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Effects of Foliar Application of Amino acid and bio fertilizer on growth and yield of onion plant under newly reclaimed land conditions

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ABSTRACT

Two experiments were achieved through winter season of 2016/2017 and 2017/2018 at the experimental station of the National Research Centre at Nubaria zone, (North Egypt) to search of onion plants to foliar application of different concentration of amino acid (Amino mix) at (1, 2 cm/L) and foliar spraying with water together with pollination by N-fixers bacteria (piogen) at (1, 2 kg/fed.) and without bio-fertilizer and interaction effect for leverage plant growth, total bulbs yield and its components as well as bulb feeding value of onion plants c.v. Giza 20. These treatments were laid out in split plot styling configuration with three replications. The concise results obtained from this field reported that: 1- Inoculated onion plants by highest level of N-fixing bacteria (piogen) at (2 kg/fed.) significantly exceed vaccinated by low level (1 kg/fed.) and without inoculated (control) in plant length, number of leaves/plant, fresh and dry weight of plant and bulb and neck parameters and total yield (ton/fed.) as well as the content of N, protein, P, K and total carbohydrate in bulb tissues. 2- Foliar application by high concentration of amino mix (2 cm/L) significantly improved all plant growth characters, total yield and its components as well as the bulb contents of the percentage of N, protein, P,K and carbohydrate followed in descending order by that plants spraying by (1 cm/L) followed with the control treatment (foliar spraying with water). 3- The interaction among bio-fertilizer and foliar application of amino mix generated no significant variance in both seasons.

***Keywords*:** Onion - N-fixing bacteria- amino mix - growth-yield- bulb quality

Introduction

Onion (*Allium cepa* L.) is important bulb crop of Egypt. As a vegetable, it is a low in fat and calories. It also contributes significantly to the human diet and has a therapeutic property. Onion is a source of ascorbic acid and dietary fiber too. It also possesses a high content of flavanoids (mainly quercetin and its conjugates) and sulpher compounds (i.e. thiosulphinates), both of which have a high level of antioxidant activity (Griffiths *et al.,* 2002).

Piogen has high amounts of symbiotic and non-symbiotic bacteria, which were responsible for fixation of N by atmosphere. The application of N fixing bacteria (Piogen) produced the following advantage as reported by (Fatma and Shafeek 2000): (a) decrease the value of mineral N by 25%. (b) Increasing the accessibility of all nutrients by plant. (c) Enhance the opposition of plant to root diseases and decrease the environment pollution created by the application of chemical fertilizers. The indiscriminate use of chemicals resulted in degradation of soil health, erosion, and loss of organic matter, nitrate pollution and also health hazard for human beings (Yang *et al.,* 2004). So, application of bio fertilizers results in increased mineral and water uptake, root development, vegetative growth and nitrogen fixation also stimulate production of growth promoting substance like vitamin-B complex, Indole acetic acid (IAA) and Gibberellic acids etc. They liberate growth promoting substances and vitamins and help to maintain soil fertility (Pratap, 2012). Several studies show that presence of *Azotobacter* spp. in soils has beneficial effects on plants, i.e., soil physic-chemical and microbiological properties. However, Shafeek *et al* (2016) found that inoculated broad bean plants by highest level of N-fixing bacteria (piogen) (2 kg/fed.) significantly exceed vaccinated by low level (1

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kg/fed.) and without inoculated (control) in plant length, number of shoots and leaves/plant, fresh and dry weight of plant and pod characters (length and wide), number of pods/plant, total yield (ton/fed.) and weight of 100- seeds as well as the content of N %, protein %, P % and K% in seeds tissues. In the same respect, Kurrey *et al* (2018) on onion plant the results shows significant increase in germination percentage (85%), bulb weight (120.7 g), maximum diameter of bulb (6.2 cm), bulb dry weight (23.9 g), plant dry weight (28.2 g), harvest index (69.35%) and plant height (57.3 cm), No. of leaves (11.4), chlorophyll- a (0.86 mg/g FW), chlorophyll b (0.47 mg/g FW) and carotenoid (0.75 mg/g FW), leaves protein (0.45 mg/g), bulb protein (1.2 mg/g), bulb sulphur (5.64 mg/g). So, keeping in view the above facts the present experiment was undertaken to find out the most effective dose of *Azotobacter* for growth and yield of onion (*Allium cepa* L.).

