Response of Celery to addition of nitrogen and spray with salicylic acid in the leaves content of nutrients

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Abstract

To study the response of the celery plant to nitrogen fertilization and spray with salicylic acid in the leaves content of nutrients, the research was conducted in one of the fields of the Department of Horticulture and Gardening Engineering / College of Agriculture / University of Baghdad within the 2019-2018 season. The research was carried out as a global experiment and with the design of complete randomized sectors (RCBD) and with three replicates, the first factor included the addition of nitrogen with three levels and its symbol (N) (N1 control) , (N2) g / m² 18 ) , (N3) 37 g / m² and the second factor spraying acid salicylic is denoted by (S) , (S1 control  ) , (S2 25 mg / L ) , (S3 50 mg / L ) , (S4) 75 mg / L ) and the interference between them. The results showed that the treatment of interference between nitrogen fertilizer and spray with salicylic acid (N3S4) in The percentage of N, P and K elements in the leaves was 1.80, 0.0080 and 2.91%, and the element Mg , Fe and Ca were 4376.3, 3111,and 6669 mg.kg⁻¹ dry matter, respectively

Keywords: celery, nitrogen , salicylic acid

1. Introduction

Celery is the second most important crops of the Umbelliferae family tent after the islands and its native origin is Europe, Asia and Africa. Its wild plants spread in an area extending from Sweden in the north to Ethiopia, Egypt, Saudi Arabia and Algeria in the south. It is also the most important green vegetable in many countries of the world (Europe, America, India, China, Japan). It is cultivated for multiple purposes (leaves, petioles, and enlarged roots), and celery leaves are medium-rich in nutrient content. As the dry matter ranges from 14-11%, its composition includes about 4% carbohydrates, 3% protein materials, and about 2% fiber, in addition to vitamins such as vitamin C, carts, B1, B2, B5, B6 and folic acid as its leaves contain a good amount Among the mineral salts, especially potassium, phosphorus, calcium, sodium, magnesium and iron [1] [and [2] and [3].

Nitrogen is the most important nutrient added to a plant. The more quantity a plant can absorb, the greater the yield. However, the large amount of nitrogen is not the important thing, but the important thing is how to supply the plant with this amount and how it absorbs it at the appropriate time. Moreover, most soils need nitrogenous compounds. For easy loss during washing, such as nitrates, or for converting some of its compounds into nitrogen gas, nitrogenous and organic fertilizers are also factors that influence vegetative and fruity growth [4].

Salicylic acid is one of the widely used phenolic compounds in plant species, and it is considered one of the plant hormones and has physiological effects on the growth and flowering of plants and the absorption of ions. And salinity [5] and [6]. Therefore, many researchers tended to use it by spraying or in addition to soil to improve plant growth and increase its resistance to inappropriate growth conditions, and due to the lack of previous studies under local conditions, this experiment was conducted, which aims to know the effect of celery fertilization by nitrogenous and salicylic acid spray on the content of celery leaves of nutrients.
2. Materials and methods

The research was conducted in the fields of the Department of Horticulture and Gardening Engineering / Al-Jadriyah Complex / University of Baghdad / for the autumn season 2018-2019 to study the effect of spraying concentrations of nitrogen (urea 46%) and salicylic acid on the content of celery leaves of nutrients. The seeds were planted during the month of September - October with the area of the plate (1 * 1) on the lines inside the plate and the distance between one line and another 20 cm. The experiment was designed according to the design of the complete randomized sectors (RCBD). The experiment included (12) treatments distributed in three randomized forms [7] and [8]. And spraying was done after the plant reached a height of 10-5 cm), and two factors were used in the experiment:

1- Add nitrogen in three levels and symbolize (N) (N1) control, (N2) g / m₂ 18, (N3) 37 g / m₂.

2- Spray salicylic acid, symbolized by (S), (S1 control), (S2 25 mg / L⁻¹), (S3 50 mg / L⁻¹, S4 75 mg / L⁻¹) and the interference between them.

