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PHYSIOLOGICAL STUDIES ON FERTILIZATION OF LECONT CV. PEAR TRANSPLANTS

1- Some vegetative growth parameters

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Abstract

This research was carried out during both 2019 and 2020 seasons to study the influence of the two investigated factors i.e., Lecont pear budded on two rootstocks (Betulaefolia and Communis) and some mineral and bio-fertilizers on some vegetative growth measurements. Results data showed that, Betulaefolia rootstock was better than Communis rootstock in this respect. Also, Concerning the specific effect of the different bio-fertilizers data indicated that, fertilizer with Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm./ transplant +3/4 dose of mineral fertilizers (75%) was superior in this respect. Concerning the interaction effect the highest vegetative growth were obtained with the combination between Lecont pear transplants budded on Betulaefolia rootstock and fertilized with soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm./ transplant +3/4 dose of mineral fertilizers (75%), however the lowest values were noticed by Lecont pear transplants budded on Communis rootstock and fertilizer with mineral element (control) during the two seasons of study.

Key wards: pear, bio-fertilizer, EM and vegetative growth.

Introduction

The pear (*Pyrus spp*.) is native to family Rosaceae. It is one of the most celebrated of deciduous fruits. Pear has been cultivated in china for approximately 3000 years, and then it has been moved to the current producer countries **(Lombard and Westwood, 1987).**

Pear fruits are considered the third in importance among other deciduous fruits in the world and fourth among all fruits **(Childers, 1994).** In the last 20 years the pear cultivated area in Egypt decreased from 14923 Fadden in 1995 to 13277 Fadden in 2017 (**FAO, 2019**). Most of this area is concentrated in Al-Behera, Alexandria, Menofia and Kalubia governorates. This decrease is due to many factors including fire blight, aging, type of rootstock, insufficient chilling in some years and other unfavorable factors. However, **Kassem and Marzouk (2002)** found that, the high cost of mineral fertilization is the big problem facing pear growers. In addition, the recent researches revealed that mineral fertilizers have a role in the health problems and environmental pollution (**Kabeel *et al*., 2005**).There is a need to offer the consumer with safety pear product by using bio-organic fertilization. There are many factors face the growers to improve and maximize their productivity for example, propagation, fertilization, irrigation and other horticultural practices. Most fruit seedlings are known to be slow growing plants, since they develop few lateral shoots and roots. Such growth habit of these seedlings poses a major problem to nurserymen, since the loss of a large portion of the plant root system in the re-transplanting process coupled with the slow vegetative growth in the first seasons account for the long time required to produce a standard nursery seedlings (**Brison, 1974**). Furthermore, a major comparison for the low of soil fertility was the extensive use of chemical fertilizers and gradually it became an expensive item in orchard management. Moreover, fruit growers are faced by the hazards of increased use of chemical in agriculture production which result in environmental pollution.

Fertilization is one of the important management tools in increasing growth and crop yield, especially with nitrogen. Nitrogen (N) is known to be one of the most major elements for plant nutrition and development. It plays an important role as a constituent of all proteins, nucleic acids and enzymes (**Nijjar, 1985**).

The use of bio-fertilizers in enhancing plant growth and yield has gained momentum in recent years because of higher cost and hazardous effect of chemical fertilizers. Nitrogen-fixing bacteria and arbuscular mycorrhizal fungi were found to enhance the growth and production of various fruit trees significantly (**Khanizadeh *et al*., 1995),** besides improving the microbiological activity in the rhizosphere (**Aseri *et al*., 2008**). Bio-fertilizer improves growth and fruit quality of pomegranate (**Wadee, 2007**). Moreover, the alternative bio-fertilizer helps to maintain and preserve soil and water resources for future generations.

Bio-fertilizers are the most importance for plant production and soil as they play an important role in increasing yield and fruit quality **(Fayed, 2005)** on apple. Also, **Hassan and Abou- Rayya (2003)** showed that all bio-fertilizers (Nitrobein, Phosphorein, Biogein and Rhizobacterin at 10, 20, 30 g per tree) were effective in improving nutritional status of Anna apple trees.

