2% (T14) and Elemental Sulpher at 0.3% + Zinc sulphate at 0.4% + Magnesium sulphate at 0.4% (T13) significantly increased leaf N, P, K, Ca, Mg, Fe, Mn and Zn content of 'Golock' mango trees during both seasons. The maximum significantly affect was observed with using Elemental Sulpher at 0.3% + Zinc sulphate at 0.4% + Borax at 0.1%. + Magnesium sulphate at 0.4% (T15) during two seasons. Latest increase with using Elemental Sulpher at 0.3% + Zinc sulphate at 0.2% (T2) during 2019 and 2020 seasons.

The obtained results are agreement with Dabke *et al.* (2013); Nafees (2011) and Taha *et al.* (2014).

Table 3. Effect of spraying with some nutrients on leaf mineral element contents (Macro elements %) of Golock mango cultivar during 2019 and 2020 seasons.

Treatments	N%		P%		K %		Ca%		Mg%	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
T1	1.74	1.76	0.22	0.23	0.37	0.38	0.38	0.39	0.30	0.31
T2	1.78	1.80	0.24	0.24	0.40	0.40	0.41	0.42	0.32	0.33
T3	1.79	1.81	0.24	0.24	0.40	0.41	0.41	0.42	0.32	0.33
T4	1.80	1.82	0.24	0.24	0.40	0.41	0.41	0.42	0.32	0.33
T5	1.82	1.84	0.24	0.25	0.40	0.40	0.41	0.42	0.32	0.33
T6	1.81	1.84	0.24	0.25	0.40	0.40	0.41	0.42	0.32	0.33
T7	1.80	1.83	0.25	0.25	0.41	0.41	0.42	0.42	0.32	0.33
T8	1.84	1.87	0.25	0.25	0.41	0.41	0.42	0.42	0.33	0.34
T9	1.86	1.88	0.25	0.26	0.40	0.41	0.42	0.42	0.33	0.33
T10	1.87	1.89	0.25	0.26	0.40	0.41	0.42	0.42	0.34	0.34
T11	1.88	1.90	0.26	0.26	0.41	0.42	0.42	0.43	0.33	0.34
T12	1.88	1.90	0.25	0.26	0.41	0.42	0.42	0.43	0.33	0.33
T13	1.89	1.91	0.26	0.26	0.41	0.41	0.42	0.43	0.34	0.34
T14	1.95	1.97	0.26	0.27	0.42	0.43	0.43	0.43	0.34	0.34
T15	2.00	2.02	0.28	0.28	0.42	0.43	0.43	0.44	0.36	0.36
L.S.D. at 5%	0.028*	0.029*	0.006*	0.005*	0.006*	0.007*	0.012*	0.012*	0.005*	0.007*

Table 4. Effect of spraying with some nutrients on the leaf mineral element contents [Micro-elements (ppm)] of Golock mango cv. during 2019 and 2020 seasons.

Treatments	Fe ppm		Mn ppm		Zn ppm	
	2019	2020	2019	2020	2019	2020
T1	169.33	174.41	24.83	25.58	29.00	29.61
T2	182.50	187.98	26.65	27.45	30.13	30.76
T3	183.56	189.07	26.98	27.79	30.07	30.71
T4	184.09	189.61	27.14	27.96	30.05	30.68
T5	182.35	187.82	26.79	27.60	30.32	30.96
T6	182.76	188.24	26.95	27.76	30.46	31.10
T7	184.00	189.52	27.42	28.24	30.87	31.51
T8	186.50	192.10	27.35	28.17	30.90	31.55
T9	187.17	192.79	27.36	28.18	30.91	31.56
T10	187.59	193.22	27.72	28.55	31.37	32.03
T11	190.50	196.22	27.75	28.59	31.41	32.07
T12	188.73	194.40	27.81	28.64	31.52	32.18
T13	190.25	195.96	27.83	28.66	31.75	32.42
T14	194.50	200.34	28.58	29.44	32.17	32.84
T15	198.00	203.94	28.88	29.74	33.38	34.08
L.S.D. at 5%	1.10**	1.13**	0.37**	0.38**	0.53**	0.54**

