*Egypt. J. Agron.* **Vol. 47**, No. 1, pp: 107 - 114 (2025)

# Egyptian Journal of Agronomy
**http://agro.journals.ekb.eg/**

## Using Vitamin E under Various Irrigation Systems to Lessen the Impact of Salty Irrigation on the Physiological Response of Sweet Corn Plants

**Hamza A. E.**[1], **Heba S. El-Batran**[1], **Yasmine H. Abd Elmohsen**[1], **Abd El-Rheem Kh. M.**[2*], **Mona E. El-Azab**[2] and **Entsar M. Essa**[3]

[1]*Vegetable Research Dept., National Research Centre, Dokki, Giza, Egypt*
[2]*Soils and Water Use Dept., National Research Centre, Dokki, Giza, Egypt*
[3]*Plant Nutrition Dept., National Research Centre, Dokki, Giza, Egypt*

A FIELD experiment was conducted to study the effects of different two irrigation systems (Sprinkler and Dripping) complemented by foliar application of vitamin E (0, 50, 100, 200 and 250 mg l-1) on growth, yield and nutritional status of sweet corn plant (Zea mays L. cv Dorado) under saline water irrigation, at the Agricultural Production and Research Station, National Research Centre (NRC), Nubaria Province, Egypt during two successive summer seasons 2023 and 2024**.** The results indicate that drip irrigation has higher growth and yield coordinates as well as nutritional status compared to sprinkler irrigation system during the two successive growing seasons. Under saline irrigation conditions, spraying vitamin E at a rate of 200 mg l-1 with drip irrigation significantly improved growth parameters, yield and nutritional status of sweet corn plants during two successive growing seasons. We can say that spraying vitamin E on sugar corn plants grown in sandy soil and irrigated with salty water can be one of the safe ways to reduce the effect of salinity on the growth and productivity of plants. Also, the drip irrigation method is the most suitable irrigation method when using salty water for irrigation.

**Keywords:** Vitamin E, Irrigation systems, Sweet corn, Productivity.

### Introduction

One of the primary staple cereal crops, maize (*Zea mays* L.) has a wide range of biological and environmental benefits. According to (Amal *et al*., 2016), sandy soils with little organic matter, elevated pH, and poor fertility boosted maize output. A hybrid of the maize plant, sweet corn (Moench) has increased levels of sugar, calcium in the kernel, and other minerals. Furthermore, sweet corn is farmed for its ethanol production, fodder; sugar, grain, and fiber, making it the fifth most cultivated cereal crop globally (Yuan *et al*., 2008).

With the significant increase in the population and the increase in demand for plant food , the problem of salinity has become one of the main problems that stand in the way of the development of agricultural production due to its direct negative effects (toxicity and osmosis ) on the plant, as well as the imbalance of nutrients and indirect effects on the physical and chemical qualities of the soil With the significant increase in the population and the increase in demand for plant food (AL Zubaidi, 1989). In his research, Khalil (2004) noted how the growth of Narang seedlings with salt levels of 2, 4, and 6 dS $m^{-1}$ was impacted by the salinity of irrigation water, soil moisture content, and soil texture. The dry weight of the leaves of Narang seedlings decreased as the salt of the irrigation water increased.

All plants produce vitamin E, a lipophilic antioxidant. In addition to stabilizing membranes that scavenge and quench several reactive oxygen species and lipid-soluble byproducts of oxidative stress, vitamin E interacts with the polyunsaturated acyl groups of lipids (Cvetkovska et al., 2005 and Noctor, 2006). Plants primarily contain vitamin E in their chloroplasts, which is crucial for safeguarding the cell membrane and other constituents. It helps move electrons and controls a variety of physiological processes, such as the growth and development of plants, aging, and the prevention of oxidation of fats and saturated fatty acids (Saltter *et al*., 2004 & Baffel and Ibrahim 2008). A non-enzymatic antioxidant, vitamin E helps plants grow and produce more, especially when they are under stress (Soltani *et al*., 2012). Vitamin E foliar spraying enhanced growth and stress tolerance and raised its concentration in plant (Muhammad *et al*., 2019).

*Corresponding author email: dr.khaledrheem75@gmail.com
Received 17/12/2024; Accepted 23/3/2025
DOI: 10.21608/AGRO.2025.344965.1584

The aim of the paper was to study the effect of spraying with vitamin E on the growth, yield and nutritional status of sweet corn plants irrigated with saline water using two different types of irrigation methods during two consecutive growing seasons.

## Materials and Methods

During the two consecutive summer seasons of 2023 and 2024, two field experiments were conducted at the Agricultural Production and Research Station, National Research Centre, Nubaria Province, Behaira Governorate, Egypt. We purchased Dorado seeds of sweet corn (*Zea mays* L.) from the Ministry of Agriculture. The seeds were planted on May 9$^{th}$, 2023, and May 13$^{th}$, 2024, respectively. Particle size distributions, soil wetness, and the physical and chemical characteristics of El-Nubaria soil samples were all assessed in accordance with Blackmore's (1972) description. As per Black *et al*., (1982), measurements were made of the soil's pH, EC, cations and anions, organic matter, CaCO3, and the amounts of accessible N, P, K, Fe, Zn, and Mn. The experiment's soil was recently reclaimed and had a sandy texture. Table (1) describes the physical and chemical examination of the experiment soil, while Table (2) details the irrigation water analysis.

