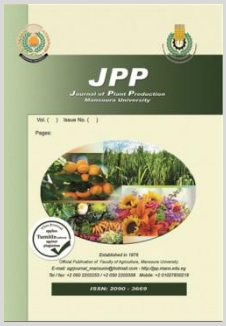
**Journal of Plant Production**

**Journal homepage & Available online at: www.jpp.journals.ekb.eg**

# Influence of Seaweed Extract, Fulvic Acid and Poly Amino Acid on the Growth and Productivity of *Capsicum annuum* L. "Super Nar" Cultivar

**Mohamed M. EL.N. M.[1] and A. A. S. A. Hassan[2]**

[1]Plant Prod. Dept. (Horticulture –Vegetables), Faculty of Technol. and Develop., Zagazig Univ., Egypt.
[2]Hort. Dept. (Olericulture), Fac. of Agric., Zagazig Univ., Egypt.




## ABSTRACT

For evaluating the effect of poly amino acid (poly amino carboxylic acid 18 %), fulvic acid (potassium fulvate 10 %) and seaweed extract (potassium alginate 10%) as foliar spray on the growth, production and some chemical constituents of Hot pepper *Capsicum annuum* L. "Super Nar" cultivar a field experiment was done. Through the 2022 and 2023 summer seasons, this experiment established in the Ghazala farm, an experimental farm owned by Zagazig University's Faculty of Technology and Development in Egypt. After 30, 60, and 90 days from the transplanting date, any stimulating ingredient should be sprayed three times per season. A completely randomized block design was used to distribute the seven treatments in the trial. In comparison to the other treatments being studied, the utilizing of seaweed extract at a concentration of 4 ml/l resulted in a substantial improvement in plant height, dry weight, number of leaves and dry weight of leaves per plant. In comparison to the control, pepper plants which sprayed with fulvic acid, poly amino acid, and seaweed extract produced a considerably higher amount of fruit per feddan. In comparison to the other treatments, the seaweed extract treatment (at 4 milliliters/liter) produced the highest N, P, and K percentages and the highest total soluble solids (TSS) content. In general, it is beneficial to spray hot pepper plants with 4 ml/l of seaweed extract three times/season in order to achieve optimal pepper growth, high fruit yield, and mineral content.

***Keywords:*** *Capsicum annuum*, poly amino, fulvic, seaweed, growth, yield

## INTRODUCTION

*Capsicum annuum* L., an herbaceous plant belonging to the Solanaceae family, originated in Central and South America and has since spread to other parts of the world (McCollum, 1980). Pepper is one of the veggies that contains the most vitamin C. The statement claims that a single 70-gram pepper fruit can meet a person's daily vitamin C requirements. There are also enough levels of niacin, vitamins B1, A, and B2, as well as other vitamins that support growth. It also contains mineral salts like calcium, iron, and potassium, as well as fluorine, which guards against tooth decay (Thang, 2007). As a widely cultivated vegetable globally, hot peppers add flavor, color, and taste to cuisine (Caporaso *et al*., 2013). Chilli peppers and their active components, such as capsaicinoids, have also been shown to possess antibacterial, anticancer, antioxidant, anti-inflammatory, and immune-modulating qualities (Popelka *et al*., 2017).

According to Statistics of the Ministry of Agriculture (2020), the area under pepper cultivation in Egypt was 39,891 feddan (21,502 fed. in new reclaimed land and 18.389 fed. in ancient agricultural land). This production in 359,933 tons of pepper (186,204 tons from new reclaimed land and 173,728 tons from ancient agricultural land), with an average of 9,023 tons per fed. (8,660 tons per fed. in new reclaimed land and 9,447 tons per fed. in ancient agricultural land).

