Effect of Spraying With Organic Sulfur and Hydrogen Peroxide on The Growth and Yield of Red Local Onions Allium Cepa L.

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Abstract

The study was conducted in the fields of the Department of Horticulture and Landscaping / College of Agriculture / University of Al-Qadisiyah / Al-Nouriah district - for the 2019-2020 agricultural season to study the effect of spraying with organic sulfur and hydrogen peroxide on the growth and yield of onions, Allium cepa L, where the study included two factors: the first factor was spraying organic sulfur at concentration (0, 2, 4 ml L⁻¹) and symbolized S1, S2, S3 and the second factor spraying with hydrogen peroxide at a concentration (0, 2, 4 ml L⁻¹) and symbolized by B1, B2, B3 and the interaction between them. A factorial experiment was conducted according to the randomized complete block design (RCBD) with three replications and the comparison between the treatments was done using the least significant difference test L.S.D at the probability level of 0.05. The results showed that spraying with organic sulfur or spraying with hydrogen peroxide in a single form led to a significant increase in all studied traits, as well as the interaction between the two factors, where the treatment S3B3 recorded the highest significant increase in plant height, leaf length, number of leaves, leaf neck diameter and yield weight per hectare of 82.00 cm plant⁻¹, 63.0 cm, 11.00 leaf Plant⁻¹, 55.67 mm Onion⁻¹, 22.67 mm Onion⁻¹, 4.146 tons. hectare⁻¹, respectively.

Keywords: Organic sulfur, Hydrogen peroxide, Onions.

1. Introduction

Onions (Allium cepa L.) belonging to the family Alliaceae are considered one of the important winter vegetable crops in Iraq due to the increasing demand for it and the market’s absorption of all its quantities supplied throughout the year [1], as well as its good economic return for its producers. Green onions are eaten fresh or used in cooking with many It is a food and has multiple benefits, including improving digestion, expelling intestinal gases, lowering blood sugar, regulating blood pressure, reducing the amount of cholesterol and fats in the blood and regulating the work of the heart. In addition to its nutritional benefit, it contains proteins, fats, carbohydrates and nutrients such as calcium, phosphorous, potassium, vitamin A, B and C [2]. And the reason for the decrease in the quantity of production in Iraq is due to the lack of service for the crop, especially in terms of choosing the variety and fertilizing, so we highlight the importance of choosing the variety and its suitability to the conditions of the region that affect the yield in quantity and quality, in addition to the soils of the central and southern regions of Iraq, which are characterized by their base and high content of lime and clay. Which makes some nutrients unavailable and difficult to be absorbed by the roots of the plant, and then the plant does not get all the needs of these nutrients, which leads to a decrease in plant production and a deterioration in its quality [3].

Onions are considered one of the plants that love sulfur fertilization and need high amounts of sulfur in order to grow well and soundly and to give a good yield, as sulfur enters the formation of many sulfur compounds specific to the smell, flavor and distinctive spicy taste resulting from the volatile sulfur substances in onions [4]. Sulfur is one of the basic elements necessary in plant nutrition, and is included in the composition of some amino acids, as it works to reduce nitrates to amino acids and then to protein in plant tissues. Sulfur is one of the important secondary elements of plants for its important role in photosynthesis (chlorophyll and its interaction With nitrogen) in the plant to represent amino acids such as cysteine and methionine and to determine the amino acids to form protein, which is important for the formation of hormones and vitamins, and increases the plant's resistance to diseases. It helps to form roots and increases the greenness of leaves and flowers and helps in raising productivity and improving the quality and size of fruits [5-7]. [8], they indicated that adding sulfur to onion plants had a significant effect on plant height and number of leaves. Plant⁻¹ compared with no fertilization, and in an
experiment to find out the effect of soil coverage, concentration and number of times of spraying with liquid sulfur Zolfast on the chemical components of onion leaves, bulb weight, total yield and bulb diameter planted in the desert areas of southern Iraq [9]. Sulfur plays a major role in the growth of the onion plant, and the yield is quantitatively and qualitatively [10,11].

As for hydrogen peroxide, which is one of the free radicals and has essential roles in the process of food assimilation of plants, as it participates in a large and diverse group of reactions and sequences of signals necessary for all aspects of root hair growth, lignin, wood differentiation, regulation of the process of opening and closing stomata, metabolic processes, normal plant growth and growth rate [12]. The research aims to study the effect of spraying plants with organic sulfur and hydrogen peroxide, individually or overlapping, on the growth and improvement of the local red onion yield under diameter conditions.

