

## Effect of cultivar and spraying with Moringa leaf extract and aspirin on some flowering and chemical traits of okra (*Abelmoschus esculentus* L)

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### Abstract

A factorial experiment was conducted with a one-time split-plot design to study the effect of two local okra cultivars Khenissiere and Al-Hussainawba and spraying Moringa leaves extract at a concentration of 0, 15 and 30 g. L<sup>-1</sup> and aspirin 0, 75, and 150 mg L<sup>-1</sup> and their interactions on the growth of okra. The results were analyzed using analysis of variance, and the averages were compared according to the Least Significant Differences (L.S.D) test at the probability level of 0.05. The most important results can be summarized as follows: Khenissiere cultivar was significantly excelled in some flowering and chemical indicators, including the number of total flowers (69.85), phosphorus (0.290), potassium (2.054), and protein in leaves (21.91) on the cultivar Al-Hussainawiya. The plants sprayed with Moringa leaf extract at a concentration of 30 g.L<sup>-1</sup> significantly excelled in flowering indicators and some chemical traits, the percentage of sets 71.02 and the number of flowers 68.78 included the percentage of nitrogen 4.078, phosphorus 0.329 , potassium 2.019, and protein in leaves 25.24. The interaction between the two experimental factors had a significant effect on all the traits under study. The plants sprayed with aspirin at a concentration of 150 mg. L<sup>-1</sup> was significantly excelled in flowering indicators and some chemical traits, including the percentage of nodes (74.14). and the number of flowers (75.50), the percentage of nitrogen (3.482), phosphorus (0.297), potassium (1.967), and protein in the leaves (21.76). The interaction between the experimental factors had a significant effect on all the traits under study.

Keywords: - okra - cultivar - moringa leaf extract - aspirin - flowering indicators, chemical indicators

### Introduction

Okra, *Abelmoschus esculentus* L., belongs to the Malvaceae family and is an important summer vegetable crop in the world. Okra production in Iraq in 2019 amounted to 58.42 tons, with a production rate of 5.586 tons. Dunum<sup>-1</sup>, for an area of 16,750 hectares, and it is noted that there is a decrease in the rate of productivity per unit area . It was compared to some countries such as Saudi Arabia, Jordan and Kuwait, where the productivity in each of them reached 14,763, 33,780 and 14,193 tons. ha<sup>-1</sup>, respectively. One of the means that can be used to improve productivity, which is environmentally friendly, is spraying with extracts, including moringa leaf extract, and spraying with aspirin(1) found, during their study about the change in some chemical traits of two okra cultivars(Nirali and Posa Sawni)

grown in the greenhouse, that the cultivar Nirali was significantly excelled on the Posa Sawni cultivar in the concentration of chlorophyll in the leaves. In a study conducted by (2) on two varieties of okra (Kashi Pragati and Kashi Kranti), it was observed that the Kashi Pragati cultivar was significantly excelled on the other cultivar in the amount of total chlorophyll in the leaves. While the other cultivar excelled in the carbohydrate content of the leaves, reaching 6.54%. Also, spraying with Acetylsalicylic acid I led to an increase in chlorophyll and protein in leaves and pods, proline, carbohydrates and sugars in seeds, pod characteristics and pod nodes compared to control. It also led to an increase in cytokinins and gibberellins and a decrease in abscisic acid. (3) found that spraying moringa leaves extract on okra plant at concentrations 30.25.20.15.10.5.0. ml.L<sup>-1</sup> The concentration

of 30 ml of Moringa extract had a significant effect on the number of days of flowering and plant height, and the effect of the extract increased on the plant with increasing concentration.(4) showed that the use of 5 tons.ha<sup>-1</sup> of gliricidia leaves significantly affected the amount of elements in the leaves of the okra plant, as the amount of nitrogen reached 5.61% and phosphorus 0.92% compared to the control 4.09% and 0.4%, respectively.(5) through their study of two okra cultivars, LD 88-1 and Kukurasungi Lucal for two seasons, indicated that the cultivar Kukurasungi Lucal It was significantly excelled on the LD 88-1 cultivar, with a percentage of nodes amounting to 96.80%, and the number of flowers amounting to 29,930 flower. plant<sup>-1</sup>.(6) when spraying pea plants with acetylsalicylic acid at two concentrations of 100 and 200 mg L<sup>-1</sup> after 30 days of cultivation, spraying with a concentration of 200 mg L<sup>-1</sup> gave the highest protein content and reduced the period required for flowering (7) found, in his study on the effect of the cultivar on the growth and yield indicators of the okra plant, the cultivar Musaliya was significantly excelled on the two cultivars Hussainawiya and Khneissari in the concentration of total chlorophyll and the percentage of carbohydrates by giving it the highest rate for both seasons, as it reached (1.84 and 1.53) mg 100g<sup>-1</sup> fresh weight and (13.54 and 10.58)% fresh weight, respectively (8) found that treating the leaves of broad bean

plant at the age of one month with acetylsalicylic acid at concentrations of 100, 250, and 500 mg L<sup>-1</sup>, that each of the two concentrations 250 and 500 mg L<sup>-1</sup> increased weight loss and reduced the amount of pigments, and the concentration of 500 mg L<sup>-1</sup> led to protein damage. While the treatment At a concentration of 100 mg L<sup>-1</sup> had no significant effect on fresh weight and pigments, nor did the two concentrations of 100 and 250 mg L<sup>-1</sup> have a significant effect on protein

1. The role of selecting the appropriate cultivar in okra productivity
2. The response of the okra plant to spraying with Moringa leaf extract and its effect on increasing the yield.
3. Effect of interaction between cultivar and spraying with Moringa leaves extract and its effect on growth and yield.