3-Flowering measurements:

Regarding the effect of foliar spray with some nutrients, on number of panicle and panicle length of mango trees "Golock cv.", data presented in Table (5) indicate that, elemental Sulpher at 0.3% + Zinc sulphate at 0.4% + Borax at 0.1%. + Magnesium sulphate at 0.4% (T15) and Elemental Sulpher at 0.3% + Zinc sulphate at 0.2% + Borax at 0.05% + Magnesium sulphate at 0.2% (T14) gave the high values in this respect during the two seasons. On the contrary the least values were obtained from 'Golock' mango trees spray with water only. The others treatments were in between during both seasons.

4-Yield indicators:

Data in Table (5) indicate that, the effect of different foliar spray with some nutrients on yield indicators i.e., number of fruits/ tree and weight of fruits per tree (kg) of 'Golock' mango trees in both experimental seasons. All applied treatments significantly increased number of fruits/ tree and weight of fruits per tree (kg) over the control during 2019 and 2020 seasons.

The obtained results regarding the increment of yield exhibited by different foliar spray with some nutrients goes in the line with those found by Mengel and Kirkpy, (1987); Fraguas and Silva, (1998); Rashmi and Singh, (2007) and Marschner, (2012).

Table 5. Effect of spraying with some nutrients on the flowering aspects and yield of Golock mango trees cv. during 2019 and 2020 seasons.

Treatments	Flowering aspects						Yield (harvested mature fruits)			
	No. of panicles peer tree		Panicle length (cm)		No. of flowers per panicle		Number of fruits per tree		Yield per tree (kg)	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
T1	90.92	93.83	20.51	21.03	484.89	504.28	313.16	323.18	75.43	77.54
T2	91.97	94.91	22.77	23.34	536.12	557.56	316.78	326.92	76.30	78.44
T3	93.07	96.05	23.07	23.64	543.18	564.91	320.57	330.83	77.22	79.38
T4	94.26	97.28	23.37	23.95	550.25	572.26	324.67	335.06	78.20	80.39
T5	96.96	100.06	24.07	24.67	566.73	589.40	333.98	344.67	80.45	82.70
T6	97.51	100.63	24.23	24.84	581.90	605.17	335.87	346.62	80.90	83.17
T7	98.43	101.58	24.53	25.15	587.94	611.45	339.70	350.57	81.66	83.95
T8	104.98	108.34	25.50	26.14	611.10	635.55	362.30	373.90	87.10	89.53
T9	108.18	111.65	26.43	27.09	633.82	659.17	373.16	385.10	89.76	92.27
T10	110.75	114.29	27.07	27.74	649.00	674.96	382.01	394.24	91.88	94.46
T11	111.71	115.28	27.60	28.29	675.46	702.48	387.54	399.94	92.68	95.28
T12	114.50	118.17	27.97	28.67	684.44	711.81	397.23	409.94	95.00	97.66
T13	116.61	120.34	28.50	29.21	697.49	725.39	404.54	417.49	96.75	99.46
T14	120.18	124.03	30.27	31.02	740.73	770.35	416.94	430.28	99.71	102.50
T15	124.44	128.42	31.67	32.46	802.34	834.43	417.00	430.34	103.25	106.14
L.S.D. at 5%	9.44*	922*	0.55*	0.56*	16.16*	16.80*	11.34*	11.70*	2.69 *	2.76*

5- Fruit quality:

- Fruit physical characteristics:

In this regards, average fruit weight (g), fruit volume (cm^3), fruit dimensions (equatorial & polar diameters), fruit shape index (L/D) and fruit thickness (cm) were evaluated fruit physical characteristics of 'Golock' mango trees in response to different applied treatments.

Results in Table (6) showed that, different treatments significantly increased average fruit weight (g), fruit volume (cm^3), fruit dimensions (equatorial & polar diameters), fruit shape index (L/D) and fruit thickness (cm) during two seasons. The maximum effect of these measurements with using elemental Sulpher at 0.3% + Zinc sulphate at 0.4% + Borax at 0.1%. + Magnesium sulphate at 0.4% (T15) during both seasons. Least treatments increased compared with the control with using elemental Sulpher at 0.3% + Zinc sulphate at 0.2% (T2) during both seasons of study.