Amino acids are participatory in the compilation of other organic compounds, such as amines, alkaloids, vitamins, enzymes and protein1. It is the essential active ingredients for the fashion of protein compilation and exceedingly employs for the biosynthesis of vitamins, coenzymes, pigments, purine and pyrimidine ground (.Kamar, *et al* 1987). Concerning to the advantageous belongings foliar spraying of amino acids, many investigator have notify that, the valuable effects of amino acids to improved growth and yield for all crops. Concerning 20 serious amino acids are contributory in the mode of each action (Awad *et al* 2007). Some researchers indicate the interest of amino acids in increasing growth, yield and chemical synthesis of some frugal plants (El-Shabasi, *et al* 2005) splash garlic plants with a mishmash of glycine, alanine, cysteine and arginine (each at 100 ppm) or with 100 ppm of cysteine alone gave significant increases total yield overhead the control by (13.96 % and 13.66 %) and (14.40 % and 16.65 %) in the first and second seasons, respectively. Commercially ready amino acid stimulus can increase fertilizer absorption, improve uptake of nutrients and water, promote the photosynthetic average and dry matter fractionate, and for this reason increase crop yield. Many Studies have been confirm that amino acids can directly or indirectly affect the physiological performance in plant growth and expansion. In addition, El-Shabasi, *et al* (2005) on garlic, Awad *et al* (2007) on potato, Faten, *et al* (2010) on squash and Shafeek *et al* (2012) on onion reported that foliar purpose of amino acids occasion an increase in plant growth, fruit yield and ingredient. In the same respect, Ghaith, and Galal (2014) inform that, foliar spraying of pea plants with mishmash of amino acid at 100 ppm significantly improved plant growth characters, total pods yield and pods goodness. However, Shafeek *et al* (2012) found that amino acid concentration of 150 ppm produced the high leaves fresh weight / plant. In the same respect, amino acid concentration of 150 ppm was the most favorable concentrations for number and weight of bulbs / m^2, total yield (ton/fed.) and average weight of bulb (g). Whereas, 200 ppm concentration of amino acid exceeded other five concentrations in N %, protein %, TSS %, and dry matter %. While, without amino acid gave the greatest mean value from carbohydrate content in bulb tissues of onion plant.

Material and Methods

This study was carried out at the experimental station of the National Research Centre, Beheira Governorate (north of Egypt), during the two winter season of 2017 and 2018 to investigate the effect of foliar application of different concentrations of amino acid (0, 1 and 2 cm/L) and soil inoculation of N-fixed bacteria (Piogen) by different levels (0. 1 and 2 kg/fed.) for influence plant growth, total yield and bulb quality of onion plants cv. Giza 20. The experimental trails were conducted in sandy soil using drip irrigation system. Chemical analysis and physical properties of the experimental soil are shown in Table (1).

Table 1: The physical and chemical properties of the experimental soil.

Physical properties							
Sand		Clay	Silt	Texture	F.C. %	W.P. %	
90.08		9.26	0.66	Sandy	16.57	5.25	
Chemical analysis							
E.C. M/m	pH	Meq/ L					
		Ca	Mg	Na	K	Hco3	Cl
17	8.2	7.02	0.527	0.982	0.31	13	0.566

The chemical constituents of Amino-mix were shown in Table (2).

Table 2: The chemical composition of amino acid (Amino- mix).

Elements (g/100cm3)	Value	Amino acid	Value	Amino acid	Value	Vitamin (mg/100cm3)	Value
Zn	2	Aspartic	249	Methionine	180	B1	0.8
Fe	1.5	Thiamine	45	Isolucine	52	B2	2.4
Mn	0.50	Serine	56	Therionine	38	B6	1.2
Mg	0.004	Glutamic	55	Lalanine	22	B12	0.82
Cu	0.004	Glysine	50	Histidine	12	Folic	4.2
Ca	0.025	Alanin	100	Lucine	40	Pantothinic	0.52
Br	0.056	Praline	38	Arginine	20	Niacine	0.14
S	0.010	Valine	68	Tryptophan	20	Ascorbic	1.00
Co	0.03	cystein	44	-	-	-	-