## MATERIALS AND METHODS

The experiment was conducted during the agricultural season 2021 and 2022 in one of the greenhouses affiliated to the Agricultural Research Station of the College of Agriculture - University of Basra with silty clay soil. Table (1) shows some of its chemical and physical properties that were analyzed in the laboratory of the Soil and Water Department - College of Agriculture - University of Basrah.

**Table 1. Some physical and chemical properties of field soil for the two experimental seasons 2021 and 2022**

| Values | Soil traits   |
|--------|---|
| 4.09   | Electrical conductivity degree (E.C) DS.m <sup>-1</sup> |
| 7.4    | pH  |
| 0.6    | Total nitrogen (mg.kg <sup>-1</sup> )                   |
| 33.55  | available Phosphorus (mg. kg <sup>-1</sup> )            |
| 18.39  | available Potassium (mg. L <sup>-1</sup> )              |

|           |                  |
|-----------|------------------|
| 0.33      | organic matter % |
|           | Soil artifacts % |
| 14.86     | sand             |
| 34.50     | silt             |
| 50.64     | Clay             |
| Silt loam | soil texture     |

The sample was analyzed in the laboratory of the College of Agriculture / Soil Department / Central Laboratory The experiment included the effect of cultivar and spraying with Moringa leaf extract and aspirin on the growth and yield of okra. The treatments were as follows:

1. The cultivar: Seeds of two local okra cultivars were sown, which are Khenissiere and El-Husseiniawiya, which is symbolized by C1 and C1.

2. Spraying with Moringa leaves extract in three concentrations 0 and 15, 30 gm.L<sup>-1</sup>

3. Spraying with aspirin in three concentrations of 0, 75 and 150 mg L<sup>-1</sup>.

The plants were sprayed four times/1/1 2020, the period between one spray and another was two weeks in 14/12021, and the spraying began one month after planting.

**Table 2. Chemical analysis of irrigation water samples for the 2022 growing season**

| 2022             | Units              | Traits                                |
|------------------|--------------------|---------------------------------------|
| <b>Tap water</b> |                    |                                       |
| 1.88             | DS.m <sup>-1</sup> | Electrical conductivity degree (E.C). |
| 7.3              |                    | pH                                    |
| 2.10             |                    | SAR                                   |
| 6.11             | mmol/l             | Ca <sup>++</sup>                      |
| 10.0             |                    | Mg <sup>++</sup>                      |
| 6.38             |                    | Na <sup>+</sup>                       |
| 20.32            |                    | Cl <sup>-</sup>                       |
| 3.2              |                    | SO <sub>4</sub> <sup>- -</sup>        |
| 0.4              |                    | HCO <sub>3</sub> <sup>-</sup>         |

A complete random block design (R.C.B.D.) was used according to the split-plot design, where the cultivars represent the main plots, while spraying with Moringa leaf extract was considered the sub-plot (1).where decomposed organic fertilizer was added at average of 10 tons. Dunum<sup>-1</sup>Then the soil was smoothed and divided into 6 lines, 45 m long, 40 cm wide,

and a distance of 40 cm between one plant and another. Triple superphosphate fertilizer (P<sub>2</sub>O<sub>5</sub> 45%) was added at an average of 35 kg / dunum, and the soil was leveled. furrow was covered with a layer of field soil with a thickness of 10 cm, a layer of decomposed animal manure and a layer of river sand with a thickness of 10 cm. A drip irrigation system

was used to irrigate the plants, and it was connected to a water tank with a capacity of 5000 liters. Cultivation of the plastic house and agricultural service operations The house was watered by the irrigation system two days before planting the seeds to moisten the soil. Then seeds of both cultivars were sown in the experimental units on 1/12 so that 3 seeds were sown for each pot on both sides of the aerator, and alternately they were reduced to one plant after germination. The length of the experimental unit was 4 meters and the number of plants in the experimental unit was 20 plants. The plants were irrigated with irrigation water and according to the treatments, 10 days after germination. All service operations and all treatments were conducted as is the practice in producing and fertilizing this crop, as the neutral compound fertilizer 20-20-20 was added at an average of 100 kg. 1 dunam in two batches, the first when performing the thinning process and the second when flowering, A preventive program was followed to protect the field from insects and diseases during the two seasons of the experiment, as super methrin 25% was sprayed to control aphids. A few drops of Tween 20 at a concentration of 0.1% were added to the solution as a dispersant. Experimental measurements were taken from four plants in each experimental unit at the end of the two growing seasons and included (total number of flowers, nitrogen in leaves, protein in leaves, phosphorus in leaves, potassium in leaves)

