



# INFLUENCE OF FOLIAR SPRAY AND SOIL APPLICATION OF THREE AMINO ACIDS COMPOUNDS IN GROWTH AND YIELD OF ONION (*ALLIUM CEPA* L.)

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## Abstract

A field experiment was implemented at vegetables field, Department of Plant Production, Technical Agricultural College, Mosul, Iraq, during 2018 season to study the effects of foliar spray and soil application of three amino acids compounds in growth and yield of onion (Azomine 4ml.L<sup>-1</sup>, Tecamin Max 3 ml.L<sup>-1</sup>, Delfan plus 3 ml.L<sup>-1</sup>). The experiment was subjected in simple experiment in randomized complete block design with three replications.

The results revealed that

- 1- The foliar spray + soil application of the three amino acid compounds effects many parameters significantly compared with soil application or foliar spray.
- 2- Foliar spray + soil application with Azomine increased significantly plant length, plant leaves number, fresh and dry weight of plant, average bulb weight, bulb diameter, total yield of bulb protein content and TSS% in bulb compared with other treatments.

**Key words :** Onion, bulb, amino acids, foliar spray.

## Introduction

Onion (*Allium cepa* L.) is a species of the *alliaceae* family of great economic importance and is the second most important vegetable crops in the world.

Amino acids can directly or indirectly influence the physiological activities of the plant. Functionally, amino acids especially L-amino acids rather than Diamino acids are involved in the enzymes responsible for the structural photosynthesis process. Also, amino acids have act as chelating effect on micronutrients, when applied together with micronutrients, the absorption and transportation of micronutrients inside the plant is easier (Ibrahim, 2010). The requirement of amino acids in essential quantities is well known as a mean to increase yield and overall quality of crops. The application of amino acids for foliar spray is based on their requirement by plants in general and critical stages of growth in particular. Also amino acids are fundamentals ingredients in the process of protein

synthesis) (Shafeek *et al.*, 2012). About 20 important amino acids are involved in the process of each function (Ewais *et al.*, 2005). Khalil *et al* (2008) found that foliar spray of both amino acids and micronutrients together on onion plants could improve the onion yield and its components. Some researchers pointed out the importance of amino acids in increasing growth, yield and chemical composition of some economic plants. El-Shabas *et al.* (2005) spraying garlic plants with a mixture of glycine, alanine, cysteine and arginine and found that spraying with 100 ppm of cysteine alone gave significant increases of total yield over the control. In the same respect (Amin *et al.*, 2011) on onion found that foliar application of Glutamic acid significantly increased plant growth, yield of onion and quality of bulbs as well as total soluble sugars were increased by increasing Glutamic acid concentrations up to 200 mg/L.

Recently, several commercial compounds that include amino acids in their composition are recommended to be

applied to increase the growth and yield of economical crops. Some of amino acids such as tryptophan were identified as precursor of phytohormones (Glawischnig *et al.*, 2000). Amino acids are involved in the synthesis of other organic compounds, such as protein, amines, alkaloids, vitamins, enzymes, terpenoids (Ibrahim *et al.*, 2010).

Amino acids are crucial to stimulating cell growth, act as buffers, provide a source of carbon and energy and protect the cells from ammonia toxicity, with amid formation (Abdel Aziz *et al.*, 2010).

Commercially available amino acid stimulants can improve fertilizer assimilation, increase uptake of nutrients and water, enhance the photosynthetic rate and dry matter partitioning, and hence increase crop yield. Amino acids are well-known as bio-stimulant which have positive effects on plant growth, yield and significantly mitigates the injuries caused by a biotic stresses (Kowalczyk and Zielony, 2008).

The aim of the present study was to investigate the effect of different compounds amino acid on growth, yield and some chemical properties of onion bulbs.

### Materials and Methods

The field experiments was implemented at vegetables field, Department of Plant Production, Technical Agricultural College, Mosul, Iraq, during season 2018. The aim of this study was to investigate the effect of three amino acids compounds (Azomine 4ml.L<sup>-1</sup>, Tecamin Max 3 ml.L<sup>-1</sup>, Delfan plus 3 ml.L<sup>-1</sup>) (The composition of this compound in table 1) as foliar and soil application near the plants roots with 10 treatments as following:

- 1- Control
- 2- Azomine 4ml.L<sup>-1</sup> foliar spray .
- 3- Azomine 4ml.L<sup>-1</sup>soil application
- 4- Azomine 4ml.L<sup>-1</sup> foliar spray + Azomine soil application.
- 5- Tecamin Max 3 ml.L<sup>-1</sup> foliar spray.
- 6- Tecamin Max 3 ml.L<sup>-1</sup> soil application .
- 7- Tecamin Max 3 ml.L<sup>-1</sup> foliar spray + soil application.
- 8- Delfan plus 3 ml.L<sup>-1</sup> foliar spray.
- 9- Delfan plus 3 ml.L<sup>-1</sup> soil application
- 10- Delfan plus. 3 ml.L<sup>-1</sup> foliar spray + soil application.

