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# THE EFFECT OF SEEDLING AGE AND SPRAYING WITH AQUEOUS EXTRACT OF GARLIC CLOVES ON THE GROWTH CHARACTERISTICS AND YIELD OF TWO HYBRIDS OF BROCCOLI

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**Abstract:**

The experiment was conducted during the two agricultural seasons 2021-2022 and 2022-2023 in the field belonging to the Agricultural Research Station of the College of Agriculture, University of Basrah, Karma Ali, with the aim of studying the effect of two hybrids (Matsuri and 2004), three seedling ages (30, 45, and 60 days), and five concentrations of Aqueous garlic extract (10, 20) ml liter$^{-1}$ of local variety garlic and (10, 20) ml liter$^{-1}$ of Chinese variety garlic and the comparison treatment (0) There were 30 factorial treatments carried out as a split factorial experiment in a randomized complete block design. The Matsuri hybrid was significantly superior in plant height, main stem diameter, number of leaves, main disc weight, and plant yield. For both seasons, the Matsuri hybrid was significantly superior in plant height, main stem diameter, number of leaves, and Weight of main disc and yield of one plant , The 30-day-old seedling treatment also outperformed the study traits, and the spraying treatment outperformed significantly, as the 20 ml L$^{-1}$ concentration significantly outperformed the study traits, and the interactions gave a significant effect in most of the studied traits, as the triple interaction outperformed the Matsuri hybrid plants that were planted at 30 days of age. Which was sprayed at a concentration of 20 ml L$^{-1}$, with a significant yield of 1.363 kg for the second season.

**Keywords:** broccoli plant, hybrids, seedling ages, aqueous extract of garlic, growth, yield introduction

Broccoli is a plant of the cruciferous family Brassicaceae, and its scientific name is L. Brassica Oleracea. It is known in Arabic as green cauliflower, and the word broccoli is of Italian origin and means the flowering top. The plant produces a number of pink disks of green, purple, or white color and is known as Sprouting broccoli or Green Sprouting broccoli. Calabrese Asparagus broccoli, grown for its inflorescences, which are eaten in the stage of green flower buds with their thick, juicy pods, which form the main (terminal) head. From a group of dense, merging clusters of true flower buds at the end of the plant's stem, which produces a number of lateral (secondary) shoots over a period of several weeks. It has many health benefits and its nutritional importance appears through its contribution to providing the human body with energy, carbohydrates, and a small percentage of fats and proteins. And fiber and vitamins, such as vitamin A, which contains a high percentage of it, It also contains vitamins C, K, B, and E, and mineral elements and salts such as calcium, potassium, iron, manganese, magnesium, zinc, and phosphorus (Hassan, 2004). Using the seedling method for vegetable crops has many advantages, such as saving the amount of seeds, saving land space, paying full attention and control over the seedling growth conditions in the nursery land, choosing healthy seedlings, as well as increasing the branching of the roots after transplanting as a result of the roots being cut off when transplanting the seedlings, Also, vegetables produced in this way are harvested at earlier times compared to those planted with seeds. Therefore, the age of the seedlings is one of the important factors in determining the success of the crop (Hassan, 1994). Spraying with organic extracts, including garlic extract, has a positive role in the growth characteristics and yield, because it contains a high percentage of... It contains amino acids with a high sulfur content, such as Cysteine and Methionine, which play an important role in vital processes within the plant cell, in addition to containing volatile oils such as Allicin, vitamins, and mineral elements (Saadoun et al. 2004).

## MATERIALS AND WORKING METHODS

The experiment was conducted in the two winter agricultural seasons 2021-2022 and 2022-2023 at the Agricultural Research Station of the College of Agriculture at the University of Basrah. Random samples were taken from the soil of the field before planting at a depth of 0-30 cm, and mixed homogeneously to estimate some of its physical and chemical characteristics in the central laboratory. affiliated with the College of Agriculture at the University of Basra (Table 1). The soil of the field was plowed twice perpendicularly, smoothed and leveled, then divided into three sectors. Each

sector contained six lines, 25 m long, 0.5 m wide, and 15 cm high, with a distance of 1 m between one line and another. Then each line was divided into five. Experimental units: Each experimental unit contains 10 plants, so that the number of experimental units becomes 30 in each sector. Seedlings were planted with a distance of 0.5 m between one seedling and another. Agricultural operations were carried out according to the recommendations followed in growing broccoli, and decomposed animal manure was added at a rate of 40 tons $ha^{-1}$ (Matloub et al., 1989). The experiment included three factors for both seasons: two hybrids of broccoli plants (Matsuri, 2004), three seedling ages (30, 45, and 60 days), and garlic extract taken from the local garlic variety (Zubair garlic) and Chinese (locally produced) at two concentrations of 10 each. And 20 ml $liter^{-1}$ ) In addition to the comparison treatment (0) spraying with distilled water only, and spraying three times after two weeks of transplanting in the field, with a week between one spraying and another, a Randomized Complete Block Design (R.C.B.D.) was used for a split factorial experiment for two times, Split Split Plot Design. The hybrid is considered the main plot, and the age of the seedlings is the secondary plot, the Sub-plot The concentrations of spraying with the extract are sub-sub plot, so the number of treatments is 30 factorial treatments with three replicates, so that the number of experimental units is 90 experimental units. The average results were statistically analyzed using the statistical program Genstat, V. 10.3 (2011), and the Least Significant Differences Test (L.S.D.) was used to compare the averages at the 0.05 probability level (Al-Rawi and Khalaf Allah, 1980).

