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RESPONSE OF DILL PLANTS TO ACTIVE YEAST, HUMIC ACID AND SOME AMINO ACIDS TREATMENTS.

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ABSTRACT

This experiment was executed during 2016/2017 and 2017/2018 to investigate the response of dill (*Anethum graveolens*) plants in term of vegetative growth, yield components, essential oil and photosynthetic pigments to active dry yeast at 2.5, 5.0 and 10 g/l, humic acid at 4 and 8 ml/l and a mixture of amino acids (Tryptophan, Methionine and Cysteine) at 200 and 400 ppm, separately or in combinations. From obtained results, it could be concluded that all examined treatments of active dry yeast, humic acid and amino acids significantly improved the vegetative growth traits, yield components, volatile oil and content of the three photosynthetic pigments compared to check treatment. The stimulation was associated with increasing the concentration of each substance Treating dill plants with active dry yeast at 10 g/l. in combination with humic acid at 8 or 4 ml/l + a mixture of amino acids at 400 or 200 ppm gave the best results with regard to vegetative growth, yield and its components as well as essential oil production.

Keywords: Dill plants- active yeast- humic acid -amino acids.

INTRODUCTION

Dill (*Anethum graveolens,L.*) belongs to Family Apiaceae, is an annual or biennial herb. In general, dill leaves (dill weeds) and seeds (small fragrant fruits) are used as seasonings. The leaves could be used in eggs, meat, salad, sea foods and soup *preparations*. The seeds could be used in bread and flavouring pickles and soups. Dill essential oil extracted from both herb and seeds is used in chewing gums, candies and pickles (Zohary and Hopf, 2000). Dill fruits have medicinal value as a diuretic, stimulant, a carminative, antispasmodic, sedative and used to treat haemorrhoids, branchial asthma, neuralgia, renal colic, dysuria, genital ulcers and dysmenorrhea (Mahran *et al.*, (1992) and Peirce, 1999).

Active yeast (*Saccharomyces cerevisiae*) as a natural biostimulant appeared to induce an astonished

influence on growth and yield of many crops. Since it's containing several nutrients, high percent of total protein and total carbohydrates as well s some hormones (IAA and GA) it may be used as soil applications, spraying or soaking suspension (Tartoura, 2001).

Active dry yeast treatments led to increases in vegetative growth traits, yield and essential oil and photosynthetic pigments of coriander (Aly *et al.*, 2007) and Rekaby, 2013), anise (Hemdan, 2008), *Ammi visnaga* (Kenawy, 2010), cumin (Helmy, 2016) and fennel (Ayyat, 2017).

Humic substances (HS) recognized as a plant growth promoter by increasing the quality of crop and enhance plant tolerance against both biotic and a biotic stresses (Gadimov *et al.*, 2007) Humic acid used for plant nutrition, enhance root, plant growth and development as well as yield due to its action on physiological and metabolic processes (Eyheraguibel *et al.*, 2008).

Many authors obtained promoting influence of humic acid treatments on the vegetative growth, yield, essential oil content and photosynthetic pigments of many plant species such as dill (Said Al-Ahl *et al*., 2016) fennel (Sharaf El-Deen *et al*., 2012), *Merremia* dissecta (Shahin *et al*., 2014), coriander (Beyzi *et al*., 2017) and black cumin (Shahraki *et al*., 2017).

Amino acids as organic nitrogenous components are the buildings blocks in protein synthesis. They are promoted cell growth (Smith, 1982). They are precursors or activators of phytohormones and growth substances (Goss, 1973 and Taiz and Zaiger, 2002). Some amino acids can act as antioxidants and enhance the antioxidant enzymes for protection against adverse environmental conditions. Moreover, they inhibit the activity of free radical groups which are major dements for chlorophyll degration (Fletcher *et al*., 1988, Schmidt, 2005, Bradely, 2013 and Hwang and Moser., 2016).

The improvement effect of amino acids on vegetative growth parameters, yield and its components, essential oil % and yield as well as the photosynthetic pigments of different plant species was concluded by many researchers. namely, Hassanein, (2003), Abd-El-Rahman *et al*., (2008) and El-Awadi and Hassan (2010) on fennel, Ali *et al*., (2006) and Yassen *et al*., (2010) on anise, Ali, (2007) on caraway and Abd El-Rahman, (2016) on chamomile.

Therefore, the objective of the present study was to explore the effect of three natural biostimulants i.e. active yeast, humic acid and amino acids as well as their interaction on improving the vegetative growth, yield and its components, essential oil production as well as photosynthetic pigments of dill (*Anethum graveolens*) plants.

MATERIALS AND METHODS

The present investigation was conducted during the two successive seasons of 2016/2017 and 2017/2018 at the nursery and laboratory of ornamental plants. Fac. of Agric. Minia Univ to examined the influence of active yeast, humic acid and a mixture of three amino acids

(Tryptophan, Methionine and Cysteine) treatments and their interaction on the vegetative growth, yield, essential oil content and photosynthetic pigments of dill (*Anethum graveolens, L.*) plants.

Fruits of dill plants were obtained from Nursery of Floriculture, Fac. of Agric, Minia Univ. They were sown in clay loamy soil. The physical and chemical analysis of the used soil are listed in Table (A)

Table (A): Physical and chemical analysis of the used soil (average of both seasons):

Soil characters	Value	Soil characters		Value
Soil type	Clay loam	Avail. P (%)		15.40
Sand (%)	28.59	Exch. K(mg/100g)		2.45
Silt (%)	30.29	Exch.Ca(mg/100g)		31.43
Clay (%)	41.12	Exch.Na(mg/100g)		2.46
Org. Matt. (%)	1.65		Fe	8.39
$CaCo_3$ (%)	2.10	DTPA Ext. (ppm)	Cu	2.04
pH (1:2.5)	7.79		Zn	2.81
E.C. (mmhos/cm)	1.06		Mn	8.19
Total N (%)	0.08			

A complete randomized block design following the split plot arrangement, in three replicates, was executed in this experiment with four treatments of active yeast in the main plots (A) and seven treatments of humic acid and/or amino acids in the sub plots (B). Therefore, the work involved 28 treatments (A×B), replicated three times each treatment consisted of one row.