Table 6. Effect of spraying with some nutrients on the fruit physical characteristics of Golock mango trees cv. during 2019 and 2020 seasons.

Treatments	Fruit weight (g)		Fruit size (cm3)		Fruit length (cm)		Fruit width (cm)		Fruit shape index		Fruit thickness (cm)	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
T1	212.14	215.11	191.90	202.01	9.60	9.87	6.36	6.52	1.51	1.51	6.87	6.97
T2	214.60	217.60	214.59	225.90	10.61	10.91	6.44	6.59	1.65	1.65	6.95	7.05
T3	217.16	220.20	219.94	231.53	10.75	11.05	6.51	6.67	1.65	1.66	7.03	7.13
T4	219.94	223.02	225.63	237.51	10.89	11.20	6.60	6.76	1.65	1.66	7.12	7.22
T5	226.24	229.41	239.08	251.68	11.22	11.53	6.79	6.95	1.65	1.66	7.33	7.43
T6	227.53	230.71	246.93	259.94	11.52	11.84	6.83	6.99	1.69	1.69	7.37	7.47
T7	226.99	230.17	251.85	265.11	11.64	11.96	6.89	7.06	1.69	1.70	7.44	7.54
T8	242.10	245.49	279.08	293.78	12.09	12.43	7.35	7.52	1.65	1.65	7.93	8.04
T9	245.27	248.70	298.35	314.06	12.54	12.90	7.57	7.75	1.66	1.66	8.17	8.29
T10	251.08	254.60	312.76	329.23	12.84	13.20	7.75	7.94	1.66	1.66	8.37	8.48
T11	253.47	257.02	328.44	345.74	13.37	13.74	7.82	8.01	1.71	1.72	8.44	8.56
T12	259.81	263.45	340.94	358.89	13.55	13.93	8.02	8.21	1.69	1.70	8.65	8.77
T13	264.59	268.29	353.77	372.40	13.80	14.19	8.16	8.36	1.69	1.70	8.81	8.93
T14	272.69	276.51	387.35	407.76	14.66	15.07	8.41	8.61	1.74	1.75	9.08	9.21
T15	282.00	282.43	434.50	457.38	15.88	16.32	8.71	8.92	1.82	1.83	9.40	9.53
L.S.D. at 5%	7.30*	7.40*	14.35*	15.10*	0.32*	0.33*	0.23*	0.23*	0.05*	0.05*	0.24*	0.25*

- Fruit chemical properties:

With respect to the relation between total soluble solids (TSS%), acidity, TSS/Acid ratio and total sugars% of mango fruit "Golock cv." and the different investigated treatments, recorded data in Table (7) clear that, there were significant differences among the investigated treatments regarding fruit juice total soluble solids (TSS%), TSS/Acid ratio and total sugars%. Furthermore, the spray with elemental Sulpher at 0.3% + Zinc sulphate at 0.4% + Borax at 0.1%. + Magnesium sulphate at 0.4% (T15) and Elemental Sulpher at 0.3% + Zinc sulphate at 0.2% + Borax at 0.05% + Magnesium sulphate at 0.2% (T14) were the best two treatments, as both achieved the highest significant values of the investigated parameters as compared with the other studied treatments during two seasons of study. Hence, the least value of fruit acidity % was detected with the trees which sprayed with Elemental Sulpher at 0.3% + Zinc sulphate at 0.4% + Borax at 0.1%. + Magnesium sulphate at 0.4% (T15) as compared with the other investigated treatments, during both seasons of study.

Obtained results regarding the positive effects of nutritive compounds on some fruit physical and chemical characteristics goes in the line of several investigation findings Banik *et al.,* (1997); Bahadur *et al.,* (1998) and Rashmi and Singh, (2007).

