Scientific Journal of Agricultural Sciences

**Print (ISSN 2535-1796) / Online (ISSN 2535-180X)**

SJAS

# Ascension Vegetative Growth and Leaf Nutritional Status of "Le- Conte" Pear Trees Grown Under Desert Soil Conditions

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**Citation:** M. S. Abd El-Karim, M. M. Sharaf, F. M. Abd El-Latif, M. M. Ali1, S. F. El-Gioushy. (2023). Ascension Vegetative Growth and Leaf Nutritional Status of "Le- Conte" Pear Trees Grown Under Desert Soil Conditions. Scientific Journal of Agricultural Sciences, 5 (4):47-63.
https://doi.org/10.21608/sjas.2023.248891.1363

**Publisher :**
Beni-Suef University, Faculty of Agriculture

**Received:** 15 /11/ 2023
**Accepted:** 16 /12/2023

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## ABSTRACT

This research was carried out on 17-year-old "Le-Conte" pear trees that were grafted on *Pyrus communis* and were growing in loamy sand soil with drip irrigation over the two seasons of 2021 and 2022, to investigate the effects of two irrigation rates ( 75 and 100% of crop water requirement), two emitter discharges (4 and 8 L/h) and anti-stress substances (wuaxal amino and free sal) and the interaction among them on vegetative growth and leaf mineral contents. Results showed that the higher irrigation rate 100% and emitter discharges of 8L/h give the highest vegetative growth values. On the other hand Mixing wuxal + free sal was the promising one concerning to vegetative growth parameters enhancement. On other side The combination of CWR at 100% + discharges of 8 + free sal recorded the highest N and Fe. Applying of CWR at 100% + discharges of 8L/h + wuaxal recorded the highest P and Mg. applying of CWR at 75% + discharges of 8L/h + free sal recorded the highest K and Zn. Applying of CWR at 75% + discharges of 4L/h + (W+F) recorded the highest of Ca values. Applying of CWR at 75% + 4L/h + wuxal recorded the highest Mn values. On the other side the lowest proline acid values were attributed to applying of CWR at 100% + wuxal + discharges of 8L/h. While applying CWR at 75% + emitter discharges of 4L/h + free sal gave the lowest peroxidase values.

**KEYWORDS:** Le-Conte Pear, Irrigation Rate, Emitter Discharges, Wuxal Amino, Free Sal, Fruit Characteristics, Yield.

## 1. INTRODUCTION

One of the most important deciduous fruits cultivated in the world is the pear. The most common pear cultivar in Egypt is called "Le-Conte," which is a cross between *(Pyrus communis* L.) and (*Pyrus serotina* Rehd) With an average production of 6.7 tonnes per feddan, Egypt's farmed land reached 13365 feddans, producing around 79206 tonnes (Ministry of Agricultural and Land Reclamation 2020).

The availability of water for pear trees and, thus, their output can be effectively controlled through irrigation. The reduction in photosynthetic rate during mild drought circumstances appears to be primarily caused by stomata closure. (Chaves *et al*., 2002). When nutrients from the soil dissolve in water, the roots absorb them and use them to nourish all of the plant's organs. If irrigation is to be used in a vineyard, a number of elements need to be taken into account. The most important ones are the quantity and timing of the water application. Sophisticated irrigation systems play a critical role in conserving irrigation water, one of agriculture's most precious and limited resources (Helweg, 1989). In the new reclaimed areas, drip irrigation systems are absolutely vital. In comparison with traditional irrigation techniques, they were found to produce 30 to 70% water savings in a variety of orchard crops, along with 10 to 60% yield gains. Under field conditions, the shape of the wetted volume of soil under a drip emitter is, according to Vermeiren and Jobling (1984), Cote *et al.* (2003), Gardenas *et al.* (2005) and Skaggs *et al.* (2010), influenced by soil texture and structure, soil hydraulic properties, anisotropy such as horizontal and vertical permeability and impervious layers. Drought stress caused highly reductions in plant growth parameters such as vegetative shoot growth, shoot diameter and leaf number (Alizadeh *et al.,* 2011). Shoot growth reduction is an adaptive mechanism which reduces tree transpiration (Mahhou *et al.,* 2005). It results from several reversible mechanisms such as decrease cell division speed (Granier *et al.,* 2000), rigidity of cellular wall limiting cell growth (Coscrove, 2005) and decrease of cell turgor (Bouchabke *et al.*, 2006). However, there is a consensus that reduction of vegetative growth is not a passive consequence of water deficiency in cells, but is rather controlled by trees (Tardieu *et al.*, 2006). Also, reduction in tree growth under water stress condition could be attributed to lower photosynthetic rate and stomatal conductance (Mpelasoka *et al.*, 2001). On the other hand by increasing amount of irrigation applied, "Le Conte" pear trees significantly highest leaf of nutrients such as N, P, K, Ca and Mg and micro nutrients such as Fe, Mn, and Zn (Abd El-Messeih and Gendy 2009; Rehab 2014).

Free Sal anti-salinity compounds, which consists of 11% calcium and 9% nitrogen. Sholi (2012) revealed that in saline soils, use of high amounts of $Ca^{2+}$ leads to increase the plant tolerance to salinity and its yield. Grattan and Grieve (1994) reported that increasing Ca level of plants will protect them from sodium chloride toxicity. Girija *et al*., (2002) asserted that in the internal environment of cell, Calcium acts as a secondary messenger and by affecting the stability and enzyme activities, can ease the stress.

Wuxal Amino satisfies the conditions set forth by the European Union for acceptance as a functioning foundation for ecological farming. Previous research is mixed in terms of the impact of Wuxal Amino, as a biofertilizer that contains proline, alanine, glycine, and threonine along with 9% organically fixed nitrogen and NPK.

The purpose of this study is to improve the nutritional quality and vegetative growth of "Le-Conte" pear trees grown in desert soil by varying the irrigation rate, emitter discharge, and use of certain ant stress chemicals.

## 2. MATERIALS AND METHODS

The study was conducted on 17 –year- old Le-Conte pear trees grafted on *Pyrus comunis*, growing in a private orchard located Cairo – Alexandria desert Road (64 Km from Cairo). The trees were planted 5 × 5 metres apart and were irrigated using a drip system following the routinely advised cultural practises.

Irrigation water chemical analysis is presented in Table (1) as well as soil chemical and Mechanical are displayed in Tables (2, 3) which estimated in laboratory of Solis, Water and Environment Research Institute.

**Table 1. Water chemical analysis.**

| Parameters | Anions | Cations | | |
|---|---|---|---|---|
| EC(ds/m) 3.13<br>ppm 2003<br>PH 7.48 | $CO3^{-2}$ -<br>$HCO3^{-}$ 2.00<br>CL 19.5<br>$SO_4^{-2}$ 9.77 | $Ca^{+2}$ 9.5<br>$Mg^{+2}$ 5.5<br>$Na^{+}$ 15.75<br>$K^{+}$ 0.52 | Residual sodium carbonates<br>Saturated sodium 49aliber49ge | -<br>5.75 |

**Table 2. Soil chemical analysis results for soil paste extract**

| Anions (mm/L) | | | | Cations (mm/L) | | | | Saturation percent SP | Electrical conductivity EC (ds/m) | Salinity (ppm) | pH 1:2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **$K^{+}$** | **$Na^{+}$** | **$Mg^{++}$** | **$Ca^{++}$** | **$SO_4^{=}$** | **CL** | **$HCO_3^{-}$** | **$CO_3^{=}$** | | | | |
| 0.42 | 5.75 | 3.5 | 4.5 | 5.17 | 8.5 | 0.5 | - | 28.00 | 1.42 | 909 | 8.33 |

**Table 3. Soil mechanical analysis.**

| Textures | Volumetric distribution of soil granules (%) | | |
|---|---|---|---|
| | Clay | Silt | sand |
| Loamy sand | 2.1 | 46.5 | 51.5 |

### 2.1.The Layout of the experiment

Fourty-eight Le-Conte pear trees, nearly similar in their growth and pathogen-free were carefully selected to build up the Skeleton of such an experiment. Those trees received 16 treatments, besides the control. Each treatment was represented by three replicates (trees).