Amino acids, the organic nitrogenous compounds, are fundamental building blocks for the synthesis of proteins (Davies, 1982). Amino acid polymerization is catalyzed by ribosomes, which produces proteins. The structural characteristics of nitrogen, carbon, and hydrogen make up amino acids. According to Buchanan *et al.* (2000), every amino acid possesses a side chain. By enhancing photosynthetic rate, nutritional water intake, dry matter partitioning, and fertilizer assimilation, commercially available amino acid boosters can boost agricultural yields (Sarojnee et al., 2009). According to Aly *et al*. (2019), foliar amino acid treatment enhanced hot pepper growth characteristics and yield in both seasons when compared to control. According to Al-Nassrallah and Al-Asadi (2023), the maximum yield component values were obtained when hot pepper (*Capsicum annuum* L.) was sprayed with amino acid at a high concentration (4 ml liter-1).

Fulvic acid is a vital component of organic matter components in compost and soils created from municipal waste, according to Senesi *et al*. (1996). Their significance in the biological processes of soil and the cycling of various environmental elements is also notable. Fulvic acid contributes significantly to soil organic matter and the dissolved organic C pool in soils, according to Van-Hees *et al*. (2005). Fulvic acids are also recognized to be essential for the mobility, biological availability, organic molecules and metal ions release and retention, as well as for the soil's capacity to buffer acids from bases (Senesi and Miano, 1995). Aminifard *et al.* (2012) indicated that fulvic acid treatment positively affected TSS content of pepper fruits. Also, Lu *et al.* (2024) revealed that Fe-fulvic acid enhanced pepper growth, increasing chemical constituents.

Spraying plants with seaweed extract significantly increased the ability of the roots to grow as well as the thickness and growth of the stems. Seaweed extracts contain

* **Corresponding author.**
**E-mail address: dr_nagy87@yahoo.com**
**DOI: 10.21608/jpp.2025.349578.1426**

variety of micro elements (B, Zn, Cu, Co and Mo) beside auxins, macro elements, cytokinins and gibberellins (Jensen, 2004; Thirumaran *et al*., 2009). According to Dhargalkar and Pereira (2005), the high-nutrient extreme seaweed extract, an incoming natural organic fertilizers source, accelerates seed germination, boosts agricultural productivity, and makes many crops more resilient. Fatty acids, phytohormones, vitamins, complex polysaccharides, and mineral elements are among the chemical components of seaweed extract (Battacharyya *et al*., 2015). In terms of plant height, leaves and branches number per plant as well as fresh weight parts per plant, Akram *et al.* (2023) demonstrate that the seaweed extract treatment was noticeably better than the concentration of 7.5 $g^{-1}$ compared to the other treatments.

The current study objectives were to: (1) evaluate the influence of three stimulants components of amino acid, seaweed extract and fulvic acid on the hot pepper growth; (2) determine the influence of these stimulants on yield and its quality; (3) recommend the best foliar application for achieving superior growth and highest yield.

## METERIALS AND METHODS

A flied experiment was conducted at Ghazala Farm (the Experimental farm), Fac. Technol. and Develop., Zagazig Univ., Egypt, during the 2022 and 2023 summer seasons to examine the effects of ploy amino acid, seaweed extract and fulvic acid on the growth and yield traits and chemical components of *Capsicum annuum* L. Super Nar cultivar. According to Chapman and Pratt (1978), the experimental soil's physical and chemical characteristics are displayed in Table 1.

**Table 1. Experimental farm soil mechanical and chemical properties (average of both seasons)**

| Mechanical analysis | | | | | | | | | | | Soil texture |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Clay (%) | | Silt (%) | | Fine sand (%) | | | Coarse sand (%) | | | | Clay |
| 48.53 | | 13.30 | | 11.28 | | | 26.89 | | | | |
| **Chemical analysis** | | | | | | | | | | | |
| Ph | E C | Organic matter | Soluble cations (meq. / L) | | | | Soluble anions (meq. / L) | | | Available (ppm) | |
| | m.mohs / cm | (%) | $Mg^{++}$ | $Ca^{++}$ | $K^{+}$ | $Na^{+}$ | $Cl^{-}$ | $HCO_3^{-}$ | $SO_4^{--}$ | N | P | K |
| 7.92 | 1.45 | 0.61 | 2.7 | 1.6 | 1.6 | 4.2 | 4.2 | 1.4 | 3.1 | 31.7 | 11.2 | 64.8 |