The study used a split plot experimental design with three replications, with foliar treatments of vitamin E (0,50,100,200, and 250 mgl$^{-1}$) applied twice during the vegetative growth stage (45 and 60 days after sowing) in the subplots and sprinkler and drip irrigation systems in the main plots. Six ridges, each measuring five meters in length and seventy centimeters in breadth, made up the 21 m2 (5*4.20) plot. Prior to planting, 150 kg of calcium superphosphate (15.5% $P_2O_5$/fed) phosphorus fertilizer was added. Following 75 days of seeding, plant samples were collected in order to measure the following growth characteristics: plant height (cm), dry weight of leaves and stem (g), and leaf area (cm$^2$) in accordance with (Radford, 1967). Ten guarded plants were randomly selected in the center of each plot during harvest in order to determine yield characteristics such as grain yield (ton fed$^{-1}$), weight of grain/plot (kg), and ear length and diameter (cm).

Total carbohydrate Determination of total carbohydrates was carried out according Herbert *et al*., (1971). Polysaccharides were determined according to Naguib (1963). Proline was assayed according to the method described by Bates *et al*., (1973). In sweet corn leaves, macronutrients (N, P, K) were determined according to Cottenie *et al.*, (1982).

Data were statistically analyzed with the help of MSTAT-C program to find out the statistical significance of the experimental results separately for each year of the experiment. The mean values of all parameters were separated by Duncan's multiple range test at 5% probability.

**Table 1. Some physical and chemical properties of the experimental soil at the beginning of the experiment.**

| Soil properties | | Values | |
|---|---|---|---|
| | | 2023 | 2024 |
| Particle size distribution(%) | Sand | 93.32 | 94.0 |
| | Silt | 4.68 | 3.56 |
| | Clay | 2.00 | 2.44 |
| | Texture | Sandy soil | Sandy soil |
| $CaCO_3$ (%) | | 2.20 | 2.22 |
| $pH_{(1:2.5\ soil\ suspension)}$ | | 8.22 | 8.21 |
| EC (dS m$^{-1}$) | | 1.81 | 1.92 |
| Soluble caions (mmol L$^{-1}$) | $Ca^{++}$ | 7.11 | 7.96 |
| | $Mg^{++}$ | 2.00 | 3.16 |
| | $Na^{+}$ | 6.04 | 6.40 |
| | $K^{+}$ | 2.95 | 1.68 |
| Soluble anions (mmol L$^{-1}$) | $CO_3^{--}$ | - | - |
| | $HCO_3^{-}$ | 1.52 | 1.52 |
| | $Cl^{-}$ | 8.33 | 7.82 |
| | $SO_4^{--}$ | 8.28 | 9.86 |
| Available nutrients mg kg$^{-1}$ | N | 26.2 | 28.3 |
| | P | 2.02 | 2.15 |
| | K | 71.6 | 69.8 |
| | Fe | 3.11 | 3.25 |
| | Mn | 0.95 | 1.01 |
| | Zn | 1.22 | 1.21 |

**Table 2. Some chemical analyses of irrigation water.**

| pH | EC dS m$^{-1}$ | Soluble cation meq. L$^{-1}$ | | | | Soluble anions | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Ca | Mg | Na | K | $CO_3$ | $HCO_3$ | Cl | $SO_4$ |
| 7.10 | 2.69 | 7.45 | 3.81 | 15.2 | 0.44 | nd. | 5.20 | 14.6 | 7.10 |

## Results and Discussion

The effects of various vitamin E concentrations on the growth characteristics of sweet corn that was irrigated with salty water using two irrigation systems (dipping and sprinkler) throughout two consecutive seasons were described by the data in Table (3). Compared to sprinkler irrigation, dripping irrigation produced noticeably higher plants. This might be because dripping irrigation improves water distribution and lowers evaporation-related water loss. Additionally, dripping irrigation increased leaf area, which is essential for photosynthesis and plant growth in general. With dripping irrigation, the dry weight of the leaves and stems increased noticeably. This suggests a rise in the production of biomass. Applying vitamin E greatly enhanced the height of the plants. This may be explained by its antioxidant properties, which shield plant cells from oxidative damage. Larger leaf area was also encouraged by vitamin E, most likely as a result of its effects on cell proliferation and division. When vitamin E was applied, the dry weight of the leaves and stems increased noticeably. This implies improved absorption and use of nutrients. Vitamin E at 200 mg/l and dripping irrigation produced the greatest results for every growth metric. This suggests that these two treatments work in concert. Vitamin E promotes plant growth and stress tolerance, while dripping irrigation offers the best possible supply of water and nutrients.

