Effect of Foliar Application For Proline, Zinc Sulphate on Growth and Yield of Okra Plant (Abelmoschus Esculentus L.)

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Abstract

The field experiment was carried out at the Researches Station and Agricultural Experiments / College of Agriculture /Al-Muthanna University during the summer agricultural season 2020 on Okra plant. To study foliar spraying application of Proline from three levels (0, 40 and 80) mg.L⁻¹ and gave P₀, P₁ and P₂ respectively. Zinc sulphate (0, 20 and 40) mg.L⁻¹ and given these Zn₀, Zn₁ and Zn₂. Using the randomized complete block design (R.C.B.D.) and each treatment was treated in three replicates. Means were compared using L.S.D at 0.05 level of significance. The results of the experiment showed The treatment of P₂ spraying with proline concentration (80 mg.L⁻¹) was superior in the percentage of Nitrogen, phosphorus and potassium in leaves, Number of branches, Leaves area and Plant yield (g) (3.09%, 0.44%, and 2.88%, 9.04 branch plant⁻¹, 0.723m², 303.39 g plant⁻¹) respectively. The results also showed that Zn₁ treatment was elevated (40 mg.L⁻¹) on all measured indicators (3.29%, 0.37%, 2.83%, 8.76 branch plant⁻¹, 0.763 m², 334.35 g plant⁻¹). The outperformed was in the significant effect of interaction treatment proline and zinc sulphate P₂Zn₁ on all measured indicators.

Keywords: Proline, Zinc sulphate, Nutrients feeding, Okra

1. Introduction

Okra (Abelmoschus esculentus L.) from the summer vegetable crops and belongs to family Malvaceae. Their original country Africa, Ethiopia, Eritrea, Egypt and Sudan. Cultivated in the regions tropical and similar to- tropical [1]. Its nutritional importance comes from containing carbohydrates, proteins, fats, some minerals and vitamins such as Thiamin, Riboflavin and Niacin [2, 3]. Effect of high pH soil, calcareous soil, summer season dry and climate hot in Iraq to lose a lot of in the nutrients elements. Therefore can be the plant nutrition improvement from during technique use sprayed manures foliar which crossing from the cellular membranes, such as: Proline which contributory in pollination tube growth and period of time lower of fertilization which contributive in improvement of fruits setting and increase of crop [4]. Zinc is one of the elements necessary in activating many from enzymes, also zinc is due to the element importance in tryptophan amino acid formation the basic source of indole acetic acid which activity of the plant cells divisions and elongation, its necessary in pollen production and the production of secondary meristem cells necessary to increase the cells thickens [5]. Zinc deficiency effect on bioprocessing such as: carbohydrates production,proteins, auxins and fruit setting [6]. The objective of this study to explain the effect of proline and the zinc on growth and yield of okra plant.

2. Materials and Methods

Was conducted The field experiment during the summer agricultural season 2020 at the Researches Station and Agricultural Experiments / College of Agriculture /Al-Muthanna University. Was carried out the factorial experiment laid out in the randomized complete block design (R.C.B.D.) with three replicates. The experiment consisted study two factors and their interaction First Factor: proline spraying (0, 40 and 80) mg.L⁻¹ gave P₀, P₁ and P₂ respectively. 2nd factor: Zinc sulphate (0, 20 and 40) mg.L⁻¹ and given these Zn₀, Zn₁ and Zn₂. Okra seeds were planted on 17/3/2020 with 4 seeds per hole, then diluted to one plant. The distance was 30 cm between plants. All service operations of the crop were conducted. Proline spraying process was carried out two time during the growth season twenty five days after planting and repeated the process after flowering 5% from plants the experiment unit. Zinc sulphate spraying after two weeks from complete proline spraying, study some adjectives such as: the Percentage of nitrogen, phosphorus and potassium in leaves, number of branches, leaves area and the single plant yield.
3. Results

3.1. Percentage of nitrogen in leaves

Results in the Table (1) shows P2 treatment significantly superiority was registered highest Percentage of nitrogen compared with remain treatments such as P1 and P4 (3.09%, 2.94% and 2.01%) respectively. Belongs to spraying of proline which it nitrogen source and the proteins genesis that perform to increase the nitrogen in plant leaves with concentration increase of proline in the spraying solution. The results were compatible with [7]. And superiorities ditto Zn1 treatment incorporeal in Percentage of nitrogen in leaves and gave out highest ratio reached 3.29% which have not a significant difference from Zn1 treatment but both the superiorities treatments incorporeal from compare treatment Zn0 which registered lowest ratio reached 1.70%. The Zinc necessary in interactions regulating of many enzymes such as: Carbonic anhydrase and Proteinase whose contributive in metabolism and transport of carbohydrate and proteins. These result is agreed with [8]. Interaction of P1Zn1 was significantly differed and superiorities in Percentage of nitrogen in leaves (3.85%).