Bio-stimulants have been described as "non-nutritional products that may reduce fertilizer use and increase yield and resistance to water and temperature stresses" which have been shown to increase plant shoot and root growth, and uptake of some nutrients **(Poincelot, 1993).** One of these bio-stimulants is EM which created in Japan over 25 years ago in University of the Ryukyus in Okinawa and marketed by EMRO (EM Research Organization). The basic purpose of EM is the restoration of healthy ecosystem in both soil and water by using three major genera of microorganisms which are found in nature: phototrophic bacteria (Rhodopseudomonas), lactic acid bacteria (Lactobacillus) and yeast (Saccharomyces) **(Higa 1998** and **Abd-Rabou, 2006).**

Many authors documented favorable effects of using EM as bio-stimulant on growth and yield of several crops. In this respect **Sangakkara (1999)** stated that EM improved nutrient uptake efficiency, enhanced root growth and increased yield; also, it was able to improve the yield of Kelsey plum **(Eissa, 2003).**

This study aimed to throw some light on the accelerating and stimulating the vigor of transplants in the first year in orchard to be ready for training in the subsequent years and suggesting the recommendation for the best source of N, P and K that applied for obtaining and vigor growth of pear transplants.

Materials and Methods

This investigation was carried out during the two successive seasons (2019 and 2020) on uniform vigor transplants of Le-Conte pear (*Pyrus communis* L.X *Pyrus pyrifolia* N.) budded on two rootstocks namely *Pyrus communis and Pyrus betulaefolia*.

This experiment aimed to know more knowledge about the effect of bio-fertilizer on growth of pear transplants. Those transplants were established at the nursery of Faculty of Agriculture Moshtohor, Benha University kalubeia governorate, Egypt.

In both seasons of study and during the last week of February, uniform and healthy one-year- old transplants of pear were transplanted and cultured individually in black plastic pot of 25 cm. in diameter that previously had been filled with specific weight of media consisting of clay and sand at equal proportion (by volume).

Before the experiments had been conducted in the first season, both soil mechanical and chemical analysis were done as shown in **Table 1(a & b)** according to the methods described by **Jackson, (1967)** and **A. O. A. C. (1985)**.

Table (1-a): Physical properties of soil (%):

Partial distribution		
Total sand	Silt	Clay
55.00	15.00	30

Table (1-b): Chemical properties of soil:

Soluble cations mg/L				Soluble anions meg/L				CaCo3	PH	EC
Mg^{++}	Ca^{++}	K^{+}	Na^{+}	HCO_3^{-}	CO_3^{--}	$SO4^{-}$	Cl^{-}			
2.10	**8.80**	**0.60**	**7.70**	**3.00**	**-**	**9.20**	**6.90**	**1.30**	**7.82**	**1.90**

The bio-fertilizers (BF) which used in this study were produced by soil microbiology unit, desert research center. Nitrobein application as an additional N bio-fertilization, while Phosphorein additional P bio-fertilization as well as Potasein additional K bio-fertilization to the transplants. This experiment involved seven treatments:

T1- Mineral fertilizers (100%) 50g from kristalon per transplant (control).

T2- Soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant +3/4 dose of mineral fertilizers (75% control).

T3- Soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant +1/2 dose of mineral fertilizers (50% control).

T4- Soil application of Effective microorganisms (EM) at 50 cm./ transplant +3/4 dose of mineral fertilizers (75% control).

T5- Soil application of Effective microorganisms (EM) at 50 cm / transplant +1/2 dose of mineral fertilizers (50% control).

T6- Soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75% control).

T7- Soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm./ transplant +1/2 dose of mineral fertilizers (50% control).

- Kristalon its contains on 19%N, 19%P, 19%K, 0.9%Mg, 0.025%B and 2%S.
- NPK mineral fertilizers were added in 4 equal doses per plant starting from April to July.
- Bio-fertilizers (Nitrobein + Phosphorein + Potasein + EM) were applied twice in April and June.