Onion seedlings were transplanted on 22 th of December for two seasons. Onion seedlings were transplanted at 25 cm distances on the two sides of each ridge. Pest control and other agriculture practices were applied as commonly recommended for commercial onion production by Ministry of Agriculture. The experimental design was split plot with three replicates, where the two levels of inoculation of N- fixing bacteria (Piogen) at level of (1 and 2 kg/fed.) as well as without bio fertilizer were arranged within the main plots, but the 3 levels of amino acid (0 , 1 and 2 cm/L) were distributed in the sub-plots. Each experiment included 9 treatments with 3 replicates. The plot area was 15 m^2 (one row of 15 m length and 1m width). The tested amino acid was applied as a foliar spray thrice by 15 day intervals, beginning from 30 days after transplanting. Piogen contains *Azotobacter* sp. a nitrogen fixing bacteria, was obtained from General Organization for Agriculture Equalization Fund (G.O.A.E.F.) Ministry of Agriculture, The soil inoculation by bio fertilizer Piogen was added at transplanting date.

The following data recorded:

1-Plant growth characters:

After 45 days from transplanting samples of onion plants were taken and number of leaves/ plant, plant length (cm), fresh weight of leaves and nick (g/plant) were recorded.

2-Bulb yield and its physical properties:

At harvest time (180 days old) the weights of bulb and neck as (g) and TSS % as well as total yield (ton/fed.) were calculated.

Samples of 10 bulbs from each experimental plot were taken and bulb length and diameter as well as neck diameter were recorded.

3-Chemical quality:

At harvest time, onion bulb samples from each experimental plot were taken for elemental analysis i.e. the percentage of N, P and k contents in dry matter bulb tissue were determined according to the methods of Pregl (1945), Troug and Mayers (1939) and Brown and Lilleland (1964) respectively. In addition, protein percentages in bulbs were calculated by multiplying nitrogen content by 6.25. Total carbohydrates g/100 g in the dry matter bulb tissue was determined according the method described by Dubois *et al* (1959). All obtained data were subjected to the statistical analysis and means were compared according to LSD at 5% level test described by Gomez and Gomez (1984).

Results and Discussion

Growth characters:

Effect of bio fertilization:

The results explain in Table (3) for effect of the calculated bio-fertilizer treating on onion plant growth characters i.e., plant height (cm), number of leaves per plant as well as fresh and dry weight of plant. However, increase the inoculation of bio-fertilizer significantly increased all plant growth characters of plants compared without bio fertilizer. These results were correct in both seasons. Lately, inoculation by high level of bio fertilizer (2 kg/fed.) significantly improved onion plant growth characters compared low level (1 g k/fed.). These notability may be refer to the microorganisms inoculation, in the first place, fortified the rhizosphere with these bacteria. Furthermore, the microbial inoculation catalyze plant growth each directly, by output plant hormones and ameliorative nutrient uptake, or indirectly, by inconstant the microbial equation in rhizosphere in advocacy of the profitable microorganisms (Amara, *et al* 1995). Otherwise, N bio-fertilizer bacteria (Piogen) promote the plant growth by N-fixing in the plowed soil and participate some growth hormone reseeds as gibberellins, auxins and cytokinins (Leaungvutiviroj *et al*. 2010). Recently, this useful action was convenient with those obtained with (Fatma and Shafeek, 2000, Elham, *et al* 2014, Shafeek, *et al* 2016 and Kurrey *et al* 2018).

Table 3: Effect of soil inoculation by Nixing bacteria with foliar spray of amino mix on growth characters of onion plants during 2017 and 2018 seasons.

Bio fertilizer levels (kg/fed.)	Amino mix levels (cm/L)	2017				2018			
		Plant length (cm)	N .of leave/ /plant	Weight (g)		Plant length (cm)	N .of leaves/ plant	Weight (g)	
				Fresh	Dry			Fresh	Dry
Without	0	52.67	6.33	119.00	14.91	61.33	6.33	112.67	14.03
	1	56.00	7.33	124.00	15.60	68.00	7.00	118.33	14.33
	2	59.33	8.00	128.33	15.96	71.00	7.00	123.67	14.80
Mean		**56.00**	**7.22**	**123.78**	**15.49**	**66.78**	**6.78**	**188.22**	**14.35**
1	0	64.67	8.00	133.67	16.75	73.00	8.33	130.00	15.11
	1	69.33	9.00	138.33	17.15	74.00	8.67	134.33	15.90
	2	72.33	9.00	141.33	17.67	77.00	9.33	138.67	16.66
Mean		**68.78**	**8.67**	**137.78**	**17.19**	**74.67**	**8.78**	**134.33**	**15.89**
2	0	78.33	9.67	147.67	17.58	79.00	9.33	138.00	17.31
	1	86.33	10.67	154.33	18.50	86.00	10.00	144.67	17.96
	2	90.67	11.33	164.00	19.50	95.67	10.33	149.33	19.50
Mean		**85.11**	**10.56**	**155.33**	**18.53**	**86.89**	**9.99**	**144.00**	**18.26**
Average	0	65.22	8.00	133.44	16.414	71.11	8.00	126.89	15.48
	1	70.56	9.00	138.89	17.08	76.00	8.56	132.44	16.06
	2	74.11	9.44	144.56	17.71	81.22	8.89	137.22	16.99
LSD at 5% level	Bio	**3.50**	**0.71**	**4.61**	**0.14**	**1.09**	**0.78**	**4.33**	**0.35**
	Mix	**1.59**	**0.20**	**2.41**	**0.27**	**2.64**	**0.24**	**1.68**	**0.29**
	Interaction	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Effect of amino mix levels:

