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Improving Productivity of "Le-Conte" Pear Trees Grown in New Reclaimed Soils Using Natural Elements Mixture and Algae Extract

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THIS study was carried out at Sedyghazi private orchard located in Abu Ghaleb road at 164 kilometer from Cairo to Alex desert road, Giza, governorate Egypt during two seasons (2019 and 2020) on thirteen - year - old Le-Conte pear trees budded on *Pyrus communis* rootstock, planted at 3.5 × 4 meters apart grown in sandy soil under drip irrigation system (EC= 3.40 dS m^{-1}). . The experiment was arranged in a spilt plot design, the main plots were represented by four levels of foliar application of *Amphora coffeaeformis* algae extract (AC_1= 0, AC_2= 250, AC_3= 500 and AC_4= 1000 ppm) and the sub plot were split by Natural Elements Mixture included three levels (NEM_1= 0, NEM_2 = 2.0 and NEM_3 =4.0 kg/tree /year). Data revealed that, NEM_2 (2.0 kg/tree/year) gave more or less similar values as those of level NEM_3 (4.0 kg/tree/year) especially for yield, TSS, TSS/acid ratio, total sugars, N, K, Fe, zn and Mn leaf content. Meanwhile, yield, fruit chemical properties, macro & micronutrients and proline content were significantly increased gradually by increasing algae extract level up to 500 ppm. In the most cases the difference between AC (500 and 1000 ppm) was insignificant. Concerning the interaction, treatments (NEM_2x AC_3), (NEM_2x AC_4), (NEM_3x AC_3) and (NEM_3x AC_4) gave more stimulating effects on most characters. So, treatments (NEM_2x AC_3) or (NEM_2x AC_4) were sufficient for helping to alleviate salinity stress and gave the highest values of yield, fruit quality and nutritional status.

Keywords: Algae extract, *Amphora coffeaeformis,* "Le-Conte" pear trees, Natural Elements Mixture, New reclaimed lands, Salinity conditions.

Introduction

Pear (*Pyrus spp*) is genus belongs to family Rosaceae, included 22 species extensively cultivated in the Mediterranean climates zones in (Asia, Europe and northern Africa). The two main species European pear (*Pyrus communis* L.) and Asian pear (*P. pyrifolia* (Burm. f.), Nak. [syn. P. serotina L] included commercial cultivated cultivars. In Egypt, European pear (*Pyrus communis* L.) is grown successfully. "Le-Conte" pear is known as a hybrid between *Pyrus serotina* x *Pyrus communis* (Lee, 1948). "Le-Conte" pear budded on *Pyrus communis* rootstock are cultivated and common in new reclaimed lands.

According to (Agricultural Statistics Institute 2019) pear cultivated area is 13439 Faddan produced 68407 Tons. Fruit orchards established in newly reclaimed soil suffered from different environmental stress as: water deficiency, salinity in soil &water, nutrients deficiency, high irradiances and climate fluctuations. (Barkat and Sayed 2012). In Egypt Pear production varied from year to year and from orchard to another. This variation may be due to many reasons included fire blight, rootstock, insufficient chilling hours , factors related flowers pollination and fertilization which caused low fruit set (Yehia & Hassan, 2005 and Khamis et al., 2018).

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Increasing limitations in agrochemical law regulations led to need for modern methods in plant nutrition and plant protection (Ronga et al., 2019). Nowadays, a great efforts are paid to find safe alternatives which are used to stimulate growth and improve yield without causing environmental pollution problems. New alternative is using Natural Elements Mixture (NEM) which included thirteen elements oxides (SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, MgO, LOI, CaO, Na_2O, K_2O, P_2O_5, SO_3 and Cl). Silicon is a main element in (NEM) whereas; silicon dioxide reached about 49 % SiO2. Recently International Plant Nutrition Institute [IPNI] (2015), Georgia, USA has listed silicon (Si) as a "beneficial element". This element plays an important role in various plants for being tolerant to anti-effects of biotic stresses caused by diseases & pests and abiotic stresses, caused by environmental stress like: salinity, heavy metals, drought, frost, high and low temperature, water flooding, etc (Sonali and Byoung, 2014). Previous studies confirm that, in the vast majority, Silicon as soil or foliar application was beneficial for stimulating growth and yield (quantity& quality) of various fruit trees (Al-Wasfy, 2013 on Sakkoti date palms, Roshdy, 2014 on Grandnaine banana plants, Kotb and Abdel-Adl, 2017 on Olinda Valencia orange)

Algae are environmentally and economically necessary and had been utilized as food and medicines for many decades ago. Recently, different species of algae produce extracts which are used in numerous foods, dairy products, medicines and cosmetic (Raja et al., 2013). *Amphora coffeaeformis* (AC) belongs to family Catenulaceae, it has a major role as a source for biodiesel production due to rapid growth (Chtourou et al., 2015). Diatoms like *Amphora coffeaeformis* (AC) are known as a resource of biochemical products like protein, carbohydrates and lipids (Rajaram et al., 2018).Furthermore, *Amphora coffeaeformis* extract is rich with bioactive constituents like fatty acids, vitamins C & E, hormones, amino acids, some macro and micro-elements especially (P, Fe and Zn), plant pigments like chlorophyll, carotenoids and natural antioxidants components which can enhance the agricultural crops productivity (El-Sayed et al., 2018). The application of algae help to decrease the amount of chemical fertilizers and pesticides used in agriculture (Radkowski and Radkowska, 2013). Algae could be mitigate salinity stress by release some chemical products varies in metabolic pathways (Fabio et al., 2014).

The target of this investigation is to detect the novel approach to enhance growth and yield (quantity& quality) of "Le-Conte" pear trees grown under salinity conditions in new reclaimed soils by determine the application level of Natural Elements Mixture - as a primary resource for (SiO_2 and other mineral oxides) – as well as the suitable dose of the algae extract *Amphora coffeaeformis* with possibility to select the best combination between them.

Materials and Methods

Experimental orchard

This study was carried out at Sedyghazi private orchard located in Abu Ghaleb road 164 kilometer from Cairo to Alex desert road, Giza, governorate Egypt. during two seasons (2019 and2020) on thirteen - year - old Le-Conte pear trees budded on *Pyrus communis* rootstock, planted at 3.5 × 4 meters apart (300 trees / feddan) grown in sandy soil under drip irrigation system (EC= 3.40 dS m^{-1}). Water chemical analysis presented in Table 1 and the nature of the experiment soil presented in Table 2. Each experimental season was began

TABLE 1. Chemical analysis of the used well water.

