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# Effect of Bio and Organic Fertilizers on Pumpkin's (Cucurbita pepo L.) Leave Content of N, P, and K

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***Abstract:*** **This study was conducted to investigate the effect of bacterial bio-fertilization *A. chroococcum* and *P. putide* and four levels of compost (0, 1, 2, 3) tons.h$^{-1}$ on the leaves content of N.P.K elements. The experiment was carried out in one of the greenhouses of the College of Agriculture - University of Al-Qadisiyah during fall season 2018-2019. It designed in accordance with the Randomized Complete Block Design (RCBD) with three replicates in sandy loam soil. The means of treatments were compared with the least significant difference (LSD) at (5)% probability level. The results present that the treatments of *A. chroococcum, P. putide* and compost at (3) tons.kg$^{-1}$ significantly increases the leaves content of K.P.K compared to all other treatments in the flowering stage (4.970, 0.5000, and 4.930) mg.kg$^{-1}$, respectively. This treatment was followed by the effect of the treatment of *A. chroococcum* and compost at (3) tons.kg$^{-1}$, which increases the values of all traits except the leaf content of (P). Bio-fertilizer with *P. putide* + *A. chroococcum* significantly increases the leaves' content of P.**

***Keyword:*** **pumpkin, bio-fertilizer, organic fertilizer, content N.P.K.**

## I. INTRODUCTION

Researchers indicated the importance of bio-fertilization [1], believe that biofertilizers are materials that contain live organisms applied to the soil or seeds in the rhizosphere, increase nutrient availability and stimulate plant growth. In addition to its role in reducing mineral fertilizers that are non-polluting, resulting in healthy food. The bacterial vaccine increases nitrogen fixation and the solubility of phosphorus, potassium, and zinc[2]. The results of [3] showed a significant increase in the nitrogen content of pumpkin leaves compared to the comparative treatment when inoculating pumpkin seeds with Azotobacter [4] showed a significant increase in leaf nitrogen content when fertilizing cucumber with Azotobacter. Many studies have indicated the importance of compost. [5] indicated a significant increase in the concentration of N, P and K elements in plant leaves when compost fertilizer was applied at the level of (20) tons.kg$^{-1}$ to cucumber plant compared to comparison treatment. Al-Umrani, (2015) indicated a significant increase in the content of leaves of pumpkin plant elements N, P, K when fertilizing with organic fertilizer. The results of [6] study showed significant increase in tomato leaf content of N, P and K elements when fertilizing the mixture of (Azotobacter + Pseudomonas + Compost) compared with the comparison treatment.

*Cucurbita pepo L*. is one of the most important vegetable crops of the Cucurbitaceae family. South America is the native where it has been cultivated by its native population for over (2000) years. From there, this vegetable crop was widely separated all over the world. It is one of the common vegetable crops in Arab countries, including Iraq [7]. In Iraq, pumpkins are planted in the open fields with two springtimes, starting in March to give their production in April and the second fall in the second half of August to give their production in October. In recent years, farmers have tended to plant pumpkins in greenhouses during winter. The planted area in Iraq in the year of (2012) is more than (148) thousand hectares at a rate of (15.472) tons/h [8].

## II. Methods and Materials

The experiment was carried out in one of the fields of the College of Agriculture - University of Al-Qadisiyah during fall season of 2018-2019 with an area of (225)m$^2$, (9 × 25)m, in sandy loam soil to study the effect of the application of bio-organic fertilization (compost) on the growth of pumpkin plant of the variety of

(Ghasala F1). The soil was prepared by plowing twice perpendicular tillage. Random samples were taken from the soil of the field on depth of (0-30) cm to determine some of the physical and chemical properties of soil before the implementation of the experiment.

**Table (1): Some physical and chemical properties of the field soil.**

| Trait | Value | Unit |
|---|---|---|
| Slay | 110 | $g.kg.soil^{-1}$ |
| Silt | 291 | |
| Sand | 599 | |
| Bulk density | 1.37 | $g.cm^{-3}$ |
| EC electrical conductivity | 2.16 | $dS\ m^{-1}$ |
| pH degree of reaction | 7.4 | - |
| CEC Exchange Capacity of Positive Ions | 19.32 | $Cmol_c\ kg^{-1}Soil$ |
| Organic matter O.M | 1.7 | $g.kg.soil^{-1}$ |
| Ready Nitrogen | 26.4 | $mg.kg.soil^{-1}$ |
| Ready phosphorus | 7.3 | |
| Ready Potassium | 158 | |
| Soil texture | Sandy loam | |

The greenhouse soil was leveled and prepared. The cultivated area was divided into three terraces along the plastic house between each terrace and the other there was an isolation distance of (1) m. Each terrace was divided into (16) experimental units. Drip irrigation systems are placed along each terrace. Pumpkin seeds were sterilized superficially using mercury chloride and alcohol and then washed with sterile distilled water to remove trace of the substance. Seeds were soaked in Arabic gum by a rate of (1:10) of Arabic gum: (1) ml distilled water for half an hour to ensure the adherence of bacteria to the seeds while taking into account the cultivation of seeds that are not pollinated with bacteria first. Pumpkin seeds were planted directly in the field on the 20th of October 2018 on both sides of the terrace by digging at a distance of (40) cm between the pits and the other [9]. After 15 days of germination, one plant was left in each planting point. The recommended levels of the fertilizers were applied as recommended by the Iraqi Ministry of Agriculture.