**Seed source and cultivation:**

The seeds of the pepper "cv. Super Nar" were sourced from Go-ara Company, Egypt, and sown in speeding trays for 30 days in a private Nursery, Qurien City, Sharkia Governorate, Egypt. The length of each hot pepper transplant was 13 to 15 cm, and they were all identical in terms of growth and development. During the summers of 2022 and 2023, seedlings were transplanted into the experimental plots on March 1 and 4, respectively. The experimental unit covered an area of 11.25 $m^2$ (2.50 m × 4.50 m), which contained 6 ridges. Each ridge measured 2.50 meters length and 75 cm width. With the use of surface irrigation, the hot pepper plants were spaced 35 cm apart along the ridge. In the region where pepper plants were produced, standard agricultural practices were followed. Under the local conditions, the recommended rate (RR) was 90 (N), 32 ($P_2O_5$), and 76 ($K_2O$) kg/feddan (0.42 % of hectare).

**Experimental Design:**

The seven treatments were arranged in a randomized complete block design with three replicates.

1- Control (without any addition)
2- Poly amino acid at 2ml/l
3- Poly amino acid at 4ml/l
4- Fulvic acid at 4ml/l
5- Fulvic acid at 6ml/l
6- Seaweed extract at 2ml/l
7- Seaweed extract at 4ml/l

**Stimulants source and application:**

GGAP (Green Group for Agricultural Projects) Company in Egypt was the source of the seaweed extract (10% potassium alginate), fulvic acid (10%) potassium fulvate, and poly amino acid (18%) poly amino carboxylic acid. Foliar applications of the stimulant treatments were made 30, 45, and 60 days following the transplant date. Five letters of solution were given to each experimental unit using Super Film as a spreading agent at a rate of 1 milliliter per liter. Using a spreading agent the control plants were sprayed with regular water.

**Sampling and recording data:**

A random sample of three hot pepper plants from each sub plot was taken at 108 and 110 planting date for growth parameters and at 155 and 162 days planting date for fruit yield and quality as well as some chemical constituents in fruits during 1st and 2nd seasons, respectively, and the following characteristics were noted:

**A. Growth parameters:**

1. Height of plant (cm).
2. Total plant dry weight (g).
3. Number of leaves per plant.
4. Dry weight of leaves per plant (g).

**B. Yield and its components:**

When the hot pepper fruits reached a length of 10–12 cm, they were collected every two days. The yield components during the harvesting stage are expressed as follows:

1. Fruits number per plant.
2. Average Fruit weight (g).
3. Fruit yield per feddan (ton).

**C. Chemical constituents and fruit quality:**

The percentages of total nitrogen, total phosphorus, and potassium in hot pepper fruits were calculated using the methods of Brown and Lilleland (1946), Hucker and Catroux (1980), and Naguib (1969). Total Soluble Solids (TSS): Were determined in fruits by utilizing hand Refractometer (Brix˚).

**Statistical Analysis**

Analysis of variance was performed on all data gathered during the two growing seasons, and the Duncan Multiple Range Test was utilized to compare means (Duncan, 1955). The Analytical Software (2008) computer software package was utilized to run all statistical analyses utilizing the analysis of variance technique.

## RESULTS AND DISCUSSION

**Growth parameters:**

Tables 2 and 3 show that spraying hot pepper plants with any stimulants under study (poly amino acid, fulvic acid or seaweed extract) offered plant height, leaves number per