**Table (1) shows some physical and chemical characteristics of field soil and irrigation water for the agricultural seasons 2021-2022 and 2022-2023.**

| Soil properties | | The first season 2021-2022 | the second season 2022-2023 |
|---|---|---|---|
| Degree of electrical conductivity (EC) (deci siemens $m^{-1}$) | | 8.45 | 7.80 |
| Soil acidity (pH) | | 7.61 | 7.43 |
| dissolved ions (mmol $l^{-1}$) | $Na^{+}$ | 24.33 | 23.17 |
| | $Ca^{++}$ | 16.74 | 15.00 |
| | $Mg^{++}$ | 8.11 | 7.29 |
| | $SO_4^{--}$ | 22.60 | 21.85 |
| | $Cl^{-}$ | 62.00 | 60.10 |
| | $HCO_3^{-}$ | 3.1 | 2.90 |
| Ready nitrogen | ppm | 191 | 187 |
| Ready phosphorus | | 74 | 72 |
| Ready potassium | | 180 | 215 |
| Organic matter (%) | | 0.65 | 0.74 |
| Soil separations (%) | | | |
| sand | | 58.2 | 63.0 |
| silt | | 10.0 | 10.6 |
| clay | | 31.8 | 26.4 |
| Soil texture | | Sand mixture | Sand mixture |
| Irrigation water | | | |
| season | pH | Degree of electrical conductivity (deci siemens $m^{-1}$) | |
| 2022-2021 | 7.85 | 6.10 | |
| 2023-2022 | 7.80 | 5.34 | |

## RESULTS AND DISCUSSION

Table (2) shows that the study factors had a "significant" effect on plant height for both seasons, as the Matsuri hybrid was significantly superior compared to the other hybrid. It was also noted that there was a significant increase with increasing seedling age. The results of the same table showed that spraying with garlic extract had a "significant" effect. In this capacity, the plants that were sprayed with the extract outperformed the control treatment plants, with a significant increase as the concentration increased, with the exception of noting that there was no "significant" difference between the plants that were sprayed with the local garlic extract for both concentrations (10 and 20 ml $L^{-1}$) for the first season, as well as Between the plants that were sprayed with the same extract at a concentration of 10 ml

$L^{-1}$ and the plants of the control treatment for the second season, The plants sprayed with Chinese garlic extract at a concentration of 20 ml $l^{-1}$ excelled in this trait for both seasons. The binary interactions, as well as the three-way interaction between the treatments, did not show a "significant" effect on plant height for both seasons, with the exception of the interaction of the hybrid with the seedling age of the second season plants, as the 30-day-old Matsuri hybrid plants were "significantly" superior in this trait, reaching 58.25 cm compared to their lowest height. In the 2004 hybrid plants grown at 60 days old, it reached 51.75 cm.

**Table (2) Effect of two broccoli hybrids, seedling age, spraying with garlic extract, and their interactions on plant height (cm) for the seasons 2021-2022 and 2022-2023.**

| The first season | | | | | | | | the second season | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hybrid | Seedling age day) ( | Spraying with garlic extract ($mL^{-1}$) | | | | | Hybrid × the age | Hybrid | Seedling age day) ( | Spraying with garlic extract ($mL^{-1}$) | | | | | Hybrid × the age |
| | | Comparison | garlic | local | garlic | Chinese | | | | Comparison | garlic | local | garlic | Chinese | |
| | | 0 | 10 | 20 | 10 | 20 | | | | 0 | 10 | 20 | 10 | 20 | |
| Matsuri | 30 | 54.00 | 57.70 | 57.33 | 60.00 | 63.37 | 58.48 | Matsuri | 30 | 54.40 | 53.23 | 58.60 | 60.27 | 64.73 | 58.25 |
| | 45 | 51.33 | 53.80 | 55.07 | 57.33 | 59.97 | 55.50 | | 45 | 53.37 | 52.33 | 55.47 | 57.43 | 60.37 | 55.79 |
| | 60 | 47.17 | 49.03 | 50.60 | 53.10 | 56.63 | 51.31 | | 60 | 49.73 | 48.77 | 51.93 | 55.02 | 57.90 | 52.67 |
| 2004 | 30 | 50.40 | 52.07 | 53.33 | 58.03 | 59.53 | 54.67 | 2004 | 30 | 51.13 | 50.77 | 54.07 | 57.47 | 60.23 | 54.73 |
| | 45 | 47.40 | 48.57 | 51.37 | 54.43 | 55.43 | 51.44 | | 45 | 49.23 | 52.43 | 50.27 | 53.27 | 57.33 | 52.51 |
| | 60 | 45.03 | 46.30 | 48.97 | 51.53 | 53.00 | 48.95 | | 60 | 48.57 | 50.43 | 51.47 | 54.70 | 53.57 | 51.75 |
| RLSD 0.05 | | | | | | N.S. | N.S | RLSD 0.05 | | | | | | N.S. | 1.92 |
| Average hybrid | | | | | | | Average hybrid | | | | | | | | |
| Hybrid × Spraying | Matsuri | 50.83 | 53.51 | 54.33 | 56.81 | 59.99 | 55.10 | Hybrid × Spraying | Matsuri | 52.50 | 51.44 | 55.33 | 57.57 | 61.00 | 55.57 |
| | 2004 | 47.61 | 48.98 | 51.22 | 54.63 | 55.99 | 51.69 | | 2004 | 49.64 | 51.21 | 51.93 | 55.14 | 57.04 | 53.00 |
| RLSD 0.05 | | | | | | N.S. | 1.76 | RLSD 0.05 | | | | | | N.S. | 2.50 |
| middle age | | | | | | | middle age | | | | | | | | |
| the age × Spraying | 30 | 52.20 | 54.88 | 55.33 | 59.02 | 61.45 | 56.58 | the age × Spraying | 30 | 52.77 | 52.00 | 56.33 | 58.87 | 62.48 | 56.49 |
| | 45 | 49.37 | 51.18 | 53.22 | 55.88 | 57.70 | 53.47 | | 45 | 51.30 | 52.38 | 52.87 | 55.35 | 58.85 | 54.15 |
| | 60 | 46.10 | 47.67 | 49.78 | 52.27 | 54.82 | 50.13 | | 60 | 49.15 | 49.60 | 51.70 | 54.86 | 55.73 | 52.21 |
| RLSD 0.05 | | | | | | N.S. | 1.31 | RLSD 0.05 | | | | | | N.S. | 0.92 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average spray | 49.22 | 51.24 | 52.78 | 55.72 | 57.99 | | Average spray | 51.07 | 51.33 | 53.63 | 56.36 | 59.02 | |
| RLSD 0.05 | | | | | | 1.40 | RLSD 0.05 | | | | | | 1.84 |