The experiment included four levels of compost (0,1,2, and 3) and two levels of *A. chroococcum and P. putide.* Thus, the experiment included (48) treatment factors. They were organized in a trial experiment designed with the design of Randomized Complete Block Design (RCBD) with three replicates. Means were compared with the least significant difference (LSD) at the level of the significant of (5)%. Determination of soil particle size distribution was estimated according to [10]. The bulk density was estimated in accordance with the method mentioned in [11]. Electrical conductivity was estimated according to the method in [12]. The pH and cation exchange capacity was estimated according to the method described in [11]. The organic matter was estimated according to the method described in [11]. Determination of the available nitrogen was done by the use of Kildal device. Phosphorus availability was determined through the use of the Spectrophotometer device. The availability of potassium was estimated by Flamephotomate device as described in [10].

## III. Study Indicators

**Plant leaves the content of NPK in flowering stage**

This estimate was done by taken by sampling from the fourth plant leaf at the bottom of the developing summit because it is physiologically active randomly from the plants of each experimental unit in the flowering stage. The leaves were washed with normal tap water and then with distilled water and dried in the oven at a temperature of (65)°C for (48) hours until the weight was constant. Each sample was milled on its own using an electric grinder, passed through a (0.5) ml diameter sieve and mixed thoroughly and (0.2) g was taken from each sample. They were digested using a mixture of sulfuric acid, pyric acid, and chloric acid. After digestion, nitrogen was determined by distillation using Kjeldahl device.Phosphorus was measured by the Spectrophotometer and potassium by Flamephotomate device [13].

## IV. Results and discussion

### 1. The effect of bacterial fertilization and compost on leaf nitrogen content in the flowering stage ($mg.N.kg^{-1}$).

Table (2) presents that the application of bio and organic fertilizers individually or double or triple overlap resulted in a significant increase in leaf content of N compared to the comparison treatment. The treatment to which the bio-fertilizer was applied with compost fertilizer at the level of (3) $tons.h^{-1}$ increased the content of N significantly over the rest of the treatments (4.970) $mg.N.kg^{-1}$. This was followed by an application of the treatment of (*A. chroococcum* + Compost) compared to the comparison treatment with an average of (4.795) $mg.N.kg^{-1}$. The increase is due to the positive effect of compost and *Azotobacter* on nitrogen fixation and nitrification processes. Bacteria multiply, resulting in increased availability of the nitrogen for plant growth [14].

**Table (2): Effect of bio and organic fertilization on leaf nitrogen content ($mg.N.kg^{-1}$).**

| ***A.chroococcum*** | ***P.putide*** | **Compost fertilizer levels P** | | | | **means** | |
|---|---|---|---|---|---|---|---|
| **A1** | **A2** | P0 | P1 | P2 | P3 | A3 | A1 |
| A0 | A0 | 4.050 | 4.120 | 4.220 | 4.230 | 4.155 | 4.235 |
| | A2 | 4.270 | 4.310 | 4.340 | 4.340 | 4.315 | |
| A1 | A0 | 4.430 | 4.520 | 4.590 | 4.620 | 4.540 | 4.651 |
| | A2 | 4.650 | 4.690 | 4.740 | 4.970 | 4.763 | |
| L.S.D | 0.1618 | | | | | 0.0809 | 0.0572 |
| A1*P | | | | | | | |
| A0 | | 4.160 | 4.215 | 4.280 | 4.285 | L.S.DA1*P=0.1144 | |
| A1 | | 4.540 | 4.605 | 4.665 | 4.795 | | |
| | | | | | | | |
| A2*P | | | | | | A2 Means | |
| A0 | | 4.240 | 4.320 | 4.405 | 4.425 | 4.348 | |
| A2 | | 4.460 | 4.500 | 4.540 | 4.655 | 4.539 | |
| L.S.D A2*P = 0.1144 | | | | | | L.S.D A2=0.0572 | |
| P Means | | 4.350 | 4.410 | 4.473 | 4.540 | L.S.D P = 0.0809 | |

P = Compost, A0= without inculation, A1=*A. chroococcum*, A2= *P. putide* A3=*A. chroococcum*+ *P. putide*

### 2. Effect of the application of bacterial biofertilizer and compost fertilizer on leaf phosphorus content in flowering stage (mg P. kg-1).

Table (3) presents that the application of bacterial biofertilizer *(A. chroococcum, P. putide*) and compost separately, double and triple application interaction resulted in significant differences in the leaf content of phosphorus compared to the comparison treatment. The treatment to which the bio-fertilizer application with compost fertilizer at the level of (3) $tons.h^{-1}$ increase phosphorous content over the rest of the treatments with mean value of (0.5000) $mg.P.kg^{-1}$. This was followed by the treatment to which *P. putide* + *A. chroococcum* applied together compared with the comparison treatment with an average of (0.4900) $mg.P.kg^{-1}$. This is due to the ability of these organisms to produce growth regulators, which increase the size of the root mass and increase its branches, leading to increased absorption of nutrients, including phosphorus [15,16].