The main structure of this research was based on the three next investigated factors:

1- Two irrigation rates were used (100 and 75% of crop water requirements)

2- Supertif drippers (4 and 8L/h) were arranged and distributed on two laterals at distances of 50 cm at each side of a tree trunk.

3- Anti–stress amendments (Wuxal amino and Free sal) were used as additional treatments to reduce the harmful effect of water and salt stress as well as enhance water use efficiency. Wuxal was added of the rate of 1L/Fad while Free sal was applied at the rate2.5L/Fad once a month, from April to September each season.

Chemical structure of wuxal amino: Nitrogen (N) 9.1 - phosphor (P) 20% - potassium (K) 10% - Chelating Iron (F) 0.05% - Chelating zinc (Zn) 0.08% - Chelating manganese (Mn) 0.08% - sulphur (S) 2.76% - Boron (B) 0.014% - Amino acid 5.55% - EDITA (Chelating material) 12.0% - PH 5.5.

Chemical structure of free sal: 11% Calcium(Ca) and 9% Nitrogen(N).

Accordingly, the three above mentioned investigated factors were arranged and combined to form the following twelve treatments beside the control.

1. Irrigation rate at 100% + emitter discharges of 4L/h + control
2. Irrigation rate at 100% + emitter discharges of 4L/h + Wuxal alone
3. Irrigation rate at 100% + emitter discharges of 4L/h + Free sal alone
4. Irrigation rate at 100% + emitter discharges of 4L/h + (W +F)
5. Irrigation rate at 100% + emitter discharges of 8L/h + control
6. Irrigation rate at 100% + emitter discharges of 8L/h + Wuxal alone
7. Irrigation rate at 100% + emitter discharges of 8L/h + free sal alone
8. Irrigation rate at 100% + emitter discharges of 8L/h + (W+F)
9. Irrigation rate at 75% + emitter discharges of 4L/h + control

10. Irrigation rate at 75% + emitter discharges of 4L/h + Wuxal alone
11. Irrigation rate at 75% + emitter discharges of 4L/h + free sal alone
12. Irrigation rate at 75% + emitter discharges of 4L/h + (W+F)
13. Irrigation rate at 75% + emitter discharges of 8L/h + control
14. Irrigation rate at 75% + emitter discharges of 8L/h + Wuxal alone
15. Irrigation rate at 75% + emitter discharges of 8L/h + free sal alone
16. Irrigation rate at 75% + emitter discharges of 8L/h + (W+F)

Crop water requirements (CWR) were used to calculate irrigation treatments. The planting region's "TAHRIR" weather data was used to hypothetically compute the amount of water. The amount of water needed was determined using the formula provided by Karmeli and Keller in 1975.

Whereas daily irrigation requirements (IR) = (Se.SL.ETo.Kc.Kr/Ea)*(1/1-Lr)

| | | |
|---|---|---|
| Se. SL | = | Plant area (Plant distance on lateral x between laterals). |
| ETo | = | Daily reference evapotranspiration on mm/day. |
| Kc | = | The coefficient factor for pear trees. |
| Kr | = | Reduction coefficient Gc/0.85. |
| Gc | = | Ground cover (area of tree canopy). |
| Ea | = | Efficiency of irrigation system (85%). |
| Lr | = | Leaching requirements = Eci/Ecd. |
| ECi | = | Electrical conductivity of irrigation water. |
| ECd | = | Electrical conductivity of drainage water. |

The penman-Monteith method was used to calculate ET crops for pear trees using the CROPWAT model (Smith 1991).

**Table 4. The average monthly and total amount of water applied during the year under two water doses ($m^3$/F/Year).**

| | 2020 | | | 2021 | |
|---|---|---|---|---|---|
| **Month** | **100%CWR(m3)** | **75%CWR(m3)** | **Month** | **100%CWR(m3)** | **75%CWR(m3)** |
| **January** | 47.7 | 35.7 | **January** | 51.2 | 38.4 |
| **February** | 87.04 | 65.2 | **February** | 107.5 | 80.6 |
| **March** | 161.2 | 120.9 | **March** | 173.2 | 129.9 |
| **April** | 294.9 | 221.1 | **April** | 319.4 | 239.5 |
| **May** | 549.5 | 412.1 | **May** | 588.8 | 441.6 |
| **June** | 667.3 | 500.4 | **June** | 725.3 | 543.9 |
| **July** | 629.7 | 472.2 | **July** | 660.4 | 495.3 |
| **August** | 660.4 | 495.3 | **August** | 691.2 | 518.4 |
| **September** | 465.9 | 349.4 | **September** | 501.7 | 376.2 |
| **October** | 307.2 | 230.4 | **October** | 358.4 | 268.8 |
| **November** | 92.1 | 69.07 | **November** | 102.4 | 76.8 |
| **December** | 64.8 | 48.6 | **December** | 68.2 | 51.1 |
| **Total** | 4027.7 | 3020.4 | | 4347.7 | 3260.5 |

### 2.2.Assessments:

#### 1. Vegetative growth parameters

In order to estimate the following four growth parameters, four main branches that were evenly spaced around the tree's periphery and each pointed in a single direction were carefully selected and labelled.

a. Average shoot length(cm).

b. Shoot diameter (cm) by a vernier caliber.

c. Average number of leaves per shoot.

d. leaf area ($cm^2$) : the leaf area was calculated by using the following equation:

Leaf area (cm2) = 0.53 (length x width) + 1.66 (Ahmed and Morsy, 1999).

#### 2. Leaf mineral contents

A representative sample of thirty leaves each season were selected in mid-September of each replication that was designated for chemical analysis. The leaves were then cleaned with tap water and oven dried at 60 °C. Using the H2SO4 and H2O2 methods previously outlined by Cottenie (1980), 0.5 grammes of the dried materials were digested**.** The extract was used to determine the following mineral contents:

1. Nitrogen content (%): using the modified-micro-Kjeldahel method as described by Plummer (1971).
2. Phosphorous content (%): using the chlorostannous reduced molybdophosphoric blue color method according to (Jackson 1973).
3. Potassium content (%): using the flame photometer apparatus (CORNING M 410).
4. Ca, Mg, Fe, Mn and Zn (ppm): Were determined by using a" Pye Unicam, model SP-1900" atomic absorption spectrophotometer with boiling air-acetylene.
5. Free leaf proline content. Was measured according to Bates *et al* (1973).