Experimental layout:

The complete randomized block design with four replications (each replicate was represented by two individual transplants) was used for arranging the differential investigated treatments. The response of Pear transplants to differential treatments of the experiment was investigated through determining of the following measurements:

- Some vegetative growth measurements:

In the last week of September during both seasons of study as the experiment was ended, the effect of different treatments on some vegetative growth measurements was evaluated by the following growth parameters during both seasons as follows:

1. Net increase in plant height = plant height at the end of September - initial plant height in the first of March.

Increment percentage in Plant height was estimated as follows:

$$\frac{\text{Final Plant height - Initial Plant height}}{\text{Initial Plant height}} \times \mathbf{100}$$

2. Stem diameter (cm) (5 cm above ground surface):

Net increase in stem diameter = stem diameter of the end of September - Initial stem diameter in the first of March.

Increment percentage in stem diameter was estimated as follows:

$$\frac{\text{Final stem diameter- Initial stem diameter}}{\text{Initial stem diameter}} \times \mathbf{100}$$

3. Average number of lateral shoots / transplant.

4. Average number of leaves / transplant.

5. Leaf area: In the last week of September during both seasons of study average leaf area of the apical 5th leaf was estimated, in cm^2 using a CI-203- Laser Area-meter made by CID, Inc., Vancouver, USA.

6. Total assimilation area.

- Statistical analysis:

All data of the present investigation were subjected to analysis of variance and significant differences among means were determined according to **(Snedecor and Cochran, 1990)**. In addition, significant differences among means were differentiated according to the Duncan, s, multiple test range **(Duncan, 1955).**

Results and Discussion

1. Increment percentage of plant height:

A. Specific effect:

Data presented in **Table (2)** noticed that, a significant differences were obtained between plant height increased percentages as affected by pear rootstocks (Betulaefolia and Communis) during both seasons of study, whereas the highest (Betulaefolia) rootstock was the superior one in this respect, where it gave the higher value of plant height as compared with the other rootstocks. Concerning the specific effect of mineral and bio-fertilizers on increment percentage of plant height increased percentages of pear transplants, data tabulated in **Table (2)** revealed that, soil application bio-fertilizers raised the plant height of pear transplants as compared to the control. On the other hand, pear transplants which were fertilized with soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm./ transplant +3/4 dose of mineral fertilizers (75%) gave the highest plant height during both seasons of study.

Table 2. Plant height increment percentage of pear transplants as influenced by NPK mineral - bio-fertilizers during 2019 and 2020 seasons**.**

Treatments	Increment percentage of plant height					
	Betulaefolia	**Communis**	**Mean**	**Betulaefolia**	**Communis**	**Mean**
	First season			Second season		
T1	6.290 i	3.630 j	**4.96 F**	11.98 h	8.25 j	**10.11 F**
T2	8.13 d	9.430 g	**13.78 D**	13.51 gh	10.05 i	**11.78 E**
T3	12.58 f	7.200 hi	**9.89 E**	15.89 ef	14.90 fg	**15.40 D**
T4	29.40 a	17.00 de	**23.20 B**	21.91 b	21.94 b	**21.93 B**
T5	11.79 f	8.430 gh	**10.11 E**	18.25 cd	16.84 de	**17.35 C**
T6	26.59 b	23.20 c	**24.90 A**	24.99 a	21.47 b	**23.23 A**
T7	17.31 de	15.35 e	**16.33 C**	18.58 c	18.37 cd	**18.48 C**
Mean	**17.44 A**	**12.03 B**		**17.88 A**	**15.97 B**	

Values within the same column and raw for any of two investigated factors were individually differentiated by capital letters, while for the interaction small letters were used, mean followed by the same letter/s were not significantly different at 5% level.

B. Interaction effect:

Data presented in **Table (2)** showed that, considerable and statistically effect in both seasons of study, whereas the highest value of plant height of Lecont pear budded on Betulaefolia pear rootstock was achieved when fertilized with soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm./ transplant +3/4 dose of mineral fertilizers (75%), however, the lowest value of plant height increased percentages was noticed by Lecont pear budded on Betulaefolia or Communis transplants and fertilized with NPK (control) during both seasons of study.