Fruits of dill plants were sown in November 6th for the two growing seasons, in (3×4.8m) plot with 60 cm distance between the rows and 30 cm between the hills within each row. So, each plot contained 7 rows (3 m in length) and 70 hills (10 hills / row and two plants / hill). Plants were thinned twice, the first one was after three weeks from planting date and the second one was after two weeks from the first one.

Treatments: The main plots (A) were as follows: Control (untreated plants), active yeast at 2.5, 5 and 10 g/l. While the sub plots (B) were as follows: Control (tap water), humic acid in form of potassium humate (Humate product) contains humic acid (80-83%), potassium (K_2O) (10 %) and total azote (7%) obtained from (United Agriculture Development (UAD) Company, New Al-Nobaria City. Al-Behera Governorate) at 4, 8 ml/l., amino acids Aminoactal contains a mixture of three amino acids (Tryptophan, Methionine and Cysteine) obtained from (Shoura Chemicals Company. Cairo Alex Desert RD., Giza Governorate) at 200, 400 ppm , humic acid at 4 ml/l + amino acids at 200 ppm and humic acid at 8 ml/l +amino acids at 400 ppm. The plants received three foliar sprays with the three tested biostimulants, the first spray was applied after 45 days from sowing date then two weeks thereafter. The plants were sprayed till run off.

All plants included control ones received organic farm yard manure (FYM) at the rate of 20 m^3 / fed. and mineral NPK fertilization at the rate of 200 kg / fed. / ammonium sulphate (20.6 % N) + 200 kg/fed. of calcium superphosphate (15.5 % P_2O_5) + 50 kg / fed. of potassium sulphate (48 % K_2O). The organic manure and the mineral phosphours were added during preparing the soil for cultivation, while the mineral NK fertalizers were divided into two batches and added at one month interval, starting December 21th in both experimental seasons. All other agricultural practices were carried out as usual in both growing seasons.

Harvesting time

In the two experimental seasons, half number of the plants were harvested for fruitful herb in milk stage (flowering and immature fruit stage) at the third week of April and the other half number of plants were harvested for fruits in mature stage (complete fruiting and mature fruits stage) at the last week of May. The following data were recorded: fresh and dry weights of herb / fed, fruit yield per plant and per feddan, essential oil % of herb and of fruits were determined according to British Pharmacopoeia, (1963), then essential oil yield (l) of herb / fed. and essential oil yield (l) of fruits / fed. were calculated. Samples of fresh leaves were taken after 2 weeks from the last treatment to estimate the content of the three photosynthetic pigments (chlorophyll a, b and carotenoids mg / F.w.) according to Fadl and Sari el Deen, (1978). The obtained data were tabulated and subjected to the proper statistical analysis using the computer program MSTAT-C (1986) according to Mead *et al.*, (1993).

RESULTS AND DISCUSSION

1-Vegetative growth traits:

Data listed in Tables (1 and 2) showed that herb fresh and dry weights / fed. of dill plants were significantly augmented due to treating with active yeast at 2.5, 5 and 10 g/l. compared with untreated plants. The highest values of both fresh and dry weights of herb were obtained due to active yeast at the highest concentration (10 g/l.).

Concerning the effect of humic acid and/or amino acids, it can be concluded that all tested treatments led to significant improvement of fresh and dry weights of dill herb per feddan compared with check treatment as shown in Tables (1 and 2). The most effective treatment which produced the heaviest fresh or dry weight was the dual treatment of humic acid at 8 ml/l + amino acids at 400 ppm. Similar trend was found in the two growing seasons.

The interaction between active yeast and humic acid and/or amino acids treatments was significant in the two experimental seasons. The most effective interaction treatment which produced the heaviest herb fresh and dry weights / fed. in both seasons was spraying with active yeast at 10 g/l. + humic acid at 8 ml/l plus amino acids at 400 ppm.

2- Yield and yield components:

It is clear from recorded data in Tables (3 and 4) that fruit yield / plant and per fed. of dill plants were significantly stimulated by the

application of active yeast at 2.5, 5 and 10 g/l. comparing to the control treatment in the first and second seasons. The stimulation of the yield was gradual with gradual increase in active yeast concentration in both seasons.

Regarding the influence of humic acid and/or amino acids treatments on fruit yield / plant / fed. of dill plants, data shown in Tables (3 and 4) proved that all used treatments significantly promoted the yield of fruits / plant / fed. comparing with untreated plants in the two experimental seasons. The highest values of fruit yield were recorded from plants received the dual treatment i.e. humic acid at 8 ml/l + amino acids at 400 ppm. Similar results were obtained in both growing seasons.

The interaction between factor A (active yeast) and factor B (humic acid and/or amino acids) was significant in the two growing seasons. in this concern, the highest values of fruit yield / plant and / fed. were produced by using active yeast at 10 g/l. plus humic acid at 8 ml/l. + amino acids at 400 ppm followed by active yeast at 10 g/l + humic acid at 4 ml/l + amino acids at 200 ppm.

3- Essential oil determination:

3-1- Essential oil % and yield / fed. of herb.