**3. peroxidase (POX):**

The plant materials used for estimation of peroxidase (POX) were the terminal buds in addition to the first and second young leaves. In this regard, 2 g of the plant materials were homogenized with 10 ml of phosphate buffer pH 6.8 (0.1 M), then centrifuge at 2$^o$C for 20 min at 20000 rpm in a refrigerated centrifuge. The clear supernatant (containing the enzymes) was taken as the enzymes source (Mukherjee and Choudhuri 1983). Peroxidase activity was assayed using a solution containing 5.8 ml of 50 mM phosphate buffer pH 7.0, 0.2 ml of the enzyme extract and 2 ml of 20 mM $H_2O_2$ after addition of 2 ml of 20 mM pyrogallol, the rate of increase in absorbance as pyrogallol was determined spectrophotometrically by UV-spectrophotometer ( Jenway) within 60 second at 470 nm and 25$^0$C (Bergmeyer, 1974). One unit of enzyme activity was defined as the amount of the enzyme that catalyzed the conversion of one micromole of $H_2O_2$ per minute at 25$^0$C (Kong *et al*., 1999). The blank sample was made by using buffer instead of enzyme extract.

## 2.3.Statistical analysis:

The experiments involved three factors (A, B and C). The first factor (A) consisted of two levels of irrigation rates (75 and 100%). The second one (B) comprised from two levels of Emitter discharges (4 and 8L/h) and the third factor (C) consists of two anti-stress substances and its combination. Furthermore, the irrigation rates, emitter discharges and anti-stress substances were selected up to be the main, sub and sub sub plots, respectively.

Results of the measured parameters are subjected to computerized statistical analysis using the MSTAT package for analysis of variance (ANOVA) (Snedecor, and Cochran, 1980). In addition; significant differences among means were distinguished according to the an's, multiple test range (Duncan, 1955), whereas capital and small letters were used for differentiating the values of specific and interaction effects of the investigated factors, respectively.

# 3. RESULTS AND DISCUSSION

## 3.1. Effect of irrigation rate, emitter discharges and ant stress treatments on vegetative growth

### 3.1.1. Shoot length (cm)

Data in Table (5) clearly showed a significant difference between the two irrigation rates in terms of average shoot length growth (cm). applying of CWR at 100% gave a significant higher shoot length (26.71 cm and 24.00 cm) during the first and second season respectively. Regarding the specific effect of emitter discharges, data indicated that the higher shoot length (26.73 cm and 25.14 cm) was recorded by emitter of 8L/h during both seasons. As for the specific effect of the tested anti stress substances, data in Table (5) illustrated that the highest shoot length was induced by applying of wuxal alone (27.11 cm and 24.08 cm) during the first and second season respectively, followed by applying of free sal alone (25.31 cm and 23.55cm). The interaction between irrigation rate, emitter discharges and anti stress substances indicated that applying CWR at 100% + emitter of 8L/h + wuxal alone reflected the highest shoot length values (30.23 cm and 28.33cm), followed by applying of CWR at 100% + emitter discharges of 8L/h + free sal alone treatment (29.87 cm and 27.57 cm). On the other way around, the reverse was true with the combination between irrigation rate at 75% + 4L/h + (W + F) as such combination

**Table 5. Effect of two irrigation rates, two emitter discharges and some anti- stress substances on shoot length(cm) and shoot diameter(cm) of Le- Conte pear trees.**

| Parameter | | Shoot length (cm) | | | Shoot diameter (cm) | | |
|---|---|---|---|---|---|---|---|
| Emitter discharges (B) | Treatments ( C ) | Irrigation rate (A) | | Means | Irrigation rate (A) | | Means |
| | | 75 % | 100 % | | 75 % | 100 % | |
| | | | | **First season; 2020/2021** | | | |
| | **Control** | 25.17f | 25.17f | **Mean ( B )**** | 0.790e | 0.790e | **Mean ( B )**** |
| **4 liter/hours** | **Waxal** | 26.00e | 25.97e | 24.12B | 0.837d | 0.870cd | 0.845A |
| | **W + F** | 19.17i | 24.60g | 26.73A | 0.853cd | 0.927a | 0.861A |
| | **F.S.** | 21.67h | 25.23f | | 0.840d | 0.857cd | |
| | | | | **Mean ( C )***** | | | **Mean ( C )***** |
| | **Control** | 25.17f | 25.17f | 25.17B | 0.790e | 0.790e | 0.790C |
| **8 liter/hours** | **Waxal** | 26.20d | 30.23a | 27.11A | 0.887bc | 0.925a | 0.880A |
| | **W + F** | 25.30f | 27.47c | 24.13C | 0.920ab | 0.857cd | 0.889A |
| | **F.S.** | 24.50g | 29.87b | 25.31B | 0.853cd | 0.867cd | 0.854B |
| **Mean ( A )*** | | 24.15B | 26.71A | | 0.846A | 0.860A | |
| | | | | **Second season; 2021/2022** | | | |
| | **Control** | 22.83g | 22.83g | **Mean ( B )**** | 0.447ef | 0.447ef | **Mean ( B )**** |
| **4 liter/hours** | **Waxal** | 20.67h | 24.20e | 21.27B | 0.483cd | 0.517ab | 0.491A |
| | **W + F** | 19.33i | 19.43i | 25.14A | 0.517ab | 0.533a | 0.473B |
| | **F.S.** | 20.73h | 20.17h | | 0.467de | 0.517ab | |
| | | | | **Mean ( C )***** | | | **Mean ( C )***** |
| | **Control** | 22.83g | 22.83g | 22.83C | 0.447ef | 0.447ef | 0.447D |
| **8 liter/hours** | **Waxal** | 23.13f | 28.33a | 24.08A | 0.449e | 0.500bc | 0.487B |
| | **W + F** | 24.10e | 26.67c | 22.38C | 0.500bc | 0.480cd | 0.508A |
| | **F.S.** | 25.73d | 27.57b | 23.55B | 0.417f | 0.467de | 0.467C |
| **Mean ( A )*** | | 22.42B | 24.00A | | 0.47A | 0.488A | |

Values followed by the same letters are not significantly different at 5% level.
* refers to specific effect of Irrigation rate respectively.
** refers to specific effect of Emitter discharges respectively.
*** refers to specific effect of Treatments respectively.

reduced the investigated parameter to the lowest values (19.17 cm and 19.33cm) during the 1st and 2nd season, respectively.

### 3.1.2. Shoot diameter (cm)

Concerning the specific effect of the two irrigation rates and emitter discharges, data tabulated in Table (5) indicated that there were no significant differences between the two rate of irrigation (75 and 100%) and emitter discharges during the first and second season. Data regarding the particular impact of anti-stress compounds showed that, when compared to the check treatment (control), all treatments significantly increased shoot diameter. In this respect the best result in shoot diameter was observed with addition of (wuxal +free sal)(0.889 cm and 0.50 cm) in the 1$^{st}$ and the 2$^{nd}$ seasons, respectively. While the lowest values was recorded by the control (0.790 cm and 0.447 cm) during the both seasons, respectively. As regard to effect of interaction between the three factors, the results in Table (5) illustrate that applying of CWR at 100% by emitter discharges of 4L/h with addition (wuxal + free sal) during the 1$^{st}$ and the 2$^{nd}$ seasons were inducing significant the highest shoot diameter (0.927 cm and 0.533 cm), respectively. Contrarily, statistically the lowest shoot diameters were recorded by control (0.790 cm and 0.447 cm) during the both seasons and applying of CWR at 75% + emitter of 8L/h + free sal alone only in second season.