The results in Table (3) predominately specific that, foliar sprinkle with amino mix for all concentration confer the maximum significant growing in plant growth individuality expressed as plant height (cm), number of leaves as well as fresh and dry weight of plant compared without amino mix sprinkle (water). However, foliar sprinkle of amino mix at high concentration (2cm/L) significantly increasing plant growth characters of onion plants followed in descending order by that plants sprinkle by amino mix at (1cm/L) followed by foliar spraying with water (control). Moreover, all plant growth characters significantly improved between high and low concentration of amino mix.

These preceding data were right in both empirical seasons. It could be concluded that, amino mix can directly or indirectly leverage the physiographic activities of the plant. Also, amino mix have action as chelating action on micronutrients, while utilized with each other with micronutrients, the assimilation and transportation of micronutrients internal the plant is easy (Ibrahim, *et al* 2010). Also amino acids are basis active ingredients in the operation of protein structure (Shafeek, *et al* 2012). identical conclusion record by (El-Shabasi, *et al* 2005, Awad *et al* 2007, Shafeek *et al* 2012, Ghaith, and Galal 2014, and Shafeek *et al* 2016) found that, amino acid mix reflected the highest values for plant growth of vegetable plants.

Effect of the interactions:

The result on Table (3) reflected that the application of high level of amino mix (2cm/L) and high level of bio fertilizer (2kg/fed.) produced the high onion plant growth characters compared other treatments in both seasons. Moreover, the statistical analysis of the obtained data discovered that the divergence within different concentrations of bio-fertilizer with foliar spraying of amino mix treatments were not suitable to reach the 5% level of significant on plant growth on both seasons.

Total yield and its composition:

Effect of bio fertilization:

The effect given in Table (4) reported that the inoculation bio-fertilizer (Piogen) which was already had high significant refreshing effects on onion plant growth had a comparable favorable action on its total yield and give rise to declared increases as compare with non pollination of bio-fertilizers. The application of bio fertilizer treatments grant the big total bulbs yield (ton/fed.), bulb and neck weight as well as the best the percentage of TSS% in the two calculated seasons. However, the pollination with high level of bio-fertilizer (piogen) at (2 kg/fed.) significantly improved total yield and its ingredient liken low level (1 kg/fed.). The excellence in total bulbs yield per fed. by inoculation of 2kg/fed. bio-fertilizer reached 45.31 % and 42.63 % respectively in the first and the second seasons respectively. Commonly, the inoculation with bio-fertilizer (Piogen) promote total yield of onion bulbs. This influence could be attributed to the function of bio-fertilizer that transform organic N form to mineral N shape, which is more impress by plants. In this solicitude, (El-Kramany, *et al* 2000) notify that the significant effect of bio-fertilizers may be due to the effect of different progeny collection such as nitrogen fixers, nutrients actuate microorganisms which help in availability of minerals and increased the concentration of extractable N, P, K, Fe, Zn and Mn. The conclusion of (Fatma and Shafeek, 2000, Elham, *et al* 2014, Shafeek, *et al* 2016 and Kurrey *et al* 2018) supported existent results.