### flowering traits of plant

#### total number of flowers

Table 3 indicates the effect of cultivar and spraying with Moringa leaf extract and aspirin and their interactions. It is noted that the Khenissiere cultivar had excelled in the total number of flowers per okra plant, where it gave the highest rate of the total number of flowers for one plant, which amounted to 69.85 flowers .plant<sup>-1</sup>). As for the Husseinawiya cultivar, it gave the number of flowers less, amounting to 65.07 plant flowers. As it gave the highest number of total flowers

for a plant, which amounted to 68.78 plant flowers<sup>-1</sup>, compared with the control treatment that gave the lowest number of flowers for this trait amounted to 66.11 plant flowers<sup>-1</sup>, The data of the same table also showed that spraying with aspirin had a significant effect. The spraying with two concentrations of 75 and 150 mg L<sup>-1</sup> was excelled and gave the highest total number of flowers in one plant, which amounted to (75.50, 66.17) flower .plant<sup>-1</sup>, compared with the lowest number of flowers for the control treatment, which amounted to 56.67 flower .plant<sup>-1</sup>. The bi and triple interaction had a significant effect in this row, as the two-way interaction between Khenissiere cultivar and spraying with the extract was excelled in concentration. 30 gmL<sup>-1</sup> gave the most total number of flowers amounted to 70.89 plant flowers<sup>-1</sup>, while the interaction between the cultivar Husseinawiya and concentration 0 g.L<sup>-1</sup> gave the lowest number of flowers amounted to 64.00 plant flowers<sup>-1</sup>. As for the effect of the interaction between the cultivar and spraying with aspirin, it had a significant effect, as two cultivars, Khenissiere and Husseinawiya, and spraying with aspirin with two concentrations of 75 and 150 mg L<sup>-1</sup> gave the highest number of total flowers, which reached (80.22, 74.22, 68.78, 65.78) flower . plant<sup>-1</sup>, respectively . While the treatment of the Husseinawiya cultivar with a concentration of 0 mg L<sup>-1</sup> gave the lowest number of total flowers for a plant, amounting to 55.22 plant flowers<sup>-1</sup> and the concentration of 150 excelled the concentration of 75, as the table shows that the interaction between spraying with Moringa leaves extract and aspirin was significant ,The plants treated by spraying with the extract at a concentration of 30 gm L<sup>-1</sup> and aspirin at a concentration of 150 mg L<sup>-1</sup> gave the highest number of flowers amounting to 81.33 flowers plant<sup>-1</sup>, while the untreated plants gave the lowest number of flowers in the same trait amounting to 56.67 flowers.plant<sup>-1</sup>. As for the triple interaction, the treatment of the treated cultivar Khenissia with a concentration of 15 gm L<sup>-1</sup> extract and 150 mg L<sup>-1</sup> extract excelled, and it gave the highest number of flowers 81.33 flowers .

plant<sup>-1</sup> Whereas, Hussainawiya and laboratory plants with a concentration of 0 gm L<sup>-1</sup> extract and 0 mg L<sup>-1</sup> aspirin gave the lowest number

of total flowers, reaching 54.00 flowers plant<sup>-1</sup>.

**Table . 3 Effect of cultivar and spraying with Moringa leaf extract and aspirin and their interactions on the total number of flowers**

| cultivar effect average | cultivar + extract | Aspirin mg l -1 |       |       | extract concentration gm l-1 | cultivar           |
|-------------------------|--------------------|-----------------|-------|-------|------------------------------|--------------------|
|                         |                    | 150             | 75    | 0     |                              |                    |
| 65.07                   | 64.00              | 72.67           | 65.33 | 54.00 | 0                            | Al-Hussainawiyah   |
|                         | 64.56              | 73.33           | 65.67 | 54.67 | 15                           |                    |
|                         | 66.67              | 76.67           | 66.33 | 57.00 | 30                           |                    |
| 69.85                   | 68.22              | 78.33           | 67.00 | 59.33 | 0                            | Al-Khenisiriya h   |
|                         | 70.44              | 81.33           | 69.00 | 61.00 | 15                           |                    |
|                         | 70.89              | 81.00           | 70.33 | 61.33 | 30                           |                    |
| 0.55                    | 0.82               | 3.00            |       |       | L.S.D P≤ 0.05                |                    |
| Extract effect average  |                    | 77.22           | 67.28 | 57.89 | average of effect of aspirin |                    |
|                         |                    | 1.46            |       |       | L.S.D P≤ 0.05                |                    |
| 66.11                   |                    | 75.50           | 66.17 | 56.67 | 0                            | Aspirin + extract  |
| 67.50                   |                    | 77.33           | 67.33 | 57.83 | 15                           |                    |
| 68.78                   |                    | 78.83           | 68.33 | 59.17 | 30                           |                    |
| 0.68                    |                    | 2.14            |       |       | L.S.D P≤ 0.05                |                    |
|                         |                    | 74.22           | 65.78 | 55.22 | Al-Hussainawiyah             | cultivar + aspirin |
|                         |                    | 80.22           | 68.78 | 60.56 | Al-Khenisiriya h             |                    |
|                         |                    | 1.71            |       |       | L.S.D P≤ 0.05                |                    |