### 3.1.3. Leaves number per shoot

Regarding the specific effect of the irrigation rate data in Table (6) indicated that applying of CWR at 100% achieved a higher leaves number per shoot (19.28 and15.83) comparing to CWR at 75% (18.01 and 14.66). As regard to the specific effect of emitter discharge data illustrated that the leaves number which was induced by 8L/h (19.73 and16.42) was higher than that induced by the lower one during the 1st and the 2nd seasons, respectively. Regarding the specific effect of anti stress substances predominating, application of all substances significantly increased the leaves number/shoot comparing to the control (chick treatment) in both seasons. The best results of leaves No./shoot was observed with the application of (wuxal +free sal) in the 1st season while the application of wuxal alone in the 2nd season was more preferable. Meanwhile the lowest value of leaves number per shoot was produced by application of free sal alone in the first season and control in the second season, respectively. As for the interaction effect, it is clear that the combination between CWR at 100% + emitter of 8L/h + wuxal alone gave the highest average leaves No./shoot (22.0 and19.57) in the 1st and the 2nd seasons, respectively.

**Table 6. Effect of two irrigation rates, two emitter discharges and some anti- stress substances on leaf area(cm$^2$) and leaves number/shoot of Le- Conte pear trees.**

| Parameter | | Leaf area(cm$^2$) | | | Leaf number/shoot | | |
|---|---|---|---|---|---|---|---|
| Emitter discharges (B) | Treatments ( C ) | Irrigation rate (A) | | Means | Irrigation rate (A) | | Means |
| | | 75 % | 100 % | | 75% | 100 % | |
| | | | | First season; 2020/2021 | | | |
| 4 liter/hours | Control | 14.50i | 14.50i | Mean ( B )** | 18.33d | 18.33d | Mean ( B )** |
| | Waxal | 16.60g | 18.47bc | 16.63B | 16.80g | 18.00e | 17.46B |
| | W + F | 17.37f | 17.30f | 17.42A | 16.83g | 21.77a | 19.73A |
| | F.S. | 15.90h | 18.37bc | | 13.67i | 15.97h | |
| | | | | Mean ( C )*** | | | Mean ( C )*** |
| 8 liter/hours | Control | 14.50i | 14.50i | 14.50F | 18.33d | 18.33d | 18.33C |
| | Waxal | 17.70e | 18.07d | 17.71B | 21.50b | 22.00a | 19.58B |
| | W + F | 18.17cd | 18.90a | 17.93A | 21.00c | 21.83a | 20.36A |
| | F.S. | 18.60b | 18.90a | 17.94A | 17.63f | 18.00e | 16.32D |
| Mean ( A )* | | 16.67B | 17.38A | | 18.01B | 19.28A | |
| | | | | Second season; 2021/2022 | | | |
| 4 liter/hours | Control | 15.50g | 15.50g | Mean ( B )* | 13.20i | 13.20i | Mean ( B )* |
| | Waxal | 15.70fg | 17.30c | 15.86B | 16.67d | 17.13c | 14.07B |
| | W + F | 16.47d | 16.20e | 16.80A | 13.73h | 15.37g | 16.42A |
| | F.S. | 14.00h | 16.23e | | 12.40j | 10.83k | |
| | | | | Mean ( C )*** | | | Mean ( C )*** |
| 8 liter/hours | Control | 15.50g | 15.50g | 15.50D | 13.20i | 13.20i | 13.20D |
| | Waxal | 16.63d | 17.77b | 15.85C | 16.23e | 19.57a | 17.40A |
| | W + F | 15.80f | 17.70b | 16.54A | 16.03ef | 18.67b | 15.95B |
| | F.S. | 16.60d | 18.70a | 16.43B | 15.83f | 18.63b | 14.43C |
| Mean ( A )** | | 15.78B | 16.89A | | 14.66B | 15.83A | |

Values followed by the same letters are not significantly different at 5% level.
* refers to specific effect of Irrigation rate respectively.
** refers to specific effect of Emitter discharges respectively.
*** refers to specific effect of Treatments respectively.

### 3.1.4. Average leaf area ($cm^2$)

Regarding the specific effect of the irrigation rate (100and 75%CWR), data in Table (6) showed that applying CWR at 100% induced a higher leaf area (17.38 $cm^2$ and 16.89 $cm^2$) as compared with the lower rate (75%). with regarding to the specific effect of emitter discharge (4 and 8L/H), data cleared that emitter of discharges 8L/h induced the better leaf area (17.42 $cm^2$ and 16.80 $cm^2$) in the 1st and the 2nd seasons, respectively. Concerning the specific effect of anti stress substances (wuxal alone, free sal alone and (W+F)) all treatments induced the highest leaf area comparing the control in both seasons. In this respect treatment of (wuxal+free sal) (17.93 $cm^2$ and 16.54 $cm^2$) and free sal alone (17.94 $cm^2$ and 16.43 $cm^2$) was the more effective followed by applying of wuxal alone (17.71 $cm^2$ and 15.85 $cm^2$) during the both seasons. As regarding of the interaction effect between three factors the maximum leaf area was detected with the combination between applying of CWR at 100% by emitter discharge 8L/H with addition of free sal (18.95 $cm^2$ and 18.90 $cm^2$), respectively. On other hand the lowest value of leaf area was recorded by control (14.50 $cm^2$ and 15.52 $cm^2$) in the 1st and 2nd seasons, respectively.

These results are in agreement with Neilson *et al*., (1995) on Gala apple trees, stated that high frequency irrigation improved tree growth than lower frequency rates. One-years-old shoot number and shoot length significantly increased as irrigation rate increasing. Shoot number at rates 100% CWR was significantly the biggest followed by rates at 75% or 50% CWR respectively. Same trend was observed with shoot length in both seasons. Reduced shoot development and enlargement as well as expanded leaves are the results of these hormone balance changes (Atkinson et al., 2000). Also, reduction in tree growth under water stress condition could be attributed to lower photosynthetic rate and stomatal conductance (Mpelasoka *et al.*, 2001). Also these results are in agreement with ZHAO *et al.,* (2012) who stated that Growth of shoot in pear trees was significantly affected by drip irrigation, as compared to flood irrigation. The positive effect of wuxal amino on vegetative growth may be due to reducing of PH. Proton loss, the suppression of transmembrane electrochemical potential gradients in plant roots, and regular physiological root processes can also be caused by high pH (Yang et al., 2007).

## 3.2. Effect of irrigation rate, emitter discharges and ant stress treatments on Leaf mineral content

### 3.2.1. Nitrogen (N%)

N (%) leaf content of Le-Conte pear trees as affected by water requirements, emitter discharges and anti-stress substances during 2021 and 2022 season are presented in Table (7). Regarding the specific effect of irrigation rate, it was obvious from the obtained results in Table (7) leaf nitrogen content was maximized due to applying 100% of the actual water requirements (2.39% and 1.41%) during the first and the second season, respectively. As regard to the specific effect of emitter discharges, the results indicated that 8L/h was the promising one. As study of anti stress substances, data in Table (7) noticed that wuxal encouraged leaf N content in the 1st season, while in the 2nd season (W+F) or free sal alone were more effective. Concerning the interaction between the three factors, it was obvious that the highest N(%) content values (3.15% and 1.73%) were recorded by applying of CWR at 100% + emitter discharges of 8L/h + free sal alone during the first and second season, respectively.