2. Materials and Methods

The experiment was carried out during the 2020 agricultural season in the fields of the Department of Horticulture / College of Agriculture / University of Al-Qadisiyah - Al-Nouriah during the 2020 growing season to know the effect of spraying with organic sulfur and hydrogen peroxide on the growth and yield of onions. 1) S1, S2, S3 and the second factor spraying with hydrogen peroxide at concentrations (0, 2, 4ml.l⁻¹) B1, B2, B3 respectively so that the number of treatments is 9 treatments and each treatment contains (10 plants), and the treatments were sprayed twice the first After planting 45 days and the second spray before flowering, and the experiment was carried out according to a randomized complete block design (RCBD), the readings were taken for measurements of vegetative growth and yield and were analyzed and compared between treatments using the least significant difference test LSD at the probability level of 0.05 on the Genstat program and the following characteristics were measured :

2.1. Measurements of vegetative growth

- plant height (cm)
- leaf length (cm)
- number of leaves (leaf.plant⁻¹)
- Onion diameter (cm)
- Onion neck diameter (mm. bulb⁻¹)

Determination of Chlorophyll Content in Spad Leaves

2.2. The yield

- Total yield (tons.ha⁻¹)

3. Results and Discussion

Table 1 shows that spraying with organic sulfur at a concentration of (4ml.l⁻¹) had a significant effect on plant height, as treatment S3 gave the highest value of 72.44 cm compared to the treatment of measure S1 which recorded 56.78 cm. It is also noted from the results of the table that the moral effect of spraying with hydrogen peroxide, where treatment B3 gave the highest rate of plant height amounted to 73.22 cm. Treatment S3B3 gave the highest rate of plant height of 82.00 cm, compared with the measurement treatment, which recorded the lowest height of one plant, which was 43.00 cm.
Table 1. Effect of spraying with organic sulfur and hydrogen peroxide on plant height (cm).

| Organic sulfur treatments | Hydrogen peroxide treatments | Sulfur rate |
|---------------------------|-----------------------------|-------------|
|                           | B₁  | B₂  | B₃  |     |
| S₁                        | 43.00 | 55.00 | 72.33 | 56.78 |
| S₂                        | 68.67 | 56.00 | 65.33 | 63.33 |
| S₃                        | 65.00 | 70.33 | 82.00 | 72.44 |
| L.S.D (0.05)              | 6.86 |     | 3.93 |     |
| Hydrogen peroxide rate    | 58.89 | 60.44 | 73.22 |     |
| L.S.D (0.05)              | 3.93 |     |     |     |

The results in Table 2 indicate that spraying with organic sulfur had a significant effect on the length of one leaf, as treatment S₃ gave the highest average leaf length of 60.0 cm compared with the treatment of measurement S₁ which recorded the lowest leaf length of 44.4 cm. It is also noted from the results of the table the moral effect of spraying with hydrogen peroxide, where treatment B₃ gave the highest average leaf length of 58.6 cm compared with the measurement treatment (B₁ without spraying) which recorded 50.4 cm. Also, the interaction between spraying with organic sulfur and hydrogen peroxide had a significant effect, as treatment S₃B₃ gave the highest single leaf length of 63.0 cm compared with the measurement treatment which recorded the lowest leaf length of 33.3 cm.

Table 2. Effect of spraying with organic sulfur and hydrogen peroxide on leaf length (cm).

| Organic sulfur treatments | Hydrogen peroxide treatments | Sulfur rate |
|---------------------------|-----------------------------|-------------|
|                           | B₁  | B₂  | B₃  |     |
| S₁                        | 33.3 | 43.7 | 56.3 | 44.4 |
| S₂                        | 55.7 | 55.7 | 56.3 | 55.9 |
| S₃                        | 62.3 | 54.7 | 63.0 | 60.0 |
| L.S.D (0.05)              | 10.64 |     | 6.14 |     |
| Hydrogen peroxide rate    | 50.4 | 51.3 | 58.6 |     |
| L.S.D (0.05)              | 6.14 |     |     |     |

Table 3 shows that the use of organic sulfur differed significantly in the number of leaves per plant, where treatment S₃ gave the highest value of 9.22 leaves.plant⁻¹ compared to treatment S₁ which recorded 6.83 leaves.plant⁻¹. It is noted from the results of the table that there is a significant difference for spraying with peroxide. Hydrogen, where treatment B₃ gave the highest average number of leaves amounted to 8.50 leaves.plant⁻¹ compared with the measurement treatment (B₁ without spraying), which recorded the lowest rate of 6.78 leaves.plant⁻¹, as well as the interaction between the addition of organic sulfur and hydrogen peroxide and there was a significant increase, which gave Treatment S₃B₃ had the highest average number of leaves reached 11.00 leaf.plant⁻¹ compared with the measurement treatment which recorded the lowest value of leaf number was 5.67 leaf.plant⁻¹.