**set percentage**

Table 4 indicates the effect of cultivar and spraying with Moringa leaf extract and aspirin and their interactions, where it is noted that there is no significant difference between the two cultivars in the characteristic of the percentage of set in the okra plant As for the effect of spraying with Moringa leaf extract, the data of the same table indicate a significant effect on this traits , where it was noted that the concentration of 30 gm L<sup>-1</sup> was significantly excelled.As they gave the highest set percentage for fruits amounted to 71.62%,

compared to the comparison treatment that gave the lowest contract percentage amounted to 65.71%.The data of the same table also showed that spraying with aspirin had a significant effect, where the spraying with two concentrations of 75 and 150 mg L<sup>-1</sup> was excelled and gave the highest percentage of fruit setting amounted to (74.14, 67.42)%, compared with the lowest rate of contraction for the control treatment of 61.01%.The third concentration was excelled to the second concentration, and the bi and triple interaction had a significant effect on this trait, as the bi-interaction between the Khenisire cultivar

and spraying with the extract at a concentration of 30 gm L<sup>-1</sup> was excelled, and gave the highest contract percentage of 72.98%. While the interaction between the cultivar Hussainawiya and the concentration 0 gm L<sup>-1</sup> gave the lowest percentage of contract amounting to 65.47%. As for the effect of the interaction between the cultivar and spraying with aspirin, it had a significant effect. Khenissiere a cultivar sprayed with aspirin at a concentration of 150 mg L<sup>-1</sup> gave the highest percentage of fruit setting, amounting to 77.10%, while the treatment of the Husseinawiya variety with a concentration of 0 mg L<sup>-1</sup> gave the lowest percentage of fruit set, amounting to 60.80%. The table also shows that the interaction between spraying

with Moringa leaves extract and aspirin was significant, where the plants treated by spraying with the extract at a concentration of 15 gm L<sup>-1</sup> and aspirin at a concentration of 150 mg L<sup>-1</sup> gave the highest contracting percentage of 77.30%. While the untreated plants gave the lowest percentage of contraction amounting to 55.70%, as for the triple interaction, the treatment of the treated cultivar Khnesiaria with a concentration of 30 gm L<sup>-1</sup> extract and 150 mg L<sup>-1</sup> extract and gave the highest percentage of set reached 79.90%. Whereas, Al-Hussainawiya and laboratory plants with a concentration of 15 gm L<sup>-1</sup> extract and 0 mg L<sup>-1</sup> aspirin gave the lowest rate of fruit set, okra plant, amounting to 53.03%.

**Table 4 Effect of cultivar and spraying with Moringa leaf extract and aspirin and their interactions on the percentage of set fruits%**

| cultivar effect average | cultivar extract + | Aspirin mg l -1 |       |       | extract concentration gm l-1 | cultivar           |
|-------------------------|--------------------|-----------------|-------|-------|------------------------------|--------------------|
|                         |                    | 150             | 75    | 0     |                              |                    |
| 66.68                   | 65.47              | 70.10           | 66.47 | 59.83 | 0                            | Al-Hussainawiyah   |
|                         | 64.31              | 75.37           | 64.53 | 53.03 | 15                           |                    |
|                         | 70.27              | 68.10           | 73.17 | 69.53 | 30                           |                    |
| 68.37                   | 65.97              | 72.1            | 66.23 | 59.50 | 0                            | Al-Khenisiriya h   |
|                         | 66.16              | 79.23           | 60.87 | 58.37 | 15                           |                    |
|                         | 72.98              | 79.90           | 73.23 | 65.80 | 30                           |                    |
| NS                      | 4.00               | 6.59            |       |       | L.S.D P≤ 0.05                |                    |
| Extract effect average  |                    | 74.14           | 67.42 | 61.01 | average of effect of aspirin |                    |
|                         |                    | 2.81            |       |       | L.S.D P≤ 0.05                |                    |
| 65.71                   |                    | 71.13           | 66.35 | 59.67 | 0                            | Aspirin + extract  |
| 65.72                   |                    | 77.30           | 62.70 | 55.70 | 15                           |                    |
| 71.62                   |                    | 74.00           | 73.20 | 67.67 | 30                           |                    |
| 2.71                    |                    | 4.64            |       |       | L.S.D P≤ 0.05                |                    |
|                         |                    | 71.19           | 68.06 | 60.80 | Al-Hussainawiyah             | cultivar + aspirin |
|                         |                    | 77.10           | 66.78 | 61.22 | Al-Khenisiriya h             |                    |
|                         |                    | 4.05            |       |       | L.S.D P≤ 0.05                |                    |

The results in tables (3 and 4) show the cultivar Khenissiere excelled on the cultivar Husseinawiya in flowering traits (the percentage of sets in flowers and the total number of flowers). The reason for the increase may be due to the genetic difference of the cultivar and its vulnerability to environmental conditions and weather factors. Since many traits may be inherited under genetic control, this result agrees with (9) Results from the two tables indicate the excelled of spraying with Moringa leaf extract concentration of  $30 \text{ gm L}^{-1}$  and spraying with aspirin at a concentration of  $150 \text{ mg L}^{-1}$  (percentage of set in flowers and total number of flowers) compared with the control treatment. The results obtained when treated with acetylsalicylic acid agree with (10) on pea plants and (11) on tomato plants, as found in (12) on okra plants.