### 3.2.2. Phosphor (P%)

Leaves content P(%) is presented in Table (7). Regarding the specific effect of irrigation rate, it is evident from the obtained results that applying of CWR at 100% induced a higher P (%) values (0.397% and 0.256%) during the first and the second season. As regard to the specific effect of emitter discharges the results indicated that using of emitter discharges of 8L/h give a higher P (%) values (0.398% and 0.257%) during both seasons. Regarding the specific effect of anti stress substances, data in Table (7) obviously reveal that applying of wuxal alone induced a higher P (%) values (0.423% and 0.260%).

**Table 7. Effect of two irrigation rates, two emitter discharges and some anti stress substances on Nitrogen (N%) and Phosphore (P%) of Le- conte pear trees.**

| Parameter | | N (%) | | | P (%) | | |
|---|---|---|---|---|---|---|---|
| Emitter discharges (B) | Treatments ( C ) | Irrigation rate (A) 75 % | Irrigation rate (A) 100 % | Means | Irrigation rate (A) 75 % | Irrigation rate (A) 100 % | Means |
| | | | | **First season; 2020/2021** | | | |
| 4 liter/hours | **Control** | 1.59f | 1.59f | **Mean ( B )**** | 0.353e | 0.353e | **Mean ( B )**** |
| | **Waxal** | 2.65cd | 2.93b | 2.07B | 0.337e-g | 0.437c | 0.329B |
| | **W + F** | 2.16e | 1.66cd | 2.37A | 0.257h | 0.267h | 0.398A |
| | **F.S.** | 1.47f | 2.53d | | 0.287gh | 0.340ef | |
| | | | | **Mean ( C )***** | | | **Mean ( C )***** |
| 8 liter/hours | **Control** | 1.59f | 1.59f | 1.59D | 0.353e | 0.353e | 0.353B |
| | **Waxal** | 2.07e | 2.88b | 2.63A | 0.330e-g | 0.587a | 0.423A |
| | **W + F** | 2.15e | 2.77bc | 2.19C | 0.410cd | 0.367de | 0.325C |
| | **F.S.** | 2.77bc | 3.15a | 2.48B | 0.297f-h | 0.483b | 0.352B |
| **Mean ( A )*** | | 2.06B | 2.39A | | 0.328B | 0.397A | |
| | | | | **Second season; 2021/2022** | | | |
| 4 liter/hours | **Control** | 1.12e | 1.12e | **Mean ( B )**** | 0.240d | 0.240d | **Mean ( B )**** |
| | **Waxal** | 1.39cd | 1.48bc | 1.36A | 0.227f | 0.283ab | 0.242B |
| | **W + F** | 1.42b-d | 1.50bc | 1.34A | 0.247c | 0.230e | 0.257A |
| | **F.S.** | 1.23de | 1.60ab | | 0.233e | 0.237de | |
| | | | | **Mean ( C )***** | | | **Mean ( C )***** |
| 8 liter/hours | **Control** | 1.12e | 1.12e | 1.12C | 0.240d | 0.240d | 0.240C |
| | **Waxal** | 1.25de | 1.39cd | 1.38B | 0.243cd | 0.287a | 0.260A |
| | **W + F** | 1.49bc | 1.34cd | 1.44A | 0.267bc | 0.267bc | 0.253AB |
| | **F.S.** | 1.24de | 1.73a | 1.45A | 0.240cd | 0.270b | 0.245BC |
| **Mean ( A )*** | | 1.28B | 1.41A | | 0.242B | 0.256A | |

Values followed by the same letters are not significantly different at 5% level.
* refers to specific effect of Irrigation rate respectively.
** refers to specific effect of Emitter discharges respectively.
*** refers to specific effect of Treatments respectively.

Data concerning the interaction between irrigation rate, emitter discharges and anti stress substances are presented in Table (7) revealed that applying CWR at 100% + emitter discharges of 8L/h + wuxal investigated the highest P(%) values (0.587% and 0.287%) during the first and the second seasons, respectively.

### 3.2.3. Potassium (K%)

Regarding the specific effect of irrigation rates (75 and 100%), data presented in Table (8) display that a higher ratio of leaf potassium (K) content was achieved by applying of CWR at 75% (1.589% and 0.928%) during the first and the second seasons, respectively. As regard to specific effect of two emitter discharges and anti stress substances there were no significant difference between all treatments during the both seasons. Regarding the interaction between irrigation rate, emitter discharges and anti stress substances, data presented in Table (8) showed that Applying CWR at 75% + discharges of 8L/h + free sal alone was induced significantly the highest K(%) leaf content (1.990% and 1.050%) in the $1^{st}$ and the $2^{nd}$ seasons, respectively.

**Table 8. Effect of two irrigation rates, two emitter discharges and some anti stress substances on potassium (K%) and calcium (Ca%) of Le- Conte pear trees.**

| Parameter | | K (%) | | | Ca (%) | | |
|---|---|---|---|---|---|---|---|
| **Emitter discharges (B)** | **Treatments ( C )** | **Irrigation rate (A)** | | **Means** | **Irrigation rate (A)** | | **Means** |
| | | **75 %** | **100 %** | | **75 %** | **100 %** | |
| | | | | **First season; 2020/2021** | | | |
| **4 liter/hours** | **Control** | 1.633d | 1.633d | **Mean ( B )**** | 1.113c-e | 1.113c-e | **Mean ( B )**** |
| | **Waxal** | 1.640cd | 1.287ef | 1.642A | 1.027ef | 0.730h | 1.128A |
| | **W + F** | 1.923ab | 1.793bc | 1.411B | 1.417a | 1.170cd | 1.075B |
| | **F.S.** | 1.650cd | 1.577d | | 1.190bc | 1.267b | |
| | | | | **Mean ( C )***** | | | **Mean ( C )***** |
| **8 liter/hours** | **Control** | 1.633d | 1.633d | 1.633A | 1.113c-e | 1.113c-e | 1.113B |
| | **Waxal** | 0.708g | 1.183f | 1.205B | 0.850g | 1.013c-e | 0.905C |
| | **W + F** | 1.533d | 1.377f | 1.657A | 0.903g | 1.453a | 1.236A |
| | **F.S.** | 1.990a | 1.230ef | 1.612A | 1.063ef | 1.090d-f | 1.153B |
| **Mean ( A )*** | | 1.589A | 1.464B | | 1.085B | 1.119A | |
| | | | | **Second season; 2021/2022** | | | |
| **4 liter/hours** | **Control** | 0.887de | 0.887de | **Mean ( B )**** | 1.577d | 1.577d | **Mean ( B )**** |
| | **Waxal** | 0.803f | 0.863ef | 0.879B | 1.597d | 1.270f | 1.742A |
| | **W + F** | 0.960bc | 0.807f | 0.894A | 2.145a | 1.713c | 1.721A |
| | **F.S.** | 0.930cd | 0.893de | | 2.120a | 1.937b | |
| | | | | **Mean ( C )***** | | | **Mean ( C )***** |
| **8 liter/hours** | **Control** | 0.887de | 0.887de | 0.887A | 1.577d | 1.577d | 1.577B |
| | **Waxal** | 1.007ab | 0.860ef | 0.883A | 1.480e | 1.870b | 1.554B |
| | **W + F** | 0.903c-e | 0.870de | 0.885A | 1.610d | 2.083a | 1.888A |
| | **F.S.** | 1.050a | 0.690g | 0.891A | 1.690c | 1.883b | 1.908A |
| **Mean ( A )*** | | 0.928A | 0.845B | | 1.725A | 1.739A | |

Values followed by the same letters are not significantly different at 5% level.
* refers to specific effect of Irrigation rate respectively.
** refers to specific effect of Emitter discharges respectively.
*** refers to specific effect of Treatments respectively.