The application of this compounds was three times after 60, 80 and 100 days of planting date. The bulblets of red local onion cultivar was sown in 1st Feb. in lomey

soil. Table 2 showed the physical and chemical properties of the experimental soil, at 20 cm distances on the two sides of each ridge. The treatments were arranged in complete randomized block design with three replicates. All experiment area received the recommended dose of organic and mineral fertilizers. The other common agricultural practices for growing onion plants according to the recommendations of commercial onion planting in Mosul, Iraq.

### Recorded data

Plant length (cm), number of leaves/plant, fresh weight of leaves (gr.), dry weight of leaves (gr.), bulb diameter (cm.), Average weight of bulb (gr.), total yield of bulbs (ton/ha.), bulb dry matter %, TSS %, N % and Protein %.

Nitrogen was determined using modified micro-Kjeldahl according to method of Huphries (1965), protein percentages in bulbs were calculated by multiplying nitrogen content by 6.25. Reading of TSS was taken using hand refract meter calibrated as percent sucrose.

The results were statistically analysis according to the statistical analysis system (SAS) (SAS, 1998) and compared with the means by Duncan multiple rang test at 0.05 level (Al-Rawy and Kalaf, 2000).

### Results and Discussion

Table 3 shows the effect of amino acid compounds on growth parameters of onion plants. Data show that growth of onion plants varied in its responses to amino acid compounds source and method of application (foliar spray or soil application), where Azomine (foliar spray + soil application) gain the highest length of the plant (38.61 cm.), the highest number of leaves per plant (6.95), highest fresh and dry weight of leaves (38.72 and 6.48), respectively with significantly superior on other treatments except Tecamen Max (foliar spray + soil application). The lowest values for this parameters were obtained from control treatment, which gain (27.45 cm., 5.05 leaf, 30.25 gr. and 5.06 gr.) for plant length, number of leaves, fresh and dry weight of leaves, respectively.

Data concerning the effect of amino acid compounds on bulb yield parameters of onion plant, *i.e.*, bulb diameter, average weight of bulb and total yield of bulbs were presented in table 4. Obtained results indicated that (foliar spray + soil application) with Azomine significantly increased all the investigated yield parameters as compared with control and with all other treatments. Results revealed that the highest values of the investigated parameters were recorded from this treatment, which are (7.24 cm) for bulb diameter, (138.27 gr.) for average

**Table 1 :** Composition of amino acids compounds.

Azomine	Tecamen Max	Delfan plus
Total amino acids 32%	Total amino acids 14.4%	Total amino acids 24%
Organic N 5%	L. amino acids 12%	Total N 9%
Liquid Organic N 4.5%	Organic acids 60%	
Organic C 10%	Total azol (N) 7%	
	pH 6.6	

**Table 2 :** Physical and chemical properties of the experimental soil.

Properties	Value
pH	7.3
Organic matter gr.Kg <sup>-1</sup>	21
E.C. ds. m <sup>-1</sup>	3.380
Cation Exchange Capacity Meq. 100 g.soil-1	14.78
Available N (ppm)	42
Available P (ppm)	0.89
Soluble K (ppm)	141
CaCO <sub>3</sub> g. Kg <sup>-1</sup>	225
Particle Size g. Kg <sup>-1</sup>	
Sand	493.5
Clay	161.8
Silt	344.7
Texture class	Lomey

**Table 3 :** Effect of amino acids compounds on vegetative growth of onion.

Treatment	Plant length( cm.)	No. ofLeaves/plant	Fresh wt.ofleaves (gr.)	Dry wt.ofleaves (gr.)
Control	27.45 d	5.05 e	30.25 d	5.06 e
Azomine foliar spray	33.42 bc	5.86 bcd	34.44 bcd	5.74 bcd
Azomine soil application	36.21 ab	6.02 bc	34.83 abc	5.83 bc
Azomine foliar + soil	38.64 a	6.95 a	38.72 a	6.48 a
Tecamin foliar spray	31.56 bcd	5.32 cde	32.18 bcd	5.36 cde
Tecamin soil application	32.44 bcd	5.74 bcde	34.22 bcd	5.78 bcd
Tecamin foliar + soil	36.52 ab	6.42 ab	36.18 ab	6.18 ab
Delfan foliar spray	28.56 cd	5.11 de	31.22 cd	5.22 de
Delfan soil application	30.41 cd	5.22 de	31.68 cd	5.34 cde
Delfan foliar + soil	33.42 bc	5.84 bcd	33.36 bcd	5.67 bcd

Means followed with the same letter are not significantly different according to Duncan multiple range test at the probability of 0.05 levels..

weight of bulb and (19.751 ton/ha) for total yield of bulbs, while the lowest values of this parameters were from control treatment, which recorded (5.02 cm., 117.42 gr., and 16.773 ton/ha) for the three parameters, respectively.