### Chemical traits in the leaves

#### 5-Total nitrogen concentration in the leaves:

Table 5 indicates the effect of cultivar and spraying with Moringa leaf extract and aspirin and their interactions, where it is noted that there is no significant difference between the two cultivars in the traits of nitrogen concentration in the leaves. The two concentrations are  $15$  and  $30 \text{ gm L}^{-1}$ . As it gave the highest concentration of nitrogen in the leaves, which amounted to (4.038 and 3.399)%, respectively, compared with the control treatment, which gave the lowest nitrogen concentration, which amounted to 2.828, and the data of the same table also shows that spraying with aspirin had a significant effect. The spraying was the concentration of  $150 \text{ mg L}^{-1}$  excelled and gave

the highest concentration of nitrogen amounted to 3.482% compared to the lowest nitrogen concentration of the treatment with a concentration of  $75 \text{ mg L}^{-1}$  It gave 3.386%, and the bi and triple interaction had a significant effect on this trait, where bi- interaction between the two cultivars Khenissiere and Al-Hussainawiyya and spraying with the extract at a concentration of  $30 \text{ g L}^{-1}$  was excelled and gave the highest concentration of nitrogen in the leaves amounted to (3.890,4.187)%, respectively. While the interaction between the Khneissery cultivar and the concentration of  $0 \text{ g L}^{-1}$  gave the lowest concentration of nitrogen in the leaves amounted to 2.747%. 3.616%, While the treatment of the Al-Hussainawi cultivar with a concentration of  $0 \text{ mg L}^{-1}$  gave the lowest nitrogen concentration of 3.313%. The table also shows that the interaction between spraying with Moringa leaf extract and aspirin was significant. The plants treated by spraying with the extract at a concentration of  $30 \text{ gm L}^{-1}$  and aspirin at a concentration of  $150 \text{ mg L}^{-1}$  gave the highest concentration of nitrogen, amounting to 4.138, While the plants treated with Moringa 0 at a concentration of  $150 \text{ mg L}^{-1}$  gave the lowest concentration of nitrogen in the leaves, amounting to 2.712%. As for the triple interaction, the treatment of the Khinesiararia cultivar with a concentration of  $30 \text{ mg L}^{-1}$  extract and  $75 \text{ mg L}^{-1}$  extract was excelled, which gave the highest nitrogen concentration in this interaction, amounting to 4.247%. While the plants of the Khinesiararia cultivar and the laboratory plants with a concentration of  $0 \text{ gm L}^{-1}$  extract and  $150 \text{ mg L}^{-1}$  aspirin gave the lowest concentration of nitrogen in the leaves, amounting to 2.697%.

Table . 5 Effect of cultivar and spraying with Moringa leaf extract and spraying with aspirin and their interactions on the percentage of nitrogen concentration in the leaves (%)

| cultivar effect average | cultivar extract + | Aspirin mg l <sup>-1</sup> |       |       | extract concentration gm l <sup>-1</sup> | cultivar           |
|-------------------------|--------------------|----------------------------|-------|-------|--|--------------------|
|                         |                    | 150                        | 75    | 0     |  |                    |
| 3.339                   | 2.909              | 2.727                      | 3.123 | 2.877 | 0  | Al-Hussainawiyah   |
|                         | 3.217              | 3.277                      | 3.120 | 3.253 | 15                                       |                    |
|                         | 3.890              | 4.043                      | 3.817 | 3.810 | 30                                       |                    |
| 3.505                   | 2.747              | 2.697                      | 2.793 | 2.750 | 0  | Al-Khenisiriyah    |
|                         | 3.581              | 3.917                      | 3.213 | 3.613 | 15                                       |                    |
|                         | 4.187              | 4.233                      | 4.247 | 4.080 | 30                                       |                    |
| NS                      | 0.155              | 0.279                      |       |       | L.S.D P ≤ 0.05                           |                    |
| Extract effect average  |                    | 3.482                      | 3.386 | 3.397 | average of effect of aspirin             |                    |
|                         |                    | 0.126                      |       |       | L.S.D P ≤ 0.05                           |                    |
| 2.828                   |                    | 2.712                      | 2.958 | 2.813 | 0  | Aspirin extract +  |
| 3.399                   |                    | 3.597                      | 3.167 | 3.433 | 15                                       |                    |
| 4.038                   |                    | 4.138                      | 4.032 | 3.945 | 30                                       |                    |
| 0.078                   |                    | 0.189                      |       |       | L.S.D P ≤ 0.05                           |                    |
|                         |                    | 3.34                       | 3.353 | 3.313 | Al-Hussainawiyah                         | cultivar + aspirin |
|                         |                    | 3.616                      | 3.418 | 3.481 | Al-Khenisiriyah                          |                    |
|                         |                    | 0.180                      |       |       | L.S.D P ≤ 0.05                           |                    |

concentration of potassium in the leaves, which amounted to 1.780%.

### 6-concentration of potassium in the leaves

Table (6) indicates the effect of cultivar and spraying with Moringa leaf extract and aspirin and their interactions, where it is noted that there is a significant difference between the two cultivars in the concentration of potassium in the leaves, where it is noted that the cultivar Khneissia has excelled in the concentration of potassium in the leaves of the okra plant, as it gave the highest concentration of nitrogen amounted to 2.054 % As for Hussainawiyah cultivar, it gave the lowest concentration of potassium in the leaves, amounting to 1.791%.