### 3.2.4. Calcium (Ca%)

Data related to the specific effect of irrigation levels are presented in Table (8) revealed that applying CWR at 100% was recorded a higher value of Ca (%) content in first season comparing of CWR at 75% with no significant difference among them in the second season. As regard to the specific effect of two emitter discharges, it is clear that a higher Ca (%) content was recorded by using discharges of 4L/h in the 1st season with no significant difference between emitter of 4 and 8L/h in the 2nd season. As study of anti stress substances, data presented in Table (8) showed that the differences between the treatments were statistically significant, a higher values of leaf calcium (Ca) content was recorded by applying (W+F) (1.236% and 1.888%) during the 1st and 2nd seasons. For the interaction between irrigation rates, emitter discharges and anti stress substances, it is evident from the data in Table (8) that applying CWR at 75% by emitter of 4L/h with addition of (W+F) was recorded a higher significant leaf Ca content (1.417% and 2.145%), followed by applying of CWR at 100% by discharges of 8L/h with addition of (W+F) during the first and the second seasons, respectively.

While the lowest values (0.73% and 1.27%) was recorded by applying CWR at 100% + discharges of 4L/h + wuxal alone during the 1st and the 2nd seasons, respectively.

### 3.2.5. Magnesium (Mg %)

Regarding the specific effect of irrigation rate, data in Table (9) indicated that increasing the water requirements (100%) caused a higher Mg (%) values (0.242% and 0.232 %) during the first and the second seasons. As regard to effect of two emitter discharges, data in Table (9) noticed that, no significant differences between 4 and 8L/h during the both seasons. As study of anti stress substances, results obtained that wuxal alone induced significantly a higher Mg (%) content (0.297% and 0.252%) in the 1st and 2nd seasons. As regard to the interaction between three factors, it was obvious from the obtained results that a higher Mg (%) values was recorded by applying CWR at 100% with addition wuxal by using discharges of 4L/h (0.305% and 0.274%) or by using discharges of 8L/h (0.301% and 0.261%) during the first and the second seasons, respectively. Also the same trend was observed by applying CWR at 100% + discharges of 4L/h + free sal only in the first season.

**Table 9. Effect of two irrigation rates, two emitter discharges and some anti stress substances on Magnesium (Mg%) and Iron (Fe ppm) of Le- Conte pear trees.**

| Parameter | | Mg (%) | | | Fe (ppm) | | |
|---|---|---|---|---|---|---|---|
| Emitter discharges (B) | Treatments ( C ) | Irrigation rate (A) 75 % | Irrigation rate (A) 100 % | Means | Irrigation rate (A) 75 % | Irrigation rate (A) 100 % | Means |
| | | | | First season; 2020/2021 | | | |
| 4 liter/hours | Control | 0.158g | 0.158g | Mean ( B )** | 103.9i | 103.9i | Mean ( B )** |
| | Waxal | 0.294c | 0.305ab | 0.243A | 126.4d | 132.6c | 122.8A |
| | W + F | 0.283cd | 0.271d | 0.219B | 152.7b | 121.6ef | 116.8B |
| | F.S. | 0.164g | 0.310a | | 121.6ef | 119.7f | |
| | | | | Mean ( C )*** | | | Mean ( C )*** |
| 8 liter/hours | Control | 0.158g | 0.158g | 0.158D | 103.9i | 103.9i | 103.9D |
| | Waxal | 0.288bc | 0.301b | 0.297A | 112.1g | 108.4h | 119.9C |
| | W + F | 0.228e | 0.191f | 0.243B | 127.2d | 124.5de | 131.5A |
| | F.S. | 0.183f | 0.242e | 0.225C | 97.50j | 156.9a | 123.9B |
| Mean ( A )* | | 0.220B | 0.242A | | 118.2B | 121.4A | |
| | | | | Second season; 2021/2022 | | | |
| 4 liter/hours | Control | 0.214g | 0.214g | Mean ( B )** | 115.8i | 115.8i | Mean ( B )** |
| | Waxal | 0.226e-g | 0.274a | 0.220B | 158.6c | 120.2ef | 142.7A |
| | W + F | 0.210g | 0.184h | 0.233A | 142.7g | 155.0d | 142.4A |
| | F.S. | 0.188h | 0.253bc | | 151.7e | 152.0e | |
| | | | | Mean ( C )*** | | | Mean ( C )*** |
| 8 liter/hours | Control | 0.214g | 0.214g | 0.214B | 115.8i | 115.8i | 115.8C |
| | Waxal | 0.245b-e | 0.261ab | 0.252A | 138.5h | 148.3f | 148.9B |
| | W + F | 0.246b-d | 0.238c-e | 0.220B | 167.3b | 161.2c | 156.5A |
| | F.S. | 0.233d-f | 0.216fg | 0.223B | 117.9i | 174.5a | 149.0B |
| Mean ( A )* | | 0.222B | 0.232A | | 138.5B | 146.6A | |

Values followed by the same letters are not significantly different at 5% level.
* refers to specific effect of Irrigation rate respectively.
** refers to specific effect of Emitter discharges respectively.
*** refers to specific effect of Treatments respectively.

### 3.2.6. Iron (Fe ppm)

Table (9) represents the effect of irrigation rate, emitter discharges and anti stress substances on Fe (ppm) in leaves of Le- Conte pear trees in 2021 and 2022 seasons. Generally applying of 100% of the actual water requirements was induced a higher leaf Fe content (121.4 ppm and 146.6 ppm) during the first and the second seasons. The specific effect of emitter discharges, the results cleared that no significant difference between discharges of 4 and 8L/h in the second season, while in the first season using emitter discharges of 4L/h was recorded the highest Fe (ppm) value.

Concerning the study of anti stress substances, data in Table (9) obtained that all anti stress substances gave significant a higher Fe leaf content than control. In this respect applying (W+F) was recorded a higher values (131.5ppm and 156.5ppm) during the first and the second seasons. While the lowest values (103.9 ppm and 115.8ppm) was recorded by control during the both seasons, respectively. As regard to the interaction between the three factors, data in Table (9) cleared that the best results were recorded by applying CWR at 100% + discharges of 8L/h + free sal (156.9 ppm and 174.5ppm) in the 1st and the 2nd seasons, respectively.

### 3.2.7. Manganese (Mn ppm)

Leaves content Mn (ppm) is presented in Table (10). As regard to the specific effect of irrigation rate, the results obtained that applying 75% of the actual water requirements was induced significantly a higher leaf Mn content (67.97 ppm and 63.32ppm) during the first and the second season, respectively.. Regarding the specific effect of emitter discharges, results in Table (10) indicated that no significant differences between 4 and 8L/h in the first season but in the second season using emitter discharges of 4L/h gave a higher value of Mn content. As regard to the specific effect of anti stress substances, applying of (W+F) was recorded the significant highest leaf Mn content (68.23 ppm and 63.34ppm) in the 1st and the 2nd seasons, respectively. The same trend recorded by control only in the second season. The combination between irrigation rates, emitter discharges and anti stress substances illustrated that applying CWR at 75% + discharges of 4L/h + wuxal significantly was responsible for stimulating the highest of leaf Mn content (78.10ppm and 83.90 ppm) in the 1st and the 2nd seasons, respectively.