Table (3) shows that the two hybrids have a "significant" effect on the stem diameter of the plant, The Matsuri hybrid was significantly superior in this trait, and it was observed that there was a significant increase with increasing seedling age and spraying with garlic extract compared to the comparison treatment plants for both seasons, with the exception of noting that there was no "significant" difference between the plants that were sprayed in the second season with local garlic extract at a concentration of 20 or 10 ml $L^{-1}$, with plants sprayed with Chinese garlic extract at a concentration of 20 ml $L^{-1}$ excelling in this trait for both seasons. The results of the same table showed a significant effect of the binary interaction between the hybrid or the age with spraying with garlic extract for the first season only, as the Matsuri hybrid plants excelled. Planted at 30 days old, the stem diameter reached 6.22 cm, and the lowest value for this trait was 3.87 cm for the 2004 hybrid plants planted at 60 days old, The plants of the same hybrid (Matsuri) that were sprayed with Chinese garlic extract at a concentration of 20 ml $L^{-1}$ also excelled when the hybrid interacted with seedling age at a value of 5.87 cm, compared to the lowest value observed in the 2004 hybrid plants for the comparison treatment, which amounted to 3.94 cm. The double interaction of seedling age and spraying with the extract showed Garlic had a significant effect on this trait in the second season only, with a value of 6.94 cm for plants grown at 30 days old, which were sprayed with Chinese garlic extract at a concentration of 20 ml $L^{-1}$, compared to the smallest diameter for plants in the control treatment grown at 60 days old, which reached 4.56 cm, while The three-way interaction between the factors did not have a significant effect for both seasons.

**Table (3) Effect of two broccoli hybrids, seedling age, spraying with garlic extract, and their interactions on main stem diameter (cm) for the seasons 2021-2022 and 2022-2023.**

