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Influence of Biofertilizers on Growth and Leaf Mineral Content in Peach Transplants

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Abstract: *This study was conducted in the Department of Biology, Al-Rasheed University College- Baghdad during 2017 growing season to investigate the influence of some microbial inoculants on 1 year's old trees of "Peento" peach cultivar. The biofertilizers treatments was control treatment (B_1), Azotobacter chroococcum (B_2), Azospirillum brasilense (B_3), Bacillusmegatherium (B_4), Azotobacter chroococcum + Azospirillum brasilense (B_5), Azotobacter chroococcum + Bacillusmegatherium (B_6), Azospirillum brasilense + Bacillusmegatherium (B_7), Azotobacter chroococcum + Azospirillum brasilense + Bacillusmegatherium to the soil (B_8).The experimental design adapted in this experiment was RCBD. The number of transplant used was 24 transplants.The results indicate that the Azotobacter chroococcum + Azospirillum brasilense + Bacillusmegatherium to the soil (B_8) treatment significantly increased leaves area of 1312 cm^2, leaf chlorophyll content of 34.56 $mg.100g^{-1}$, increase in stem diameter of 2.24 mm and the highest average of branches length of 19.20 cm.As the same treatment has been giventhe highest leaf nitrogen content of 1.60 %, the highest leaf potassium content of 1.66 %, highest leaf zinc content of 18.12 ppm and highest leaf manganese content of 2.134 ppm. The lowest values for these treatments for all studied traits were in the control treatment (B_1).*

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I. Introduction

Peaches (*Prunus persica* L.) are native to family Rosaceae. They were early cultivated in China since approximately 4000 years ago from it speeded world wide.Worldwide, peaches' production increased inthe past 20 years, due to the new established orchardson large surfaces, as a result of peaches' consumeincrease and also to the new technology linksdeveloped for peach culture (Iuliana, 2013). The acreage of peach in the world reached about 1499872 hectare, with production of 21083151 tons,the main producing countries are China then Italy (FAO, 2013). The estimated number of peach fruit trees in Iraq, including nearly 152273 tree produces up to 2451 tons, and the average production per tree about 16.1 kg (PCBS, 2013).

The use of microbial inoculants in agriculture has greatly increased during the past two decades (Hayat et al.2010) as the public and private sector agricultural research and development communities work for solutions to problems associated with modern agriculture.Microbial inoculants are typically classified as biocontrol agents (also called Biopesticides) or biofertilizers (Bashan and Holguin 1998). Biofertilizers are biological products containing living microorganisms that, when applied to seed, plant surfaces, or soil, promote growth by several mechanisms such as increasing the supply of nutrients, increasing root biomass or root area, and increasing nutrient uptake capacity of the plant (Vessey, 2003).Biofertilizers can be used as complements to mineral fertilizers (Canbolat et al. 2006). Microbial inoculants mainly include free-living bacteria, fungi, and arbuscular mycorrhizal fungi (AMF) (Berg, 2009;Dodd and Ruiz-Lozano, 2012; Vessey, 2003) that were isolated from a variety of environments including soil,plants, plant residues, water, and composted manures.Many previous studies revealed biofertilizersaffects the some characteristics growth and leaf mineral content(Nithya et al. 2011) found the *Azotobacte*r and *Aspergillus*sppaffected significantly in most recipes vegetative growth studied in mulberry trees.(Dutt et al. 2013) found that adding five type of fungi to soil enhanced leaf mineral content (P, Zn, Mn, Fe) of apricot trees. (Al-Hadethiet al. 2014) reported that biofertilizer (Nitrobeine)increased the vegetative growth characteristics and leaf chlorophyll and nitrogen and potassium content of apricot trees. (Haggaget al. 2014) Found the biofertilizers affected significantly in most recipes vegetative growth studied in olive trees. The target of this study was to evaluate "Peento" peach cultivar parameters under biofertilizers treatments.

II. Materials and Methods

This study was conducted in the Department of Biology, Al-Rasheed University College- Baghdad during 2017 growing season to investigate the influence of some microbial inoculants on 1 year's old trees of

"Peento" peach cultivar. Transplants were cultivated in plastic bags with a diameter of 25 cm. Transplants were healthy, similar in vigor and subjected to the same horticultural practices adapted in the region.The biofertilizers treatments were as follows:

1. The control treatment (**B_1**).
2. Added the *Azotobacter chroococcum* to the soil (**B_2**).
3. Added the *Azospirillum brasilense* to the soil (**B_3**).
4. Added the*Bacillusmegatherium*to the soil (**B_4**).
5. Added the *Azotobacter chroococcum+ Azospirillum brasilense*to the soil (**B_5**).
6. Added the *Azotobacter chroococcum+Bacillusmegatherium* to the soil (**B_6**).
7. Added the *Azospirillum brasilense +Bacillusmegatherium* to the soil (**B_7**).
8. Added the *Azotobacter chroococcum+ Azospirillum brasilense +Bacillusmegatherium* to the soil (**B_8**).