As for the effect of spraying with Moringa leaf extract, the data of the same table indicate a significant effect on this trait. It was noted that the two concentrations 15 and 30 gm L<sup>-1</sup> were significantly excelled, where they gave the highest concentration of potassium in the leaves, amounting to (1.929, 2.019)%, respectively, compared with the control treatment, which gave the lowest concentration of potassium in it, which amounted to 1.819. The data of the same table also showed that spraying with aspirin had a significant effect. It was excelled spraying with two concentrations of 75 and 150 mg L<sup>-1</sup>

and gave the highest concentration of potassium in the leaves, which amounted to (1.976,1.934) in sequence, compared with the lowest concentration of potassium in the leaves, which reached 1.858%.The bi and triple interaction had a significant effect on this trait, as the bi- interaction between the cultivar Khenissiere and spraying with the extract at two concentrations of 15 and 30 g L<sup>-1</sup> gave the highest concentration of potassium in the leaves, amounting to (2.209,2.043)%.While the interaction between the cultivar Al-Hussainawiya and the concentration of 0 gm L<sup>-1</sup> gave it the lowest concentration of potassium, which amounted to 1.728%. As for the effect of the interaction between the cultivar and spraying with aspirin, it had a significant effect, as the cultivar Al-Khenisia and spraying with aspirin at two concentrations of 75 and 150 mg L<sup>-1</sup> gave the highest concentration of potassium in the leaves. It reached (2.104,2.062)%, respectively

While the treatment of Hussainawiya cultivar with a concentration of 0 mg L<sup>-1</sup> gave the lowest concentration of potassium in this trait, amounting to 1.720%. The table also shows that the interaction between spraying with Moringa leaf extract and aspirin was significant.The plants treated by spraying with the extract at a concentration of 30 gm L<sup>-1</sup> and aspirin at a concentration of 150 mg L<sup>-1</sup> gave the highest concentration of potassium in the leaves, amounting to (2.092%), while the untreated plants gave the lowest concentration of it in the same traits , amounting to 1.767%.As for the triple interaction, the treatment of the treated cultivar excelled with a concentration of 30 gm L<sup>-1</sup> extract and 150 mg L<sup>-1</sup> extract and gave the highest concentration of potassium in the leaves, amounting to 2.297%.While the plants of Hussainawiya cultivar and the plants with a concentration of 0 g L<sup>-1</sup> extract and 0 mg L<sup>-1</sup> aspirin gave the lowest

**Table .6 Effect of cultivar and spraying with Moringa leaf extract and aspirin and their interactions on potassium concentration in leaves (%)**

| cultivar effect average | cultivar extract | Aspirin mg l -1 |       |       | extract concentration gm l-1 | cultivar           |
|-------------------------|------------------|-----------------|-------|-------|------------------------------|--------------------|
|                         |                  | 150             | 75    | 0     |                              |                    |
| 1.791                   | 1.728            | 1.817           | 1.730 | 1.637 | 0                            | Al-Hussainawiyah   |
|                         | 1.814            | 1.837           | 1.827 | 1.780 | 15                           |                    |
|                         | 1.830            | 1.887           | 1.860 | 1.743 | 30                           |                    |
| 2.054                   | 1.911            | 1.937           | 1.900 | 1.897 | 0                            | Al-Khenisiriyah    |
|                         | 2.043            | 2.080           | 2.087 | 1.963 | 15                           |                    |
|                         | 2.209            | 2.297           | 2.200 | 2.130 | 30                           |                    |
| 0.054                   | 0.0421           | 0.072           |       |       | L.S.D P≤ 0.05                |                    |
| Extract effect average  |                  | 1.976           | 1.934 | 1.858 | average of effect of aspirin |                    |
|                         |                  | 0.0315          |       |       | L.S.D P≤ 0.05                |                    |
| 1.819                   |                  | 1.877           | 1.815 | 1.767 | 0                            | Aspirin extract +  |
| 1.929                   |                  | 1.958           | 1.957 | 1.872 | 15                           |                    |
| 2.019                   |                  | 2.092           | 2.030 | 1.937 | 30                           |                    |
| 0.023                   |                  | 0.049           |       |       | L.S.D P≤ 0.05                |                    |
|                         |                  | 1.847           | 1.806 | 1.720 | Al-Hussainawiyah             | cultivar + aspirin |
|                         |                  | 2.104           | 2.062 | 1.997 | Al-Khenisiriyah              |                    |
|                         |                  | 0.047           |       |       | L.S.D P≤ 0.05                |                    |

### The concentration of phosphorous in leaves:

Table 7 indicates the effect of the cultivar and spraying with Moringa leaf extract and aspirin and their interactions, where it is noted that there is a significant difference between the two cultivars in the concentration of phosphorus in the leaves of the dry matter. Where Khenissiere a cultivar excelled in the concentration of phosphorus in the leaves, where it gave the highest concentration of phosphorus, amounting to 0.290%, while Hussainawiya cultivar gave the lowest concentration of phosphorus in the leaves, amounting to 0.270%. As for the effect of spraying with Moringa leaf extract, the data of the same table indicate a significant effect on this characteristic. It was observed that the two concentrations, 15 and 30 gm L<sup>-1</sup>, were significantly excelled, where they gave the highest concentration of phosphorus in the leaves, amounting to (0.281, 0.329)%, respectively, compared with the control treatment, which gave the lowest concentration of phosphorus, amounting to 0.229%. The data of the same table also show that spraying with aspirin had a significant effect. The spraying was excelled on the concentration of 150 mg L<sup>-1</sup>, and gave the highest concentration of phosphorus in the leaves, amounting to 0.297%, compared to the lowest concentration of phosphorus for the control treatment, which gave a concentration of 0.259%. The bi and triple interaction had a significant effect on this trait, as the bi-interaction between the cultivar Khenissiere and Husainawiya and spraying with the extract