| The first season | | | | | | | | the second season | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hybrid | Seedling age (day) | Spraying with garlic extract ($mL^{-1}$) | | | | | Hybrid × the age | Hybrid | Seedling age (day) | Spraying with garlic extract ($mL^{-1}$) | | | | | Hybrid × the age |
| | | Comparison | garlic | local | garlic | Chinese | | | | Comparison | garlic | local | garlic | Chinese | |
| | | 0 | 10 | 20 | 10 | 20 | | | | 0 | 10 | 20 | 10 | 20 | |
| Matsuri | 30 | 5.57 | 5.66 | 6.25 | 6.62 | 7.02 | 6.22 | Matsuri | 30 | 5.61 | 6.10 | 6.35 | 6.91 | 7.22 | 6.44 |
| | 45 | 4.25 | 4.38 | 5.31 | 5.18 | 5.71 | 4.97 | | 45 | 5.10 | 5.57 | 5.54 | 6.05 | 6.40 | 5.73 |
| | 60 | 3.68 | 3.77 | 4.26 | 4.53 | 4.89 | 4.22 | | 60 | 5.19 | 4.98 | 4.94 | 5.16 | 5.52 | 5.16 |
| 2004 | 30 | 4.57 | 4.86 | 4.89 | 5.37 | 5.65 | 5.07 | 2004 | 30 | 5.31 | 5.80 | 5.89 | 6.30 | 6.67 | 5.99 |
| | 45 | 3.93 | 4.43 | 4.46 | 4.88 | 4.92 | 4.52 | | 45 | 4.08 | 4.53 | 4.78 | 5.35 | 5.83 | 4.91 |
| | 60 | 3.33 | 3.67 | 3.76 | 4.28 | 4.32 | 3.87 | | 60 | 3.94 | 4.25 | 4.18 | 4.85 | 4.92 | 4.43 |
| RLSD 0.05 | | | | | | N.S. | 0.29 | RLSD 0.05 | | | | | | N.S. | N.S |
| Average hybrid | | | | | | | Average hybrid | | | | | | | | |
| Hybrid × Spraying | Matsuri | 4.50 | 4.61 | 5.27 | 5.44 | 5.87 | 5.14 | Hybrid × Spraying | Matsuri | 5.30 | 5.55 | 5.61 | 6.04 | 6.38 | 5.77 |
| | 2004 | 3.94 | 4.32 | 4.37 | 4.84 | 4.96 | 4.49 | | 2004 | 4.44 | 4.86 | 4.95 | 5.50 | 5.80 | 5.11 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RLSD 0.05 | | | | | N.S. | 1.76 | RLSD 0.05 | | | | | N.S. | 0.23 | |
| middle age | | | | | | middle age | | | | | | | | |
| the age × Spraying | 30 | 5.07 | 5.26 | 5.57 | 6.00 | 6.33 | 5.64 | the age × Spraying | 30 | 5.46 | 5.95 | 6.12 | 6.60 | 6.94 | 6.21 |
| | 45 | 4.09 | 4.41 | 4.88 | 5.03 | 5.32 | 4.74 | | 45 | 4.59 | 5.05 | 5.16 | 5.70 | 6.12 | 5.32 |
| | 60 | 3.50 | 3.72 | 4.01 | 4.40 | 4.60 | 4.05 | | 60 | 4.56 | 4.62 | 4.56 | 5.00 | 5.22 | 4.79 |
| RLSD 0.05 | | | | | N.S. | 0.25 | LSD 0.05 | | | | | 0.37 | | 0.18 |
| Average spray | | 4.22 | 4.46 | 4.82 | 5.14 | 5.42 | | Average spray | | 4.87 | 5.21 | 5.28 | 5.77 | 6.09 | |
| RLSD 0.05 | | | | | | 0.21 | RLSD 0.05 | | | | | | | 0.21 |

Table (4) shows that the study factors had a significant effect on the number of leaves per plant for both seasons, as the Matsuri hybrid plants were significantly superior to the 2004 hybrid. It was also noted that there was a significant increase with increasing seedling age, noting that there was no significant difference between the plants grown at the age of 30. And 45 days in this capacity for the second season, and the plants that were sprayed with garlic extract outperformed the plants in the control treatment, with a significant increase as the spray concentration increased, and the plants that were sprayed with Chinese garlic extract (10 or 20 ml $l^{-1}$) outperformed them with a "non-significant" difference between them. For the second season, followed by plants that were sprayed with local garlic extract (10 or 20 ml $l^{-1}$) with a non-significant difference for both seasons. The double and triple interactions for both seasons did not show a significant effect on the number of leaves per plant, with the exception of the interaction between the hybrid and seedling age for the first season. The Matsuri hybrid plants planted at 30 days old gave the highest number of leaves, reaching 23.63 leaves, compared to the lowest number in the 2004 hybrid plants planted at 60 days old. a day", which amounted to 18.95 sheets.

**Table (4) Effect of two broccoli hybrids, seedling age, spraying with garlic extract, and their interactions on the number of leaves for the seasons 2021-2022 and 2022-2023.**