These outcomes could be attributed to the fact that the drip irrigation system, which was utilized daily, kept the soil water around the roots. These findings on various plant species were validated by Ibrahim and El-Hosary (1992), Khattab *et al*., (2016). By creating a wetting front, drip irrigation optimizes the growth circumstances by lowering the salt surrounding the root. The cost of maintaining crop production with salt water varies depending on the economics, societal preferences, and resource availability Gaurav (2016). Vitamin E have been found to promote greater absorption of ions, improved transfer of ions, and heightened metabolic activities. As a result, there is a rise in the processes involved in carbon building, leading to enhanced growth of plants. Consequently, plants that have been treated with vitamins exhibit a high plant growth (Ali and Hussein, 2019). Our findings are consistent with those of Abdou *et al*., (2019), Ayyat *et al*., (2021), Lalarukh and Shahbaz (2020), and Abdou and Badr (2022). Limited supplies of saline irrigation water present difficulties for farmers in freshly reclaimed lands. This is because vitamin E has been demonstrated to positively affect the chemical composition and vegetative growth of economically significant plants (Soltani *et al*., 2012; Ali and Hussein, 2019 and Sadiq *et al*., 2019).

In sweet corn grown on sandy soil with saline irrigation over two seasons, the data in Table (4) detailed the effects of irrigation techniques and vitamin E foliar spray on the levels of polysaccharides, carbohydtates and proline. When compared to sprinkler irrigation, dripping irrigation consistently produced larger quantities of proline, total carbohydrate, and polysaccharides. There was statistical significance in these differences. Better water distribution and less water stress may be the cause of this, which would improve photosynthesis and the synthesis of carbohydrates. Additionally, increased proline content a crucial osmoprotectant that aids plants in overcoming stress was encouraged by dripping irrigation. The use of vitamin E dramatically raised total carbs and polysaccharides. This implies that vitamin E can improve the metabolism of carbohydrates and photosynthesis. Proline content rose as well, suggesting that vitamin E plays a part in stress tolerance. The highest values for every measure were obtained when dripping irrigation and 200 mg/l of vitamin E were combined. In order to maximize crop output and quality, it is crucial to optimize both irrigation and nutrient management, as this synergistic impact emphasizes.

According to Sadak *et al*., (2010), vitamin E treatment of sunflower increased total carbohydrates, stimulated protein synthesis, and postponed the senescence of the plant. Furthermore, by increasing the amount of certain bioregulators or by stimulating the synthesis of carbohydrates, vitamin E treatments enhanced the accumulation of total soluble sugars in sweet corn (Rady *et al*., 2011). Badr *et al*., (2021) studied the relationship between two types of irrigation methods (sprinkler and drip) on the content of proline, polysaccharides and total carbohydrates in sweet corn. They found that the best irrigation method is drip irrigation, which gave the highest values for the aforementioned traits.

The production characteristics of sweet corn planted in sandy soil over two seasons were impacted by the irrigation method and vitamin E foliar spray, as indicated by the data in Table (5). Dripping irrigation resulted in ears that were longer and wider than sprinkler irrigation. This could be due to improved water distribution and reduced water stress, which would encourage the development of the ears. Dripping irrigation also improved grain weight per plot and overall grain production. This implies increased grain filling and yield. Applying vitamin E greatly enlarged the width and length of the ears. This implies that vitamin E can improve the size and growth of the ears. Additionally, vitamin E raised grain production and weight per plot, suggesting better grain filling and greater productivity. The highest values for all yield parameters were obtained when dripping irrigation and 200 mg/l of vitamin E were combined. This synergistic effect emphasizes how crucial it is to maximize sweet corn output by optimizing both irrigation and nutrient management.

These results are consistent with those of Abdelaziz *et al*., (2018) and Colaizzi (2004). Drip irrigation may have contributed to these gains in various examined yields and their characteristics by maintaining the water contents around the root system in the root zone around field capacity and preventing water shortages, particularly during the reproduction stage. As a result, the increased water availability may improve photosynthetic metabolic transport from leaves to seeds as well as mineral absorption. As a result, grain yield and its characteristics benefit from the available soil moisture, and vice versa. These findings are consistent with those of Khattab *et al*., (2016), El-Nagar (2003), and Ragheb *et al*., (2000). According to Panel *et al*., (2006), sweet corn was more likely than maize to take water from deeper soil layers. According to Abdul Latif et al., (2015), the particular irrigation management that produced a radial distribution pattern and effective nutrient fertigation in the wetted soil volume where the majority of the roots are connected near the emitter or along each lateral line was responsible for the increase in sunflower yield from drip irrigation. According to El-Bassiouny et al., (2005), applying a vitamin E foliar spray to faba bean plants increased their growth metrics, yield components, and levels of carotenoids, chlorophyll a, and b. Similarly, phytoregulator chemicals (Vitamin E) have been proposed to improve and withstand the negative impacts of biotic and abiotic stressors, including salt and moisture stress, on plant growth and yield (Demiral and Turkan 2005 and Raga Babo *et al*., 2005).