The present results are in harmony with those found by **Kannaiyan (2002), Aseri *et al*., (2008**) and **Kumar *et al.,* (2013).**

2 - Increment percentage of stem diameter:

A. Specific effect:

Regarding the specific effect of pear rootstocks on increment percentage of stem diameter data tabulated in **Table (3)** showed that, Lecont pear budded on Betulaefolia rootstock was better than the other investigated rootstock (Communis) in this respect. Concerning the specific effect of the different treatments on pear transplants stem diameter increment percentage, data tabulated in **Table (3)** revealed that, fertilization with soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm./ transplant +3/4 dose of mineral fertilizers (75%) was superior in this respect, where it was able to increase significantly stem diameter increment percentage as compared with the different investigated fertilization treatments during both 2019 and 2020 seasons of study. Fertilization with soil application of Effective microorganisms (EM) at 50 cm / transplant +3/4 dose of mineral fertilizers (75%) came in the second rank.

B. Interaction effect:

Data presented in **Table (3)** showed a considerable and statistically effect in both seasons of the study, where the highest stem diameter increment percentage was obtained with the combination between Lecont pear budded on Betulaefolia pear transplants and fertilized with Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm / transplant +3/4 dose of mineral fertilizers (75%) or soil application of Effective microorganisms (EM) at 50 cm./ transplant +3/4 dose of mineral fertilizers (75%), however the lowest value in stem diameter was noticed by Lecont pear budded on Communis pear transplants and fertilizer with mineral element (control) during the two seasons of study.These results are agreement with that reported by **Abo Taleb *et al*., (1999) and Abd Ella *et al.,* (2006).**

Table 3. Stem diameter increment percentage of pear transplants as influenced by NPK mineral - bio-fertilizers during 2019 and 2020 seasons**.**

Treatments	Increment percentage of stem diameter					
	Betulaefolia	**Communis**	**Mean**	**Betulaefolia**	**Communis**	**Mean**
	First season			Second season		
T1	20.17 f	20.61 ef	**20.39 C**	21.43 efg	19.33 g	**20.40 E**
T2	24.83 bc	23.26 cde	**24.04B**	22.22 efg	23.98 e	**23.10 D**
T3	21.66 def	21.15 ef	**21.41 C**	21.48 efg	20.12 fg	**20.77 DE**
T4	37.33 a	35.22 a	**36.28 A**	37.51 b	31.00 cd	**34.26 B**
T5	24.79 bc	24.30 bcd	**24.54 B**	34.41 bc	23.61 ef	**29.01 C**
T6	37.11 a	36.11 a	**36.61 A**	42.22 a	34.41 bc	**38.31 A**
T7	26.11 b	23.00 cde	**24.56 B**	31.66 cd	30.55 d	**31.11 C**
Mean	**27.43 A**	**26.24 B**		**30.13 A**	**26.14 B**	

Values within the same column and raw for any of two investigated factors were individually differentiated by capital letters, while for the interaction small letters were used, mean followed by the same letter/s were not significantly different at 5% level.

3- Number of lateral shoots per transplant:

A. Specific effect:

Data tabulated in **Table (4)** indicated that, Lecont pear budded on Betulaefolia rootstock gave the highest values of the investigated parameter (number of lateral shoots) as compared with the other investigated rootstock (Lecont pear budded on Communis) during the two seasons of study. Concerning the specific effect of different fertilization treatments on number of lateral shoots, data presented in **Table (4)** revealed that, the investigated parameter took the dissimilar trend where their values were significantly increased when the transplants were fertilized with Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75%) or Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5g/ transplant + Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75%) during to both seasons for number of lateral shoots per transplant.

B. Interaction effect:

Data in **Table (4)** it is quite clear that, the best result in significantly regarding number of lateral shoots was obtained with Lecont pear budded on Betulaefolia rootstock combined fertilized with Effective microorganisms (EM) at 50 cm./ transplant +3/4 dose of mineral fertilizers (75%) or Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75%) during two seasons. On the other hand, lowest value in number of shoots was noticed by Lecont pear budded on Communis transplants fertilized with mineral element (control) during the two seasons of study.

The present results are in harmony with those found by **Abo Taleb *et al*., (1999).**

Table 4. Number of lateral shoots per pear transplant as influenced by NPK mineral - bio-fertilizers during 2019 and 2020 seasons.