PH	Ec ds/m	Soluble cations meq/L				Soluble anions meq/L			
		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{-}	HCO_3^{-}	SO^{-}_4	CL^{-}
8.3	3.40	10	1.4	20.0	0.12	-----	0.9	10.0	20.0

TABLE 2. Physical and chemical properties of the experiment soil.

Sand%	Silt%	Clay%	Soil Texture	PH	Ec ds/m	Soluble cations meq/L				Soluble anions meq/L			
						Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{-}	HCO_3^{-}	SO^{-}_4	CL^{-}
93.3	0.2	6.5	Sandy	7.0	2.70	9.0	7.0	13.0	0.3	-----	1.2	5.9	18.8

in mid-January and finished in late August during two seasons. Forty-eight fruitful pear trees were chosen and devoted for this study. These trees were uniform in their size shape and diseases free as well as they received regularly the same horticultural practices adopted in pear orchards of the region.

Experiment design

This experiment consist of three levels of Natural Elements Mixture as soil application (NEM_1= 0, NEM_2 = 2.0 and NEM_3 =4.0 kg/tree /year) and four levels of algae extract (*Amphora cofeaeformis*) as foliar spray application (AC_1= 0, AC_2= 250, AC_3= 500 and AC_4= 1000 ppm). The experiment was arranged in a spilt plot design, the main plots were separated for foliar application of *Amphora coffeaeformis* algae extract and the sub plot were split by Natural Elements Compound. Thus the experiment was consisted of twelve treatments with four replicates, one tree for each replicate.

Rate and application method of Natural Elements Mixture

Natural Elements Mixture (NEM) was bought from "El-Ahram Company for Mining and Natural Fertilizers", Giza. Egypt. Natural Elements Mixture treatments were added once in mid-January in each season as a ditch application (25-30cm depth) under the drippers for each devoted tree. The chemical composition of Natural Elements Mixture (NEM) was present in Table 3.

Application method of algae extract

Amphora coffeaeformis algae extract was kindly proved from Algal Biotechnology Unit, National Research Centre (NRC), Giza, Egypt. It was isolated from drainage water of Ismailia Governorate. Algae extracts was prepared and described by El-Sayed et al. (2018). It should be taking into consideration that algae extract treatments were foliar spray three times through each growing season i.e., just at fruit set, one and two months after fruit set. Triton B at 0.1% was used as a wetting agent with each treatment even control.

Data recorded and determinations

Impact of different treatments was assessed through the response of the following measurements.

Total Chlorophyll content

Six leaves were collected after one month from the third spray of algae extract, chlorophyll content was measured by using a SPAD – 502 MINOLTA chlorophyll meter.

Leaf Dry Matter %

The same Leaves sample were weighted, then leaves sample were oven dried at 70°C till a constant weight and leaf dry matter % was calculated by equation (leaves dry weight/ leaves fresh weight)*100

Yield and its components

Le-Conte pear fruits were picked up after approximately 135 to 147 days from full bloom, when fruit firmness reached approximately about 14-15 lb/inch^2 and TSS in fruits juice about 13-14 % Swindeman (2002). In late August of each season (2019 and 2020) at harvesting time, total yield was estimated on basis of number and weight of harvested mature fruits and expressed as (Kg)/ tree and also yield (ton)/ fed were calculated.

Fruit Quality: for each season, samples of twenty fruits / tree (replicate) were picked randomly for determination the following physical and chemical *characteristics.*

Fruit physical characteristics:

Fruit size (volume cm^3)

Fruit firmness (lb/inch^2) by using fruit pressure tester model FT 327 (3-27 Lbs)

Fruit length (cm.)

Fruit diameter (cm)

Fruit shape index (fruit length /fruit diameter ratio)

Fruit chemical characteristics

Total titratable acidity percentage in fruit juice was determined as anhydrous malic acid according A.O.A.C. (1984).

TSS % was determined using hand refractometer. T.S.S/acid ratio was calculated

Determination of total sugars % content and

TABLE 3. Analysis of Natural Elements Mixture (NEM).

Ingredient	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	LOI	CaO	Na_2O	K_2O	P_2O_5	Cl	SO_3
Value%	49.2	0.61	6.0	5.2	0.65	3.0	7.0	11.3	2.0	3.75	6.3	0.44	4.55

reducing sugars using 3, 5-dinitrosalisylic acid (DNS) according to James (1995) then non-reducing sugars was calculated.

Leaf minerals content

In the second week of August twenty five leaves from the middle part of non-fruiting current season shoots were collected at random from each tree, as recommended by (Chmtonaparb &Cumming, 1981). The samples were washed several times with tap water then with distilled water, dried at 70 ºc in an electric oven till constant weight. Dry leaves were grounded and digested according to (Jackson, 1973). Leaf mineral content of N, P, K, Na, Fe, Zn, and Mn was determined according to (Cottenie et al., 1982).

Proline content: free proline content (ppm) in leaves was measured according to Bates et al. (1973).

Statistical analysis

Data were subjected to computerized statistical analysis using Statistix 9 package for analysis of variance (ANOVA) and means of various treatments were compared using LSD at 0.05 according to Snedecor and Cochran (1990).

Results and Discussion

Total chlorophyll (SAPD) and leaf dry matter %

Results in Table 4 revealed that in the two seasons, total chlorophyll (SAPD) and leaf dry matter % was insignificantly affected with Natural Elements Mixture with exception of dry matter % in the second season. In general, foliar application with algae extract, irrespective the level, showed a prominent significant increase in both characters than unsprayed tress (AC_1). Regarding the interaction, the least significant values of both characters recorded by unsprayed tress (AC_1) under all levels of ($NEM_{1:4}$). Other examined combinations created more stimulative impact on both characters, so collected data proved that treatment (NEM_1X AC_3) in the first season and (NEM_1X AC_2) in the second season were the most beneficial treatments for both leaf SPAD and dry matter %.

The noticeable impact of alga extract could be recognized to its influence in increasing cell membrane permeability and enhancing plant efficacy in the absorption of various nutrients ie: nitrogen, which has a direct relationship with leaf chlorophyll content. Furthermore, algae extract was rich with cytokines which delays the senility of leaves by reducing the degradation of chlorophyll (Raupp and Oltmanns, 2006 and Yassen et al., 2007). In addition (El-Sayed et al., 2018) pointed out that *Amphora coffeaeformis* algae extract is rich in various pigments like chlorophyll and carotenoids (β-carotene and fucoxanthin) which improve various activities of the cell. Moreover, Mogazy et al. (2020) pointed out that foliar application of White Lupine (*Lupinus albus* L.) plants with *Amphora coffeaeformis algae* extract (1 and 2 g L^{-1}) enhanced significantly plant height, number of leaves, leaf area, root length, shoot & root (fresh and dry weights) and chlorophyll a & b.