Over the course of two seasons, the data in Table, 5 demonstrated the effects of the irrigation system and vitamin E foliar spray on the levels of N, P, and K in the leaves of sweet corn planted in sandy soil. Dripping irrigation consistently resulted in higher levels of potassium (K), phosphorus (P), and nitrogen (N) in sweet corn leaves compared to spray irrigation. These differences were statistically significant. Applying vitamin E considerably raised the amount of N, P, and K in leaves. This implies that vitamin E may improve the absorption and assimilation of nutrients. The highest values for every nutrient parameter were obtained when dripping irrigation and 200 mg/l of vitamin E were combined. The combination of dripping irrigation and Vitamin E at 200 mg/l yielded the highest values for all nutrient parameters. This synergistic effect highlights the importance of optimizing both irrigation and nutrient management for maximizing nutrient uptake and crop quality.

In comparison to ring basin irrigation, Bandyopadhyay *et al*, (2019) found that drip fertigation can boost crop P absorption and coconut water consumption efficiency by 3.2 times. The higher uptake may be credited to drip application of irrigation below the soil's infiltration capacity throughout the crop growth period causing preferential uptake of nutrients (Kalita *et al*., 2022).

**Table 3. Effect of irrigation system and vitamin E foliar spray on growth parameters of sweet corn.**

| Treatments | Plant height (cm) | Leaf area ($cm^2$) | Dry weight (g) | | Plant height (cm) | Leaf area ($cm^2$) | Dry weight (g) | |
|---|---|---|---|---|---|---|---|---|
| | | | Leaves | Stem | | | Leaves | Stem |
| | First season | | | | Second season | | | |
| Irrigation system | | | | | | | | |
| Sprinkler | 92.3 | 196.1 | 13.6 | 33.5 | 93.1 | 196.0 | 13.7 | 33.4 |
| Dripping | 101.2 | 201.8 | 17.0 | 37.6 | 101.8 | 201.7 | 17.1 | 37.6 |
| LSD $_{0.05}$ | 2.33 | 3.41 | 1.64 | 1.40 | 2.32 | 3.41 | 1.63 | 1.40 |
| Vitamin E (mg $l^{-1}$) | | | | | | | | |
| 0 | 93.2 | 195.6 | 16.8 | 30.7 | 93.3 | 195.7 | 16.6 | 31.0 |
| 50 | 94.5 | 214.9 | 17.9 | 31.8 | 94.6 | 214.5 | 17.8 | 31.8 |
| 100 | 99.2 | 216.8 | 18.6 | 36.0 | 99.0 | 216.6 | 18.5 | 36.1 |
| 200 | 103.1 | 219.1 | 19.1 | 40.0 | 103.2 | 219.0 | 19.0 | 39.9 |
| 250 | 103.0 | 218.9 | 19.0 | 39.8 | 103.0 | 218.8 | 19.0 | 39.8 |
| LSD $_{0.05}$ | 3.30 | 6.10 | 2.03 | 1.88 | 3.31 | 6.12 | 2.02 | 1.90 |
| Irrigation system × Vitamin E | | | | | | | | |
| Sprinkler | | | | | | | | |
| 0 | 95.6 | 185.7 | 14.2 | 30.6 | 96.5 | 186.0 | 14.3 | 30.5 |
| 50 | 96.4 | 190.1 | 15.6 | 31.5 | 96.6 | 190.0 | 15.7 | 31.5 |
| 100 | 99.2 | 196.2 | 18.8 | 34.1 | 99.3 | 196.3 | 18.6 | 34.2 |
| 200 | 100.5 | 214.5 | 19.6 | 36.2 | 100.4 | 214.5 | 19.6 | 36.2 |
| 250 | 100.3 | 214.3 | 19.2 | 36.0 | 100.1 | 214.1 | 19.3 | 36.1 |
| Dripping | | | | | | | | |
| 0 | 99.7 | 199.1 | 22.1 | 30.9 | 99.6 | 198.8 | 22.0 | 30.8 |
| 50 | 100.8 | 209.8 | 23.4 | 32.3 | 100.6 | 209.5 | 23.3 | 32.2 |
| 100 | 107.6 | 222.2 | 24.1 | 37.8 | 107.5 | 221.8 | 24.0 | 37.8 |
| 200 | 110.3 | 238.6 | 25.6 | 42.2 | 110.1 | 236.1 | 25.5 | 42.3 |
| 250 | 109.1 | 237.5 | 24.9 | 41.8 | 109.8 | 236.0 | 24.8 | 41.8 |
| LSD $_{0.05}$ | 3.66 | 8.60 | 2.90 | 2.65 | 3.66 | 8.61 | 2.90 | 2.66 |