Table 3. Effect of spraying with organic sulfur and hydrogen peroxide on the number of leaves (leaf.plant⁻¹).

| Organic sulfur treatments | Hydrogen peroxide treatments | Sulfur rate |
|---------------------------|-----------------------------|-------------|
|                           | B₁  | B₂  | B₃  |     |
| S₁                        | 5.67 | 7.50 | 7.33 | 6.83 |
| S₂                        | 6.33 | 7.17 | 7.17 | 6.89 |
| S₃                        | 8.33 | 8.33 | 11.00 | 9.22 |
| L.S.D (0.05)              | 0.84 |     | 0.48 |     |
| Hydrogen peroxide rate    | 6.78 | 7.67 | 8.50 |     |
| L.S.D (0.05)              | 0.48 |     |     |     |

The results in Table 4 showed that spraying with organic sulfur had a significant effect on the measurement of bulb diameter, where treatment S₃ gave the highest measurement of 51.67 cm compared with control treatment S₁ which recorded 35.89 cm. The diameter of the bulb amounted to 47.36 cm compared with the control treatment (B₁ without spraying) which recorded 41.22 cm. As for the interaction between spraying organic sulfur and hydrogen peroxide, it had a significant effect, as the treatment S₃B₃ gave the highest mean of measuring the diameter of the bulb reached 55.67 cm compared with the measurement treatment that recorded the lowest measurement The diameter of the onion was 29.67 cm.
Table 4. Effect of spraying with organic sulfur and hydrogen peroxide on the diameter of the bulb (cm).

| Organic sulfur treatments | Hydrogen peroxide treatments                                                                 |
|--------------------------|---------------------------------------------------------------------------------------------|
|                          | Hydrogen peroxide rate                                                                      | Sulfur rate |
|                          | B₁ | B₂ | B₃ |                         |
| S₁                       | 29.67 | 36.00 | 42.00 | 35.89                |
| S₂                       | 46.00 | 43.67 | 45.00 | 44.89                |
| S₃                       | 48.00 | 51.33 | 55.67 | 51.67                |
| L.S.D (0.05)             | 3.50 |       |       | 2.02                |

The results in Table 5 showed that the spraying of organic sulfur differed significantly in the measurement of the diameter of the bulbous neck of one plant, whereby treatment S₃ gave the highest measurement of 20.89 mm compared with the control treatment S₁ which recorded the lowest measurement of 14.22 mm, as it is noted from the results of the table the significant effect of spraying with hydrogen peroxide. Whereas, treatment B₃ gave the highest average diameter of bulb neck diameter of 18.89 mm compared with the control treatment (B₁ without spraying) which recorded 16.44 mm, as well as the interaction between spraying with organic sulfur and hydrogen peroxide had a significant effect, whereby treatment S₃B₃ gave the highest diameter of bulb neck which was 22.67 mm compared with The measurement treatment that recorded the lowest diameter of the onion neck was 10.67 mm.

Table 5. Effect of spraying with organic sulfur and hydrogen peroxide on the diameter of the onion neck (mm).

| Organic sulfur treatments | Hydrogen peroxide treatments                                                                 |
|--------------------------|---------------------------------------------------------------------------------------------|
|                          | Hydrogen peroxide rate                                                                      | Sulfur rate |
|                          | B₁ | B₂ | B₃ |                         |
| S₁                       | 10.67 | 17.00 | 15.00 | 14.22                |
| S₂                       | 18.00 | 18.67 | 19.00 | 18.56                |
| S₃                       | 20.67 | 19.33 | 22.67 | 20.89                |
| L.S.D (0.05)             | 1.53 |       |       | 0.88                |
| hydrogen peroxide rate   | 16.44 | 18.33 | 18.89 |                      |
| L.S.D (0.05)             | 0.88 |       |       |                      |

Table 6 shows that the spraying of organic sulfur increased the rate of chlorophyll content of leaves, where treatment S₃ recorded the highest content of 35.82% compared with the control treatment S₁ which recorded the lowest content of chlorophyll leaves amounted to 29.26%. The results of the table also found a significant increase of spraying with hydrogen peroxide, where Treatment B₃ recorded the highest rate of chlorophyll content amounted to 36.05% compared to treatment (B₁ without spraying) which recorded 28.70%, while the interaction between the addition of organic sulfur and hydrogen peroxide differed significantly as treatment S₃B₃ gave the highest content of chlorophyll amounted to 37.30% compared with the control treatment that The lowest content was recorded at 20.30%.