Treatments	Number of shoots per transplant					
	Betulaefolia	**Communis**	**Mean**	**Betulaefolia**	**Communis**	**Mean**
	First season			Second season		
T1	2.33 bc	2.00 c	**2.17 C**	2.67 c	2.33 c	**2.50 B**
T2	3.00 bc	2.67 bc	**2.83 BC**	3.00 c	3.00 c	**3.00 B**
T3	2.67 bc	2.33 bc	**2.50 BC**	2.67 c	2.33 c	**2.500 B**
T4	4.33 a	3.33 ab	**3.83 A**	4.67 a	3.33 bc	**4.00 A**
T5	3.33 ab	3.00 bc	**3.17 AB**	3.00 c	2.67 c	**2.83 B**
T6	4.33 a	3.33 ab	**3.83 A**	4.33 ab	3.33 bc	**3.83 A**
T7	3.00 bc	3.00 bc	**3.00 ABC**	2.67 c	2.33 c	**2.50 B**
Mean	**3.29 A**	**2.81 B**		**3.29 A**	**2.76 B**	

Values within the same column and raw for any of two investigated factors were individually differentiated by capital letters, while for the interaction small letters were used, mean followed by the same letter/s were not significantly different at 5% level.

4- Number of leaves per transplant:

A. Specific effect:

Data tabulated in **Table (5)** indicated that, Lecont pear budded on Betulaefolia rootstock gave the highest values of the investigated parameter (number of leaves) as compared with the other investigated rootstock (Communis) during the two seasons of study. Regarding the specific effect of different fertilization treatments on number of leaves, data presented in **Table (5)** revealed that, the investigated parameter took the dissimilar trend where their values were significantly increased when the transplants were fertilized with Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm./ transplant +3/4 dose of mineral fertilizers (75%) or soil application of Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75%) during to both seasons of study.

B. Interaction effect:

Concerning the interaction between pear rootstocks (Betulaefolia and Communis) and different fertilizers on number of leaves per transplant, data are recorded in **Table (5)** it is quite clear that, the best result in significantly regarding number of leaves was obtained with Lecont pear budded on Betulaefolia rootstock combined fertilized with soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75%). The combination between Lecont pear budded on Communis rootstock with control treatment (50 g from kristalon per transplant) had the lowest effect regarding number of leaves during both seasons of study.

The present results are in harmony with those found **Fawzy *et al*., (2010).**

Table 5. Number of leaves per pear transplant as influenced by NPK mineral - bio-fertilizers during 2019 and 2020 seasons.

Treatments	Number of leaves per transplant					
	Betulaefolia	**Communis**	**Mean**	**Betulaefolia**	**Communis**	**Mean**
	First season			Second season		
T1	16.33 f	15.67 f	**16.00 C**	13.67 f	13.33 f	**13.50 D**
T2	18.67 c	16.67 ef	**17.67 B**	18.33 c	15.67 ed	**17.00 C**
T3	18.00 cde	16.67 ef	**17.33 B**	15.33 de	13.67 f	**14.50 D**
T4	20.33 ab	18.67 c	**19.50 A**	20.67 ab	16.33 d	**18.50 B**
T5	19.00 bc	17.00 def	**18.00 B**	18.67 c	14.33 ef	**16.50 C**
T6	20.67 a	18.67 c	**19.67 A**	21.00 a	19.00 c	**20.00 A**
T7	18.33 cd	16.67 ef	**17.50 B**	19.33 bc	15.33 de	**17.33 C**
Mean	**18.76 A**	**17.14 B**		**18.14 A**	**15.38 B**	

Values within the same column and raw for any of two investigated factors were individually differentiated by capital letters, while for the interaction small letters were used, mean followed by the same letter/s were not significantly different at 5% level.

5- Average leaf area and total assimilation area (cm^2)

A. Specific effect:

Data in **Tables (6 and 7)** revealed that, Lecont pear budded on Betulaefolia rootstock gave the higher values of leaf area as compared with the other investigated rootstock (Lecont pear budded on Communis) during the two seasons of study. Regarding the specific effect of different fertilization (bio and mineral fertilizers) on average leaf area and total assimilation area (cm^2), data presented in **Tables (6 and 7)** indicated that, all the investigated fertilization significantly increased average leaf area and total assimilation area (cm^2) of pear transplants as compared with control. The best result in significantly regarding leaf area and total assimilation area was obtained with Lecont pear transplants fertilized with soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75%) or soil application of Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75%). On the contrary, the least value was obtained when pear transplants fertilized with control (Mineral fertilizers (100%) 50 g from kristalon per transplant) in both seasons of study.