**Table 4. Effect of irrigation system and vitamin E foliar spray on polysaccharides, total carbohydrate and proline content on sweet corn plant.**

| Treatment | Carbohydrates mg/g DW | Polysaccharides mg/100 g DW | Proline mg/100 g DW | Carbohydrates mg/g DW | Polysaccharides mg/100 g DW | Proline mg/100 g DW |
|---|---|---|---|---|---|---|
| | | First season | | | Second season | |
| Irrigation system | | | | | | |
| Sprinkler | 311.2 | 281.4 | 12.73 | 312.1 | 280.3 | 12.74 |
| Dripping | 316.2 | 280.1 | 13.88 | 316.3 | 280.2 | 13.90 |
| LSD $_{0.05}$ | 1.88 | 0.81 | 0.56 | 1.86 | 0.81 | 1.86 |
| Vitamin E (mg $l^{-1}$) | | | | | | |
| 0 | 298.4 | 270.1 | 11.42 | 298.3 | 270.0 | 11.43 |
| 50 | 300.3 | 277.1 | 12.11 | 300.1 | 277.2 | 12.12 |
| 100 | 314.2 | 288.2 | 13.43 | 313.5 | 289.0 | 13.41 |
| 200 | 332.1 | 303.4 | 15.21 | 332.0 | 303.1 | 15.22 |
| 250 | 331.4 | 299.5 | 14.95 | 331.3 | 298.2 | 14.94 |
| LSD $_{0.05}$ | 1.88 | 4.41 | 0.15 | 1.88 | 4.40 | 0.15 |
| Irrigation system × Vitamin E | | | | | | |
| Sprinkler | | | | | | |
| 0 | 296.6 | 266.6 | 10.88 | 296.5 | 267.5 | 10.90 |
| 50 | 299.5 | 271.1 | 11.20 | 298.4 | 272.2 | 11.23 |
| 100 | 312.7 | 284.4 | 13.06 | 312.6 | 284.5 | 13.10 |
| 200 | 325.2 | 298.2 | 14.00 | 325.2 | 299.1 | 14.01 |
| 250 | 324.8 | 297.5 | 13.98 | 324.8 | 297.5 | 14.00 |
| Dripping | | | | | | |
| 0 | 300.1 | 271.5 | 11.92 | 300.0 | 271.5 | 11.91 |
| 50 | 306.2 | 280.2 | 12.00 | 305.6 | 280.3 | 12.01 |
| 100 | 317.8 | 290.2 | 13.61 | 317.8 | 291.3 | 13.61 |
| 200 | 333.4 | 305.1 | 16.32 | 333.5 | 306.1 | 16.33 |
| 250 | 329.2 | 305.0 | 16.11 | 329.3 | 305.5 | 16.12 |
| LSD $_{0.05}$ | 4.66 | 2.47 | 0.21 | 4.70 | 2.50 | 0.22 |

**Table 5. Effect of irrigation system and vitamin E foliar spray on yield parameters of sweet corn.**

| Treatments | Ear length cm | Ear diameter | Wight of grain/plot kg | Grain Yield ton $fed^{-1}$ | Ear length cm | Ear diameter | Wight of grain/plot kg | Grain Yield ton $fed^{-1}$ |
|---|---|---|---|---|---|---|---|---|
| | | First season | | | | Second season | | |
| Irrigation system | | | | | | | | |
| Sprinkler | 20.2 | 13.2 | 3.61 | 0.72 | 20.1 | 13.3 | 3.60 | 0.72 |
| Dripping | 22.3 | 13.8 | 4.33 | 0.87 | 22.3 | 13.7 | 4.32 | 0.86 |
| LSD $_{0.05}$ | 0.47 | 0.11 | 0.50 | 0.01 | 0.47 | 0.11 | 0.50 | 0.01 |
| Vitamin E (mg $l^{-1}$) | | | | | | | | |
| 0 | 20.0 | 13.7 | 4.52 | 0.90 | 20.1 | 13.6 | 4.51 | 0.90 |
| 50 | 20.8 | 14.0 | 5.00 | 1.00 | 20.7 | 14.1 | 5.00 | 1.00 |
| 100 | 21.4 | 14.2 | 5.56 | 1.11 | 21.3 | 14.1 | 5.55 | 1.11 |
| 200 | 23.5 | 15.0 | 6.41 | 1.28 | 23.5 | 15.1 | 6.40 | 1.28 |
| 250 | 22.1 | 14.5 | 5.90 | 1.18 | 22.0 | 14.4 | 5.91 | 1.18 |
| LSD $_{0.05}$ | 1.25 | 0.45 | 0.45 | 0.11 | 1.24 | 0.44 | 0.45 | 0.11 |
| Irrigation system × Vitamin E | | | | | | | | |
| Sprinkler | | | | | | | | |
| 0 | 21.3 | 13.6 | 4.60 | 0.92 | 21.2 | 13.5 | 4.61 | 0.92 |
| 50 | 22.0 | 13.9 | 5.22 | 1.04 | 22.0 | 13.8 | 5.21 | 1.04 |
| 100 | 23.1 | 14.2 | 6.44 | 1.29 | 23.1 | 14.3 | 6.44 | 1.29 |
| 200 | 24.5 | 14.8 | 7.56 | 1.51 | 24.6 | 14.6 | 7.55 | 1.51 |
| 250 | 23.8 | 14.3 | 6.61 | 1.32 | 23.7 | 14.3 | 6.60 | 1.32 |
| Dripping | | | | | | | | |
| 0 | 21.8 | 13.8 | 4.82 | 0.96 | 21.7 | 13.7 | 4.81 | 0.96 |
| 50 | 22.5 | 14.1 | 5.62 | 1.12 | 22.4 | 14.0 | 5.61 | 1.12 |
| 100 | 24.0 | 14.4 | 7.11 | 1.42 | 24.1 | 14.5 | 7.12 | 1.42 |
| 200 | 24.8 | 15.2 | 8.85 | 1.77 | 24.8 | 15.3 | 8.84 | 1.77 |
| 250 | 23.9 | 14.4 | 7.25 | 1.45 | 23.8 | 14.8 | 7.24 | 1.45 |
| LSD $_{0.05}$ | 0.80 | 0.25 | 0.92 | 0.25 | 0.79 | 0.25 | 0.91 | 0.25 |