| | | The first season | | | | | | | the second season | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hybrid | Seedling age (day) | Spraying with garlic extract ($mL^{-1}$) | | | | | Hybrid × the age | | Hybrid | Seedling age (day) | Spraying with garlic extract ($mL^{-1}$) | | | | | Hybrid × the age | |
| | | Comparison | garlic | local | garlic | Chinese | | | | | Comparison | garlic | local | garlic | Chinese | | |
| | | 0 | 10 | 20 | 10 | 20 | | | | | 0 | 10 | 20 | 10 | 20 | | |
| Matsuri | 30 | 21.50 | 22.44 | 23.58 | 24.00 | 26.61 | 23.63 | | Matsuri | 30 | 21.00 | 23.07 | 22.43 | 24.27 | 27.43 | 23.64 | |
| | 45 | 19.55 | 21.33 | 22.78 | 23.33 | 24.24 | 22.25 | | | 45 | 20.47 | 21.83 | 22.27 | 24.23 | 24.30 | 22.62 | |
| | 60 | 18.33 | 19.30 | 20.66 | 21.14 | 23.16 | 20.52 | | | 60 | 20.70 | 20.93 | 22.30 | 23.07 | 23.53 | 22.11 | |
| 2004 | 30 | 18.90 | 19.68 | 21.27 | 20.92 | 23.14 | 20.78 | | 2004 | 30 | 19.53 | 19.37 | 21.43 | 24.47 | 25.23 | 22.01 | |
| | 45 | 18.44 | 19.66 | 20.44 | 20.55 | 22.66 | 20.35 | | | 45 | 18.47 | 20.40 | 20.13 | 19.47 | 21.27 | 19.95 | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 60 | 17.44 | 18.77 | 19.33 | 18.66 | 20.55 | 18.95 | | 60 | 16.60 | 18.33 | 18.27 | 21.83 | 20.33 | 19.07 |
| RLSD 0.05 | | | | | | N.S. | 1.10 | RLSD 0.05 | | | | | | N.S. | N.S |
| Average hybrid | | | | | | | Average hybrid | | | | | | | | |
| Hybrid × Spraying | Matsuri | 19.79 | 21.02 | 22.34 | 22.82 | 24.67 | 22.13 | Hybrid × Spraying | Matsuri | 20.72 | 21.94 | 22.33 | 23.86 | 25.09 | 22.79 |
| | 2004 | 18.26 | 19.37 | 20.35 | 20.05 | 22.12 | 20.03 | | 2004 | 18.20 | 19.37 | 19.94 | 21.92 | 22.28 | 20.34 |
| RLSD 0.05 | | | | | | N.S. | 1.42 | RLSD 0.05 | | | | | | N.S. | 1.00 |
| middle age | | | | | | | middle age | | | | | | | | |
| the age × Spraying | 30 | 20.20 | 21.06 | 22.43 | 22.46 | 24.88 | 22.21 | the age × Spraying | 30 | 20.27 | 21.22 | 21.93 | 24.37 | 26.33 | 22.82 |
| | 45 | 19.00 | 20.50 | 21.61 | 21.94 | 23.45 | 21.30 | | 45 | 19.47 | 21.12 | 21.20 | 21.85 | 22.78 | 21.28 |
| | 60 | 17.89 | 19.04 | 20.00 | 19.90 | 21.86 | 19.74 | | 60 | 18.65 | 19.63 | 20.28 | 22.45 | 21.93 | 20.59 |
| RLSD 0.05 | | | | | | N.S. | 0.46 | RLSD 0.05 | | | | | | N.S. | 1.58 |
| Average spray | | 19.03 | 20.20 | 21.35 | 21.44 | 23.40 | | Average spray | | 19.46 | 20.66 | 21.14 | 22.89 | 23.68 | |
| RLSD 0.05 | | | | | | | 1.26 | RLSD 0.05 | | | | | | | 1.50 |

Table (5) shows that the hybrid treatment was significantly superior to the weight of the flower disc, as the Matsuri hybrid was significantly superior to the 2004 hybrid in both seasons. The seedling age treatment was also significantly superior with increasing seedling age in both seasons. As for the spray treatment, it was also significantly superior with increasing spray concentrations. On the weight of the main disc. Regarding the double and triple interactions, it becomes clear in the first season that the interaction between the hybrid and spraying has a significant superiority in this trait, as the Matsuri hybrid plants at a spray concentration of 20 ml $l^{-1}$ Chinese garlic excelled in the weight of the main disk, as its weight reached 910.2 grams, compared to the lowest weight of 468.4 grams for the 2004 hybrid plants at The comparison treatment for spraying, and the interaction between age and spraying had a significant increase in the weight of the main disk, as the highest weight reached 980.2 grams for plants that were 30 days old and spraying with a concentration of 20 ml $L^{-1}$ of Chinese garlic extract, and the lowest weight reached 450.0 grams for plants that were 60 days old and spraying with the comparison treatment. The interaction between hybridity, age, and the triple interaction had a significant significant effect.

As for the effect of the double and triple interactions in the second season, all of them were significant except for the interaction between the hybrid and the age, as the interaction between the hybrid and spraying had a significant effect on the weight of the main disc, as the weight of the disc reached 1017.7 grams for the Matsuri hybrid plants when sprayed with a concentration of 20 ml $l^{-1}$ garlic. Chinese. The lowest weight was 547.9 grams for hybrid plants in 2004 when sprayed with a concentration of 10 ml $liter^{-1}$ of local garlic. As for the interaction between age and spraying, its effect was significant on the same characteristic, as the highest weight of the main disc reached 1104.7 grams for 30-day-old plants when sprayed at a concentration of 20 ml $L^{-1}$, while the lowest weight was 518.7 grams for plants 60 days old when sprayed with a concentration of 10 ml $L^{-1}$. Local garlic, and the Matsuri hybrid plants at 30 days old when sprayed with a concentration of 20 ml $L^{-1}$ Chinese garlic were significantly superior, as it gave the highest weight of 1181.0 g, while the triple intervention gave the lowest weight of 462.3 g for the 2004 hybrid plant at the age of 60 days when sprayed with a concentration of 10 ml. $L^{-1}$ local garlic.