The experimental unit included one transplant and the number of treatment was eight and replicated three times. The experimental design adapted in this experiment was RCBD. The number of transplant used was 24 transplants. The obtained results were subjected to analysis of variance according to (Elsahookie and Wuhaib, 1990) using L.S.D 0.05 for comparing differences between various treatment means.
The following parameters were determined in this experiment:

1. Leaves area (cm^2): By taken ten leaves from the middle position of the shoot randomly and measuring leaf area (cm^2). ByDigimizer program Windows 7 operating system, then mean of leaf area × number of leavesto calculate the total leaves area.
2. Leaf chlorophyll contents(mg.100g^{-1} fresh weight): Representative fresh leaf sample at middle part of shoots were taken in the first week of June and used for analysis of chlorophyll were calorimetrically according to Mackinny (1941).
3. Leaf dry weight %: Various leaves were taken from the sapling was weighing then drained degree 3. While proven weight and calculated the percentage of dry matter by dividing weight after drying on weight before drying× 100.
4. Increase in stem diameter (mm): Stem diameter were measured by (Vernier) at the beginning and end of the experiment, according to the difference between them and that such an increase in stem diameter.
5. Average of branches length (cm): Taking four branches of each experimental unit at the beginning of the month of July and measured annual shoots formed during the season in each unit empirical metric tape measure and mined the average branches length.
6. Leaf Mineral Content:leaf chemical constitute: samples of twentyleaves from the middle part of shootsaccording to Chuntonarb and Cummings,(1981), were selected at random from eachreplicate (1^{st}week of June) to measure theircontent of N, P, Kaccording to Wilde et al (1985)ondry weight basis.Manganese and Zinc weredetermined as ppm using atomic absorptionaccording to (Carter, 1993).

III. Results And Discussions

Effects of biofertilizers on leaves area, leaf chlorophyll content, leaf dry weight, Increase in stem diameter Average of branches length: Data concerning the effect of treatments onleaves area,leaf chlorophyll content, leaf dry weight, increase in stem diameter and average of branches length during the experiment are listed in Table (1). The data cleared that*Azotobacter chroococcum + Azospirillum brasilense + Bacillusmegatherium* (B_8), significantly increased leaves area of 1312 cm^2, leaf chlorophyll content of 34.56 mg.100g^{-1}, increase in stem diameter of 2.24 mm and the highest average of branches length of 19.20 cm. Table (1) also shows that the treatments did not significantly affect the leaf dry weight. The lowest values for these treatments for all studied traits were in the control treatment (B_1). The increase in vegetative traits may be attributed to bio-fertilizer, which has contributed to an increase in the rate of biochemical processes involving nitrogen, phosphorus and potassium compounds to form compounds and basic components of photosynthesis and respiration as well as their contribution to the formation and growth of a large number of enzymes (Barker and Pilbeam, 2007). As well as the effect of bio-fertilizers on the improvement of biological and physical soil properties as well as the chemical properties resulting from the release of larger quantities of nutrients available for absorption by the roots and thus influence the physiological processes such as increase the efficiency of photosynthesis in the leaves (Yu et al, 2014) and increase It produces carbohydrates and thus increases vegetative growth.These results are in agreement with those obtained by,(Kumar et al, 2013) on peartrees, (Al-Hadethi, 2015) on apricot trees; they found that the leaves area and increase in stem diameter and average of branches length positively correlated with biofertilizers in those trees.

Table 1: Effects of biofertilizers on leaves area, leaf chlorophyll content, leaf dry weight, Increase in stem diameter Average of branches length ofPeentopeach trees during 2017 season.

Treatments	Leaves area (cm^2)	Chlorophyll content($mg.100g^{-1}$)	Leaf dry weight (%)	Increase in stem diameter (mm)	Average of branches length (cm)
B_1	1122	30.38	30.65	1.66	11.26
B_2	1236	32.15	30.44	1.88	14.82
B_3	1188	31.22	31.19	1.80	13.19
B_4	1174	31.06	30.22	1.76	13.85
B_5	1244	33.50	30.56	1.98	15.92
B_6	1230	32.86	30.28	1.94	17.28
B_7	1272	31.14	31.12	2.02	16.77
B_8	1312	34.56	31.24	2.24	19.20
L.S.D 0.05	**44.93**	**0.48**	**N.S**	**0.14**	**1.27**

Effects of biofertilizers on leaf N, P, K, Zn and Mn content: Data concerning the effect of treatments on nitrogen, phosphor, potassium, zinc and manganese are listed in Table (2). The data cleared that,*Azotobacter chroococcum* + *Azospirillum brasilense* + *Bacillusmegatherium* (B_8), significantly increased and gave the highest leaf nitrogen content of 1.60 %, the highest leaf phosphor content of 0.27 %, the highest leaf potassium content of 1.66%, highest leaf zinc content of 18.12 ppm and highest leaf manganese content of 2.134 ppm. Table (2) also shows the lowest values for these treatments for all studied elements were in the control treatment (B_1). The result of these results is the increase in leaves area and leaf chlorophyll content as shown in Table 1, which results in the absorption of these elements to meet their vegetative needs and the growth of the tree. The addition of bio fertilizer has increased the content of peach leaves of the elements as a result of increased growth and efficiency of photosynthesis (Mosa et. al, 2016) by increasing the leaves area and leaf content of chlorophyll and increasing the soil content of these elements as a result of adding to the soil, resulting in increased absorption and increase the content of the leaves of these elements.These results are in agreement with those obtained by, (Fawzi et. al, 2010) on pear trees, (Dutt et al. 2013) on apricot trees,(Kumar et al, 2013) on pear trees; they found that the leaves mineral content positively correlated with biofertilizers in those trees.

Table 2: Effects of biofertilizers on leaves mineral contentofPeentopeach trees during 2017 season.

Treatments	N (%)	P (%)	K (%)	Zn (ppm)	Mn (ppm)
B_1	1.09	0.16	1.26	16.19	1.745
B_2	1.21	0.17	1.33	16.37	1.759
B_3	1.25	0.17	1.38	16.66	1.822
B_4	1.16	0.20	1.35	17.00	1.750
B_5	1.55	0.19	1.48	16.78	1.818
B_6	1.42	0.22	1.50	17.23	1.856
B_7	1.48	0.24	1.43	17.88	1.902
B_8	1.60	0.27	1.66	18.12	2.134
L.S.D 0.05	**0.13**	**0.03**	**0.16**	**0.34**	**0.040**

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