Yield and its components

Data concerning yield and its components present in Table 5 indicated that, fruit weight, fruit numbers and yield were significantly affected with Natural Elements Mixture , foliar application with algae extract and their interaction in the two seasons. With respect to the Natural Elements Mixture it could be observe that, adding the second or third levels of NEM (2.0 and 4.0 kg/ tree/year) gave the highest significant values of yield and its components in the two seasons with exception of fruit weight and yield in the second season, whereas, only the high level 4.0 kg/tree/ year (NEM_3) gave the highest significant values. Regarding algae extract it obvious that, in general yield and its components were significantly increased gradually by increasing algae extract level up to 500 ppm (AC_3). On the other hand, in the most cases the difference between (AC_3) and (AC_4) (500 and 1000 ppm) was insignificant in the two seasons. In regard to the interaction between the two factors in most cases, treated with Natural Elements Mixture alone [treatments (NEM_2xAC_1) and (NEM_3x AC_1)] increased all yield characters compared with untreated trees (NEM_1x AC_1). Foliar application with algae extract alone [treatments (NEM_1x AC_2), (NEM_1 x AC_3) and (NEM_1 x AC_4)] increased all yield characters gradually with increasing algae extract levels compared with the untreated trees (NEM_1x AC_1). Other combinations gave more stimulating effects on yield and its components and in most cases the highest values were recorded by treatment (NEM_2xAC_4) which gave the greatest fruit numbers /tree. Whereas, treatment (NEM_3x AC_3) gained the heaviest fruit weight. On the other hand, treatment (NEM_3xAC_4) gave the highest yield either per tree or (NEM_3xAC_4) Fed. This is true in both seasons of the study.

Depending upon the average of the interaction in the two seasons compared with the control. It could be noticed that, soil application of NEM_2

TABLE 4. Effect of Natural Elements Mixture and foliar application of algae extract on total chlorophyll and leaf dry matter % of "Le-Conte" pear trees grown in new reclaimed soil during 2019 and 2020 seasons

Algae extract (ppm)	Natural Elements Mixture Kg/tree							
	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean
	Total Chlorophyll (SPAD)				Dry matter %			
2019 season								
0 (AC_1)**	49.6 bc	49.4 bc	51.4 bc	50.1 C	47.6 e	49.7 de	52.1 cd	49.8 B
250 (AC_2)**	48. 8 c	51. 8 bc	48.1 c	49.6 C	56.2 ab	51.9 cd	51.7 cd	53.3 A
500 (AC_3)**	59.6 a	51.1 bc	54.6ab	55.1 A	56.4 a	53.3 a-d	53. 4 a-c	54.4 A
1000 (AC_4)**	52.1 bc	51.6 bc	52.9 bc	52.2 B	52.7 b-d	56.0 ab	53.0 a-c	54.6 A
Mean	52.51 A	51.0 A	51.7 A		53.2 A	52.7 A	53.1A	
2020 season								
0 (AC_1)**	50.3 bc	50.2 c	50.1 c	50.2 B	51.2 de	48.49 f	50.4 e	50.0 B
250 (AC_2)**	54.5 a	51.9 a-c	53.1 a-c	53.2 A	54.8 a	46.73 g	47.4 fg	49.6 B
500 (AC_3)**	54. 0 ab	52.2 a-c	54.1 ab	53.4 A	54.1 ab	52.25 b-d	53.0 bc	53.1 A
1000 (AC_4)**	50. 7 a-c	53.4 a-c	54.6 a	52.9 A	50.9de	51.87 c-e	55.3 a	52.7 A
Mean	52.4 A	51.9A	52.7 A		52.8 A	49.8 C	51.5 B	

*NEM: Natural Elements Mixture
**AC: Algae extract
In each season, means of each of (NEM) and Algae extract levels or their interactions having the same letters are not significantly different at 5% level.

(2 Kg/tree) followed by foliar application by AC_3 (500ppm) and AC_4 (1000 ppm) [treatments (NEM_2xAC_3) and (NEM_2x AC_4)] increased yield /Fed by 83.0% and 93.0%, respectively than the control. Meanwhile, soil application by the high level of NEM (4 Kg/tree) followed by spraying with AC_3 (500ppm) and AC_4 (1000 ppm) [treatments (NEM_3xAC_3) and (NEM_3x AC_4)] increased yield /Fed by 94.0% and 90.0%, respectively than the control.

El Sharony et al. (2015) revealed that spraying mango trees cv. Fagri Kalan with algae extract at 2% was very effective for increasing fruit set, fruit retention, yield and fruit quality. Therefore, algae extract could be suggested as a natural bio stimulants for enhancing desirable characters of mango cv. Fagri Kalan. On the other hand, Mohamed (2017) observed that the promising treatment was (NMC at 2.5 kg/tree + selenium spray at 5 ppm) which had the highest yield as number or weight of fruits per tree of mango Keitt the aforementioned treatment increased the macronutrient and micronutrient in leaves of mango Keitt.

Effect on fruit physical properties

Data in Tables 6 and 7 represent the effect of Natural Elements Mixture and foliar application of algae extract and their interactions on some fruit physical properties of "Le-Conte" pear in 2019, and 2020 seasons.

Concerning, fruit volume was affected significantly by Natural Elements Mixture in the second season only, but it was difficult to observe a constant trend. Whereas it was affected significantly by algae extract in the two seasons, where 500 ppm (AC_3) and 1000 ppm (AC_4) recorded the highest values in the two seasons. Regarding the interaction, untreated trees (NEM_1x AC_1) gave the least significant values of fruit volume especially in the first season. On the other hand, the highest values were obtained when combining any (NEM) level with 500 ppm (AC_3) or 1000 ppm (AC_4). In most cases, Natural Elements Mixture and foliar application of algae extract and their interactions affected lack significant on fruit firmness, fruit length, fruit width and fruit shape. However, treatment (NEM_3x AC_4) recorded the greatest fruit volume and treatment (NEM_2x AC_3) & (NEM_3x AC_4) achieved the highest fruit length and width, whereas, treatment (NEM_2x AC_2) gained the most oblong shape. On the other hand, control fruits were the most firm ones.

Effect on some fruit chemical properties

Data in Table 8 show the effect of Natural Elements Mixture and foliar application of algae extract and their interactions on some fruit chemical properties of "Le-Conte" pear in 2019, and 2020 seasons.