Data presented in Tables (5 and 6) indicated that essential oil % and yield / fed. of dill fruitful herb / fed. were significantly increased due to applying active yeast at different concentrations (2.5, 5 and 10 g/l.) in comparison with control treatment in the two growing seasons. The highest percentage and yield / fed. of essential oil were resulted due to application of the highest concentration (10 g/l.) in both experimental seasons.

Spraying dill plants with humic acid and/or amino acids at all tested concentrations resulted in a significant increase of essential oil percentage and yield per fed of herb compared with check treatment in the two growing seasons (Tables 5 and 6). The best results in this regard was resulted from spraying plants with humic acid at 8 ml/l + amino acids at 400 ppm.

The interaction between active yeast and humic acid and/or amino acids had significant effect for the two seasons on essential oil % and yield / fed. of dill herb (Tables 5 and 6). The most effective interaction treatment was active yeast at 10 g/l. plus humic acid at 8 ml/l. + amino acids at 400 ppm.

3-2- Essential oil % and yield / fed. of fruits

Data illustrated in Tables (7 and 8) revealed that active yeast treatments (2.5, 5 and 10 g/l) significantly augmented the essential oil % and yield of fruits / fed. compared to untreated plants in the two growing seasons, such increase was gradually according to the gradual increase in active yeast concentration.

In regard to the effect of spraying humic acid and/or amino acids on essential oil % and yield of fruits / fed. data in Tables (7 and 8) showed that all the treatments gave significant increase of essential oil % and yield / fed of fruits in the first and second seasons compared to control

treatment. The dual treatments were better than the treatments of either humic acid or amino acids alone, also, amino acid alone was more effective than humic acid alone for both used concentrations in both growing seasons. The highest essential oil % and yield per fed. of fruits were obtained from the dual treatment of humic acid at 8 ml/l + amino acids at 400 ppm.

The interaction treatments had significant effect on essential oil % and yield of fruits / fed. of dill plants in the two growing seasons. In this concern, the highest values of the percentage and yield of essential oil of dill fruits were detected as a result of treating the plants with active yeast at 10 g/l + humic acid at 8 ml/l combined with amino acids at 400 ppm.

4- Photosynthetic pigments

Data shown in Tables (9, 10 and 11) revealed that active yeast at 2.5, 5 and 10 g/l. significantly enhanced the content of the three photosynthetic pigments i.e. chlorophyll a, b and carotenoids in the fresh leaves of dill plants compared to the control in the two growing seasons. The increases of chlorophyll a, b and carotenoids contents were gradual with the gradual increase of active yeast concentrations.

It is evident from the obtained data that the three photosynthetic pigments content in the fresh leaves of dill plants were significantly promoted due to spraying the plants with humic acid and/or amino acids at all examined concentrations comparing with check treatment in the two growing seasons. Among the tested treatments, the dual treatment of humic acid at 8 ml/l + amino acid at 400 ppm was more effective than other treatments which produced the highest contents of the three pigments in both growing seasons.

The interaction between active yeast and humic acid and/or amino acids had significant influence on the content of the three photosynthetic pigments in the two experimental seasons. In general, the highest content of chlorophyll a, b and carotenoids were obtained due to active yeast at 10 g/l with humic acid at 8 ml/l + amino acids at 400 ppm.

Finally, the beneficial effects of active yeast, humic acid and amino acids on the vegetative growth (fresh and dry weights of herb), yield (fruit yield /plant and / fed.), essential oil percentage and yield / fed. of the herb and fruits as well as photosynthetic pigments of dill plants obtained in the present experiment were also found by many researchers. For example: Aly *et al*., (2007) and Rekaby, (2013) on coriander, Hemdan, (2008) on anise, kenawy, (2010) on *Ammi visnaga*, Helmy, (2016) on cumin and Ayyat, (2017) on fennel plant found similar results regarding the promoting effect of active yeast. The enhancing influence of humic acid obtained in the present work was also noticed by Said Al-Ahl *et al*., (2016) on dill, Sharaf El-Deen *et al*., (2012) on fennel, Shahin *et al*., (2014) on *Merremia dissecta*, Beyzi *et al*., (2017) on coriander and Shahraki *et al*., (2017) on black cumin. While, the improving influence of amino acids on vegetative growth, yield, essential oil production and photosynthetic

pigments found in the present investigation on dill plants was also, concluded by Hassanein, (2003), Abd El- Rahman *et al*., (2008) and El-Awadi and Hassan (2010) on fennel, Ali *et al*., (2006) and Yassen *et al*., (2010) on anise, Ali, (2007) on caraway and Abd El-Rahman, (2016) on chamomile.

As a conclusion, treating dill plants with active yeast at 10 g/l combined with humic acid at 8 ml/l + amino acids (Tryptophan, Methionine and Cysteine) at 400 ppm is suggested to improve yield of herb, fruits and essential oil % and yield quantitatively and qualitatively.

Table (1): Effect of spraying with active yeast, humic acid and/or amino acids on fresh weight of herb / fed. (ton) of dill (*Anethum graveolens*, L.) plants during 2016/2017 and 2017/2018 seasons.