plant and dry weight of leaves per plant and total dry weight of plant highest values in comparison with control. Generally speaking, hot pepper development metrics were steadily improved in both seasons by increasing the amount of poly amino acid, fulvic acid, or seaweed extract. The leaves dry weight per plant increased by approximately 43.15 and 64.08 percent for the two seasons, respectively, when a 4 ml/l rate of seaweed extract was applied over the control treatment. Similarly, amino acid boosters administered at 0.45 g or 0.27 g/ pepper plant resulted in a considerable improve in plant height and shoot dry matter, according to Sarojnee *et al*. (2009). Furthermore, Marhoon and Abbas (2015) found that when sweet pepper cultivars were treated with 800 mg/l amino acids or 6 ml/l seaweed extract, there was a substantial enhance in plant height, branch count, and the dry matter percentage of shoots. Additionally, Abd El-Baky *et al*. (2020) observed that a high fulvic acid rate (3g/l) was associated with higher plant height, leaf count, and dry weight of okra plant leaves and/or branches.

**Table 2. Influence of seaweed extract, fulvic acid and poly amino acid on plant height (cm) and plant dry weight (g) of *Capsicum annuum* L. "Super Nar" cultivar during 2022 and 2023 seasons**

| Treatments | Plant height (cm) | | Plant dry weight (g) | |
|---|---|---|---|---|
| | 2022 season | 2023 season | 2022 season | 2023 season |
| Control | 46.67 d | 50.33 f | 97.33 e | 98.00 e |
| Poly amino acid at 2ml/l | 60.67bc | 58.33de | 110.33cd | 113.67 c |
| Poly amino acid at 4ml/l | 62.67 b | 63.67 c | 114.00bc | 122.00 b |
| Fulvic acid at 4ml/l | 57.67 c | 56.67 e | 107.33 d | 108.00 d |
| Fulvic acid at 6ml/l | 60.33bc | 60.67cd | 111.00bcd | 114.67 c |
| Seaweed extract at 2ml/l | 63.67 b | 70.67 b | 116.67ab | 128.00 a |
| Seaweed extract at 4ml/l | 67.67 a | 79.67 a | 121.67 a | 133.00 a |

**Means within a column followed by different letter (s) are statistically different using the Duncan Multiple Range Test at a 0.05 level of probability.**

**Table 3. Influence of seaweed extract, fulvic acid and poly amino acid on leaves number /plant and dry weight of leaves /plant (g) of *Capsicum annuum* L. "Super Nar" cultivar during 2022 and 2023 seasons**

| Treatments | Leaves number per plant | | Leaves dry weight / plant (g) | |
|---|---|---|---|---|
| | 2022 season | 2023 season | 2022 season | 2023 season |
| Control | 359.33 f | 359.67 f | 14.67 d | 13.00 e |
| Poly amino acid at 2ml/l | 422.00 d | 423.67 d | 16.67 c | 15.67 d |
| Poly amino acid at 4ml/l | 431.00 c | 436.00 c | 17.67 c | 18.00 b |
| Fulvic acid at 4ml/l | 414.00 e | 420.67de | 16.33 c | 16.00 cd |
| Fulvic acid at 6ml/l | 421.00 d | 418.33 e | 17.33 c | 17.33 bc |
| Seaweed extract at 2ml/l | 453.67 b | 458.00 b | 19.33 b | 20.00 a |
| Seaweed extract at 4ml/l | 482.33 a | 497.67 a | 21.00 a | 21.33 a |

**Means within a column followed by different letter (s) are statistically different using the Duncan Multiple Range Test at a 0.05 level of probability.**

**Yield components:**

In addition, in Table 4, sprayed hot pepper plants with 4 ml/l of seaweed extract at 3 times / season exhibited significant variations from control and the other stimulants under study, yield the highest values of average fruit weight (g), fruits number / plant and fruits yield / feddan (ton). Furthermore, the yield components steadily increased as poly amino acid, fulvic acid or seaweed extract were raised from the low to high rate. Salim *et al.* (2021) demonstrated that spraying with amino acids stimulated yield components including fruits number per tomato plant, fruit weight average and total yield of fruits /fed. compared to control plants. Moreover, Pinkky and Dilip (2023) found that fulvic acid foliar treatment at 5.5 ml/l and 7.8 ml /l gave significantly higher fruits number per plant which subsequently lead to an improve in plant marketable yield in comparison to the control. In addition, Pal *et al.* (2024) marketable fruit yields of bell pepper (*Capsicum annuum* L.) were higher (31 %) with the application of seaweed extract at 5 and 7.5 g/l.

