Effect of phosphate rock and kinetin and its interactions in the growth of basil plant *Ocimum Basilicum*

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Abstract

An plastic pots experiment was conducted, in (the Botanical Garden of Biology Department in the Faculty of Education Ibn Al-Haytham- University of Baghdad), for a growing season (2019-2020), in order to study the effect of phosphate rocks, the level of addition and non-addition, the last is the control treatment, and spraying with kinetin, In three concentrations (25, 50, 100) mg L⁻¹ as well as control treatment it's do not spray, and the their interactions on the content of: nitrogen, phosphorus, potassium, chlorophyll and concentration: protein and carbohydrates in the shoot of basil. The results confirmed that the addition of phosphate rock and sprinkling of kinetin and its interference have a significant effect on the studied traits of basil. The treatment of adding the phosphorous rock and the concentration 100 mg. L⁻¹ gave in the highest values for the above mentioned characteristics.

Keywords: pollutants; kinetin; plant growth

1. Introduction

Providing mineral nutrients is a major factor in plant growth, and phosphorous is one of the main components in building energy complexes and the vital construction of nucleic acids and cell membranes and has an important role in regulating the number of enzymes [1] Being a great nutrient for plant growth and development, phosphorus limits crop production, as a result of the increase in the human population in the world, international progress in human civilization, and the ease of use and treatment of medicinal plants and the speed of treatment and cure with them because they contain active substances that affect physiologically and biologically and the side effects of chemical drugs have increased the [2] basil is a medicinal plant from the Lamiaceae family [3] the global resources of phosphate rocks are inexpensive contains 11-11% [3] Iraq ranks second in the world of its possession of more than (10) billion tons, or (9%) of the world phosphate reserves. And phosphate rocks in the Akashat area have a high phosphate content, as the concentration of phosphate oxide P2O in it reaches 30% [4] Cytokinins is a plant hormone, consisting of adenine derivatives with a side chain linking with the sixth nitrogen atom [5] Cytokinins metabolism is a protein synthesis, contributes to controlling the cell cycle, stimulates chloroplast formation and delays aging of cut leaves due to its ability to accumulate amino acids when exogenously added [6] Cytokinins affects plant growth and development through its effect on cell division, growth and differentiation of vegetative parts of the plant, leaf aging, apical
dominance, the relationship between source and downstream, nutrient absorption and vascularization, gametophyte, embryonic growth, and response to biotic and abiotic factors[7]

This study aimed to show the effect of rock phosphate and kinetin and their interactions on the basil plant.

2. Materials and methods
The experiment was conducted in the Botanical Garden in the Biology Department, College of Education for Pure Sciences - Ibn Al Haytham, university of Baghdad, during the growing season 2019-2020, using plastic containers. I took the soil from the botanical garden. After grinding and smoothing, it was homogenized, and the soil was weighed and packed in pots, with a weight of 5 kg per pot. 5 g of phosphate rock F26 (PO4) Ca10 (12% concentration) was added to the addition treatment. The experience was designed according to design the sectors are completely random (RCBD) as a Factorial Experiment (3 × 4 × 2) two factors included, it is three concentrations of kinetin mg.L-1 (25, 50 and 100) mg.L-1 in addition to the control treatment and the addition of 5 g of phosphate rock F26 (PO4) Ca10 (a concentration of 12%) and no addition, And with three replications, it will be (24) experimental units. Basil seeds were planted on 20/3/2019.

Ten seeds were placed in each pot, it was irrigated with water to reach 50% of the field capacity, and on 7/4/2019 after two weeks from the date of planting, the plants were reduced to 3 plants per pot with all agricultural operations, including removal of jungle and irrigation, according to weight loss. The plants were sprayed with kinetin in the morning according to the previously prepared concentrations and at concentrations of (25, 50 and 100) mg. L⁻¹ Using a hand sprinkler 1 liter capacity, after the fourth leaf stage. On 6/5/2019, The spraying was evenly and until complete wetting, Control are sprayed with distilled water, with the continuation of irrigation with a solution of NaCl concentrations. And on 26/5/2019. Samples were taken from the shoot of the plant after 51 days have passed from the date of planting, Some characteristics of the basil plant have been studied: 1- Total chlorophyll content in plant leaves: 1- Total chlorophyll content was estimated using a spad device by taking an average of four readings of four papers randomly from each treatment. 2- After drying the samples were ground, a known weight was taken from them, and digested according to the method (Agiza et al., 1960). [8] The acid extract of nitrogen samples was estimated according to Chapman and Pratt (1961) [9], Phosphorous according to Matt's method (1970). [10], potassium according to Page et al. (1982) [11].