Humic acid and /or amino acidstreatments (B)	Active yeast treatments (A)				Mean(B)
	0.0	2.5 g/l	5 g/l	10 g/l	
First season					
Control	12.06	13.23	14.71	15.96	13.99
HA at 4 ml/l	13.71	16.62	19.55	20.46	17.59
HA at 8 ml/l	14.59	17.95	20.70	22.29	18.88
AA at 200 ppm	14.05	16.93	19.80	20.66	17.86
AA at 400 ppm	15.04	18.23	22.00	22.73	19.50
HA4 ml/l+AA200 ppm	17.88	21.13	24.64	25.02	22.17
HA8 ml/l+AA400 ppm	20.93	22.56	26.22	27.10	24.20
Mean (A)	15.47	18.09	21.09	22.03	
L.S.D. at 5%	A: 0.56 B: 0.47 AB: 0.94				
Second season					
Control	14.63	16.00	16.47	17.26	16.09
HA at 4 ml/l	17.22	18.81	20.40	22.34	19.69
HA at 8 ml/l	17.52	19.19	21.95	24.25	20.73
AA at 200 ppm	17.32	18.88	20.74	22.61	19.89
AA at 400 ppm	18.30	20.29	23.05	25.47	21.78
HA4 ml/l+AA200 ppm	21.64	23.50	25.68	27.02	24.46
HA8 ml/l+AA400 ppm	22.97	24.21	26.85	27.82	25.46
Mean (A)	18.51	20.13	22.16	23.82	
L.S.D. at 5%	A: 0.64B 0.80: AB: 1.60				

HA: Humic acid AA: Amino acids

Table (2): Effect of spraying with active yeast, humic acid and/or amino acids on dry weight of herb / fed. (ton) of dill (*Anethum graveolens*, L.) plants during 2016/2017 and 2017/2018 seasons.

Humic acid and /or amino acidstreatments (B)	Active yeast treatments (A)				Mean (B)
	0.0	2.5 g/l	5 g/l	10 g/l	
First season					
Control	2.567	2.81	3.16	3.473	3.003
HA at 4 g/l	2.961	3.465	4.264	4.67	3.840
HA at 8 g/l	3.54	4.085	4.831	5.071	4.382
AA at 200 ppm	3.088	3.685	4.363	4.862	4.000
AA at 400 ppm	3.706	4.245	5.018	5.484	4.613
HA4g/l+AA200ppm	4.046	4.746	5.627	6.37	5.197
HA8g/l+AA400ppm	4.398	4.996	5.986	6.716	5.524
Mean (A)	3.472	4.005	4.750	5.235	
L.S.D. at 5%	A: 0.110 B 0.093: AB: 0.186				
Second season					
Control	2.937	3.291	3.639	3.91	3.444
HA at 4 g/l	3.354	3.701	4.248	4.866	4.042
HA at 8 g/l	3.886	4.409	5.098	5.766	4.790
AA at 200 ppm	3.57	4.001	4.632	5.127	4.333
AA at 400 ppm	4.202	4.815	5.678	6.222	5.229
HA4g/l+AA200ppm	4.826	5.443	6.174	6.729	5.793
HA8g/l+AA400ppm	5.162	5.624	6.496	7	6.071
Mean (A)	3.991	4.469	5.138	5.660	
L.S.D. at 5%	A: 0.082B: 0.144 AB: 0.289				
HA: Humic acid	AA: Amino acids				

Table (3): Effect of spraying with active yeast, humic acid and/or amino acids on fruits yield / plant (g) of dill (*Anethum graveolens*, L.) plants during 2016/2017 and 2017/2018 seasons.

Humic acid and /or amino acidstreatments (B)	Active yeast treatments (A)				Mean(B)
	0.0	2.5 g/l	5 g/l	10 g/l	
First season					
Control	20.14	22.27	26.90	29.46	24.69
HA at 4 ml/l	21.68	25.28	30.31	33.88	27.79
HA at 8 ml/l	25.51	30.74	33.48	38.36	32.02
AA at 200 ppm	22.68	26.49	32.53	36.49	29.55
AA at 400 ppm	27.28	31.02	36.62	42.22	34.29
HA4 ml/l+AA200 ppm	32.97	36.97	42.24	47.66	39.96
HA8 ml/l+AA400 ppm	36.07	42.02	47.26	52.48	44.46
Mean (A)	26.62	30.69	35.62	40.08	
L.S.D. at 5%	A: 2.06 B: 1.60 AB: 3.19				
Second season					
Control	25.61	28.69	31.19	35.29	30.19
HA at ml/l	32.43	35.01	43.20	49.93	40.14
HA at 8 ml/l	35.86	41.85	46.71	56.31	45.18
AA at 200 ppm	33.42	37.73	46.05	53.39	42.65
AA at 400 ppm	38.83	44.34	51.19	57.48	47.96
HA4 ml/l+AA200 ppm	43.37	48.13	54.70	59.15	51.34
HA8 ml/l+AA400 ppm	45.31	50.69	56.92	60.49	53.35
Mean (A)	36.40	40.92	47.14	53.15	
L.S.D. at 5%	A: 1.46 B: 1.41 AB: 2.83				
HA: Humic acid	AA: Amino acids				

Table (4): Effect of spraying with active yeast, humic acid and/or amino acids on fruits yield / fed. (kg) of dill (*Anethum graveolens*, L.) plants during 2016/2017 and 2017/2018 seasons.