**Table 4. Influence of seaweed extract, fulvic acid and poly amino acid on yield components of *Capsicum annuum* L. "Super Nar" cultivar during 2022 and 2023 seasons**

| Treatments | Number of fruits/plant | | Average weight of fruit (g) | | Fruit yield /feddan (ton) | |
|---|---|---|---|---|---|---|
| | 2022 season | 2023 season | 2022 season | 2023 season | 2022 season | 2023 season |
| Control | 8.67 e | 8.67 e | 42.33 d | 36.67 d | 3.348 e | 2.865 g |
| Poly amino acid at 2ml/l | 11.00cd | 11.67 d | 49.33cd | 43.00 c | 4.905cd | 4.524 f |
| Poly amino acid at 4ml/l | 11.00cd | 13.00 c | 49.67 c | 53.33 b | 4.935cd | 6.255 d |
| Fulvic acid at 4ml/l | 10.33 d | 12.67cd | 47.67cd | 46.00 c | 4.437de | 5.256 e |
| Fulvic acid at 6ml/l | 12.00 c | 15.33 b | 51.67bc | 53.33 b | 5.595 c | 7.368 c |
| Seaweed extract at 2ml/l | 13.33 b | 14.67 b | 58.33ab | 65.67 a | 7.008 b | 8.670 b |
| Seaweed extract at 4ml/l | 15.33 a | 17.33 a | 65.33 a | 69.33 a | 9.015 a | 10.812a |

**Means within a column followed by different letter (s) are statistically different using the Duncan Multiple Range Test at a 0.05 level of probability.**

**Chemical constituents and fruit quality:**

During the two tested seasons, the hot pepper plant's total nitrogen percentage peaked at around (2.39 and 2.62 %) for seaweed extract at 4 ml/l rate treatment, compared to the other three treatment under study (Table 5). In comparison to the other stimulants under investigation, hot pepper plants sprayed with 4 ml/l seaweed extract had the highest levels of total phosphorus percentage. Furthermore, 4 and 2 ml/l of seaweed extract provided the highest values for potassium percentage and TSS content in hot pepper fruits (3.88 and 3.89% as well as 9.51 and 10.07 Brix°) when compared to the other stimulant rates studied and control in the first and second

seasons (Table 6). Similarly, Shabana *et al*. (2015) found that the maximum fruit quality (TSS as well as N, P, and K percentages) of sweet pepper was obtained with foliar spraying with seaweed extract. According to Hammam *et al*. (2020), plants applied with 200 ppm of amino acid had the highest percentages of total carbohydrates, phosphorus, potassium and nitrogen in their pepper fruit chemical composition when compared to the control. Additionally, Kiran *et al*. (2021) noted that, in comparison to the control, the amino acids foliar spray had the highest TSS value (11.51 Brix°) in chilli fruits. Additionally, Fe-fulvic acid improved the nutritional value of pepper, according to Lu et al. (2024).

**Table 5. Influence of seaweed extract, fulvic acid and poly amino acid on total nitrogen and total phosphorus percentages of *Capsicum annuum* L. "Super Nar" cultivar during 2022 and 2023 seasons**

| Treatments | Total nitrogen (%) | | Total phosphorus (%) | |
|---|---|---|---|---|
| | 2022 season | 2023 season | 2022 season | 2023 season |
| Control | 2.10 c | 2.08 d | 0.217 d | 0.213 d |
| Poly amino acid at 2ml/l | 2.50 a | 2.49ab | 0.247 c | 0.250 c |
| Poly amino acid at 4ml/l | 2.37ab | 2.35bc | 0.257bc | 0.247 c |
| Fulvic acid at 4ml/l | 2.31 b | 2.28 c | 0.280 b | 0.250 c |
| Fulvic acid at 6ml/l | 2.47ab | 2.44bc | 0.277 b | 0.283 b |
| Seaweed extract at 2ml/l | 2.35ab | 2.48ab | 0.263bc | 0.290 b |
| Seaweed extract at 4ml/l | 2.39ab | 2.62 a | 0.323 a | 0.333 a |