at a concentration of 30 g L<sup>-1</sup> was excelled and gave the highest concentration of phosphorus in the leaves, which reached (0.314 and 0.344)%, respectively. While the interaction between the chlorine cultivar and the concentration of 0 gl-1 gave it the lowest concentration of phosphorus, which was 0.216%. As for the effect of the interaction between the cultivar and spraying with aspirin, it had a significant effect, as the cultivar Khenissiere and spraying with aspirin at a concentration of 150 mg L<sup>-1</sup> gave the highest concentration of phosphorus in the leaves, which reached 0.309%. While the treatment of the Husseinawiya cultivar with a concentration of 0 mg L<sup>-1</sup> gave the lowest concentration in the same trait, where it gave the lowest concentration of 250%. The table also shows that the interaction between spraying with Moringa leaf extract and aspirin was significant, as the plants treated by spraying with the extract at a concentration of 30 gm L<sup>-1</sup> and aspirin at a concentration of 150 mg L<sup>-1</sup> gave the highest concentration of phosphorus in the leaves, which reached 0.342%. While the untreated plants gave the lowest concentration of the element phosphorous, where it gave the lowest concentration of 0.191%. As for the triple interaction, the treatment of the treated cultivar with a concentration of 30 gm L<sup>-1</sup> extract and aspirin 150 mg L<sup>-1</sup> was excelled. and it gave the highest concentration in this triple interaction, which was 0.368%, while the plants of Hussainawiya and laboratory plants with a concentration of 0 gm L<sup>-1</sup> extract and 0 mg L<sup>-1</sup> aspirin gave the lowest concentration of phosphorus, amounting to 0.187.

Table (7) Effect of cultivar and spraying with Moringa leaf extract and aspirin and their interactions on the phosphorus concentration in the leaves

| cultivar effect average | cultivar extract + | Aspirin mg l <sup>-1</sup> |       |                | extract concentration gm l <sup>-1</sup> | cultivar                     |
|-------------------------|--------------------|----------------------------|-------|----------------|--|------------------------------|
|                         |                    | 150                        | 75    | 0              |  |                              |
| 0.270                   | 0.216              | 0.240                      | 0.221 | 0.187          | 0  | Al-Hussainawiyah             |
|                         | 0.280              | 0.298                      | 0.281 | 0.261          | 15                                       |                              |
|                         | 0.314              | 0.315                      | 0.324 | 0.302          | 30                                       |                              |
| 0.290                   | 0.243              | 0.262                      | 0.270 | 0.195          | 0  | Al-Khenisiriya h             |
|                         | 0.282              | 0.296                      | 0.274 | 0.277          | 15                                       |                              |
|                         | 0.344              | 0.368                      | 0.333 | 0.331          | 30                                       |                              |
| 0.02                    | 0.0164             | 0.018                      |       |                | L.S.D P ≤ 0.05                           |                              |
| Extract effect average  | 0.297              |                            |       | 0.284          | 0.259                                    | average of effect of aspirin |
|                         | 0.006              |                            |       | L.S.D P ≤ 0.05 |  |                              |
| 0.229                   | 0.251              |                            |       | 0.246          | 0.191                                    | Aspirin + extract            |
| 0.281                   | 0.297              |                            |       | 0.277          | 0.269                                    |                              |
| 0.329                   | 0.342              |                            |       | 0.329          | 0.316                                    |                              |
| 0.007                   | 0.011              |                            |       | L.S.D P ≤ 0.05 |  |                              |
|                         | 0.284              |                            |       | 0.276          | 0.250                                    | Al-Hussainawiyah             |
|                         | 0.309              |                            |       | 0.292          | 0.268                                    | Al-Khenisiriya h             |
|                         | 0.016              |                            |       | L.S.D P ≤ 0.05 |  |                              |

### The amount of protein in the leaves

Table (8) indicates the effect of cultivar and spraying with Moringa leaf extract and aspirin and their interactions. It is noted that there is a significant difference between the two cultivars in the amount of protein in the leaves of the dry matter, where the Khunaisri cultivar was excelled to the Hussainawi cultivar. As for the effect of spraying with Moringa leaf extract, the data of the same table indicate a significant effect on this traits, where it was noted that the concentrations 15 and 30 gm L<sup>-1</sup> were significantly excelled. As it gave the largest amount of protein in the leaves, which amounted to (25.24, 21.24)%, respectively, compared with the control

treatment, which gave the lowest amount of protein in the leaves, amounting to 17.67%. The data of the same table also showed that spraying with aspirin had a significant effect. It was excelled to spraying with a concentration of 150 mg L<sup>-1</sup> and gave the highest amount of protein in the leaves, amounting to 21.76%, compared to the lowest amount of protein for the treatment whose concentration was 75 mg L<sup>-1</sup> where it gave 21.16%. The bi and triple interaction had a significant effect in this traits, The bi-interaction between the cultivar Khenissiere , Hussainawiyah and spraying with the extract at a concentration of 30 gm L<sup>-1</sup> was excelled, and gave the largest amount of protein in the leaves, which amounted to (26.17, 24.31)%,