**Table (3): Effect of bio and organic fertilization on leaf phosphorus content during the flowering stage (mg.P.kg$^{-1}$)**

| ***A.chroococcum*** **A1** | ***P.putide*** **A2** | **Compost fertilizer levels (P)** | | | | **Means** | |
|---|---|---|---|---|---|---|---|
| | | P0 | P1 | P2 | P3 | A3 | A1 |
| A0 | A0 | 0.3600 | 0.3700 | 0.3800 | 0.3900 | 0.3750 | 0.3950 |
| | A2 | 0.4000 | 0.4100 | 0.4200 | 0.4300 | 0.4150 | |
| A1 | A0 | 0.4400 | 0.4500 | 0.4600 | 0.4700 | 0.4550 | 0.4725 |
| | A2 | 0.4800 | 0.4900 | 0.4900 | 0.5000 | 0.4900 | |
| L.S.D | 0.01349 | | | | | 0.00674 | 0.00477 |
| A1*P | | | | | | | |
| A0 | | 0.3800 | 0.3900 | 0.4000 | 0.4100 | L.S.DA1*P=0.00954 | |
| A1 | | 0.4600 | 0.4700 | 0.4750 | 0.4850 | | |
| | | | | | | | |
| A2*P | | | | | | A2 Mean | |
| A0 | | 0.4000 | 0.4100 | 0.4200 | 0.4300 | 0.4150 | |
| A2 | | 0.4400 | 0.4500 | 0.4550 | 0.4650 | 0.4525 | |
| L.S.D A2*P = 0.00954 | | | | | | L.S.D A2=0.00477 | |
| P Mean | | 0.4200 | 0.4300 | 0.4375 | 0.4475 | L.S.D P =0.00674 | |

P = Compost, A0= without inculation, A1=*A. chroococcum*, A2= *P. putide* A3=*A. chroococcum*+ *P. putide*

3. **Effect of the application of bacterial biofertilizer and compost fertilizer on leaf content of potassium during flowering stage (mg K.kg$^{-1}$).**

The results of Table (4) indicated that the application of bio and organic fertilizers individually or double or triple interference resulted in a significant increase in leaf content of K compared to the comparison treatment. The application of bio-fertilizer mixture with compost fertilizer at the level of (3) tons.h$^{-1}$ significantly increases the content of (K) more than the rest of the treatments with an average of (4.930) mg.k.kg$^{-1}$. This increase was followed by slightly lower increase resulted in the application of (*A. chroococcum* + Compost) with level of (3) tons.h$^{-1}$ compared with the comparison treatment with an average of (4.805) mg.k.kg$^{-1}$. The reason for this increase because of the role of compost in increasing the activity of *Azotobacter* bacteria, which leads to increased secretion of growth regulators and increased absorption of nutrients such as potassium [5].

**Table (4): Effect of bio and organic fertilization on potassium content of leaf during the flowering stage (mg.K.kg$^{-1}$)**

| **A.chroococcum A1** | **P.putide A2** | **Compost fertilizer level (P)** | | | | **Means** | |
|---|---|---|---|---|---|---|---|
| | | P0 | P1 | P2 | P3 | A3 | A1 |
| A0 | A0 | 3.230 | 3.550 | 3.650 | 3.870 | 3.575 | 3.971 |
| | A2 | 3.940 | 4.460 | 4.500 | 4.570 | 4.367 | |
| A1 | A0 | 4.600 | 4.610 | 4.630 | 4.680 | 4.630 | 4.705 |
| | A2 | 4.700 | 4.730 | 4.760 | 4.930 | 4.780 | |
| L.S.D | 0.4204 | | | | | 0.2102 | 0.1486 |
| A1*P | | | | | | | |
| A0 | | 3.585 | 4.005 | 4.075 | 4.220 | L.S.DA1*P=0.2973 | |
| A1 | | 4.650 | 4.670 | 4.695 | 4.805 | | |
| | | | | | | | |
| A2*P | | | | | | A2 Mean | |
| A0 | | 3.915 | 4.080 | 4.140 | 4.275 | 4.103 | |
| A2 | | 4.320 | 4.595 | 4.630 | 4.750 | 4.574 | |
| L.S.D A2*P = 0.2973 | | | | | | L.S.D A2=0.1486 | |
| P Mean | | 4.117 | 4.338 | 4.385 | 4.513 | L.S.D P =0.2102 | |

P = Compost, A0= without inculation, A1=*A. chroococcum*, A2= *P. putide* A3=*A. chroococcum*+ *P. putide*

The application of (*A. chroococcum* + *P. putide*) together with the compost achieved the highest values content leave contend of N, P, K elements compared to the rest of the experimental treatments and this is an economic benefit provided by this application.

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