**Means within a column followed by different letter (s) are statistically different using the Duncan Multiple Range Test at a 0.05 level of probability.**

**Table 6. Influence of seaweed extract, fulvic acid and poly amino acid on potassium percentage and total soluble solids content (Brix°) of *Capsicum annuum* L. "Super Nar" cultivar during 2022 and 2023 seasons**

| Treatments | Potassium percentage | | TSS content (Brix°) | |
|---|---|---|---|---|
| | 2022 season | 2023 season | 2022 season | 2023 season |
| Control | 3.29 d | 3.31 d | 3.44 b | 3.58 d |
| Poly amino acid at 2ml/l | 3.31 d | 3.42cd | 4.70 b | 4.65cd |
| Poly amino acid at 4ml/l | 3.38cd | 3.56bc | 3.53 b | 5.20 c |
| Fulvic acid at 4ml/l | 3.46 c | 3.59bc | 4.30 b | 4.67cd |
| Fulvic acid at 6ml/l | 3.48 c | 3.45cd | 4.80 b | 5.44bc |
| Seaweed extract at 2ml/l | 3.64 b | 3.71ab | 8.01 a | 6.75 b |
| Seaweed extract at 4ml/l | 3.88 a | 3.89 a | 9.51 a | 10.07 a |

**Means within a column followed by different letter (s) are statistically different using the Duncan Multiple Range Test at a 0.05 level of probability.**

## CONCLUSION

According to the aforementioned findings, it is recommended to apply seaweed extract at a rate of 4.0 milliliters per liter three times per season to hot pepper (*Capsicum annuum*, L.) plants in order to improve plant growth, yield components, and fruit quality.

## REFERENCES


Abd El-Baky, M.M.H., M. EL-Desuki, S.R. Salman, M. M. Abd El-Wanis, S.D. Abou-Hussein and M.O. Bakry (2020). Effect of humic and fulvic acid on growth and yield of two okra cultivars grown in Wadi El-Tor, South Sinai. Middle East Journal of Applied Sciences, 10 (1): 101-109.

Al-Nassrallah, R. Sh. M. and A. D. K. Al-Asadi (2023). Effect of the ergostim and amino acids on vegetative growth characteristics and mineral content of hot pepper (*Capsicum annuum* L.). University of Thi-Qar Journal of agricultural research, 12 (1): 139-153.

Aly, A. N. Eliwa and M. H. Abd El Megid (2019). Improvement of growth, productivity and some chemical properties of hot pepper by foliar application of amino acids and yeast extract. Potravinarstvo Slovak Journal of Food Sciences, 13 (1): 831-839.

Aminifard, M. H. H. Aroiee, H. Nemati, M. Azizi and H. Z. E. Jaafar (2012). Fulvic acid affects pepper antioxidant activity and fruit quality. African Journal of Biotechnology, 11(8): 13179-13185.

Analytical Software (2008). Statistix Version 9, Analytical Software, Tallahassee, Florida, USA.

Battacharyya, D., M. Z. Babgohari, P. Rathor and B. Prithiviraj (2015). Seaweed extracts as biostimulants in horticulture. Sci. Hortic., 196 (11): 39-48.

Brown, J. D. and O. Lilleland (1946). Rapid determination of potassium and sodium in plant material and soil extracts by Flame Photometry. Proc. Amer. Soc. Hort. Sci., 48: 341-346.

Buchanan, B. B., W. Gruissem and R. L. Jones (2000). Biochemistry and Molecular Biology of plants. Rockville, American Society of plant physiologists, 67. capsaicinoids in chili fruits produced under greenhouse conditions. Journal of Revista Mexicana de Ciencias Agrícolas, 11 (3): 300-309.