Data in table 5 showed the effect of amino acid compounds on bulb quality parameters of onion (bulb dry matter %, TSS %, N % and protein %). The results reported that (foliar spray + soil application) with Azomin significantly increased all the investigated parameters as

compared with control and with many other treatments, results reported that the greatest values were recorded from this treatment, which are (12.82%) for dry matter %, (11.92%) for TSS%, (2.32%) for N % and (14.50%) for protein %.

The increased in vegetative growth, yield and bulb quality of onion parameters shown in tables 3, 4, 5 as a result of applying amino acid compounds may be due to the composition of this compounds especially its contain many amino acids, which is very necessary for plant growth and yield. Amino acids can directly or indirectly influence the physiological activities of the plant and involved in the enzymes responsible for the structural photosynthesis process, also amino acids have act as chelating effect on micronutrients, when applied together with micronutrients, the absorption and transportation of micronutrients inside the plant is easier (Ibrahim, 2010). This results is in agreements with many other researchers, El-Shabas *et al.* (2005) spraying garlic plants with a mixture of glycine, alanine, cysteine and arginine and found that spraying with 100 ppm of cysteine alone gave significant increases of total yield over the control. Khalil *et al.* (2008) found that foliar spray of both amino acids and micronutrients together on

onion plants could improve the onion yield and its components. Amin *et al.* (2011) on onion found that foliar application of Glutamic acid significantly increased plant growth, yield of onion and quality of bulbs as well as total soluble sugars were increased by increasing Glutamic acid concentrations up to 200 mg/L.

## Conclusion

From the results of this study we can conclude that :

**Table 4 :** Effect of amino acids compounds on yield of onion.

Treatment	Bulb diameter (cm.)	Average weight of bulb (gr.)	Total yield of bulbs (ton/ha)
Control	5.02 e	117.42 f	16.773 f
Azomine foliar spray	6.74 b	131.67 bc	18.809 bc
Azomine soil application	6.96 ab	130.45 bc	18.634 bc
Azomine foliar +soil	7.24 a	138.27 a	19.751 a
Tecamin foliar spray	6.01 d	127.41 bcde	18.200 bcde
Tecamin soil application	6.21 cd	129.62 bcd	18.516 bcd
Tecamin foliar + soil	6.58 bc	132.52 b	18.930 b
Delfan foliar spray	5.11 e	122.72 e	17.530 e
Delfan soil application	5.41 e	124.25 de	17.749 de
Delfan foliar + soil	5.82 d	126.34 cde	18.047 cde

Means followed with the same latter are not significantly different according to Duncan multiple range test at the probability of 0.05 levels.

**Table 5 :** Effect of amino acids compounds on of bulb quality of onion.

Treatment	Bulb dry matter %	TSS %	N %	Protein %
Control	10.22 e	10.21 f	1.74 c	10.87 f
Azomine foliar spray	12.02 b	11.22 bc	2.12 ab	13.25 b
Azomine soil application	12.22 ab	11.53 b	2.03 abc	12.68 bc
Azomine foliar + soil	12.82 a	11.92 a	2.32 a	14.50 a
Tecamin foliar spray	11.42 bc	10.86 de	1.94 bc	12.12 cde
Tecamin soil application	11.86 b	11.02 cd	1.86 bc	11.62 def
Tecamin foliar + soil	12.12 ab	11.32 bc	1.92 bc	12.01 cde
Delfan foliar spray	10.52 de	10.41 f	1.71 c	10.68 f
Delfan soil application	10.67 cde	10.42 f	1.82 bc	11.37 ef
Delfan foliar + soil	11.02 cd	10.53 ef	1.98 abc	12.37 bc

Means followed with the same latter are not significantly different according to Duncan multiple range test at the probability of 0.05 levels.

1- The foliar spray + soil application of the three amino acid compounds effects many parameters significantly compared with soil application or foliar spray.

2- Foliar spray + soil application with Azomine increased significantly plant length , plant leaves number , fresh and dry weight of plant, average bulb weight, bulb diameter, total yield of bulb, protein content and TSS% in bulb compared with other treatments.

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