Humic acid and /or amino acidstreatments (B)	Active yeast treatments (A)				Mean (B)
	0.0	2.5 g/l	5 g/l	10 g/l	
First season					
Control	784	866	1046	1146	960
HA at 4 ml/l	843	983	1179	1318	1081
HA at 8 ml/l	992	1195	1302	1492	1245
AA at 200 ppm	882	1030	1265	1419	1149
AA at 400 ppm	1061	1206	1424	1642	1333
HA4 ml/l+AA200 ppm	1282	1438	1642	1854	1554
HA8 ml/l+AA400 ppm	1403	1634	1838	2041	1729
Mean (A)	1035	1193	1385	1559	
L.S.D. at 5%	A: 80 B: 62 AB: 124				
Second season					
Control	996	1116	1213	1372	1174
HA at 4 ml/l	1261	1362	1680	1942	1561
HA at 8 ml/l	1395	1627	1816	2190	1757
AA at 200 ppm	1300	1467	1791	2076	1659
AA at 400 ppm	1510	1724	1990	2236	1865
HA4 ml/l+AA200 ppm	1686	1872	2127	2300	1996
HA8 ml/l+AA400 ppm	1762	1971	2213	2352	2075
Mean (A)	1416	1591	1833	2067	
L.S.D. at 5%	A: 57 B: 55 AB: 110				
HA: Humic acid	AA: Amino acids				

Table (5): Effect of spraying with active yeast, humic acid and/or amino acids on essential oil percentage of herb of dill (*Anethum graveolens*, L.) plants during 2016/2017 and 2017/2018 seasons.

Humic acid and /or amino acidstreatments (B)	Active yeast treatments (A)				Mean(B)
	0.0	2.5 g/l	5 g/l	10 g/l	
First season					
Control	1.4	1.42	1.43	1.49	1.44
HA at 4 ml/l	1.52	1.58	1.66	1.67	1.61
HA at 8 ml/l	1.57	1.68	1.82	1.85	1.73
AA at 200 ppm	1.53	1.66	1.68	1.74	1.65
AA at 400 ppm	1.65	1.74	1.85	1.93	1.79
HA4 ml/l+AA200 ppm	1.67	1.8	1.93	1.96	1.84
HA8 ml/l+AA400 ppm	1.74	1.94	1.97	1.98	1.91
Mean (A)	1.58	1.69	1.76	1.80	
L.S.D. at 5%	A: 0.05 B: 0.04 AB: 0.08				
Second season					
Control	1.5	1.52	1.6	1.65	1.57
HA at 4 ml/l	1.58	1.61	1.83	1.89	1.73
HA at 8 ml/l	1.61	1.65	1.9	2.01	1.79
AA at 200 ppm	1.58	1.62	1.85	1.89	1.74
AA at 400 ppm	1.62	1.67	1.92	2.02	1.81
HA4 ml/l+AA200 ppm	1.83	1.88	1.94	2.07	1.93
HA8 ml/l+AA400ppm	1.93	1.95	1.97	2.1	1.99
Mean (A)	1.66	1.70	1.86	1.95	
L.S.D. at 5%	A: 0.04 B: 0.03 AB: 0.05				
HA: Humic acid	AA: Amino acids				

Table (6): Effect of spraying with active yeast, humic acid and/or amino acids on essential oil yield of herb / fed. (liter) of dill (*Anethum graveolens*, L.) plants during 2016/2017 and 2017/2018 seasons.

Humic acid and /or amino acidstreatments (B)	Active yeast treatments (A)				Mean(B)
	0.0	2.5 g/l	5 g/l	10 g/l	
First season					
Control	35.9	40.1	45.5	51.9	43.4
HA at 4 ml/l	44.9	54.8	70.9	78.3	62.2
HA at 8 ml/l	55.8	68.7	87.9	94	76.6
AA at 200 ppm	47.1	61.2	73.4	84.5	66.6
AA at 400 ppm	61.3	74	93.1	105.9	83.6
HA4 ml/l+AA200 ppm	67.8	85.3	108.7	124.9	96.7
HA8 ml/l+AA400 ppm	76.5	97	118.1	133	106.2
Mean (A)	55.6	68.7	85.4	96.1	
L.S.D. at 5%	A: 3.7 B: 2.2 AB: 4.5				
Second season					
Control	44.1	50.2	58.3	64.6	54.3
HA at 4 ml/l	53	59.5	77.9	91.9	70.6
HA at 8 ml/l	62.5	72.8	97	115.9	87.1
AA at 200 ppm	56.4	64.9	85.5	96.7	75.9
AA at 400 ppm	68.2	80.6	108.9	125.7	95.9
HA4 ml/l+AA200 ppm	88.3	102.4	119.8	139.5	112.5
HA8 ml/l+AA400 ppm	99.9	109.5	127.7	146.8	121.0
Mean (A)	67.5	77.1	96.4	111.6	
L.S.D. at 5%	A: 3.0 B: 3.1AB: 6.1				
HA:Humic acid	AA:Amino acids				

Table (7): Effect of spraying with active yeast, humic acid and/or amino acids on essential oil percentage of fruits of dill (*Anethum graveolens*, L.) plants during 2016/2017 and 2017/2018 seasons.

Humic acid and /or amino acidstreatments (B)	Active yeast treatments (A)				Mean(B)
	0.0	2.5 g/l	5 g/l	10 g/l	
First season					
Control	2.23	2.29	2.41	2.49	2.36
HA at 4 ml/l	2.26	2.62	3.13	3.23	2.81
HA at 8 ml/l	2.42	2.69	3.22	3.45	2.95
AA at 200 ppm	2.31	2.64	3.13	3.32	2.85
AA at 400 ppm	2.44	2.75	3.25	3.52	2.99
HA4 ml/l+AA200 ppm	2.53	2.8	3.26	3.54	3.03
HA8 ml/l+AA400 ppm	2.67	2.82	3.31	3.55	3.09
Mean (A)	2.41	2.66	3.10	3.30	
L.S.D. at 5%	A 0.05:B: 0.05 AB: 0.09				
Second season					
Control	2.3	2.35	2.49	2.58	2.43
HA at 4 ml/l	2.35	2.69	3.2	3.28	2.88
HA at 8 ml/l	2.4	2.85	3.34	3.42	3.00
AA at 200 ppm	2.36	2.7	3.22	3.3	2.90
AA at 400 ppm	2.44	2.87	3.36	3.46	3.03
HA4 ml/l+AA200 ppm	2.56	2.91	3.42	3.54	3.11
HA8 ml/l+AA400 ppm	2.65	2.96	3.43	3.6	3.16
Mean (A)	2.44	2.76	3.21	3.31	
L.S.D. at 5%	A: 0.06 B: 0.03 AB: 0.05				
HA: Humic acid	AA: Amino acids				

Table (8): Effect of spraying with active yeast, humic acid and/or amino acids on essential oil yield of fruits /fed. (liter) of dill (*Anethum graveolens*, L.) plants during 2016/2017 and 2017/2018 seasons.