### 3.2.8. Zinc (Zn ppm)

Leaves content Zn (ppm) is presented in Table (10). Regarding the specific effect of irrigation rate, the results obtained that applying CWR at 100% was induced significantly a higher Zn leaf content (63.02 ppm and 63.78 ppm) during the first and the second season. As regard to the specific effect of emitter discharges, the results cleared that a higher values of Zn content (62.32 ppm and 64.00 ppm) was induced by using emitter discharges of 4L/h during the both seasons. As regard to the specific effect of anti stress substances, it is cleared from the data in Table (10) did not show significant effect on Zn content during the both seasons. Regarding to effect of the interaction between irrigation rates, emitter discharges anti stress substances. The results in Table (10) obtained that applying CWR at 75 % + emitter discharges of 8L/h + free sal was recorded a higher Zn values (72.40 ppm and 84.23 ppm) in the 1st and the 2nd seasons, respectively.

This results are agreement with Abd El-Messeih and Gendy., (2009) they reported that increasing amount of irrigation applied, “Le Conte” pear trees significantly highest leaf of nutrients such as N, P, K, Ca and Mg and micro nutrients such as Fe, Mn, and Zn. Also in peach trees Ali (2006) obtained that potassium percentage significantly decreased by increasing of irrigation rates. While, nitrogen and phosphorus contents increased as irrigation rate increased in both seasons. So, decreasing of fruit weight and size and increasing of fruit total soluble solids with low irrigation rates of 50% or75% CWR may be due to decreasing of leaf nitrogen content which in true reduces cell grows and increasing of potassium content which lead to sugar accumulation in fruit tissues. On other hand this study are on the same line with Nooghi and Mozafari., (2012) they indicated that The Ca application increased roots Fe and shoots Zn concentrations in pistachio

**Table 10. Effect of two irrigation rates, two emitter discharges and some anti stress substances on Manganase (Mn ppm) and Zinc (Zn ppm) of Le- Conte pear trees**

| Parameter | | Mn (ppm) | | | Zn (ppm) | | |
|---|---|---|---|---|---|---|---|
| Emitter discharges (B) | Treatments ( C ) | Irrigation rate (A) 75 % | Irrigation rate (A) 100 % | Means | Irrigation rate (A) 75 % | Irrigation rate (A) 100 % | Means |
| | | | | First season; 2020/2021 | | | |
| 4 liter/hours | Control | 63.60d | 63.60d | Mean ( B )** | 64.50c | 64.50c | Mean ( B )** |
| | Waxal | 78.10a | 64.40d | 67.02A | 53.50g | 68.50b | 62.32A |
| | W + F | 70.10c | 65.90d | 66.85A | 61.30d | 65.50c | 61.21B |
| | F.S. | 64.40d | 66.10d | | 56.90ef | 63.87c | |
| | | | | Mean ( C )*** | | | Mean ( C )*** |
| 8 liter/hours | Control | 63.60d | 63.60d | 63.60C | 64.50c | 64.50c | 64.50A |
| | Waxal | 64.40d | 65.90d | 68.20A | 51.20h | 64.60c | 59.45D |
| | W + F | 64.80d | 72.10c | 68.23A | 59.80d | 57.40e | 61.00C |
| | F.S. | 74.73b | 65.70d | 67.73B | 72.40a | 55.30fg | 62.12B |
| Mean ( A )* | | 67.97A | 65.91B | | 60.51B | 63.02A | |
| | | | | Second season; 2021/2022 | | | |
| 4 liter/hours | Control | 64.03e | 64.03e | Mean ( B )** | 62.77f | 62.77f | Mean ( B )** |
| | Waxal | 83.90a | 60.17f | 67.90A | 58.13g | 71.27c | 64.00A |
| | W + F | 78.13b | 69.97c | 53.65B | 69.10d | 80.00b | 61.73B |
| | F.S. | 67.43d | 55.53g | | 48.93i | 59.00g | |
| | | | | Mean ( C )*** | | | Mean ( C )*** |
| 8 liter/hours | Control | 64.03e | 64.03e | 64.03A | 62.77f | 62.77f | 62.77C |
| | Waxal | 34.20j | 48.63i | 56.73C | 44.10j | 57.33g | 57.71D |
| | W + F | 51.07h | 54.20g | 63.34A | 65.53e | 52.07h | 66.68A |
| | F.S. | 63.73e | 49.27hi | 58.99B | 84.23a | 65.03e | 64.30B |
| Mean ( A )* | | 63.32A | 58.23B | | 61.95B | 63.78A | |

Values followed by the same letters are not significantly different at 5% level.
* refers to specific effect of Irrigation rate respectively.
** refers to specific effect of Emitter discharges respectively.
*** refers to specific effect of Treatments respectively.

seedlings. Ca can reduce some adverse effects of high salinity on chemical composition of pistachio seedlings. On other side amino acids can impact directly and indirectly the physiological activities in plant growth and development (Davies *et al,* 1982). Specially amino acid chelated–Fe increased total Fe, Zn and Mn content of leaves in Williams Pear when compared with control (Koksal *et al,* 1999).

### 3.2.9. Proline acid (mg $g^{-1}$ DW)

Regarding the specific effect of rate of irrigation, data in Table (11) indicated that a higher proline acid values (o.342 mg $g^{-1}$ DW and o.416 mg $g^{-1}$ DW ) was recorded by applying CWR at 75%. As regard to the specific effect of two emitter discharges (4 and 8L/h), it was clear that a higher proline acid values (0.347 mg $g^{-1}$ DW and 0.430 mg $g^{-1}$ DW) was achieved by using of emitter discharges of 4L/h during the first and the second season, respectively. Concerning the specific effect of anti-stress substances, data presented in Table (11) reveal that a higher significant values of proline acid (0.345 mg $g^{-1}$ DW and 0.399 mg $g^{-1}$ DW) was recorded by control in the 1st and the 2nd seasons. In contrast the lowest proline acid value was recorded by applying of free sal alone in the first season and wuxal alone in the second season.

**Table 11. Effect of irrigation rates, different emitter discharges and some anti-stress substances on proline acid (mg $g^{-1}$ DW) and Peroxidase(ug/g f.wt)**