Concerning, total acidity the data revealed that total acidity was significantly affected by (NEM) levels and the untreated trees (NEM_1) gave the highest values of total acidity during two seasons. In the same time the first level of algae extract (AC_1) gave the highest significant values of total acidity. With respect to combination between (NEM) and algae extract total acidity was decreased by the third level of (NEM) under any given algae extract level except (AC_1) especially in the second season.

Values of TSS % and T.S.S/acid ratio in the two seasons were significantly affected by (NEM) levels. In both seasons, the first level of Natural Elements Mixture (untreated trees) gave the least significant values of TSS% and T.S.S/acid ratio. On the contrary, the third level of Natural Elements Mixture (NEM_3: 4 kg/tree/year) gave the highest significant values of TSS% and T.S.S/acid ratio. It is obvious that, in the two seasons TSS% and T.S.S/acid ratio were increased significantly by increasing algae extract level up to 500 ppm (AC_3) and 250 ppm (AC_2), respectively. More increase in algae level did not differ significantly in both parameters. As for the interaction the untreated trees with (NEM) under any level of algae extract gave the lowest significant values of TSS% and T.S.S/acid ratio. When combining different levels of (NEM) and algae extract, it is observed that in most cases, the second and the third levels of (NEM) combined with the second , the third or the forth levels of algae extract recorded the highest values of TSS% and T.S.S/acid ratio.

Data in Table 9 show the effect of Natural Elements Mixture and foliar application of algae extract and their interactions on total sugars, reducing sugars and non-reducing sugars in fruits of "Le-Conte" pear trees in 2019, and 2020 seasons.

Values of total sugars, reducing sugars and non-reducing sugars were affected significantly with Natural Elements Compound, algae extract and their interaction in the two seasons with exception of non-reducing sugars in the in the first season. Untreated trees (NEM_1) gave the least values of three characters during two seasons. On

TABLE 5. Effect of Natural Elements Mixture and foliar application of algae extract on *Yield and its components* of "Le-Conte" pear trees grown in new reclaimed soil during 2019 and 2020 seasons

Algae extract (ppm)	Natural Elements Mixture Kg/tree															
	0 (NEM_1)*	2(NEM_2)*	4(NEM_3)*	Mean	0 (NEM_1)*	2(NEM_2)*	4(NEM_3)*	Mean	0 (NEM_1)*	2(NEM_2)*	4(NEM_3)*	Mean	0 (NEM_1)*	2(NEM_2)*	4(NEM_3)*	Mean
	Fruit number/tree				Fruit weight (g)				Yield kg/tree				Yield ton/fed			
2019 season																
0 (AC_1) **	133.3 e	146.7 d	151.0 d	143.7 D	163.2 e	162.2 e	160.5 e	162.0 B	21.75 d	23.82 cd	25.22 cd	23.59 C	6.53 e	7.15 e	7.27 e	6.98 C
250 (AC_2) **	156.7 d	177.3 c	181.3 c	171.8 C	167.3 e	171.0 e	173.3 de	170.6 B	26.21 c	30.34 b	30.76 b	29.10 B	7.37 de	9.10 bc	9.43 bc	8.63 B
500 (AC_3) **	150.0 d	201.7 ab	195.0 b	182.2 B	187.8 cd	193.3 bc	212.3 a	197.8 A	31.50 b	39.01 a	41.39 a	37.30 A	8.45 cd	11.70 a	12.42 a	10.86 A
1000 (AC_4) **	176.7 c	208.3 a	201.7 ab	195.6 A	189.3 c	200.0 a-c	206.7 ab	198.7 A	33.42 b	41.67 a	41.67 a	38.92 A	10.02 b	12.50 a	12.50 a	11.67 A
Mean	154.2 B	183.5 A	182.3 A		176.9 B	181.6 AB	188.2 A		28.22 B	33.71 A	34.76 A		8.09 B	10.11 A	10.40 A	
2020 season																
0 (AC_1) **	128.3 g	155.3 f	168.0 de	150.6 C	174.2 cd	162.7 d	182.8 bc	173.2 B	22.40 f	25.37 ef	30.64 cd	26.14 C	6.72 f	7.61 ef	9.19 cd	7.84C
250 (AC_2) **	162.0 ef	193.3 b	177.3 cd	177.6 B	176.7 cd	161.1 d	191.7 a-c	176.5 B	28.55 de	31.07 cd	33.99 bc	31.20 B	8.57 de	9.32 cd	10.20 bc	9.36B
500 (AC_3) **	159.3 f	208.3 a	214.3 a	194.0 A	193.6 a-c	201.3 ab	207.2 a	200.7 A	30.83 cd	41.91 a	44.39 a	39.04 A	9.25 cd	12.57 a	13.32 a	11.71A
1000 (AC_4)	182.3 bc	213.3 a	209.0 a	201.6 A	191.3 a-c	204.5 a	201.9 ab	199.2 A	34.83 b	43.59 a	42.20 a	40.21 A	10.45 b	13.08 a	12.66 a	12.06A
Mean	158.0 B	192.6 A	192.2 A		184.0 B	182.4 B	195.9 A		29.15 C	35.49 B	37.81 A		8.75 C	10.65 B	11.34 A	

*NEM: Natural Elements Mixture
**AC: Algae extract
In each season, means of each of (NEM) and Algae extract levels or their interactions having the same letters are not significantly different at 5% level

TABLE 6. Effect of Natural Elements Mixture and foliar application of algae extract on fruit volume and fruit firmness of "Le-Conte" pear trees grown in new reclaimed soil during 2019 and 2020 seasons

Algae extract (ppm)	Natural Elements Mixture Kg/tree							
	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean
	Fruit volume (cm^3)				Fruit firmness ($lb/inch^2$)			
	2019 season							
0 (AC_1)**	154.0 e	161.5 de	165.7 c-e	160.4 C	18.75 a	15.55 b-d	16.56 bc	16.95 A
250 (AC_2)**	175.0 b-e	172.2 b-e	165.7 c-e	171.0 BC	15.67 b-d	14.39 d	14.35 d	14.80 B
500 (AC_3)**	196.6 ab	185.5 a-d	177.2 b-e	186.5 AB	14.87 cd	15.13 b-d	14.83 cd	14.94 B
1000 (AC_4)**	193.3 a-c	192.8 a-c	211.7 a	199.3 A	16.21 bc	16.70 b	15.89 b-d	16.26 A
Mean	179.5 A	178.0 A	180.1 A		16.37 A	15.44 B	15.41 B	
	2020 season							
0 (AC_1)**	171.1 d-f	159.4 f	181.1 c-e	170.5 B	14.92 a	13.91 a	15.92 a	14.92 A
250 (AC_2)**	174.4 d-f	164.7 ef	185.5 b-c	174.9 B	16.63 a	13.63 a	14.95 a	15.07 A
500 (AC_3)**	205.0 a	201.6 ab	201.0 ab	202.5 A	15.55 a	14.93 a	16.11 a	15.53 A
1000 (AC_4)**	201.1 ab	196.6 a-c	197.5 a-c	198.4 A	16.62 a	15.56 a	14.52 a	15.57 A
Mean	187.9 AB	180.6 B	191.3 A		15.93 A	14.51 A	15.37 A	

*NEM: Natural Elements Compound

**AC: Algae extract

In each season, means of each of (NEM) and Algae extract levels or their interactions having the same letters are not significantly different at 5% level.