The studied
Determination of N, P, K, Mg, Fe and Ca nutrients in the leaves).

3. Results and Discussion

3.1. The percentage of nitrogen in the leaves.

The results of Table 1. indicate a significant effect on increasing the percentage of nitrogen in the treatment of nitrogen addition (N3) as it recorded 1.52% compared to the measurement treatment that recorded the rate of 1.09 %, as well as the treatment of spray with salicylic acid (S4) which recorded the highest percentage of 1.50% It surpassed the measurement transaction, which scored 1.18 %. As for the interference treatment ((N3S4), it affected significantly by giving the highest percentage of nitrogen that reached 1.80 % in comparison with the measurement treatment that gave the lowest percentage of 0.86 %.

| N x S | N1  | S1  | S2  | S3  | S4  | N  |
|-------|-----|-----|-----|-----|-----|----|
|       |     |     |     |     |     |    |
| N1    | 0.86| 1.06| 1.18| 1.28| 1.09|    |
| N2    | 1.36| 1.43| 1.48| 1.44| 1.43|    |
| N3    | 1.33| 1.40| 1.53| 1.80| 1.52|    |
| L.S.D | 0.042|    |     |     |     |    |
| L.S.D | 0.024|    |     |     |     |    |

3.2. The percentage of phosphorus in the leaves.

The results of Table 2. showed that there were significant differences for the treatment of nitrogen addition in the percentage of phosphorus at treatment (N3) was 0.0017 % compared to the measurement treatment that recorded the rate of 0.0042 %, as well as the treatment of spray with salicylic acid (S4) which recorded the highest percentage of 0.150% It surpassed the measurement transaction, which scored 0.18 %. As for the interference treatment ((N3S4), it affected significantly by giving the highest percentage of nitrogen that reached 1.80 % in comparison with the measurement treatment that gave the lowest percentage of 0.023 %.

| N x S | S1  | S2  | S3  | S4  | N  |
|-------|-----|-----|-----|-----|----|
|       |     |     |     |     |    |
| N1    | 0.0023| 0.0030| 0.0043| 0.0070| 0.0042|
| N2    | 0.0080| 0.0060| 0.0070| 0.0060| 0.0067|
| N3    | 0.0070| 0.0077| 0.0060| 0.0080| 0.0071|
| L.S.D | 0.0015| 0.00055| 0.0057| 0.0070| 0.00075|
| L.S.D | 0.00057| 0.00087|     |     |    |

3.3 The percentage of potassium in the leaves.

The results in Table 3. indicate the effect of nitrogen addition on the percentage of potassium, as treatment (N3) was significantly superior to 2.66% over comparison treatment, which recorded the lowest percentage of 1.71%, as well as superior treatment of spray with salicylic acid (S4) significantly. 2.63% compared to the measurement treatment recorded 1.48%. As for the interference between the factors, the table showed that the N3S4 treatment gave the highest percentage of potassium at 2.91% compared to the measurement treatment that recorded the lowest percentage of 1.05%.
Table 3. Response of celery to nitrogen fertilization and spray with salicylic acid in the percentage of potassium in the leaves.

| N x S | S1  | S2  | S3  | S4  | N   |
|-------|-----|-----|-----|-----|-----|
| N1    | 1.05| 1.59| 1.77| 2.42| 1.71|
| N2    | 1.09| 1.89| 2.10| 2.55| 1.91|
| N3    | 2.31| 2.63| 2.80| 2.91| 2.66|
| L.S.D | 1.48| 2.04| 2.22| 2.63| 0.098|

3.4. Magnesium element (mg. kg\(^{-1}\) dry matter)

It is clear from Table 4. that there was a significant difference in the treatment of nitrogen addition in the leaf content of magnesium when treatment (N3) where the leaf content of magnesium was recorded at 2751.3 mg. Kg\(^{-1}\) is a dry substance compared to the treatment treatment that contains the leaf content of magnesium reached 1057.9 mg. kg\(^{-1}\) dry matter, as well as the treatment of spraying with salicylic acid (S4) was significantly superior to 2261.3 mg.kg\(^{-1}\) dry substance on the treatment treatment that reached 1006.3 mg. Kg\(^{-1}\). It gave a moral superiority of 4376.3 mg. kg\(^{-1}\) dry substance over the measurement treatment that recorded 760.5 mg. kg\(^{-1}\) dry matter.