Humic acid and /or amino acidstreatments (B)	Active yeast treatments (A)				Mean(B)
	0.0	2.5 g/l	5 g/l	10 g/l	
First season					
Control	17.4	20	25.1	28.5	22.8
HA at 4 ml/l	19.1	25.7	36.8	42.5	31.0
HA at 8 ml/l	24.1	32.1	42	51.6	37.5
AA at 200 ppm	20.5	27.4	39.5	47.2	33.7
AA at 400 ppm	25.9	33.3	46.3	57.8	40.8
HA4 ml/l+AA200 ppm	32.5	40.2	53.5	65.7	48.0
HA8 ml/l+AA400 ppm	37.3	46.1	60.8	72.3	54.1
Mean (A)	25.3	32.1	43.4	52.2	
L.S.D. at 5%	A: 2.3 B: 1.7 AB: 3.4				
Second season					
Control	22.9	26.2	30.3	35.4	28.7
HA at 4 g/l	29.5	36.6	53.8	63.7	45.9
HA at 8 g/l	33.3	46.4	60.7	74.9	53.8
AA at 200 ppm	30.7	39.7	57.7	68.5	49.2
AA at 400 ppm	36.8	49.6	67	77.4	57.7
HA4g/l+AA200ppm	43.3	54.3	72.9	81.5	63.0
HA8g/l+AA400ppm	46.8	58.5	75.8	84.8	66.5
Mean (A)	34.8	44.5	59.7	69.5	
L.S.D. at 5%	A: 2.2 B: 1.7AB: 3.5				
HA:Humic acid	AA:Amino acids				

Table (9): Effect of spraying with active yeast, humic acid and/or amino acids on chlorophyll a content (mg/ g F.W.) of dill (*Anethum graveolens*, L.) plants during 2016/2017 and 2017/2018 seasons.

Humic acid and /or amino acidstreatments (B)	Active yeast treatments (A)				Mean(B)
	0.0	2.5 g/l	5 g/l	10 g/l	
First season					
Control	2.109	2.114	2.198	2.228	2.162
HA at 4 ml/l	2.268	2.277	2.4	2.469	2.354
HA at 8 ml/l	2.365	2.381	2.49	2.582	2.455
AA at 200 ppm	2.271	2.282	2.403	2.479	2.359
AA at 400 ppm	2.369	2.386	2.495	2.589	2.460
HA4 ml/l+AA200 ppm	2.416	2.424	2.524	2.629	2.498
HA 8 ml/l+AA400ppm	2.424	2.435	2.528	2.669	2.514
Mean (A)	2.317	2.328	2.434	2.521	
L.S.D. at 5%	A: 0.013 B: 0.012AB:0 .024				
Second season					
Control	2.114	2.114	2.225	2.285	2.185
HA at 4 ml/l	2.286	2.287	2.461	2.488	2.381
HA at 8 ml/l	2.47	2.47	2.635	2.65	2.556
AA at 200 ppm	2.287	2.288	2.463	2.496	2.384
AA at 400 ppm	2.471	2.471	2.64	2.655	2.559
HA4 ml/l+AA200 ppm	2.634	2.638	2.686	2.725	2.671
HA8 ml/l+AA400 ppm	2.648	2.652	2.692	2.815	2.702
Mean (A)	2.416	2.417	2.543	2.588	
L.S.D. at 5%	A: 0.011 B: 0.013AB:0.026				
HA:Humic acid	AA: Amino acids				

Table (10): Effect of spraying with active yeast, humic acid and/or amino acids on chlorophyll b content (mg/ g F.W.) of dill (*Anethum graveolens*, L.) plants during 2016/2017 and 2017/2018 seasons.

Humic acid and /or amino acidstreatments (B)	Active yeast treatments (A)				Mean(B)
	0.0	2.5 g/l	5 g/l	10 g/l	
First season					
Control	0.748	0.753	0.773	0.787	0.765
HA at 4 ml/l	0.76	0.771	0.82	0.83	0.795
HA at 8 ml/l	0.802	0.834	0.862	0.875	0.843
AA at 200 ppm	0.767	0.774	0.825	0.84	0.802
AA at 400 ppm	0.822	0.836	0.87	0.886	0.854
HA4 ml/l+AA200 ppm	0.852	0.867	0.886	0.9	0.876
HA8 ml/l+AA400 ppm	0.866	0.878	0.889	0.908	0.885
Mean (A)	0.802	0.816	0.846	0.861	
L.S.D. at 5%	A: 0.004 B: 0.004AB:0 .008				
Second season					
Control	0.752	0.757	0.775	0.8	0.771
HA at 4 ml/l	0.763	0.777	0.825	0.84	0.801
HA at 8 ml/l	0.817	0.847	0.867	0.886	0.854
AA at 200 ppm	0.767	0.782	0.832	0.842	0.806
AA at 400 ppm	0.823	0.853	0.874	0.895	0.861
HA4 ml/l+AA 200 ppm	0.864	0.875	0.896	0.914	0.887
HA8 ml/l+AA 400 ppm	0.87	0.88	0.904	0.928	0.896
Mean (A)	0.808	0.824	0.853	0.872	
L.S.D. at 5%	A: 0.007 B: 0.006AB: 0.012				
HA:Humic acid	AA: Amino acids				

Table (11): Effect of spraying with active yeast, humic acid and /or amino acids on carotenoids content of dill (*Anethum graveolens*, L.) plants during 2016/2017 and 2017/2018 seasons.