**Table 6. Effect of irrigation system and vitamin E foliar spray on N, P and K content of leaves sweet corn plant.**

| Treatment | N | P | K | N | P | K |
|---|---|---|---|---|---|---|
| | | % | | | % | |
| | | First season | | | Second season | |
| Irrigation system | | | | | | |
| Sprinkler | 1.52 | 0.14 | 1.39 | 1.51 | 0.14 | 1.38 |
| Dripping | 1.53 | 0.15 | 1.41 | 1.53 | 0.15 | 1.40 |
| $LSD_{0.05}$ | 0.01 | 0.02 | 0.10 | 0.01 | 0.02 | 0.10 |
| Vitamin E (mg $l^{-1}$) | | | | | | |
| 0 | 1.76 | 0.16 | 1.46 | 1.77 | 0.16 | 1.45 |
| 50 | 1.82 | 0.17 | 1.48 | 1.82 | 0.17 | 1.49 |
| 100 | 1.91 | 0.18 | 1.56 | 1.90 | 0.19 | 1.55 |
| 200 | 2.05 | 0.20 | 1.75 | 2.04 | 0.21 | 1.75 |
| 250 | 2.00 | 0.19 | 1.74 | 2.01 | 0.19 | 1.74 |
| $LSD_{0.05}$ | 0.13 | 0.12 | 0.20 | 0.12 | 0.12 | 0.20 |
| Irrigation system × Vitamin E | | | | | | |
| Sprinkler | | | | | | |
| 0 | 1.80 | 0.18 | 1.55 | 1.81 | 0.18 | 1.57 |
| 50 | 1.91 | 0.19 | 1.68 | 1.90 | 0.19 | 1.69 |
| 100 | 2.11 | 0.21 | 1.82 | 2.10 | 0.22 | 1.82 |
| 200 | 2.43 | 0.26 | 2.04 | 2.44 | 0.27 | 2.06 |
| 250 | 2.13 | 0.26 | 2.00 | 2.12 | 0.26 | 2.00 |
| Dripping | | | | | | |
| 0 | 1.85 | 0.19 | 1.61 | 1.85 | 0.19 | 1.63 |
| 50 | 1.95 | 0.22 | 1.80 | 1.94 | 0.21 | 1.81 |
| 100 | 2.18 | 0.24 | 2.11 | 2.17 | 0.24 | 2.14 |
| 200 | 2.66 | 0.30 | 2.34 | 2.65 | 0.32 | 2.35 |
| 250 | 2.15 | 0.28 | 2.29 | 2.16 | 0.29 | 2.30 |
| $LSD_{0.05}$ | 0.55 | 0.61 | 0.23 | 0.56 | 0.62 | 0.24 |

By altering the metabolism of photosynthesis, which raised the nitrogen content, foliar application of vitamin E treatments may have a significant impact on a number of physiological and metabolic processes (Marzauk *et al*., 2014). In comparison to the control treatments, Shafeek *et al*., (2013) found that foliar spraying vitamin E considerably raised the proportion of nitrogen and protein contents in lettuce leaf tissue.

### Conclusion

All things considered, this study offers insightful information about how vitamin E and irrigation techniques affect sweet corn yield metrics under saline water irrigation. According to the results, dripping irrigation with foliar spray of vitamin E (200 mg $l^{-1}$) can greatly increase crop production, productivity and nutritional status.

### Consent for publication

All authors declare their consent for publication.

### Author contribution

The manuscript was edited and revised by all authors.

### Conflicts of Interest

The author declares no conflict of interest.

### References


Abdou, M.A.H., Badr, M. (2022) Influence of some natural substances on caraway plants. *Minia Journal of Agricultural Research and Development* **42**, 19-32.