Table 7. Effect of spraying with some nutrients on the fruit chemical properties of Golock mango trees cv. during 2019 and 2020 seasons

Treatments	TSS %		Acidity %		TSS / Acid ratio		Total sugars %	
	2019	2020	2019	2020	2019	2020	2019	2020
T1	15.15	15.40	0.55	0.54	27.61	28.63	10.09	10.28
T2	16.80	17.07	0.43	0.42	39.06	40.49	10.24	10.43
T3	17.22	17.50	0.39	0.38	44.40	46.03	10.40	10.59
T4	17.67	17.95	0.30	0.30	58.09	60.23	10.57	10.76
T5	18.72	19.02	0.27	0.27	68.27	70.78	10.96	11.16
6T5	18.93	19.23	0.23	0.22	82.84	85.89	11.04	11.24
T7T	19.07	19.38	0.23	0.22	84.65	87.76	11.17	11.37
T8	21.13	21.47	0.22	0.21	97.65	101.24	12.12	12.33
T9	22.21	22.56	0.20	0.19	113.78	117.96	12.58	12.80
T10	23.28	23.65	0.17	0.17	138.34	143.42	12.95	13.17
T11	23.59	23.97	0.16	0.16	145.92	151.28	13.09	13.31
T12	24.49	24.88	0.16	0.15	157.69	163.48	13.49	13.72
T13	25.41	25.81	0.14	0.14	181.41	188.07	13.79	14.03
T14	27.82	28.27	0.13	0.13	206.89	214.49	14.31	14.55
T15	30.45	30.94	0.13	0.13	235.66	244.32	14.92	15.17
L.S.D. at 5%	0.69*	0.70*	0.01*	0.01*	5.94*	6.15*	3.35*	3.37*

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تأثير الرش الورقي ببعض العناصر الغذائية على النمو والحالة الغذائية وإنتاجية أشجار المانجو صنف جولك

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قسم البساتين- كلية الزراعة- جامعة بنها

تم اجراء هذا البحث فى مزرعة خاصة بمنطقة ابوصوير - محافظة الإسماعيلية – مصر خلال موسمين تجريبيين (2019 و2020) على أشجار مانجو صنف جولك مطعومة علي الاصل البلدى عمرها عشر سنوات ومنزرعة في ارض طينية على مسافة 6× 6 م وتروي بنظام الري الغمر. اشتملت هذه الدراسة على 14 معاملة بالاضافة الي المقارنة. حيث تم تقييم تاثير تلك المعاملات من خلال بعض قياسات النمو الخضرى مثل طول وسمك الفرخ وعدد الاوراق علي الفرخ ومساحة الورقة ، وتقدير محتوى الاوراق من بعض العناصر الكبرى والصغرى ، وكذلك قياس بعض دلائل المحصول مثل عدد النورات الزهرية علي الشجرة وطول النورة وعدد الازهار على النورة وعدد الثمار لكل شجرة ومحصول الشجرة بالكيلو جرام. كما تم قياس وتقدير بعض صفات جودة الثمار الطبيعية والكيماوية. اوضحت النتائج ان رش اشجار المانجو صنف جولك بالكبريت المعدنى وسلفات الزنك والبورون وسلفات الماغنسيوم مرتين سنويا فى الاسبوع الاخير من سبتمبر والاسبوع الاول من فبراير يحسن من النمو الخضرى والحالة الغذائية والمحصول وصفات جودة ثمار المانجو صنف جولك مقارنة بالكنترول (الرش بالماء). كما بينت النتائج ان افضل معاملة هى رش اشجار المانجو الجولك بالكبريت المعدنى بنسبة 0.3% + سلفات الزنك بنسبة 0.4% + بورون بنسبة 0.1% + سلفات الماغنسيوم بنسبة 0.4 % يليها الرش بالكبريت المعدنى بنسبة 0.3% + سلفات الزنك بنسبة 0.2 % + بورون بنسبة 0.05 % + سلفات الماغنسيوم بنسبة 0.2 % خلال موسمي الدراسة. وكانت اقل المعاملات تاثيرا هى الرش بالماء فقط (المقارنة) والرش بالكبريت المعدنى بنسبة 0.3% + سلفات الزنك بنسبة 0.2 %.