Humic acid and /or amino acidstreatments (B)	Active yeast treatments (A)				Mean(B)
	0.0	2.5 g/l	5 g/l	10 g/l	
First season					
Control	0.836	0.846	0.871	0.882	0.859
HA at 4 g/l	0.863	0.877	0.9	0.91	0.888
HA at 8 g/l	0.898	0.904	0.924	0.939	0.916
AA at 200 ppm	0.87	0.879	0.906	0.913	0.892
AA at 400 ppm	0.906	0.908	0.932	0.943	0.922
HA4g/l+AA200ppm	0.912	0.917	0.941	0.949	0.930
HA8g/l+AA400ppm	0.922	0.926	0.944	0.953	0.936
Mean (A)	0.887	0.894	0.917	0.927	
L.S.D. at 5%	A: 0.005 B: 0.004AB: 0.008				
Second season					
Control	0.839	0.854	0.874	0.89	0.864
HA at 4 ml/l	0.879	0.886	0.904	0.928	0.899
HA at 8 ml/l	0.907	0.914	0.934	0.955	0.928
AA at 200 ppm	0.884	0.894	0.912	0.934	0.906
AA at 400 ppm	0.912	0.918	0.938	0.958	0.932
HA4 ml/l+AA200 ppm	0.921	0.928	0.951	0.969	0.942
HA8 ml/l+AA400 ppm	0.928	0.933	0.954	0.979	0.949
Mean (A)	0.896	0.904	0.924	0.945	
L.S.D. at 5%	A: 0.006 B: 0.006AB:0 .012				
HA:Humic acid	AA:Amino acids				

REFERENCES

Abd El-Rahman, A.H. (2016): Possibility of improving the productivity of *Matricaria chamomilla* plants by using some agricultural treatments. M.Sc. Thesis, Fac. Agric., Al-Azhar Univ.

Abd El-Rahman, S.S.A.; Faragallah, M.A. and Abd El-Kader, A.A.S. (2008): Growth, yield and chemical composition of *Foeniculum vulgare*, Mill. as affected by nitrogen, dry yeast and tryptophan application. Assiut J. of Agric. Sci., 39 (3): 115-134.

Ali, A.F.; Azzaz, N.A. and Hassan, E.A. (2006): Influence of spraying active dry yeast, methionine and ascorbic acid on growth, yield and oil of anise (*Pimpinella anisum, L.*) plants. Minia J. Agric. Res. & Dev.26 (4): 683-716.

Ali, E.A. (2007): Effect of spraying with zinc and some amino acids on growth, yield, oil production and plant constituents of caraway (*Carum carvi*, L.) plants. M.Sc. Thesis, Fac. Agric., Cario Univ.

Aly, M.K.; Mohamed, M.A.H.; Attia, F.A.; El-Sayed, A.A. and Abd EL-Gawad, M.H. (2007): Effect of some organic and biofertilization treatments on coriander plants. L. Vegetative growth and yield. 1st Inter. Conf. on Desert . Cultivation, Problems & Solutions, Minia., Egypt. 27-29, March. p. 101-111.

Ayyat, A.M.M. (2017): Response of fennel (*Foeniculum vulgare, Miller*) plants to mineral, organic and bio- fertilization, as well as, royal jelly treatments. Ph.D.Thesis, Fac. Agric., Minia univ., Egypt.

Beyzi, E.; Gunes, A. and Gurbuz, B. (2017): Effect of humic acid treatments on yield, morphological characteristics and essential oil components of coriander (*Coriandrum sativum, L.*) Res. J. of soil Biology, 9 (1): 1-8.

Bradley, D. (2013): Antioxidant nanotubes. Amino acids radical assimilation. Spectroscopy Now.Com.

British Pharmacopoeia (1963) : Determination of Volatile Oil Drugs. The Pharmaceutical Press, London.

El-Awadi, M.E. and Hassan, E.A (2010): Physiological response of fennel (*Foeniculum vulgare*, Mill) plants to some growth substances. The effect of certain amino acids and a pyrimidine derivative. J. of American Sci., 6 (7): 120-125.

Eyheraguibel, B., Silvestre. J. and Morard, P. (2008): Effect of humic substances derived from organic waste enhancement on the growth and mineral nutrition of maize. Biores. Technol., 99 : 4206-4241.

Fadl, M.S. and Seri El-Deen, S.A. (1978): Effect of N-benzyladenine on photosynthetic pigments and total soluble sugars of olive seedlings grown under saline conditions. Res. Bull.,

Fac. Agric., Ain Shams Univ., 843.

Fletcher, R.A., Hofstra, G. and Gad, J. (1988): Comparative fungi toxic and plant growth regulating properties of triazole derivatives. Plant Cell Physiology, 27: 367-371.

Gadimov, A.; Ahmaedova, N. and Alieva, R.C. (2007): Symbiosis nodules bacteria *Rhizobium legominosarum* with peas (*Pisum sativum*) nitrate reductase, salinification and potassium humate .Azerbaijan National Academy of Sciences. Azerbaijan. Natl Acad Sci, Baku 4:158-163.

Goss, J. A. (1973): Amino Acid Synthesis and Metabolism. In: Physiology of plants and their cells. Pergamon Press, Inc., New York. P 202.