Table 4. Response of celery to nitrogen fertilization and spray with salicylic acid in the leaf content of magnesium (mg. kg\(^{-1}\) dry matter).

| N x S | S1  | S2  | S3  | S4  | N   |
|-------|-----|-----|-----|-----|-----|
| N1    | 760.5| 1048.1| 1281.1| 1241.7| 1057.9|
| N2    | 1102.7| 1125.4| 1237.2| 1165.9| 1157.8|
| N3    | 1155.8| 2185.0| 3289.6| 4376.3| 2751.3|
| L.S.D | 1006.3| 1452.9| 1903.6| 2261.3| 25.91|
| L.S.D | 29.92|     |     |     |     |

3.5. Iron element (mg. kg\(^{-1}\) dry matter)

Table 5. indicates a significant increase in the treatment of nitrogen addition in the leaf content of iron element when treatment (N3) that recorded a concentration of 2548 mg. kg\(^{-1}\) dry substance compared to the measurement treatment that recorded the leaf content amounting to 1444 mg. kg\(^{-1}\) dry substance, as well as treatment Spraying with salicylic acid (S4) differed significantly by giving it a concentration of 2348 mg. kg\(^{-1}\) dry substance compared to the measurement treatment that recorded mg. kg\(^{-1}\) dry substance. As for the interaction treatment between urea addition and salicylic acid (N3S4), the highest iron level was recorded at 3111 mg. kg\(^{-1}\) dry matter compared to the measurement treatment recorded the lowest rate of 987 mg. kg\(^{-1}\) dry substance.

Table 5. Response of celery to Nitrogen Fertilization and Spray with Salicylic Acid in Leaves of Iron (mg. kg\(^{-1}\) dry matter).

| N xS | S1  | S2  | S3  | S4  | N   |
|------|-----|-----|-----|-----|-----|
| N1   | 987 | 1011| 1289| 2490| 1444|
| N2   | 1294| 1411| 1145| 1444| 1323|
| N3   | 1122| 3212| 2843| 3111| 2548|
| L.S.D| 1134| 1878| 1011| 2348| 250.4|
| L.S.D| 289.1|    |    |    |     |

3.6. Calcium element (mg. kg\(^{-1}\) dry matter)

Table 6. shows the presence of significant differences in the nitrogen addition factors in the foliar content of calcium, where treatment (N3) gave the leaf content amounting to 5304 mg. kg\(^{-1}\) dry substance while the measurement treatment recorded the leaf content was 3615 mg. kg\(^{-1}\) dry matter, as well as treatment Spraying with salicylic acid (S4) differed significantly in the leaf content of calcium, as it recorded 5612 mg. kg\(^{-1}\) dry substance. The measurement treatment recorded the lowest leaf content of 3739 mg. kg\(^{-1}\) dry substance. As for the interaction between the factors, the treatment (N3S4) was significantly affected by giving it the highest calcium level of 6609 mg. kg\(^{-1}\) dry substance, while the measurement treatment recorded the lowest rate of 2292 mg. kg\(^{-1}\) dry substance.
Table 6. Response of celery to nitrogen fertilization and spray with salicylic acid in the leaves content of calcium (mg. kg-1 dry matter).

| NxS   | S1   | S2   | S3   | S4   | N   |
|-------|------|------|------|------|-----|
| N1    | 2292 | 3336 | 3814 | 5018 | 3615|
| N2    | 5034 | 4398 | 4525 | 5148 | 4776|
| N3    | 3891 | 5087 | 5566 | 6669 | 5304|
| L.S.D  | 0.05 |      | 876.3 |     | 438.1|
|       | 3793 | 4274 | 4635 | 5612 |     |
| L.S.D  | 0.05 |      |      |     | 505.9|