TABLE 7. Effect of Natural Elements Mixture and foliar application of algae extract on fruit length, fruit width and fruit shape of "Le-Conte" pear trees grown in new reclaimed soil during 2019 and 2020 seasons

Algae extract (ppm)	Natural Elements Mixture Kg/tree											
	0 (NEM_1) *	2 (NEM_2) *	4 (NEM_3) *	Mean	0 (NEM_1) *	2 (NEM_2) *	4 (NEM_3) *	Mean	0 (NEM_1) *	2 (NEM_2) *	4 (NEM_3) *	Mean
	Fruit length (cm)				Fruit width (cm)				Fruit shape			
2019 season												
0 (AC_1) **	8.22 ab	8.52 ab	8.42 ab	8.39 A	6.67 a-d	6.33 b-e	6.80 a-d	6.60 A	1.23 a	1.34 a	1.24 a	1.31 A
250 (AC_2) **	8.33 ab	8.63 ab	8.07 ab	8.34 A	6.23 c-e	6.70 a-d	6.12 de	6.35 A	1.34 a	1.28 a	1.32 a	1.31 A
500 (AC_3) **	8.48 ab	8.66 ab	8.79 ab	8.64 A	6.95 a-c	6.57 a-e	6.77 a-d	6.76 A	1.21 a	1.31 a	1.29 a	1.27 A
1000 (AC_4) **	7.51 b	8.86 a	8.80 a	8.39 A	5.87 e	7.03 ab	7.16 a	6.69 A	1.27 a	1.26 a	1.23 a	1.26 A
Mean	8.14 B	8.67 A	8.52 AB		6.43 A	6.66 A	6.71 A		1.27 A	1.30 A	1.27 A	
2020 season												
0 (AC_1) **	8.63 ab	8.28 ab	8.58 ab	8.50 A	6.54 c	6.14 d	6.68 bc	6.45 B	1.31 ab	1.34 ab	1.28 ab	1.31 A
250 (AC_2) **	8.54 ab	8.67 ab	8.00 b	8.40 A	6.50 c	3.13 d	6.20 d	6.28 B	1.31 ab	1.42 a	1.29 ab	1.34 A
500 (AC_3) **	8.70 ab	8.99 a	8.23 ab	8.64 A	6.89 b	7.19 a	6.67 bc	6.91 A	1.26 b	1.26 b	1.23 b	1.25 A
1000 (AC_4) **	8.43 ab	8.43 ab	8.63 ab	8.50 A	6.77 bc	6.73 bc	6.80 bc	6.77 A	1.25 b	1.25 b	1.27 b	1.26 A
Mean	8.59 A	8.59 A	8.36 A		6.68 A	6.55 A	6.59 A		1.28 A	1.32 A	1.27A	

*NEM: Natural Elements Compound
**AC: Algae extract
In each season, means of each of (NEM) and Algae extract levels or their interactions having the same letters are not significantly different at 5% level.

TABLE 8. Effect of Natural Elements Mixture and foliar application of algae extract on some fruit chemical properties of "Le-Conte" pear trees grown in new reclaimed areas during 2019 and 2020 seasons

Algae extract (ppm)	Natural Elements Mixture Kg/tree											
	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean
	Total acidity (mg/ 100ml juice)				Total soluble solids %				T.S.S/acid ratio			
	2019 season											
0 (AC_1)**	0.827a	0.703b	0.593de	0.708A	12.67d	13.35bc	13.50bc	13.27C	15.75d	18.99c	22.71ab	19.15B
250 (AC_2)**	0.697bc	0.603c-e	0.587e	0.629B	13.26cd	13.67b	14.43a	13.79B	19.01c	22.75ab	24.64a	22.13A
500 (AC_3)**	0.690bc	0.620b-e	0.587e	0.632B	13.33b-d	14.23a	14.48a	14.02AB	19.60c	23.13a	24.67a	22.47A
1000 (AC_4)**	0.673b-d	0.623b-e	0.570e	0.622B	13.43bc	14.47a	14.47a	14.12A	19.97bc	23.42a	25.51a	22.96A
Mean	0.722A	0.638B	0.584C		13.25C	13.93B	14.22A		18.58C	22.07B	24.38A	
	2020 season											
0 (AC_1)**	0.793a	0.717b	0.653b-d	0.721A	12.33e	13.67cd	13.93bc	13.31C	15.60g	19.12ef	21.30cd	18.67B
250 (AC_2)**	0.700bc	0.647cd	0.593de	0.647B	12.60e	13.93bc	14.34ab	13.62B	18.03f	21.73cd	24.21ab	21.32A
500 (AC_3)**	0.657b-d	0.663bc	0.580e	0.636B	13.23d	14.25ab	14.43a	13.97A	20.10de	21.50cd	24.96a	22.21A
1000 (AC_4)**	0.670bc	0.643c-e	0.593de	0.633B	13.47cd	14.40ab	14.47a	14.11A	20.16de	22.50bc	24.46ab	22.37A
Mean	0.705A	0.668B	0.605C		12.91B	14.06A	14.29A		18.49C	21.21B	23.73A	

*NEM: Natural Elements Compound
**AC: Algae extract
In each season, means of each of (NEM) and Algae extract levels or their interactions having the same letters are not significantly different at 5% level.