**Table (5) The effect of two broccoli hybrids, seedling age, spraying with garlic extract, and their interactions on the weight of the main disk (g) for the seasons 2021-2022 and 2022-2023.**

| The first season | | | | | | | | the second season | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hybrid | Seedling age day) ( | Spraying with garlic extract ($mL^{-1}$) | | | | | Hybrid × the age | Hybrid | Seedling age day) ( | Spraying with garlic extract ($mL^{-1}$) | | | | | Hybrid × the age |
| | | Comparison | garlic | local | garlic | Chinese | | | | Comparison | garlic | local | garlic | Chinese | |
| | | 0 | 10 | 20 | 10 | 20 | | | | 0 | 10 | 20 | 10 | 20 | |
| Matsuri | 30 | 560.3 | 640.0 | 750.0 | 890.0 | 1050.0 | 778.1 | Matsuri | 30 | 632.0 | 620.7 | 850.0 | 1010.7 | 1181.0 | 858.9 |
| | 45 | 510.0 | 591.3 | .3685 | 765.0 | 8700. | 684.3 | | 45 | 591.3 | 651.3 | 633.3 | 831.3 | 1021.0 | 745.7 |
| | 60 | 490.3 | 540.0 | 610.0 | 715.3 | 810.7 | 633.3 | | 60 | 542.7 | 575.0 | 570.0 | 928.3 | 851.0 | 693.4 |
| 2004 | 30 | 510.0 | 595.0 | 700.0 | 825.3 | 910.3 | 708.1 | 2004 | 30 | 590.0 | 640.0 | 632.0 | 883.3 | 1028.3 | 754.7 |
| | 45 | 485.3 | 531.0 | 600.0 | 651.0 | 741.3 | 601.7 | | 45 | 548.0 | 622.0 | 679.0 | 693.3 | 832.7 | 675.0 |
| | 60 | 410.0 | 485.0 | 525.0 | 610.0 | 650.3 | 536.1 | | 60 | 505.7 | 462.3 | 569.7 | 627.3 | 731.0 | 579.2 |
| RLSD 0.05 | | | | | | N.S. | N.S | RLSD 0.05 | | | | | | 31.83 | N.S |
| Average hybrid | | | | | | | Average hybrid | | | | | | | | |
| Hybrid × Spraying | Matsuri | 520.1 | 590.6 | 681.8 | 790.1 | 910.2 | 698.6 | Hybrid × Spraying | Matsuri | 588.7 | 615.7 | 684.4 | 923.4 | 1017.7 | 766.0 |
| | 2004 | 468.4 | 537.0 | 608.3 | 695.4 | 767.3 | 615.3 | | 2004 | 547.9 | 574.8 | 626.9 | 734.7 | 864.0 | 669.6 |
| RLSD 0.05 | | | | | | 30.03 | 29.91 | RLSD 0.05 | | | | | | 31.83 | 29.83 |
| middle age | | | | | | | middle age | | | | | | | | |
| the age × Spraying | 30 | 535.2 | 617.5 | 725.0 | 857.7 | 980.2 | 743.1 | the age × Spraying | 30 | 611.0 | 630.3 | 741.0 | 947.0 | 1104.7 | 806.8 |
| | 45 | 497.7 | 561.2 | 642.7 | 708.0 | 805.7 | 643.0 | | 45 | 569.7 | 636.7 | 656.2 | 762.3 | 926.8 | 710.3 |
| | 60 | 450.0 | 512.7 | 567.5 | 662.7 | 730.5 | 584.7 | | 60 | 524.2 | 518.7 | 569.8 | 777.8 | 791.0 | 636.3 |
| RLSD 0.05 | | | | | | 38.25 | 24.51 | LSD 0.05 | | | | | | 39.41 | 22.24 |
| Average spray | | 494.3 | 563.8 | 645.1 | 742.8 | 838.8 | | Average spray | | 568.3 | 595.2 | 655.7 | 829.1 | 940.8 | |
| RLSD 0.05 | | | | | | 20.44 | | RLSD 0.05 | | | | | | 22.20 | |

Table (6) shows that the Matsuri hybrid was significantly superior in yield per plant to the 2004 hybrid in both seasons. It is also clear from the same table that the seedling age was significantly superior as it increased for both seasons, and the spray treatment was also significantly superior as the concentration increased for both seasons. As for the double

and triple interactions in the first season, the table shows that the Matsuri hybrid plants that were sprayed with a concentration of 20 ml $l^{-1}$ Chinese garlic were significantly superior in yield per plant, as the highest value reached 1.039 grams, compared to the lowest value that reached 0.532 grams for the 2004 hybrid plants that were sprayed with a concentration of (0). The same table also shows that the plants that were planted at 30 days old and sprayed with a concentration of 20 ml $L^{-1}$ Chinese garlic were significantly superior, as the yield for this treatment reached 1.128 grams, compared to the lowest yield of 0.508 grams for the 60-day-old plants that were sprayed with the comparison treatment. As for the double and triple interactions for the second season, the same table showed that the Matsuri hybrid plants that were sprayed with a concentration of 20 ml $L^{-1}$ Chinese garlic were significantly superior, as the highest plant yield for this treatment reached 1.162 grams, compared to the lowest yield that reached 0.615 grams for the 2004 hybrid plants that were sprayed with a concentration of (0). The 30-day-old plants that were sprayed with a concentration of 20 ml $l^{-1}$ of Chinese garlic also excelled significantly, as they gave the highest plant yield of 1.273 grams, compared to the lowest yield of 0.579 grams for the 60-day-old plants that were sprayed with a concentration of 10 ml of local garlic. The table also shows the significant superiority of the triple intervention for the Matsuri hybrid plants that were planted at 30 days old and sprayed with a concentration of 20 ml $L^{-1}$ Chinese garlic. The highest plant yield was 1.363 g compared to the lowest yield of 0.518 g for the 2004 hybrid plants that were planted at 60 days old and sprayed with a concentration of 10 ml $L^{-1}$. 1 local garlic.