Abdou. M.A.H., El-Sayed, A.A., Taha, R.A., Ahmed, S.K., El-Nady, M.K. (2019) Response of cumin plant to some organic, biofertilization and antioxidant treatments I. vegetative growth and fruits yield. *Scientific Journal of Flowers and Ornamental Plants* **6**, 81-88.

Abdul Latif, Q., Mumtaz, A. G., Ali, A. M., Nisar, A. M., Soomro A., Aneela, H.M. (2015) Effect of Drip and Furrow Irrigation Systems on Sunflower Yield and Water Use Efficiency in Dry Area of Pakistan. *American-Eurasian J. Agric. & Environ. Sci*. **15**, 1947-1952.

Abdelaziz, N.M., Islam, A., Mesbah, A.O., Garcia, Y., Garcia, A. (2018) Effect of irrigation and nitrogen fertilization strategies on silage corn grown in semi-arid conditions. *Agronomy* **8**,208.

Ali, B.A.A., Hussein, J.K. (2019). Effect of some antioxidants on the growth of Senna coffee plant (*Cassia occidentalis*) growing under the influence of salt stress. *Euphrates Journal of Agricultural Science* **11**, 1-12.

AL Zubaidi, A. H. (1989) Salinity of the soil. Theoretical and applied foundations. Ministry of higher education and scientific research. University of Baghdad. The House of wisdom

Amal, G., Nabila, A., Zaki. M., Hassanein, M.S., Sh, G., Tawifk, M.M. (2016) Influence of nitrogen fertilizer sources on yield and its components of some maize varieties. *RJPBCS* **7**,1005.

Ayyat, A.M., Kenawy, A.G.M., Aboel-Ainin, M.A., Abdel-Mola, M.A.M. (2021) Improving growth, productivity and oil yield of *Nigella sativa*, L. plants by foliar spraying with some stimulants. *Journal of Plant Production* **12**, 339-344.

Bandyopadhyay, A., Ghosh, D. K., Biswas, B., Parameswarappa, M. H., Timsina, J. (2019) Fertigation Effects on Productivity, and Soil and Plant Nutrition of Coconut (*Cocos nucifera* L.) in the Eastern Indo-Gangetic Plains of South Asia. *International Journal of Fruit Science* **19**, 57-74.

Baffel, S.O., M.M.Ibrahim (2008) Antioxidants and accumulation of a- tocopherol induce chilling tolerance in Medicago sativa. *Int.J.Agric.Biol.***10**,593-598.

Bates, L.S., Waldan R.P., Teare, L.D. (1973) Rapid determination of free proline under water stress studies. *Plant Soil* **39**,205–207.

Black, C.A., Evans, D.D., Ensminger, L.E., White, G.L., Clarck, F.E. (1982) Methods of soil analysis, Part 2.Agron. Inc. Madison wise.

Blackmore, A.D., Davis, T.D., Jolly, D., R.H. Walser (1972) Methods of chemical analysis of soils. Newzealand. Soil Dureau. P A2.1, Dep. No. 10

Colaizzi, P.D.A.D., Schneider S.R., Evett, T.A. (2004) Howell comparison of sdi,lepa, and spray irrigation performance for grain sorghum. *A.S.A.E.* **47**,1477–1492.

Cotteine, A., Verloo, M., Kiekens, L., Velgh G., Camerlynck, R. (1982) Chemica; Analysis of plants and soils. pp: 44-45. State Univ. Ghent Belgium, 63.

Cvetkovska, M., Rampitsch C., Bykova N., Xing, T. (2005) Genomic analysis of MAP kinase cascades in Arabidopsis defense responses. *Plant Mol Biol Rep*., **23**:331-343.

Demiral, T., I. Turkan (2005) Comparative lipid peroxidation antioxidant defense systems and proline content in roots of two rice cultivars in salt tolerance. *Envir. And Exper. Bot*. **53**, 247-257.

El-Bassiony, M.S., Gobarah, M.E., Ramadan A.A. (2005) Effect of antioxidants on growth, yield and favism caustive agents in seeds of *vicia faba* L. plants grown under reclaimed sandy soil. *J. of Agron*. **4**, 281 - 287.

Elham, A. Badr, Mervat, S. S., Gehan S. B. and Howida H. A. K. (2021) Physiological response of sweet corn (*Zea mays* Ls.) grown under sandy soil to α- tocopherol treatments and different irrigation systems. *Bull. Natl. Res. Cent*. **45**, 1-10.

El–Nagar, G. R. (2003) Integrating of mineral and bio–fixed nitrogen fertilization in maize production under different irrigation regimes. *Assiut J. Agric. Sci.* **34**, 53–76.

Gaurav, J. (2016) A review on drip irrigation using saline irrigation water in potato (*Solanum tuberosum L.*). *Journal of Agroecology and Natural Resource Management* **3**, 43-46.

Herbert D., Phipps P.J., Strange, R.E. (1971) Chemical analysis of microbial cells. Methods Microbiol **5B**,209–344.