TABLE 9. Effect of Natural Elements Mixture and foliar application of algae extract total sugars, reducing sugars and non-reducing sugars in fruits of "Le-Conte" pear trees grown in new reclaimed soil during 2019 and 2020 seasons

Algae extract (ppm)	Natural Elements Mixture Kg/tree											
	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean	0 (NEM_1)*	2 (NEM_2)*	4 (NEM3)*	Mean
	Total sugars (%)				Reducing sugars (%)				Non- reducing sugars (%)			
	2019 season											
0 (AC_1)**	6.07e	7.36cd	7.63b-d	7.02C	3.73b	4.87ab	5.35a	4.65B	2.33a	2.49a	2.28a	2.37A
250 (AC_2)**	7.02d	7.45cd	8.02a-c	7.50BC	4.88ab	5.55a	5.52a	5.32AB	2.14a	1.91a	2.51a	2.19A
500 (AC_3)**	7.46cd	7.96bc	8.42ab	7.94AB	5.74a	5.89a	6.02a	5.88A	1.72a	2.06a	2.39a	2.06A
1000 (AC_4)**	7.83b-d	7.83b-d	8.87a	8.18A	5.50a	5.66a	6.13a	5.76A	2.33a	2.18a	2.74a	2.41A
Mean	7.09C	7.65B	8.24A		4.96B	5.49AB	5.75A		2.13a	2.16a	2.48a	
	2020 season											
0 (AC_1)**	6.65e	6.76de	7.64b-e	7.02C	3.87f	4.53d-f	5.74a-c	4.71B	2.78a-c	2.23b-d	1.90cd	2.30B
250 (AC_2)**	7.30c-e	7.21c-e	7.88bc	7.46BC	5.24b-d	4.80c-f	4.27ef	4.77B	2.06b-d	2.42b-d	3.61a	2.70A
500 (AC_3)**	7.50b-e	7.52b-e	8.46ab	7.82AB	5.16b-e	4.91c-e	5.65a-c	5.24AB	2.34b-d	2.61bc	2.82ab	2.59AB
1000 (AC_4)**	7.67b-d	7.55b-e	9.00a	8.07A	5.95ab	5.30b-d	6.21a	5.82A	1.71d	2.25b-d	2.78a-c	2.25B
Mean	7.28B	7.26B	8.25A		5.05B	4.89B	5.47A		2.23B	2.37AB	2.78A	

*NEM: Natural Elements Compound
**AC: Algae extract
In each season, means of each of (NEM) and Algae extract levels or their interactions having the same letters are not significantly different at 5% level

the other hand, in most cases the high level of Natural Elements Mixture (NEM_3: 4 kg/tree/year) gave the highest significant values of total sugars, reducing sugars and non-reducing sugars in both season. Regarding algae extract it is obvious that total sugars and reducing sugars were increased gradually by increasing algae extract level up to 1000 ppm (AC_4). On the contrary, the differences between (500 ppm) and (1000 ppm) were lacked significance. With respect to the interaction, it could be noticed that untreated trees (NEM_1x AC_1) gave the least content of total sugars and reducing sugars. On the other hand, treatments (NEM_3x AC_3) and (NEM_3xAC_4) recorded the highest values of total sugars, reducing sugars and non-reducing sugars. Other treatments gave more or less similar values with the same statically stand point.

These results could be explain by saying that *Amphora coffeaeformis* is considered a good source of vit (A, C, B_1, B_2, B_9, and E), polyunsaturated fatty acids, sulfated polysaccharides, β-glucans, α-tocopherol, amino acids and total protein (Chtourou et al. 2015, El-Sayed et al. and 2018 Hassan et al. 2020) which may be improve the fruit quality. On the other hand Mansour and Mubarak (2014) pointed out that, treated with 2.5 Kg Natural Elements Mixture as soil application + 20ppm Co as foliar application recommended as optimum treatment for improving yield, fruit quality and leaf mineral content of Navel orange trees.

Effect on some macronutrients content

Data in Table 10 show the effect of Natural Elements Mixture and foliar application of algae extract and their interactions on N, P and K content of "Le-Conte" pear in 2019 and 2020 seasons.

Data indicated that, leaf nitrogen content significantly affected with Natural Elements Compound, foliar application with algae extract and their interaction in the two seasons With respect to the Natural Elements Mixture it could be noticed that, the medium level of NEM (2.0 kg/tree/year) gave the highest values of N% during the two growing seasons followed closely by (4.0 kg/tree/year) in the second season only. Regarding algae extract it noticed that, N % was significantly increased gradually by increasing algae extract level up to 500 ppm (AC_3) in the second season only. The difference between (AC_3) and (AC_4) (500 and 1000 ppm) was insignificant. Regarding the interaction, untreated trees with Algae extract under any (NEM) level [treatments (NEM_1x AC_1) (NEM_2x AC_1) and (NEM_3x AC_1)] gave the least significant values of nitrogen content. On the other hand, in the two seasons the highest values were recorded by certain treatments (NEM_2x AC_3) and (NEM_3x AC_3) some other combinations gave more or less similar values with the same statistical stand point especially in the first season.

As for leaf phosphorus content was affected significantly by Algae extract its combination in the first season only. It is obvious that untreated trees with Algae extract (AC_1) gave the least significant values of the phosphorus content. Other levels of Algae extract (AC_2, AC_3 and AC_4) gave more or less insignificant values with the same statically stand point. Regarding the interaction, the second, third and fourth levels of Algae extract combined with any level of Natural Elements Mixture almost recorded the highest significant values of phosphorus content in the first season.

Concerning leaf potassium content, it was affected significantly by (NEM) in the two growing seasons. Where, the third level of Natural Elements Mixture NEM_3 (4.0 kg/tree/year) gave the highest values followed closely by NEM_2 (2.0 kg/tree/year) in the second season only. On the other hand, K% was affected significantly by Algae extract in the first season only and the highest significant value was recorded by (AC_4) 1000pm. Meanwhile, the interaction between the untreated trees by (NEM) combined with any level of Algae extract recorded the least values of K%. On the other hand, the highest values were recorded when combined the second and third levels of (NEM) with the (AC_3 and AC_4 levels).

These results may be due to that alga extract is a resource of protein which split into natural amino acids used directly in the metabolism (Marrez et al., 2014). It also contains some macronutrients such N, P and K. Meanwhile, algae extract influence the nutrients uptake by roots (Abd El-Mawgoud et al., 2010). In this respect, Enan et al., 2016 found that, foliar application of alga extract up to 2.5 g/l caused in a significant increases in N, P and K content in sugar beet leaves. So alga extract, can contribute to provide of some plant nutrients.

Effect on some micronutrients content

Data in Table 11 show the effect of Natural Elements Mixture and foliar application of algae extract and their interactions on some micronutrients content (Fe, Zn and Mn) of "Le-Conte" pear in 2019 and 2020 seasons.