**Table (6) Effect of two broccoli hybrids, seedling age, spraying with garlic extract, and their interactions on the yield per plant (kg) for the seasons 2021-2022 and 2022-2023.**

| The first season | | | | | | | | the second season | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hybrid | Seedling age day) ( | Spraying with garlic extract ($mL^{-1}$) | | | | | Hybrid × the age | Hybrid | Seedling age day) ( | Spraying with garlic extract ($mL^{-1}$) | | | | | Hybrid × the age |
| | | Comparison | garlic | local | garlic | Chinese | | | | Comparison | garlic | local | garlic | Chinese | |
| | | 0 | 10 | 20 | 10 | 20 | | | | 0 | 10 | 20 | 10 | 20 | |
| Matsuri | 30 | 0.630 | 0.717 | 0.845 | 1.021 | 1.225 | 0.888 | Matsuri | 30 | 0.714 | 0.698 | 0.959 | 1.171 | 1.363 | 0.981 |
| | 45 | 0.579 | 0.663 | 0.768 | 0.862 | 0.981 | 0.770 | | 45 | 0.666 | 0.735 | 0.728 | 0.949 | 1.162 | 0.848 |
| | 60 | 0.551 | 0.609 | 0.685 | 0.799 | 0.910 | 0.711 | | 60 | 0.610 | 0.641 | 0.650 | 1.020 | 0.961 | 0.776 |
| 2004 | 30 | 0.578 | 0.663 | 0.785 | 0.925 | 1.030 | 0.796 | 2004 | 30 | 0.666 | 0.730 | 0.727 | 1.008 | 1.183 | 0.863 |
| | 45 | 0.553 | 0.597 | 0.677 | 0.739 | 0.840 | 0.681 | | 45 | 0.613 | 0.682 | 0.759 | 0.785 | 0.938 | 0.755 |
| | 60 | 0.465 | 0.546 | 0.594 | 0.690 | 0.745 | 0.608 | | 60 | 0.566 | 0.518 | 0.641 | 0.724 | 0.822 | 0.654 |
| RLSD 0.05 | | | | | | N.S | N.S | RLSD 0.05 | | | | | | 0.064 | N.S |
| Average hybrid | | | | | | | Average hybrid | | | | | | | | |
| Hybrid × Spraying | Matsuri | 0.586 | 0.663 | 0.766 | 0.894 | 1.039 | 0.790 | Hybrid × Spraying | Matsuri | 0.663 | 0.691 | 0.779 | 1.047 | 1.162 | 0.868 |
| | 2004 | 0.532 | 0.602 | 0.685 | 0.784 | 0.872 | 0.695 | | 2004 | 0.615 | 0.643 | 0.709 | 0.839 | 0.981 | 0.758 |
| RLSD 0.05 | | | | | | 0.030 | 0.027 | RLSD 0.05 | | | | | | 0.037 | 0.033 |
| middle age | | | | | | | middle age | | | | | | | | |
| the age | 30 | 0.604 | 0.690 | 0.815 | 0.973 | 1.128 | 0.842 | the age | 30 | 0.690 | 0.714 | 0.843 | 1.089 | 1.273 | 0.922 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| × Spraying | 45 | 0.566 | 0.630 | 0.722 | 0.801 | 0.911 | 0.726 | × Spraying | 45 | 0.640 | 0.708 | 0.744 | 0.867 | 1.050 | 0.802 |
| | 60 | 0.508 | 0.578 | 0.639 | 0.744 | 0.828 | 0.659 | | 60 | 0.588 | 0.579 | 0.646 | 0.872 | 0.892 | 0.715 |
| RLSD 0.05 | | | | | | 0.038 | 0.021 | RLSD 0.05 | | | | | | 0.045 | 0.021 |
| Average spray | | 0.559 | 0.632 | 0.725 | 0.839 | 0.955 | | Average spray | | 0.639 | 0.667 | 0.744 | 0.943 | 1.071 | |
| RLSD 0.05 | | | | | | 0.021 | | RLSD 0.05 | | | | | | 0.026 | |

It is clear from the results of tables (2, 3, 4, 5, and 6) that the Matsuri hybrid plants for both seasons are superior in vegetative growth and yield indicators compared to the 2004 hybrid plants. This may be attributed to the genetic difference between them, and the extent of their influence and response to the prevailing environmental conditions (Hassan, 2004), and is in line with That, along with Zaki et al. (2015) and Sarker et al. (2022), Al-Salhi and Mahmoud 2020, and Allela and Hamdani (2019).

The positive effect of the early seedling age (30 days) and its superiority over the rest of the ages in the study (45 and 60 days) may be due to the fact that seedlings at this age are more able to withstand the transplant shock, and are more rapid and responsive to resuming growth and renewing the root system. Which may be exposed to wounds and cuts during the transplantation process, and this has a positive effect on vegetative growth and yield indicators, such as plant height, stem diameter, number of leaves, leaf area, main disc weight, and plant yield (Matloub et al., 1989 and Hassan, 1994). These results are consistent with all From Soniya et al. (2019), Pandey et al. (2021), Pradhan and Singh (2022), and Abbas (2023).