B. Interaction effect:

Concerning the interaction effect of the two investigated factors i.e., pear rootstocks (Betulaefolia and Communis) and different fertilization on average leaf area and total assimilation area (cm^2) of pear transplants, data presented in **Table (6 and 7)** showed variable response of the two rootstocks to the different combination of fertilization treatments.

The highest values of leaf area and total assimilation area were that combination between Lecont pear budded on Betulaefolia rootstock and fertilization with soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant+ Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75%) or soil application of Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75%). On the other hand, the lowest value of leaf area and total assimilation area was detected by Lecont pear budded on Communis rootstock and control treatment during both seasons of study.

The obtained results are confirmed by those previously mentioned by **Kabeel *et al*., (2005**), **Shadad *et al*., (2005) and Wadee, (2007**).

Table 6. Leaf area (cm^2) of pear transplant as influenced by NPK mineral - bio-fertilizers during 2019 and 2020 seasons.

Treatments	Leaf area (cm^2)					
	Betulaefolia	**Communis**	**Mean**	**Betulaefolia**	**Communis**	**Mean**
	First season			Second season		
T1	15.00 h	16.10 gh	**15.55 E**	17.56 gh	16.33 h	**16.95 D**
T2	20.56 cd	17.28 e-h	**18.92 CD**	20.22 def	16.67 h	**18.44 C**
T3	22.73 bc	18.90 def	**20.82 B**	23.41 b	16.33 h	**19.87 B**
T4	25.22 b	20.86 cd	**23.04 A**	26.67 a	21.33 cd	**24.00 A**
T5	20.00 d	19.67 de	**19.83 BC**	22.33 bc	19.33 ef	**20.83 B**
T6	28.57 a	20.00 d	**24.84 A**	26.33 a	21.33 cd	**23.83 A**
T7	18.52 d-g	17.00 fgh	**17.76 D**	20.67 de	18.93 fg	**19.80 B**
Mean	**21.51 A**	**18.54 B**		**22.46 A**	**18.61 B**	

Table 7. Total assimilation area (cm^2) per pear transplant as influenced by NPK mineral - bio-fertilizers during 2019 and 2020 seasons.

Treatments	Total assimilation area per transplant (cm^2)					
	Betulaefolia	**Communis**	**Mean**	**Betulaefolia**	**Communis**	**Mean**
	First season			Second season		
T1	244.90 j	252.10 j	**248.50 G**	274.30 h	217.70 j	**246.00 F**
T2	383.60 de	274.90 i	**329.30 E**	370.60 d	260.90 i	**315.80 D**
T3	407.90 c	314.90 g	**361.40 C**	357.60 d	223.10 j	**290.40 E**
T4	525.40 b	389.30 d	**457.30 B**	550.80 a	315.70 f	**43.20 B**
T5	380.00 e	328.10 f	**354.00 D**	416.70 b	277.00 h	**346.80 C**
T6	590.00 a	385.50 de	**487.80 A**	552.90 a	374.90 d	**463.90 A**
T7	333.20 f	282.90 h	**308.10 F**	399.40 c	290.20 g	**344.80 C**
Mean	**409.30 A**	**318.20 B**		**417.50 A**	**279.90 B**	

Values within the same column and raw for any of two investigated factors were individually differentiated by capital letters, while for the interaction small letters were used, mean followed by the same letter/s were not significantly different at 5% level.

6- Root length (cm):

Referring the specific effect of pear rootstocks (Betulaefolia and Communis) on root length (cm) data in **Table (8)** revealed that, a significant differences were obtained between root length as affected by pear rootstocks (Betulaefolia and Communis) during both seasons of study, whereas the highest (Betulaefolia) rootstock was the superior one in this respect, where it gave the higher value of root length (cm) as compared with the other rootstock. Meanwhile Communis rootstock came in the second rank. Concerning the specific effect of the different mineral and bio-stimulants (Nitrobein, Phosphorein, Potasein and EM) on pear transplants root length, data tabulated in **Table (8)** showed that, Lecont pear transplants fertilized with soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75%) was superior in both seasons, where it was able to increase significantly root length as compared with the different investigated fertilization during both seasons of study.