Data revealed that, leaf iron content was affected significantly by Natural Elements Mixture in the first season only whereas, the high level of Natural Elements Mixture NEM_3 (4.0 kg/tree/year) gave the highest significant values for iron content. In the two seasons, AC_1 level (0 ppm) gave the least significant values of iron content. On the other hand, iron content was increased gradually by increasing algae extract level up to AC_4 level (1000 ppm) especially in the first season. Regarding the interaction, the untreated trees by algae extract combined with any level of (NEM) gave the least significant values of iron content. Other combinations between two factors increased leaf iron content and the highest values were obtained by [treatments (NEM_1x AC_4), (NEM_2x AC_4), (NEM_3x AC_3) and (NEM_3x AC_4)] especially in the first season.

Zinc content was affected significantly by Natural Elements Mixture in the first season only whereas, trees treated with the second or third levels of NEM (2.0 or 4.0 kg/tree/year) gave the highest significant values of leaf zinc content. In the two seasons zinc content was increased significantly by increasing algae extract level up to 500 ppm (AC_3). Meanwhile the difference between (AC_3) and (AC_4) (500 and 1000 ppm) was insignificant in the two season. Concerning the interaction, the highest significant values of zinc content were recorded when combining the second and third levels of (NEM) with the (AC_3 and AC_4 levels).

Data concerning leaf manganese content was affected significantly with Natural Elements Compound, algae extract and its interaction in the two seasons. With respect to the Natural Elements Mixture data showed that, the medium level of NEM (2.0 kg/tree/year) gave more or less similar values. Results also revealed that, in the two seasons the fourth level of algae extract 1000ppm gave the highest values of manganese content followed closely with untreated trees (AC_1) and 500 ppm (AC_3) in the first and second season, respectively. In the two seasons the highest significant values of leaf manganese were recorded by some treatments [(NEM_2x AC_4), (NEM_3x AC_2), (NEM_3x AC_3) and (NEM_3x AC_4)]

In this respect, Abdel Rahman et al. (2009) revealed that, adding Natural Elements Mixture as a soil application enhanced macro and micro nutrients content (N. P, K, Ca, Mg, Fe, Zn and Mn) in Navel orange leaf compared with control.

Effect on proline content

Data in Table 12 show the effect of Natural Elements Mixture and foliar application of algae extract and their interactions on proline content in leaves of "Le-Conte" pear trees in 2019, and 2020 seasons.

Values of proline content was affected significantly with Natural Elements Compound, algae extract and their interaction in the two seasons. Data reveled that, the high levels of Natural Elements Mixture (4.0 kg/tree/year) recorded the highest significant values of proline content in the two seasons followed with lack significant by the medium level (2.0 kg/tree/year) in the second season only. With respect to algae extract it is obvious that proline content increased gradually by increasing algae extract up to the high level (AC_4: 1000ppm). Meanwhile, when combining Natural Elements Mixture with algae extract levels, untreated trees (NEM_1x AC_1) recorded the least significant values of proline content during the two growing seasons. Whereas, the highest values were obtained when combining the forth level of algae extract (1000 ppm) with the any level from (NEM) especially in the second season.

These data could be explained by, algae extract included some bioactive compounds such as proline, plant hormones, citric and ascorbic acid which are mitigation of salinity stress (Ibrahim 2016).

Conclusion and Recommendation

It could be evidently concluded that, "Le-Conte" pear trees grown under salinity conditions in new reclaimed soils showed an acute reduction in yield and fruit quality, the application of Natural Elements Mixture and algae *Amphora coffeaeformis* extract mitigated the disadvantaged effect of salinity stress on pear trees. In general, combining the medium level of NEM (2.0 kg/tree/year) and the third level of *Amphora coffeaeformis* extract at 500 ppm [treatment (NEM_2x AC_3)] was sufficient for helping trees to alleviate salinity stress and gave the high values of yield and its components. Meanwhile, treatment (NEM_2x AC_4) achieved about 93% increase in yield per Fed. than the control. In additional improved fruit chemical properties, as well as macro and micronutrients content.

TABLE 10. Effect of Natural Elements Mixture and foliar application of algae extract on nitrogen, phosphorus and potassium content in leaves of "Le-Conte" pear trees grown in new reclaimed areas during 2019 and 2020 seasons

Algae extract (ppm)	Natural Elements Mixture Kg/tree											
	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean
	N%				P %				K%			
2019 season												
0 (AC_1)**	1.90 g	2.55 b-d	2.20 ef	2.22 C	0.113 d	0.133 b-d	0.133 b-d	0.127 B	1.77e	1.99 d 2.15	2.15 b	1.98 C
250 (AC_2)**	2.12 fg	2.44 c-e	2.33 d-f	2.30 C	0.173 a	0.147 a-d	0.130 b-d	0.150 AB	1.99 d	2.11 bc	2.31 a	2.14 B
500 (AC_3)**	2.76 a-c	2.99 a	2.92 a	2.89 A	0.163 ab	0.127 cd	0.157 a-c	0.149 AB	1.99 d	2.05 b-d	2.33 a	2.12 B
1000 (AC_4)**	2.80 ab	2.64 a-d	2.40 d-f	2.61 B	0.160 a-c	0.157 a-c	0.143 a-d	0.153 A	2.02 cd	2.38 a	2.28 a	2.23 A
Mean	2.39 B	2.66 A	2.46 B		0.153 A	0.149 A	0.141 A		1.94C C\	2.14 B	2.27 A	
2020 season												
0 (AC_1)**	1.65 d	1.95 cd	2.31 b	2.13 B	0.120 a	0.122 a	0.145 a	0.129 A	1.81 d	2.15 a-c	2.21 ab	2.06 A
250 (AC_2)**	1.96 cd	2.42 b	2.27 bc	2.22 B	0.122 a	0.128 a	0.155 a	0.135 A	1.94 cd	2.02 b-d	2.26 a	2.07 A
500 (AC_3)**	2.42 b	2.80 a	2.91 a	2.55 A	0.124 a	0.126 a	0.131 a	0.127 A	2.00 b-d	2.21 ab	2.32 a	2.18 A
1000 (AC_4)**	2.43 b	2.44 b	2.42 b	2.43 A	0.125 a	0.145 a	0.139 a	0.136 A	2.00 b-d	2.37 a	2.27 a	2.21 A
Mean	1.99 B	2.52 A	2.48 A		0.123 A	0.130 A	0.142 A		1.94 B	2.18 A	2.27 A	

*NEM: Natural Elements Compound

**AC: Algae extract

In each season, means of each of (NEM) and Algae extract levels or their interactions having the same letters are not significantly different at 5% level.