Ibrahim, M.E., El-Hosary, H.M. (1992) Effect of irrigation intervals and plant density on some varieties of corn. *Menufiya J. Agric. Res*., **17**, 1083–1093.

Kalita P. , Thakuria, R.K., Deka, B., Choudhary H. (2022) Effect of varying drip irrigation levels and NPK fertigation on nutrient uptake, root characteristics, physiological behaviour and head quality of broccoli (*Brassica oleracea* var. italica) in warm humid climatic condition of Assam. *The Pharma Innovation Journal*, **SP-11**, 563-569.

Khalil, N. H. (2004) The influence of the salinity of irrigation water, the moisture level of the soil and its texture on the growth of seedlings of Naring (*Citrus aurantium* L.) Master's thesis.Faculty of Agriculture. University of Baghdad.

Khattab, E.A., Afifi, M.H., Badr, E.A., Gehan, A.A. (2016) The productivity of some varieties of lentil under irrigation intervals in conditions of Sinai. *Int. J. Chem. Tech. Res.,* **9**, 77–81.

Lalarukh, I. and Shahbaz, M. (2020) Response of antioxidants and lipid peroxidation to exogenous application of alpha-tocopherol in sunflower (*Helianthus annuus* L.) under salt stress. *Pak. J. Bot*. 52, 75-83.

Muhammad, S., Nudrat, A. Akram, M. A., F. Al Qurainy, Parvaiz A. (2019) Alpha-Tocopherol-Induced Regulation of Growth and Metabolism in Plants Under Non-stress and Stress Conditions , Journal of Plant Growth Regulation , **38**:1325–1340.

Naguib, M.I. (1963) Colourimetric estimation of plant polysaccharides. Zeit , **16**:15–22.

Neama M. Marzauk, Shafeek, M.R., Helmy Y.I., Ahmed A.A., Magda, A.F. (2014) Effect of vitamin E and yeast extract foliar application on growth, pod yield and both green pod and seed yield of broad bean (*Vicia faba* L.). *Middle East j. Appl. Sci*., **4**, 61-67.

Noctor, G. (2006) Metabolic signaling in defense and stress: The central roles of soluble redox couples. *Plant Cell Enviro*., **2** ,409-425.

Panel, I., Farre I., Faci, J.M. (2006) Comparative response of maize (*Zea mays* L) and sorghum (*Sorghum bicolor* L Moench) to deficit irrigation in a Mediterranean environment. Agric. *Water Manag*. 83,135–143.

Radford P.J. (1967) Growth analysis formulae–their use and abuse. *Crop Sci*. **7**:171–175.

Rady, M.M., Sadak, M.S., El-Bassiouny, H.M.S. Abd El-Monem, A.A. (2011) Alleviation the adverse effects of salinity stress in sunflower cultivars using nicotinamide and α-tocopherol. Aust J Basic. *Appl. Sci*., **5**,342–355.

Ragheb, H.M., Gameh, M.A., Nafady, M.H., Ahmed, A.R. (2000) Growth, yield, water use efficiency and nutrients contents of two bean varieties under trickle and sprinkler irrigation regimes in the New valley. *Assiut. J. Agric. Sci*. **33**, 1–24.

Raja Babo, C., Vigayalakshini, C., Mohandass S. (2005) Evaluation of rice (Oriza *sativa* L.) genotypes for salt tolerance. *J. of Food Agric. And Environment*., **3**, 190-195.

Sadak, M.S., Rady, M.M., Badr N.M., Gaballah, M.S. (2010) Increasing sunflower salt toleramce using nicotinamide and α-tocopherol. Int. J. Acad. Res., 2:263–270.

Sadiq, M., Akram N.A., Ashraf, M., Al-Qurainy F., Ahmad, P. (2019) Alpha-tocopherol-induced regulation of growth and metabolism in plants under non-stress and stress conditions. Journal of Plant Growth Regulation, 38: 1325-1340.

Sattler, S.E., Gilliland L.U., Magallanes- Lundback M., Pollard M., Penna D. D. (2004) Vitamin E is essential for seed longevity and for preventing lipid peroxidation during germination. *Plant Cell* **16**, 1419-1432.

Shafeek, M.R., Helmy Y.I., Neama M. M., Magda, A. F. S., Nadia, M. O. (2013) Effect of foliar application of some antioxidants on growth, yield and chemical composition of Lettuce plants (*Lactuca Sativa* L.) under plastic house condition. *Middle East Journal of Applied Sciences* **3**, 70-75.

Soltani, Y., Saffari, V. R., Moud A. A. M., Mehrabani, M. (2012) Effect of foliar application of αtocopherol and pyridoxine on vegetative growth, flowering, and some biochemical constituents of *Calendula officinalis* L. plants. *African J. of Biotechnol*. **11**, 11931-11935.

Yuan, J.S., Tiller, K.H., Al-Ahmad H., Stewart N.R., Stewart, C.N. (2008) Plants to power: bioenergy to fuel the future. *Trends Plant Sci*. **13**,421–429.