Hassanein, R. A. M. (2003): Effect of some amino acids, trace elements and irradiation on fennel (*Foeniculum vulgare L.*). Ph.D. Thesis. Fac. Agric., Cairo Univ.

Helmy, T.A. (2016): Influence of some agricultural treatments on cumin plant. Ph.D. Thesis, Fac. Agric., Minia Univ., Egypt.

Hemdan, Sh. H. (2008): Effect of some organic and biofertilization treatments on anise plants. M. Sc. Thesis, Fac. Agric. Minia. Univ.

Hwang, H. and Moser, J. K. (2016): Amino acids antioxidants for fryin oil . Amercian Oil Chemists Society (Abstract).

Kenawy, A.G. (2010): Response of *Ammi visnaga,* L. plants to some organic and bio- fertilization treatments. Ph. D. Thesis, Fac. Of Agric., Minia Univ.

Mahran, G.H.; Kadry, H.A.; Thabet, C.X.; El-Olemy, M.M.; Al-Azizi, M.M.; Schiff, P.L. and Wong, L.K.N. (1992): GCIMS analysis of volatile oil of fruits of *Anethum graveolens*. Int. J. Pharamacognosy, 30 (2) : 139-144.

Mead, R.; Currow, R.N. and Harted, A.M. (1993): Statistical Methods in Agricultural and Experimented Biology. 2nd Ed. Chapman and Hall, London, pp. 10-44.

MSTAT-C (1986): A microcomputer program for the design, management and analysis of agronomic research experiments (version 4), Michigan State Univ., USA.

Peirce, A. (1999): The American pharmaceutical association practical guide to natural medicines. Slonesong Press, New York.

Rekaby, A.M. (2013): Improving the productivity of coriander plants by the use of some unconventional treatments. Ph.D. Thesis, Fac. Agric., Miniia Univ., Egypt.

Said- Al Ahl, H.A.H.; El-Gendy, A.G. and Omar, E.A. (2016): Humic acid and indole acetic acid affect yield and essential oil of dill grown under two different locations in Egypt. J. Pharm. Sci & Res., 8(7) : 594-606.

Schmidt, R.E. (2005): Biostimulants function in Turf grass nutrition. Ph.D. Emeritus Virginia Tech.

Shahin, S.M.; Bachran, A.; El-Sayed, A. and El-Tayeb, H.F. (2014): Improving growth and quality of Merremia dissecta (Jacq). H.G. Hallier twiner by some fertilization treatments. Alex. J. Agric. Res.,Vol. 59, No. l, pp. 43-49.

Shahraki, G.M.; Ganjali, H.R. and Javadzadeh, S.M. (2017) : Effect of manure foliar application of humic acid on yield and yield component of *Nigella sativa*, Inter. J. Agri. Biosci., 6 (1): 25-27.

Sharaf- El-Deen, M.N.; Massoudm, H.Y. and Ahmed, M.A. (2012): Effect of humic acid and fertilizers types on vegetative growth, fruit yield, essential oil, quality of fennel (*Foeniculum vulgare* Mill.) plants. J. Plant production, Mansoura Univ., Vol.3 (2): 201-215.

Smith, T.A. (1982): The function and metabolism of polyamines in higher plants. In Wareing P.F. (Ed.) Plant Growth Substances, Academic Press, New York.

Taiz, L. and Zeiger, E. (2002): Plant Physiology. Sunderland, Sinauer p.690.

Tartoura, E.A.A. (2001): Response of pea plants to yeast extract and two sources of N fertilizers. J. of Agric. Sci., Mansoura university, 26 (12) : 7887-7901.

Yassen, A.A; Mazhar, A.A.M. and Zaghloul, S.M. (2010): Response of anise plants to nitrogen fertilizer and foliar spray of tryptophan under agricultural drainage water. New York Sci. J., 3 (9): 120-127.

Zohry, D. and Hopf, M. (2000): Domestication of Plants in The Old World (3rd ed), Oxford: University Press .p.206.

استجابة نباتات الشبت لمعاملات الخميرة النشطة وحمض الهيوميك وبعض الأحماض الأمينية

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أجريت هذه التجربة خلال موسمي 2016/ 2017، 2018/2017 لدراسة استجابة نباتات الشبت من حيث النمو الخضري والمحصول ومكوناته والزيت الطيار وصبغات البناء الضوئي للخميرة النشطة بتركيز 2,5 ، 5 ، 10 جم / لتر ، حمض الهيوميك بتركيز 4 ، 8 مل / لتر وكذلك خليط من الاحماض الامينية (التربتوفان والميثيونين والسيستئين) بتركيز 200 ، 400 جزء في المليون توضح النتائج ان كل معاملات الخميرة وحمض الهيوميك والأحماض الأمينية أدت الي تحسين معنوي لصفات النمو الخضري ومكونات المحصول والزيت الطيار وكذلك محتوي صبغات البناء الضوئي الثلاث مقارنة بمعاملة الكنترول وكان التحسن في الصفات يزداد تدريجيا مع الزيادة التدريجية مع تركيزالمواد المختلفة معاملة نباتات الشبت بالخميرة النشطة بتركيز10 جم/ لتر + حمض الهيوميك بتركيز 8 او 4 مل / لتر + الاحماض الامينية بتركيز 400 او 200 جزء في المليون أدت الي الحصول علي أفضل النتائج فيما يخص النمو الخضري والمحصول ومكوناته وانتاج الزيت العطري (الطيار).

كلمات مفتاحية: نبات الشمر– الخميرة النشطة– حمض الهيوميك– الأحماض الأمينية.