Caporaso, N., A. Paduano, G. Nicoletti and R. Sacchi (2013). Capsaicinoids, antioxidant activity, and volatile compounds in olive oil flavoured with dried chili pepper (*Capsicum annuum*). Eurpian Journal of Lipid Science and Technology, 115 (12): 1434-1442.

Chapman, D. H. and R. F. Pratt (1978). Methods of Analysis for Soils, Plants and Waters. Div. Agric. Sci. Univ. of California USA pp16-38.

Davies, D.D. (1982). Physiological aspect of protein turnover. Encycl. Pl. Physiol., New Series, 14 A (Nucleic acids and proteins: structure, biochemistry and physiology of proteins. Boulter, D. and B. Partier (Editors), Springer Verlag, New York, US.

Dhargalkar, V. and K. Pereira (2005). Seaweed: promising plant of the millennium, Sci. Cult., 71: 60-66.

Duncun, D.B. (1955). Multiple ranges and multiple F test. Biometrics, 11: 1-42.

Hammam, K. A., E. A. Eisa and A. A. Dewidar (2020). Effect of organic fertilization and amino acids on growth, chemical composition and capsaicin content of hot pepper (*Capsicum annum* L var. Minimum) plant. Asian Plant Research Journal, 6(4): 40-52.

Hucker, T.W.G. and G. Catroux (1980). Phosphorus in sewage ridge and animal waste slurries. Proceeding of the EEC Seminar, Haren (Gr); Groningen Netherlands 12, 13 June.

Jensen, E. (2004). Seaweed; Fact or Fancy From the Organic Broadcaster, Published by Moses the Midwest Organic and Sustainable Education. From the Broad Caster, 12 (3): 164-170.

Kiran, S., M. I. Ashraf, M. F. Shafique, P. A. khan, M. T. Yasin, M. Khan, S. Hameed and S. Ishaq (2021). Effect of different amino acids on the morphology and bio-chemical attributes of chilli (*Capsicum frutescens* L.). International Journal of Agronomy and Agricultural Research, 18 (3): 55-61.

Lu, Q., Z. Xu, Q. Zhang, Z. Zhang, Y. Zhang, T. Zhang, J. Li and X. Wang (2024). Foliar application of Fe-fulvic acid: A strategy to reduce heavy metal accumulation and enhance nutritional quality. Food Chemistry, X, 24 (10): 1-9.

Marhoon, I. A. and M. K. Abbas (2015). Effect of foliar application of seaweed extract and amino acids on some vegetative and anatomical characters of two sweet pepper (*Capsicum annuum* L.) cultivars. International Journal of Research Studies in Agricultural Sciences, 1 (1): 35-44.

McCollum, J. P. (1980). Producing Vegetable Crop 3rd ed. The Interstate Printer and Publisher. USA, Page 607.

Naguib, M. I. (1969). Colorimeter determination of nitrogen components of plant tissues. Bull. Fac. Sci., Cairo Univ, 43: 1-9.

Pal, S. Ch., Md. B. Hossain, D. Mallick, F. Bushra, S.M.R. Abdullah, P. K. Dash and D. Das (2024). Combined use of seaweed extract and arbuscular mycorrhizal fungi for alleviating salt stress in bell pepper (*Capsicum annuum* L.). Scientia Horticulturae, 325: 1-16.

Pinkky, K. and N. Dilip (2023). Effect of fulvic acid on yield performance of organic bell pepper (*Capsicum annuum* L.) under open-field conditions in Tennessee. Organic Agriculture, 13 (7): 1-11.

Popelka, P., P. Jevinová, K. Šmejkal and P. Roba (2017). Antibacterial activity of capsicum extract against selected strains of bacteria and micromycetes. Potravinarstvo Slovak Journal of Food Sciences, 11 (1): 223-229.

Salim, B.B.M., Y.A. M.Salama, M.S. Hikal, A.Abou El-Yazied and H.G. Abd El-Gawad (2021). Physiological and biochemical responses of tomato plant to amino acids and micronutrients foliar application. Egypt. J. Bot., 61 (3): 837-848.