respectively. While the interaction between the Legionnaires cultivar and the concentration of 0 g L<sup>-1</sup> gave the least amount of protein amounted to 17.17%, while the effect of the interaction between the cultivar and spraying with aspirin had a significant effect. Khenissiere a cultivar sprayed with aspirin at a concentration of 150 mg L<sup>-1</sup> gave the highest amount of protein in the leaves, amounting to 22.60%, while the treatment of the Husseinawiya cultivar with a concentration of 0 mg L<sup>-1</sup> gave the lowest concentration in the same trait, as it gave the lowest concentration of 20.71%. The table also shows that the interaction between spraying with Moringa leaf extract and aspirin was significant, as the plants treated with spraying with extract at a concentration of 30 gm L<sup>-1</sup>

and aspirin at a concentration of 150 mg L<sup>-1</sup> gave the highest amount of protein in the leaves, amounting to 25.86%. While the plants treated by spraying with an extract at a concentration of 0 gm L<sup>-1</sup> and aspirin at a concentration of 150 mg L<sup>-1</sup> gave the least amount of protein, as it gave a protein of 16.95%. As for the triple interaction, the treatment of the treated Khneissia cultivar excelled with a concentration of 30 gm L<sup>-1</sup> extract and aspirin 75 mg L<sup>-1</sup> extract and gave the highest concentration in this triple interaction of 26.54%, while the plants of the Husseinawiya and laboratory plants gave a concentration of 0 gm L<sup>-1</sup> extract and 150 mg L<sup>-1</sup> extract Aspirin, the lowest amount of protein in the leaves was 16.85%.

**Table 8 Effect of cultivar and spraying with Moringa leaf extract and spraying with aspirin and their interactions on the amount of protein in the leaves**

| cultivar effect average | cultivar extract | Aspirin mg l <sup>-1</sup> |       |       | extract concentration gm l <sup>-1</sup> | cultivar           |
|-------------------------|------------------|----------------------------|-------|-------|--|--------------------|
|                         |                  | 150                        | 75    | 0     |  |                    |
| 20.87                   | 18.18            | 17.04                      | 19.52 | 17.98 | 0  | Al-Hussainawiya h  |
|                         | 20.10            | 20.48                      | 19.50 | 20.33 | 15                                       |                    |
|                         | 24.31            | 25.27                      | 23.85 | 23.81 | 30                                       |                    |
| 21.91                   | 17.17            | 16.85                      | 17.46 | 17.19 | 0  | الخنيسري           |
|                         | 22.38            | 24.48                      | 20.08 | 22.58 | 15                                       |                    |
|                         | 26.17            | 26.46                      | 26.54 | 25.50 | 30                                       |                    |
| 0.88                    | 0.97             | 1.74                       |       |       | L.S.D P ≤ 0.05                           |                    |
| Extract effect average  |                  | 21.76                      | 21.16 | 21.23 | average of effect of aspirin             |                    |
|                         |                  | 0.79                       |       |       | L.S.D P ≤ 0.05                           |                    |
| 17.67                   |                  | 16.95                      | 18.49 | 17.58 | 0  | Aspirin extract +  |
| 21.24                   |                  | 22.48                      | 19.79 | 21.46 | 15                                       |                    |
| 25.24                   |                  | 25.86                      | 25.20 | 24.66 | 30                                       |                    |
| 0.49                    |                  | 1.18                       |       |       | L.S.D P ≤ 0.05                           |                    |
|                         |                  | 20.93                      | 20.96 | 20.71 | Al-Hussainawiyah                         | cultivar + aspirin |
|                         |                  | 22.60                      | 21.36 | 21.76 | Al-Khenisiriyah                          |                    |
|                         |                  | 1.13                       |       |       | L.S.D P ≤ 0.05                           |                    |

The results in tables (6, 7 and 8) show the cultivar Khneisseria excelled on the cultivar Husaynawiyya in yield traits (phosphorus ratio, potassium ratio, and protein in the leaves.) The reason for the increase may be due to the genetic difference of the cultivar and its vulnerability to environmental conditions and weather factors, where many traits may be inherited under genetic control. This result is consistent with. Tables 5, 6, and 7 show that the treatment with Moringa leaf extract and aspirin led to the accumulation of nitrogen, phosphorus, and potassium. This may be due to the role of these compounds in activating many vital processes which increased the activity of plants in absorbing nutrients from the soil, including nitrogen, phosphorus and potassium, and then increasing its concentration in the leaves. These antibiotics also have a role in protecting the plant from oxidative damage, and this leads to the protection of the photosynthesis process (14) in addition to their role in increasing plant hormones in the plant (9) which are the auxins that play a role in the development of roots (15) and cytokinins that help the transfer of nutrients from the roots and direct them towards the vegetative system and leaves (16) and thus accumulate them in the leaves. The results obtained when treated with Moringa leaf extract agree with (17) that foliar spraying with Moringa leaf extract increased the cowpea yield by 25-30%. (18) noted that the extract of Moringa leaves is rich in zeatin, a natural cytokinin, and a hormone that promotes plant growth, and this agreed with what was mentioned by (19) on broad beans and tomatoes and (20) who found an increase in the yield of cowpea plants sprayed with the extract compared to the control treatment. The results obtained when treated with aspirin are consistent with (10) on pea plants, as well as what (11) found that spraying salicylic acid at concentrations of 50 and 100 mg L<sup>-1</sup> on tomato plants significantly increased carbohydrate content.

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