B. Interaction effect:

Data presented in **Table (8)** show a considerable and statistically effect in both seasons of the study, where the highest root length was obtained with the combination between Lecont pear budded on Betulaefolia Pear transplants and fertilized with soil application of Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75%) or soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75%) in both seasons of study. However the lowest value in root length was noticed by Lecont pear budded on Communis rootstock Pear and fertilizer with mineral element (control) during the both seasons.

Table 8. Root length (cm) per pear transplant as influenced by NPK mineral - bio-fertilizers during 2019 and 2020 seasons.

Treatments	Root length (cm) per transplant					
	Betulaefolia	Communis	Mean	Betulaefolia	Communis	Mean
	First season			Second season		
T1	32.00 ef	23.33 i	**27.67 E**	30.33 d	20.67 h	**25.50 F**
T2	35.50 bc	25.67 gh	**30.58 C**	34.00 b	24.33 g	**29.17 D**
T3	33.50 de	25.00 hi	**29.25 D**	32.33 c	23.33 g	**27.83 E**
T4	40.33 a	30.67 f	**35.5 A**	36.67 a	28.33 e	**32.50 B**
T5	35.00 bcd	27.33 g	**31.17 C**	34.00 b	26.33 f	**30.17 C**
T6	38.67 a	34.50 cd	**36.58 A**	37.67 a	32.33 c	**35.00 A**
T7	36.50 b	30.33 f	**33.42 B**	34.33 b	25.67 f	**30.00 CD**
Mean	**35.93 A**	**28.12 B**		**34.19 A**	**25.86 B**	

Values within the same column and raw for any of two investigated factors were individually differentiated by capital letters, while for the interaction small letters were used, mean followed by the same letter/s were not significantly different at 5% level.

General conclusion and discussion

From previous data we can conclude that, Lecont pear budded on betulaefolia and fertilized by soil application of Nitrobein at 5 g/ transplant + Phosphorein at 5 g/ transplant + Potasein at 5 g/ transplant + Effective microorganisms (EM) at 50 cm/ transplant +3/4 dose of mineral fertilizers (75% control), showed highest vegetative growth parameters and these result may be attributed to the superiority of betulaefolia than communis. Also, we can point out to treatment which gave more nutrients compared with all other treatments which reflected on highest vegetative parameters.

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دراسات فسيولوجية علي تسميد شتلات الكمثرى صنف ليكونت

1- بعض قياسات النمو الخضرى

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أجريت هذه الدراسة خلال موسمين متتاليين 2019 و2020 فى مشتل قسم البساتين بكلية الزراعة بمشتهر – جامعة بنها على شتلات كمثرى ليكونت مطعومة علي اصلي الكميونس والبتشيليفوليا عمرها سنه لدراسة استجابة هذه الشتلات للتسميد المعدنى والحيوى كإضافة أرضية. واوضحت النتائج ان النمو الخضرى لشتلات الكمثرى ليكونت المطعومة علي الاصل بيتشيليفوليا افضل من شتلات الكمثرى ليكونت المطعومة علي الاصل كميونس، كما تبين ان تسميد شتلات الكمثرى ليكونت بالنيتروبين والفوسفورين والبوتاسين بمعدل 5 جرام لكل شتلة من كل سماد + السماد الحيوى EM بمعدل 50 سم3 لكل شتلة + الكريستالون بمعدل 37.5 جرام لكل شتلة (75 % من المقارنة) خلال موسمى الدراسة. كما اوضحت النتائج المتحصل عليها ان تسميد شتلات الكمثرى ليكونت المطعومة علي الاصل بيتشيليفوليا بالنيتروبين والفوسفورين والبوتاسين بمعدل 5 جرام لكل شتلة من كل سماد + السماد الحيوى EM بمعدل 50 سم3 لكل شتلة + الكريستالون بمعدل 37.5 جرام لكل شتلة (75 % من المقارنة) تعطى افضل قياسات النمو الخضرى ، بينما اقل القياسات كانت مع شتلات الكمثرى صنف ليكونت المطعومة علي الاصل كميونس والمسمدة بالكريستالون فقط (المقارنة) بينما كانت باقى المعاملات وسطا بينهما.