TABLE 11. Effect of Natural Elements Mixture and foliar application of algae extract on iron, zinc and manganese content in leaves of "Le-Conte" pear trees grown in new reclaimed soil during 2019 and 2020 seasons

Algae extract (ppm)	Natural Elements Mixture Kg/tree											
	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	Mean
	Fe ppm				Zn ppm				Mn ppm			
2019 season												
0 (AC_1)**	299.9 f	254.3 e	273.7 cd	252.6 C	42.71 f	51.70 e	53.69 c-e	49.37 C	90.53 f	113.2ab	106.8 b-d	103.5 AB
250 (AC_2)**	264.0 de	282.8 bc	288.8 bc	278.6 B	52.20 e	62.79 b-d	62.11 b-d	59.03 B	88.13f f104.4	104.4 cd	113.9 a	102.2 B
500 (AC_3)**	287.4 bc	279.9 b-d	290.4 a-c	285.9 B	53.33 de	72.33 a	67.84 ab	62.89 AB	98.10 e	102.1 de	110.0 a-c	103.4 B
1000 (AC_4)**	293.8 ab	308.3 a	308.3 a	303.5 A	62.62 b-d	67.51 ab	67.84 ab	65.99 A	97.47 e	109.3 a-c	109.7 a-c	105.4 A
Mean	268.8 C	281.3 B	290.3 A		52.72 B	63.58A	61.67 A		93.56 B	107.3 A	110.1A A\	
2020 season												
0 (AC_1)**	226.5 c	253.9 a-c	243.4 bc	241.3 B	45.27 d	53.33 b-d	50.36 cd	49.56 B	94.03 b	100.7 b	97.40 b	97.37 B
250 (AC_2)**	245.0 a-c	282.5 a-c	286.7 a-c	271.4 AB	48.87 d	52.79 b-d	52.92 b-d	51.53 B	91.67 b	93.67 b	113.9 a	99.74 B
500 (AC_3)**	287.4 a-c	291.3 ab	296.0 ab	291.6 A	53.33 b-d	68.08 a	61.29 a-c	60.90 A	98.10 b	113.7 a	114.5 a	108.8 A
1000 (AC_4)**	286.7 a-c	299.5 ab	305.4 a	297.2 A	68.31 a	63.32 ab	64.13 ab	65.25 A	98.80 b	116.7 a	115.7 a	110.4 A
Mean	261.4 A\	281.8 A\	282.9 A\		53.94 A	59.31 A	57.17 A		95.65 B	106.2 A	110.4 A	

*NEM: Natural Elements Compound
**AC: Algae extract
In each season, means of each of (NEM) and Algae extract levels or their interactions having the same letters are not significantly different at 5% level.

TABLE 12. Effect of Natural Elements Mixture and foliar application of algae extract on proline content in leaves of "Le-Conte" pear trees grown in new reclaimed soil during 2019 and 2020 seasons

Algae extract (ppm)	Natural Elements Mixture Kg/tree			Mean
	0 (NEM_1)*	2 (NEM_2)*	4 (NEM_3)*	
	µ mol proline / gm. dry weight			
2019 season				
0 (AC_1)**	0.313g	0.387f	0.407f	0369D
250 (AC_2)**	0.443f	0.580e	0.570e	0.531C
500 (AC_3)**	0.607e	0.617de	0.667cd	0.630B
1000 (AC_4)**	0.730c	0.820b	0.887a	0.8122A
Mean	0.523C	0.601B	0.6325A	
2020 season				
0 (AC_1)**	0.393d	0.407d	0.437cd	0.412C
250 (AC_2)**	0.460cd	0.577b-d	0.603bc	0.547B
500 (AC_3)**	0.623bc	0.653b	0.693ab	0.657B
1000 (AC_4)**	0.730ab	0.760ab	0.867a	0.786A
Mean	0.552B	0.599AB	0.650A	

*NEM: Natural Elements Compound
**AC: Algae extract
In each season, means of each of (NEM) and Algae extract levels or their interactions having the same letters are not significantly different at 5% level.

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Conflicts of Interest

No conflicts of interest during this study.

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تحسين انتاجية أشجار الكمثرى الليكونت النامية في الاراضى المستصلحة حديثا بأستخدام مخلوط العناصر الطبيعية ومستخلص الطحالب

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أجريت هذه الدراسة خلال موسمين (٢٠١٩،٢٠٢٠) فى مزرعة سيدي غازي الخاصة في طريق أبو غالب بطريق القاهرة اسكندرية الصحراوي، محافظة الجيزة (مصر). علي أشجار الكمثرى ليكونت عمر ١٣ سنة المطعومة علي أصل *Pyrus communis* علي مسافة زراعة 3.5*4 م ونامية فى ارض حديثة الاستصلاح (تربة رملية) تحت ظروف الري بالتنقيط وملوحة (3.40 ds m-1) . تم توزيع التجربة في تصميم قطع منشقة حيث أحتوت القطع الرئيسية علي أربع مستويات رش ورقي من مستخلص الطحالب للطحلب *Amphora coffeaeformis* (AC_1= 0, AC_2= 250, AC_3= 500 and AC_4= 1000 ppm) في حين أحتوت القطع المنشقة علي ثلاث مستويات من مخلوط العناصر الطبيعية (NEM_1= 0, NEM_2 = 2.0 and NEM_3 =4.0 kg/tree /year). وقد أوضحت النتائج أن المستوي الثاني لمخلوط العناصر الطبيعية (2 كجم / شجرة في السنة) أعطى نتائج مساوية للمستوى الثالث(4 كجم / شجرة في السنة) بدون فارق معنوي بينهما لكلا من المحصول ، المواد الصلبة الذائبة ، المواد الصلبة الذائبة / للحموضة، السكريات الكلية، محتوى الاوراق من (النتروجين، البوتاسيوم ، الحديد ، الزنك والمنجنيز) وعلاوة على ذلك فقد لوحظ انه حدث زيادة تدريجية في المحصول والصفات الكيماوية للثمار ومحتوى الاوراق من العناصر الكبرى والصغرى والبرولين مع زيادة تركيز مستخلص الطحالب حتي المستوي الثالث (500ppm) وان كان في أغلب القياسات لايوجد فرق معنوى بين (500ppm) و (1000ppm) . أما بالنسبة للتفاعل فقد أعطت المعاملات (NEM_2x AC_3), (NEM_2x AC_4), (NEM_3x AC_3) and (NEM_3x AC_4) تأثير محفز لمعظم الصفات . وعلي ذلك يمكن بالتوصية بمعاملة أشجار الكمثرى ليكونت بالمعاملة (NEM_2x AC_3) أو المعاملة (NEM_2x AC_4) حيث أنهم كانوا ذا تأثير ملوحظ علي تخفيف أجهاد الملوحة وأعطت أعلي القيم للمحصول ومكوناته وصفات الجودة للثمار و الحالة الغذائية للاشجار.