Sarojnee, D. Y., B. Navindra and S. Chandrabose (2009). Effect of naturally occurring amino acid stimulants on the growth and yield of hot peppers (*Capsicum annum* L.). Journal of Animal & Plant Sciences, 5 (1): 414-424.

Shabana, A. I., M.R. Shafeek, H. I. Ahmed and F. S. Abdel-Al (2015). Improving growth, fruit setting, total yield and fruit quality of sweet pepper plants (*Capsicum annum* L.) by using antioxidant and seaweed extracts. Middle East Journal of Agriculture, 4 (2): 154-161.

Statistics of the Ministry of Agriculture (2020). Statistics of medicinal and aromatic crops production in Egypt.

Thang, P. T. N. (2007). Ripening behavior of capsicum (*Capsicum annuum* L.) fruit. Ph. D. Thesis, Adelaide Unv., South Australia,pp.149.

Thirumaran G., M. Arumugam, R. Arumugam and P. Anantharaman (2009). Effect of sea weed liquid fertilizer on growth and pigment concentration of *Abelmoschus esculentus* L Taub. Am Euras. J. Agron., 2 (2): 50 -56.

# تأثير مستخلص الأعشاب البحرية وحمض الفولفيك وحمض الأمينات العديدة على نمو وإنتاجية الفلفل صنف "سوبر نار"

**محمد الناجي محمد محمد[1] وعاصم احمد سيد احمد[2]**

[1]قسم الإنتاج النباتي، كلية التكنولوجيا والتنمية، جامعة الزقازيق، مصر
[2]قسم البساتين ،كلية الزراعة ،جامعة الزقازيق،مصر

## الملخص

أجريت تجربة حقلية لتقييم تأثير حمض الأمينات العديدة (البولي أمينو الكربوكسيلي 18٪) وحمض الفولفيك (فولفات البوتاسيوم 10٪) ومستخلص الأعشاب البحرية (ألجينات البوتاسيوم 10٪) عن طريق الرش الورقي على النمو والمحصول وبعض المكونات الكيميائية لنبات الفلفل الحار صنف "سوبر نار". تم إجراء هذه التجربة في المزرعة التجريبية (مزرعة غزالة) لكلية التكنولوجيا والتنمية، جامعة الزقازيق، مصر خلال موسمي الصيف المتتاليين لأعوام 2022 و 2023. تم رش أي مركب من منشطات النمو ثلاث مرات في الموسم بعد 30 و 60 و 90 يومًا من ميعاد الشتل. تتكون التجربة من سبع معاملات موزعة بتصميم القطاعات كاملة العشوائية. أدى استخدام مستخلص الأعشاب البحرية بمعدل 4 مللي / لتر إلى تحسين معنوي في ارتفاع النبات والوزن الجاف الكلى للنبات وعدد الأوراق لكل نبات ووزن الأوراق الجافة لكل نبات مقارنة بالمعاملات الأخرى قيد الدراسة. أدى رش نباتات الفلفل بالأحماض الأمينية العديدة وحمض الفولفيك ومستخلص الأعشاب البحرية إلى زيادة معنوية في إنتاجية الثمار لكل فدان مقارنة بالكنترول. كما تم الحصول على أعلى النسب المئوية من النيتروجين والفوسفور والبوتاسيوم ومحتوى المواد الصلبة الذائبة الكلية باستخدام مستخلص الأعشاب البحرية (4 مللي/لتر) مقارنة بالمعاملات الأخرى. بشكل عام، للحصول على أفضل نمو وإنتاجية عالية من الثمار ومحتوى معدني من الفلفل، من المفضل رش النباتات بمستخلص الأعشاب البحرية بمعدل 4 مل/ل ثلاث مرات في الموسم.

***الكلمات الداله:*** الفلفل، الأمينات العديدة، الفولفك، الأعشاب البحرية، النمو، المحصول