Table 1. Effect of foliar application with Proline, Zinc sulphate and their interaction on Nitrogen percentage in Okra leaves.

| Proline | Levels of Zinc sulphate | Rat of Proline |
|---------|-------------------------|----------------|
|         | Zn0   | Zn1   | Zn2   |             |
| P0      | 1.15  | 2.62  | 2.28  | 2.01        |
| P1      | 1.86  | 3.11  | 3.85  | 2.94        |
| P2      | 2.09  | 3.43  | 3.74  | 3.09        |
| Rat of Zinc sulphate | 1.70  | 3.05  | 3.29  |             |

L.S.D0.05 P= 0.276 Zn= 0.276 PZn= 0.479

3.2. Percentage of phosphorus in leaves

Perform concentration increase of proline to positive increase in Percentage of phosphorus in leaves table (2) where gave P2 treatment highest Percentage of phosphorus reached 0.44%. Cause belongs to role of proline on promoted mineral elements absorption from soil such as phosphorus, [9]. concentration increase register truffle of the Zinc sprayed in Zn1 treatment Percentage highest of phosphorus in Okra plant leaves reached 0.37% which have not a significant difference from Zn2 treatment but both the superiorities treatments incorporeal from compare treatment Zn0 which registered lowest ratio reached 0.30%. Zinc is necessary for root cell membrane protection, and its function, it is helped on transport of P from roots to leaves, [10]. gave interaction between proline and Zinc sulphate in P2Zn1 treatment highest Percentage of phosphorus reached 0.49%.

Table 2. Effect of foliar application with Proline, Zinc sulphate and their interaction on Phosphorus percentage in Okra leaves.

| Proline | Levels of Zinc sulphate | Rat of Proline |
|---------|-------------------------|----------------|
|         | Zn0   | Zn1   | Zn2   |             |
| P0      | 0.20  | 0.28  | 0.29  | 0.26        |
| P1      | 0.32  | 0.34  | 0.38  | 0.35        |
| P2      | 0.39  | 0.49  | 0.45  | 0.44        |
| Rat of Zinc sulphate | 0.30  | 0.37  | 0.37  |             |

L.S.D0.05 P= 0.022 Zn= 0.022 PZn= 0.038

3.3. Percentage of Potassium in leaves

The results showed in the table (3) occurred an incorporeal increase in Potassium ratio increased with concentration of proline in the spraying solution where gave value upper P2 treatment cussedness (2.88%), which have not a significant difference from P1 treatment (2.82%). While both the superiorities treatments incorporeal from compare treatment P0 which registered lowest ratio reached (2.07%). This belongs to the proline spraying which perform to concentration increasing of nitrogen in the leaves, table (1) whose role promote on absorption of potassium. Spraying Zinc had significant effect in that adjective, bereaved gave Zn1 treatment Percentage highest of potassium was 2.83%, which have not a significant difference from Zn0 treatment. While both superiorities treatments on compared treatment which gave (2.35%). These result is agreed with [11]. While not there a significant effect from interaction between proline and the Zinc in Percentage of the potassium in leaves.
3.4. Number of branches per plant

From the table (4) register the highest concentration of the proline P2 increase significantly in number of branches where gave 9.04 branch per plant compare with P1 and P0 treatment (7.34 and 4.62 branch per plant) respectively. Might belongs these increasing to proline spraying which perform to increase elements concentrations N,P,K in leaves, tables (1),(2) and (3) the necessary in metabolic processes and bettering growth adjectives such as: number of branches add- on the amino acid contributing in ethicizing of the proteins and enzymes and munitioning of the energy which is performing to activity of the growth vegetative [12], and from the very table there are increase in number of branches with increase of Zinc sulphate concentration in the spraying solution, where register Zn2 treatment number biggest from branches reached 8.76 branch per plant. Spraying of Zinc sulphate performed important role in activity increase of photosynthesis process from during genesis of the chlorophyll, adding into genesis of the amino acid (tryptophan) the bio initiator that ethicizing IAA auxin the necessary in cell dichotomy and elongating and activity of many enzymes such as: dehydrogenase, Proteinase, Isomerases, Peptidase and Phosphohyrolase [13, 14]. The necessary in bettering of the plant growth epithets These result is agreed with [15]. While not there a significant effect from interaction between proline and the Zinc in number of branches.