The superiority of the spraying treatment with Chinese garlic extract in terms of vegetative growth characteristics and yield may be attributed to the fact that the extract contains amino acids with a high sulfur content, such as Cysteine and Methionine, which have a "major" role in vital processes within the plant cell, in addition to containing volatile oils. Such as Allicin, vitamins and minerals, which is why spraying with garlic extract had a significant superiority in the vegetative growth indicators under study by Saadoun et al. (2004) as shown in Appendix (4) Some chemical components and element content in the aqueous extract of garlic cloves, and this is consistent with Hammad et al. (2020) and Mahmood et al. (2021).

## REFERENCES


1. **Abbas, S.H. (2023).** Effect of Planting Dates on Stability of New Rice Genotypes Traits Grown in Iraqi Conditions . Basrah J. Agric. Sci., 36(2), 1-16.
2. **Al-Rawi, Khashi Mahmoud and Abdul Aziz Muhammad Khalaf Allah (1980).** Design and analysis of agricultural experiments. Dar Al Kutub Printing and Publishing Foundation. Universityof Al Mosul. Iraq. 488 p.
3. **Allela, W.B.M. and Hamdani, S. Y. H.(2019) .** Effect of some Agricultural Treatments on Chemical and Qualitative Characters of Five Cucumber hybrids Grown under Unheated Greenhouse . Basrah J. Agric. Sci., 32(Spec Issue): 47-58.
4. **Al-Salhi, Mariwan Ghaidan Majeed Hamid and Janour Hadi Mahmoud (2020).** The effect of planting dates and spray levels with seaweed extract on the growth characteristics and yield of two varieties of broccoli (Brassica oleracea var.italica). Kirkuk University Journal of Agricultural Sciences, Volume (11) Issue (2): 68-79.
5. **Hassan, Ahmed Abdel Moneim (1994).** Basics of vegetable production in desert lands. Arab House for Publishing and Distribution. First edition. Egypt. 280 pages.
6. **Saadoun, Saadoun Abdul Hadi; Thamer Khudair Marza and Razzaq Kazem Hassan (2004).** The effect of spraying garlic extract and licorice roots with a mixture of iron and zinc on the growth and yield of two varieties of tomatoes. Iraqi Journal of Agricultural Sciences, 35(1): 35-40.
7. **Hassan, Ahmed Abdel Moneim (2004).** Plant breeding series. General principles of plant breeding. Arab House for Publishing and Distribution. faculty of Agriculture. Cairo University. Egypt.
8. **Hammad, Hamid Saleh; Zeina Hazbar Khazal and Khaled Ibrahim Mustaf (2020).** The effect of spraying with liquid sulfur (Zolfast) and garlic extract on the growth and production of cauliflower. Diyala Journal of Agricultural Sciences, 12(4): 503-513.
9. **Mahmood, A. K.; Samal J. Omar, S. J. and Halshoy, H. S. (2021).** The impact of (alga mix) seaweed and garlic extraction on growth and yield of cauliflower. Euphrates Journal of Agriculture Science,13 (3):9-15.
10. **Mahmood, A. K.; Samal J. Omar, S. J. and Halshoy, H. S. (2021).** The impact of (alga mix) seaweed and garlic extraction on growth and yield of cauliflower. Euphrates Journal of Agriculture Science,13 (3):9-15.
11. **Pandey, S.; Chaurasiya, P. C. and Gayen, R. (2021).** Effect of genotypes and planting dates of broccoli on growth, stalk length and yield attributes. International Journal of Chemical Studies, 9(1): 2985-2988.

12. **Pradhan, A. and Singh, A. (2022).** Response of organic manure and age of seedling on growth and yield of broccoli (Brassica oleracea var. italica) cv. Besty. The Pharma Innovation Journal, 11(8): 2014-2016.
13. **Sarker, M.; Islam, M.d. S.; Biswojit, D.; Dwipok, D.N.; Jannatul, F. and Masuma, Z. A. (2022).** Effect of sowing dates and varieties on growth and yield of broccoli under acidic soil condition of Sylhet. Annual Research & Review in Biology, 37(10): 111-118.
14. **Soniya, I. A.; Tahmina Mostarin, T.; Khatun, K.; Ehsanul Haq, M. D.; Akhter, S.; Sharmin, I.; Monira, S. and Parvin, A. (2019).** Effect of starter solution and age of seedling on growth and yield of broccoli (Brassica Oleracea var. Italica). Asian Journal of Research in Crop Science, 4(4): 1-11.
15. **Zaki, M.F.; Saleh, S.A.; Tantawy, A.S. and El-Dewiny, C.Y. (2015).** Effect of different rates of potassium fertilizer on the growth, productivity and quality of some broccoli cultivars under new reclaimed soil conditions. International Journal of ChemTech Research, 8(12):28-39.
16. **Wanted, Adnan Nasser; Ezz El-Din Sultan Mohammed and Karim Saleh Abdul (1989).** Vegetable production, second revised edition. Ministry of Higher Education and Scientific Research. University of Al Mosul. The Republic of Iraq. 336 p.