Table 6. Effect of spraying with organic sulfur and hydrogen peroxide on total chlorophyll (Spad).

| Organic sulfur treatments | Hydrogen peroxide treatments                                                                 |
|--------------------------|---------------------------------------------------------------------------------------------|
|                          | Hydrogen peroxide rate                                                                      | Sulfur rate |
|                          | B₁ | B₂ | B₃ |                         |
| S₁                       | 20.30 | 33.12 | 34.35 | 29.26                |
| S₂                       | 31.12 | 35.53 | 36.50 | 34.38                |
| S₃                       | 34.68 | 35.48 | 37.30 | 35.82                |
| L.S.D (0.05)             | 2.01 |       |       | 1.16                |
| hydrogen peroxide rate   | 28.70 | 71.34 | 36.05 |                      |
| L.S.D (0.05)             | 1.16 |       |       |                      |

It is noted from the results in Table 7 that the addition of organic sulfur had a significant effect on the weight of onions per hectare, where treatment S₃ recorded the highest weight of 3.246 tons. hectares¹ compared with treatment S₁ which recorded the lowest rate of 2.803 tons. hectares¹. A significant difference was also observed when spraying with hydrogen peroxide, where treatment B₃ gave the highest average onion weight per hectare, which amounted to 3.057 tons.ha⁻¹ compared with the control treatment (B₁ without spraying), which recorded 2.334 tons.ha⁻¹, as for the interaction between the addition of organic sulfur and peroxide Hydrogen was significantly affected by giving the S₃B₃ treatment the highest weight of onions per hectare, which amounted to 4.146 tons. hectares¹, compared with the measurement treatment, which recorded the lowest weight per hectare of 1.956 tons. hectares¹.
Table 7. Effect of spraying with organic sulfur and hydrogen peroxide in the total yield (ton.ha⁻¹).

| Organic sulfur treatments | Hydrogen peroxide treatments | sulfur rate |
|--------------------------|-------------------------------|------------|
|                          | B₁                             | B₂         | B₃         |
| S₁                       | 1.956                          | 3.598      | 2.855      | 2.803      |
| S₂                       | 2.190                          | 2.484      | 2.171      | 2.282      |
| S₃                       | 2.855                          | 2.738      | 4.146      | 3.246      |
| L.S.D (0.05)             | 0.653                          | 0.377      |            |
| hydrogen peroxide rate   | 2.334                          | 2.940      | 3.057      |
| L.S.D (0.05)             | 0.377                          |            |            |

4. Discussing the Result

The increase in vegetative growth that occurred as a result of spraying with organic sulfur may be due to the increased absorption by the plant and thus to an increase in its concentration within the tissues of onion plants, which contributed to this increase, as sulfur works to increase cell divisions in the meristematic areas as well as to prolong the lengths of cells, which leads to an increase in Plant height table (1) [13]. And the reason for the increase of chlorophyll in the leaves (table 6) as a result of adding sulfur may be due to the fact that sulfur leads to an increase in the chemical and biological activity of iron, which leads to an increase in the formation and accumulation of chlorophyll and the entry of sulfur as a main component in multiple enzymes as well as amino acids necessary for the formation and construction of chlorophyll in addition to being encouraging to absorb nitrogen, which is an essential component of chlorophyll [14]. It may cause an increase in the rate of photosynthesis, which leads to the accumulation of formed nutrients and thus an increase in the diameter of the bulb and productivity (Table 4, 5 and 7) [15]. It may also be attributed to the role of sulfur in limiting the spread of insects and other pests and their harmful effects [16], as well. The effect of sulfur is attributed to their absorption by the plant and the increase in their concentration inside the onion plants. A balance will occur in the food processing in the tissues of the leaf, which contributes to an increase in vegetative growth [17] and sulfur may work to direct processed foodstuffs towards the area of spraying on the plant (the vegetative total), which may increase From the growth and expansion of cells, the leaf area of the plant increases [18].

Hydrogen peroxide plays a vital role in the plant by sending chemical signals that lead to the plant’s resistance to stress, and it has a major role in sending molecular chemical signals to correct and develop the plant [19,20], thus increasing the studied characteristics of the plant because of its presence as a signal carrier for the processes of Growth and development in plants, such as cell elongation, increased growth and division, and it has a role in growth by stimulating oxidative processes during development processes. It also works on the growth and expansion of roots, and this is reflected in the vegetative growth of the plant [21]. Hence its positive reflection on the total product in Table (7).

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