-4 The percentage of protein in the plant: The percentage of protein in the shoot was estimated according to the method of Vopyan (1984). [12]

\% Protein ratio = 6.25\% nitrogen concentration

The carbohydrates were estimated in the dry leaves according to the method Herbert et al. (1971) [13] using phenol - sulfuric acid The results were analyzed statistically according to (SAS, 2012). [14] Averages were compared using the lowest significant difference at a 0.05 likelihood level.

3. Results and discussion
The results of table (1) confirmed that there was a significant increase in the chlorophyll content with the increase in kinetin concentrations, And when adding phosphate rock, when raising the kinetin concentration from zero to 100 mg. L⁻¹, it led to a significant increase in the average chlorophyll content, with an increase of 43.75%. When adding phosphate rock, it led to a significant increase in the average chlorophyll content, with an increase of 10.97%. The interaction was significant between the study workers, as the concentration exceeded 100 mg. L⁻¹ of kinetin
with the addition of phosphate rock, and it gave the highest value of 2.56 for this characteristic, with an increase of 183.00% compared to the control treatment.

The results of table (2) confirmed that there was a significant increase in the rate of nitrogen concentration by increasing the concentration of kinetin from zero to 100 mg. L⁻¹, and with an increase rate of 105.00%, the nitrogen concentration was significantly increased by the addition of fertilizer, and an increase of 12.93% compared with no addition. As for the overlap between the two treatments it had a significant effect on nitrogen concentration. The concentration gave 100 mg. L⁻¹ of kinetin with the addition of 5 gm of phosphate rock highest value for element concentration it is 1.68.

| Tab [1] Effect of phosphate rock and kinetin and its interactions in chlorophyll content of basil plant |
|---------------------------------------------------------------|
| Rock phosphate (gm) | kinetin concentrations(mg.L⁻¹) | Effect the average rock phosphate |
|---------------------|-------------------------------|---------------------------------|
| 0                   | 0                             | 25                              | 50      | 100      | 38.68 |
| 5                   | 5.25                          | 5.50                            | 5.75    | 5.75     | 42.92 |
| Effect the average kinetin | 3.65                         | 4.25                            | 4.45    | 4.50     |
| LSD (0.05 )        | kinetin = 0.23             | rock phosphate = 0.20           | The interaction = 0.42 |

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| Tab [2] Effect of phosphate rock and kinetin and its interactions in N basil plant |
|---------------------------------------------------------------|
| Rock phosphate (gm) | kinetin concentrations(mg.L⁻¹) | Effect the average rock phosphate |
|---------------------|-------------------------------|---------------------------------|
| 0                   | 0.75                          | 0.90                            | 1.42    | 1.60     | 1.16 |
| 5                   | 0.85                          | 1.10                            | 1.63    | 1.68     | 1.31 |
| Effect the average kinetin | 0.80                         | 1.00                            | 1.52    | 1.64     |
| LSD (0.05 )        | kinetin =0.11                 | rock phosphate =0.07            | The interaction =0.17 |

The results of Table 3 showed that there was a significant increase in the concentration of phosphorous with increasing the concentration of kinetin, when the concentration was raised from zero to 100 mg. L⁻¹, it significantly increased the element concentration rate, with an increase of 66.66%. When adding phosphate rock, the phosphorus concentration increased significantly with an increase of 24.00%. As for the interaction between the two quintin and the phosphate rock, it was significant, and As for the interaction between quinine and phosphate rock, it was significant, and the concentration was given to 100 mg. 1 liter of kinetin with the addition of phosphate rock. The highest value of the element's concentration was 0.80, compared to other concentrations.
The results of Table (4) showed that there was a significant increase in the concentration of potassium when the kinetin concentration was raised from zero to 100 mg, with an increase rate of 61.11%. The results of the table also indicated a significant increase in focus element when adding phosphate fertilizer, with an increase of 14.28% compared to no addition. The effect of the interaction was significant between the study factors in the concentration of potassium, where the concentration gave 100 mg.1 liter of kinetin and the addition of 5 grams of fertilizer, the highest value of the element's concentration, which reached 0.94.