| Parameter | | Proline acid (mg $g^{-1}$ DW) | | | Peroxidase(ug/g f.wt) | | |
|---|---|---|---|---|---|---|---|
| Emitter discharges (B) | Treatments (C) | Irrigation rate(A) 75 % | Irrigation rate(A) 100 % | Means | Irrigation rate (A) 75% | Irrigation rate (A) 100 % | Means |
| | | | | **First season; 2020/2021** | | | |
| **4 liter/hours** | **Control** | 0.345c | 0.345c | **Mean ( B )**** | 0.632d | 0.632d | **Mean ( B )**** |
| | **Waxal** | 0.442a | 0.292f | 0.347A | 0.278h | 0.137i | 0.422B |
| | **W + F** | 0.388b | 0.319de | 0.276B | 0.377g | 0.548e | 0.672A |
| | **F.S.** | 0.313e | 0.329c-e | | 0.087i | 0.683cd | |
| | | | | **Mean (C)***** | | | **Mean (C)***** |
| **8 liter/hours** | **Control** | 0.345c | 0.345c | 0.345A | 0.632d | 0.632d | 0.632A |
| | **Waxal** | 0.290f | 0.191h | 0.307B | 1.287a | 0.895b | 0.649A |
| | **W + F** | 0.334cd | 0.202h | 0.308B | 0.445f | 0.382g | 0.438C |
| | **F.S.** | 0.277f | 0.224g | 0.286C | 0.383g | 0.720c | 0.468B |
| **Mean ( A )*** | | 0.342A | 0.281B | | 0.515B | 0.579A | |
| | | | | **Second season; 2021/2022** | | | |
| **4 liter/hours** | **Control** | 0.399e | 0.399e | **Mean ( B )**** | 0.673a | 0.67 a | **Mean ( B )**** |
| | **Waxal** | 0.547a | 0.229h | 0.428A | 0.375g | 0.388g | 0.527B |
| | **W + F** | 0.517b | 0.375ef | 0.331B | 0.439d-g | 0.592 c | 0.557A |
| | **F.S.** | 0.450c | 0.508b | | 0.427e-g | 0.655ab | |
| | | | | **Mean (C)***** | | | **Mean ( C )***** |
| **8 liter/hours** | **Control** | 0.399e | 0.399e | 0.399A | 0.673a | 0.673a | 0.673A |
| | **Waxal** | 0.255g | 0.269g | 0.325C | 0.636a-c | 0.481d-f | 0.470C |
| | **W + F** | 0.427d | 0.277g | 0.399A | 0.581c | 0.492de | 0.526B |
| | **F.S.** | 0.314f | 0.310f | 0.395B | 0.424fg | 0.499d | 0.501B |
| **Mean ( A )*** | | 0.413A | 0.345B | | 0.528B | 0.556A | |

Values followed by the same letters are not significantly different at 5% level.
* refers to specific effect of Irrigation rate respectively.
** refers to specific effect of Emitter discharges respectively
*** refers to specific effect of Treatments respectively

As regard to the interaction between irrigation rate, emitter discharges and anti-stress substances, data refer that the lowest proline acid values was attributed to applying CWR at 100% + wuxal alone + discharges of 8L/h in the 1st season or + discharges of 4L/h in the 2nd season, respectively.

Leaf free proline concentration and watering rate have a negative correlation. This suggests that low irrigation, as opposed to moderate and high irrigation, significantly reduced the total chlorophyll in the leaves and stimulated the manufacture and storage of this amino acid in the "Le Conte" pear. This relationship between water irrigation level and the accumulation of proline in the leaves could be explained as water stress inhibit proline oxidation in the mitochondria and alter the permeability of the mitochondrial membranes. Moreover, water stress prevents proline from being incorporated into proteins, which causes proline to accumulate under stressful situations. According to Abd El-Messeih and Gendy (2009), trees under water stress may not be able to synthesise as much protein and chlorophyll, which could explain the increase of leaf free proline levels in those plants.

This study's findings regarding the impact of ant stress treatments on free proline content are consistent with those of Mohammed et al. (2021), who discovered that plants grown in soil treated with NaCl exhibited the highest proline accumulation regardless of treatment. On the other hand, wuxal amino treatment (2 and 3 cm L -1) using various application methods reduced proline accumulation relative to control plants.

### 3.2.10. Peroxidase (POX) (ug/g f.wt)

As regard to the specific effect of irrigation rate, data in Table (11) indicated that a higher values of peroxidase (0.579 ug/g f.wt and 0.556 ug/g f.wt) was recorded by applying CWR at 100% during the first and the second season. Regarding the specific effect of two emitter discharges, the results illustrated that using of emitter discharges of 8L/h was recorded a higher peroxidase (PXO) values (0.672 ug/g f.wt and 0.557 ug/g f.wt) during the both seasons. As study of anti-stress substances, the lowest peroxidase values was recorded by applying of (W+F) (0.438 ug/g f.wt and 0.526 ug/g f.wt) during the first and the second season. Also the same trend occurs with applying wuxal alone only in the second season. In contrast the highest values was recorded by control (0.632 ug/g f.wt and 0.673 ug/g f.wt) during the both seasons and by applying wuxal alone only in the first season. Concerning the interaction between three factors, results in Table (11) illustrated that a higher peroxidase values were recorded by applying CWR at 75% + emitter discharges of 4L/h + free sal in the first season or + wuxal alone in the second season, respectively.

The formation of free radicals and active oxygen species, which damage cell membranes and cause lipid peroxides to accumulate, is the primary cause of the biochemical limitation under water-stress circumstances (Chaves and Oliveira, 2004). (Edreva, 2005).

## 4. CONCLUSION

In general, the results from the previous study clearly showed that applying 100 or 75 % of the actual water requirements by using of emitter discharges of 8L/h with addition wuxal as ant stress treatment due to enhancing vegetative growth and Nutritional Status of ‘’Le- Conte’’ Pear Trees under Desert Soil Condition.

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## الملخص العربى

## تحسين النمو الخضرى والمحتوى المعدنى لاشجار الكمثرى الليكونت تحت ظروف ألاراضى الصحراوية

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هذه الدراسة اجريت خلال موسمى ٢٠٢١ و ٢٠٢٢على أشجار كمثرى صنف الليكونت عمرها ١٧عام مطعومة على أصل الكميونس نامية فى أرض رملية تحت نظام الرى بالتنقيط وذلك لدراسة تاثير معدلات الرى (١٠٠ و٧٥% من الاحتياجات المائية) وكذلك تاثير معدل تصريف النقاط (٤ أو ٨ لتر فى الساعة) بالاضافة الى تأثير بعض مضادات الاجهاد (الوكسال امينو و الفريسال ) على النمو الخضرى وكذلك المحتوى المعدنى للاوراق. أوضحت النتائج أن معدل الرى ١٠٠% مع استخدام تصريف ٨ لتر فى الساعة مع الفريسال ادى الى تحسين المساحة الورقية بينما مع الوكسال كان الافضل فى تحسين طول النمو الخضرى وعدد الاوراق على النمو. بالنسبة للمحتوى المعدنى للاوراق فقد أظهرت النتائج أن أستخدام معدل رى ١٠٠% مع معدل تصريف ٨ لتر /ساعة مع اضافة الفريسال أدى الى زيادة كلا من النيتروجين و الحديد بينما أستخدام معدل رى ١٠٠% مع معدل تصريف ٨ لتر/ساعة مع اضافة الوكسال أدى الى تحسين محتوى الاوراق من الفوسفور و المغنسيوم فى حين أن استخدام معدل رى ٧٥% مع معدل تصريف ٨ لتر/ساعة مع اضافة الفريسال أدى الى تعديل البوتاسيوم والزنك للافضل. استخدام معدل رى ٧٥% مع معدل تصريف ٤ لتر/ساعة مع اضافة كلا من الوكسال والفريسال معا ادى الى تحسين مستوى الكالسيوم فى الاوراق بينما اضافة الوكسال بمفرده مع نفس معدلى الرى و التصريف السابقين أدى الى تحسين مستوى المنجنيز فى الاوراق. على جانب اخر فان أقل محتوى من الحامض الامينى البرولين تم تسجيله مع معدل رى ١٠٠% + الوكسال + معدل تصريف ٨ لتر/ساعة بينما اقل محتوى لانزيم البيروكسيديز تم تسجيله مع معدل رى ٧٥% + معدل تصريف ٤ لتر/ساعة + الفريسال.

**الكلمات الافتتاحية :** الكمثرى الليكونت، معدل الرى، تصريف النقاطات، الوكسال امينو، الفريسال، النمو الخضرى، المحتوى المعدنى للاوراق، حامض البرولين، انزيم البيروكسيديز.