Table 4. Effect of foliar application with Proline, Zinc sulphate and their interaction on number of branches per plant.

| Proline | Levels of Zinc sulphate | Rat of Proline |
|---------|-------------------------|---------------|
|         | Zn0 | Zn1 | Zn2 |               |
| P0      | 2.74 | 4.37 | 6.74 | 4.62          |
| P1      | 5.10 | 7.30 | 9.63 | 7.34          |
| P2      | 7.79 | 9.42 | 9.92 | 9.04          |
| Rat of Zinc sulphate | 5.21 | 7.03 | 8.76 |               |
| L.S.D 0.05 | P= 0.837 | Zn= 0.837 | PZn= N.S |     |

3.5. Leaves area (m²)

Perform concentration increase of proline into increase incorporeal in Leaves area epithet, where register P2 treatment biggest Leaves area reached 0.723 m², which did not differ significantly from P1 treatment, while both his the treatments superiorities on compared treatment P0 which gave leaves area smaller 0.441 m². Might belongs that to proline which contributive in preserver on osmotic potential to cell, which promoting water absorption from the amid growth, preserver on cells distension pressure and increase of his volume, adding into leaves content increase from nitrogen, table (1), the necessary in physiological and metabolic processes such as: the photosynthesis. And increasing of phosphorus, table (2), and its active role in cells dichotomy processes and nuclear acids genesis RNA, DNA. Ditto the potassium, table (3) which contributive in translocating of carbohydrate the plant interiority and this helped in increasing the leaves area, adding into the amino acid performing to increase period and number of the cellular divisions and its elongations. Perform spraying plants with Zinc sulphate to significant increase in the leaves area, where registered Zn2 treatment 0.763 m². may be reason this increase belongs to Zinc which perform to tryptophan genesis, the bio- initiator that ethicizing plant hormone IAA which affect in cells dichotomy process and this helped in increasing the leaves area [16]. And gave interaction between proline and Zinc sulphate biggest of leaves area cussedness P2Zn2 treatment reached 0.925 m².

Table 5. Effect of foliar application with Proline, Zinc sulphate and their interaction on leaves area (m²).

| Proline | Levels of Zinc sulphate | Rat of Proline |
|---------|-------------------------|---------------|
|         | Zn0 | Zn1 | Zn2 |               |
| P0      | 0.376 | 0.398 | 0.549 | 0.441          |
| P1      | 0.510 | 0.806 | 0.815 | 0.710          |
| P2      | 0.533 | 0.711 | 0.925 | 0.723          |
| Rat of Zinc sulphate | 0.473 | 0.638 | 0.763 |               |
| L.S.D 0.05 | P= 0.059 | Zn= 0.059 | PZn= 0.102 |     |
3.6. Plant yield (g)

Showed the results in table (6), increase incorporeal in single Plant yield with concentration increase of the proline in the spraying solution where gave P3 treatment higher plant yield reached to 303.39 g, with comparing the P0 treatment (non-sprayed) whom gave lower plant yield reached 181.92 g. Vestige truffle of spraying Zinc sulphate on plant yield increase where gave Zn2 treatment value biggest came to 334.35 g with compare Zn0 treatment which registered low of plant yield reached to 172.49 g. Probably treatments to role of the proline and Zinc sulphate in enhancing plant capable of the getting the mineral elements such as: nitrogen, table (1) phosphorus, table (2) and potassium, table (3) which needed the plant in photosynthesis efficiency increase and carbohydrate production, addition to positive role of the Zinc in pollen activity increase and efficiency of fertilization and pollination processes this perform to increase plant yield. These result is agreed with [17].

Table 6. Effect of foliar application with Proline, Zinc sulphate and their interaction on plant yield (g).

| Proline | Levels of Zinc sulphate | Rat of Proline |
|---------|-------------------------|----------------|
| P0      | 143.00                  | 265.67         | 181.92         |
| P1      | 162.36                  | 355.63         | 272.68         |
| P2      | 212.13                  | 381.74         | 303.39         |
| Rat of Zinc sulphate | 172.49                  | 251.14         | 334.35         |
| L.S.D 0.05 | P= 24.965               | Zn= 24.965     | PZn= 43.241    |

Conclusion

The results of the search indicate the possibility of using spraying proline concentration (80 mg.L-1) plus the concentration Zinc sulphate (40 mg.L-1) where gave the results beneficial in increasing attributes the vegetative growth and yield of okra plant.

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