The increase in the level of added nitrogen fertilizer caused an increase in the leaf content of nitrogen (Table No. 1), as the leaf content of nitrogen increases with the increase of its added level, which explains the role of the nitrogen component in increasing the efficiency of photosynthesis as a result of improving the characteristics of vegetative growth, which enhances the processes of building bases Nitrogenous, amino acids, some vitamins, and some other organic compounds that nitrogen enters in their composition leading to increased nitrogen absorption and accumulation in the plant. Nitrogen also contributed to increasing the activity of all vital activities of the plant, which in turn helped speed my work. The construction of phospholipids, nucleic acids, energy-rich compounds and enzymatic accompaniments, which led to an increase in the leaf content of phosphorus (Table 2) in addition to the role of large phosphorus in building the important part of cytochrome in the process of breathing and active absorption of nutrients [1], that the addition of nitrogen contributed to the role High regulatory for potassium in preserving the water balance and soluble movement and its catalytic role for enzymes accompanying the representation of carbohydrates and in increasing the activity of different biological processes which contributed to increasing the plant's need for potassium (Table 3), which led to an increase in potassium concentration in Papers [10]. Also, nitrogen affects the process of building some growth regulators such as auxin and cytokine, which causes increased cell division and an increase in the leafy area and the number of leaves, which causes an increase in photosynthesis and thus an increase in the production of carbohydrates in the leaves [11] as these results agreed with [12] on the celery plant. Likewise, the reason for the increase of urea fertilizer from the ratio of elements (NPK) in the leaves is that the urea fertilizer increased the nitrogen ready for absorption in the soil by the plant and thus an increase in its ratio in the leaves [13]. Also, nitrogen fertilization increases the growth of vegetative and root plants, increasing the absorption of elements from the soil [14]. These results are consistent with the findings of [15] on celery.

As for salicylic acid, it is an important role in plant growth, and it is a plant phenol, and it is today considered a growth regulator and has a role in the defensive mechanics of the plant to resist biological efforts [18]. Through the results obtained, we note that salicylic acid has contributed to improving most of the studied traits significantly. This may be due to the role of salicylic acid in increasing the content of auxins and cytokines [19] or through its role in stimulating the enzymes responsible for photosynthesis and expediting the formation of photosynthetic pigments. (Chlorophyll) [20]. And that helped increase the percentage of chlorophyll and thus increase the accumulation of processed food. Salicylic acid also plays a role in stopping the activity of Acc- Oxidas [21]. It also plays a role in increasing the effectiveness of the peroxidase enzyme [22]. Salicylic acid also has a positive effect in increasing the activity of biological processes and increasing the leaf content of chlorophyll pigments that convert light energy into chemical energy investing in increasing plant activity, as well as salicylic acid has a role in increasing the plant’s protein content, and the results agree with many researchers who indicated that Salicylic acid has promoted growth under salinity use, including dry weight [23] and is consistent with the results [24]. Through tables (1, 2, 3, 4, 5, and 6), which indicates an improvement in the nitrogen level in the presence of salicylic acid, this may be due to the role it plays in improving the ability of the plant to absorb the necessary elements in addition to improving the plant’s ability to withstand the inappropriate conditions, which reflected positively on the improvement The ability of the plant to manufacture food by photosynthesis and increase proteins by creating the appropriate conditions for increasing the genetic expression of DNA, which led to an increase in the synthesized proteins, which in turn caused an increase in the yield and some other growth indicators. This is consistent with [25] where it was found that the external addition of salicylic acid to tomato plants increased the content of chlorophyll and the leaf content and absorption of the necessary elements such as potassium, calcium, etc. and agreed with [26] that the salicylic acid causes an increase in photosynthesis or its role in increasing auxins [27], [28] and [29].

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