The results of Table (5) also indicated that there was a significant increase in protein concentration. When raising the concentration of kinetin from zero to 100 mg. L-1, the rate of protein percentage increased by an increase of 105.00%, and when the fertilizer level was raised from 0 to 5 grams, the rate of protein percentage increased by an increase of 12.60%, and the interaction had a positive effect in increasing the percentage Protein, the concentration of 100 mg-l-1 with a level of 5 grams of fertilizer gave the highest value of protein content and it was 1.29%.

The results of Table (6) confirmed that there was a significant increase in the percentage of: 

| Tab [3] Effect of phosphate rock and kinetin and its interactions in P basil plant |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Rock phosphate (gm)             | kinetin concentrations(mg.L⁻¹) | Effect the average rock phosphate |
| 0                               | 0.38             | 0.48            | 0.56            | 0.61            | 0.50            |
| 5                               | 0.46             | 0.55            | 0.70            | 0.80            | 0.62            |
| Effect the average kinetin      | 0.42             | 0.51            | 0.63            | 0.70            |
| LSD (0.05)                      | kinetin = 0.05   | rock phosphate =0.02 |
|                                 | The interaction =0.07 |

| Tab [4] Effect of phosphate rock and kinetin and its interactions in K basil plant |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Rock phosphate (gm)             | kinetin concentrations(mg.L⁻¹) | Effect the average rock phosphate |
| 0                               | 0.51             | 0.72            | 0.76            | 0.81            | 0.70            |
| 5                               | 0.58             | 0.80            | 0.88            | 0.94            | 0.80            |
| Effect the average kinetin      | 0.54             | 0.76            | 0.82            | 0.87            |
| LSD (0.05)                      | kinetin =0.04    | rock phosphate =0.02 |
|                                 | The interaction =0.06 |

| Tab [5] Effect of phosphate rock and kinetin and its interactions in broten basil plant |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| Rock phosphate (gm)             | kinetin concentrations(mg.L⁻¹) | Effect the average rock phosphate |
| 0                               | 4.69             | 5.63            | 8.88            | 10.00           | 7.30            |
| 5                               | 5.31             | 6.88            | 10.19           | 10.50           | 8.22            |
| Effect the average kinetin      | 5.00             | 6.25            | 9.53            | 10.25           |
| LSD (0.05)                      | kinetin = 0.12   | rock phosphate =0.09 |
|                                 | The interaction =0.20 |
carbohydrates in the vegetative part of the basil plant, when raising the concentration of kinetin from zero to 100 mg. Liter -1 led to a significant increase in the percentage of carbohydrates with an increase of 13.20%, and at the level of addition Phosphate rock also had a significant increase in this characteristic, and the average of this characteristic was 0.59 when adding fertilizer, compared with 0.55 when not adding, and the interaction between the study workers also had a significant effect, as the concentration exceeded 100 mg. L\(^{-1}\) with the level of 5 grams of fertilizer And they gave the highest value of the trait, which was 0.65.

From the results obtained from the results of the previous tables, we conclude the importance of the role that kinetin plays, as there was an increase in the studied traits as a result of the role of kinetin in stimulating the increase in cell length and increase in width (Al-Raoie, 2010) [15]. As kinetin stimulates cell division by activating the processes of absorption and transfer of materials manufactured in papers and increases the production of nucleic acids and the formation of proteins, thus providing the raw materials that the cell needs for division and increasing its expansion (El-Baz et al., 2008) [16]. Or, it may be due to the role it plays in increasing the efficiency of photosynthesis by increasing the chlorophyll content, delaying its destruction and delaying leaf ageing (Kieber and Schaller, 2014) [7]. The reason for the increase in the above characteristics is also due to the role of phosphate rock fertilizer in increasing the readiness of phosphorous in the growth medium and increasing its absorption and then increasing its content in the plant. Plant and the positive effect of phosphorus in most vital processes, as it helps in the formation and division of cells and its participation in the formation of energy-rich compounds, and in the formation of the enzymatic accompaniments that accompany the representation of carbohydrates, leading to the power of vegetative growth of the plant (Al-Naimi, 1999) [17]. And phosphorous comes second after nitrogen in terms of importance for its participation in several functions within the plant, it is included in the composition of phospholipids (Havlin et al. 1999) [18]. It participates with nitrogen in building cell membranes and in the synthesis of energy compounds such as ATP and enzymatic conjugates such as NADH2 and NADPH2 and enters into forming esters with hydroxyl groups of sugars and alcohols (Taiz and Zeiger, 2002) [19]. Which affected the improvement of the nutritional status of the plants, which was positively reflected in its growth and an increase in the values and rates of the studied traits.

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