Effect of amino mix levels:

Data registered in Table (4) private that total bulbs yield (ton/fed.) of onion plants are affected by different amino acid mix treatments. Whereas, the biggest total bulbs yield (ton/fed.) of onion plants and its component expressed as bulb and neck weight at (g) and percentage of TSS % were acquired significantly excess with high concentration of amino mix at (2 cm/L) pursue in downhill order by that plant spraying low level (1 cm/L) pursue by control treatment. These returns were correct in jointly experiential seasons. Furthermore, distinctions in total bulbs (yield/fed.) by foliar spray of high level of amino mix (2 cm/L) amount to 10.54 % and 14.98 % respectively in first and second seasons compared control treatment. The statistical analysis during various treatments was big suitable to reach the 5% level, However, using the highest level of amino mix (2 cm/L) significantly increased most characters of onion bulb compared low level (1 cm/L). On the other hand, weight of bulb and neck as (g) and TSS% were also influenced by different level of amino mix concentrations and showed the same trend of total yield as aforementioned before. These increases might be imputing to increase the vegetative growth (Table 3). Also, might be due to providing easily exporter of growing material which forms the model of protein in the living tissues (Ghaith, and Galal 2014). Our conclusion are in conformity with those aforesaid by Khalilzadeh, *et al*. (2012) reported that,

foliar application of amino acid mix at 36% significantly increased the number of seeds/pod, number of pods/plant, seed weight, seed yield and biological yield of bean plants.

Effect of the interactions:

The interaction between foliar applications of amino mix treatments and the inoculations of different levels of bio-fertilizer (piogen) and are presented in (Table 4). However, no significant interaction action was acquired on total yield and its synthesis except, bulb weight as (g) in the first season only. Ordinarily, the inoculations of highest concentration of bio-fertilizer (piogen) (2 kg/fed.) with high level of foliar spraying amino mix (2 cm/L) produced the highest total bulbs yield and its components of onion plants. On the contrary, foliar spraying with water and without bio fertilizer produced less total yield and bulb characters.

Table 4: Effect of soil inoculation by N-fixing bacteria with foliar spray of amino mix on yield characters of onion plants during 2017 and 2018 seasons.

Bio fertilizer levels (kg/fed.)	Amino mix levels (cm/L)	2017				2018			
		Total yield (tom/fed)	Weight (g)		TSS %	Total yield (tom/fed)	Weight (g)		TSS %
			Bulb	Neck			Bulb	Neck	
Without	0	7.373	59.21	26.08	15.00	6.922	48.71	22.69	15.00
	1	7.480	88.13	26.69	15.00	7.641	81.12	24.00	15.00
	2	7.711	90.83	27.68	15.00	7.660	81.96	26.33	15.00
Mean		**7.522**	**79.39**	**26.62**	**15.00**	**7.412**	**70.60**	**24.34**	**15.00**
1	0	8.273	93.27	31.33	19.33	8.231	88.40	28.00	19.00
	1	8.890	94.17	33.33	20.00	9.270	100.33	30.67	20.00
	2	9.261	95.53	41.67	20.00	9.973	102.67	36.67	20.67
Mean		**8.812**	**94.32**	**35.44**	**15.78**	**9.152**	**97.13**	**31.78**	**19.89**
2	0	10.270	103.40	51.33	20.67	9.740	109.33	50.67	21.33
	1	10.862	111.33	58.67	21.00	10.963	112.33	53.67	23.33
	2	11.671	116.33	61.00	21.67	11.001	113.67	61.00	24.67
Mean		**10.930**	**100.36**	**58.00**	**21.11**	**10.572**	**111.78**	**55.11**	**23.11**
Average	0	8.633	85.29	36.25	18.33	8.300	82.15	33.79	18.44
	1	9.078	97.88	39.56	18.67	9.289	97.93	36.11	19.44
	2	9.543	100.90	43.45	18.89	9.543	99.43	41.33	20.11
LSD at 5% level	Bio	**0.211**	**5.51**	**9.52**	**0.71**	**0.393**	**10.83**	**6.25**	**1.78**
	Mix	**0.282**	**2.55**	**2.49**	**NS**	**0.222**	**9.92**	**1.89**	**NS**
	Interaction	**NS**	**4.42**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Bulb physical quality:

Effect of bio fertilization:

Data in table (5) reported that the trend was (2 kg/fed.) bio-fertilizer (piogen) > (1 kg/fed.) bio-fertilizer > control. However, by increasing the level of inoculation of bio-fertilizer up to (2 kg/fed.) significantly increased bulb physical quality expressed as (bulb length and diameter and neck diameter as well as total carbohydrate (mg/kg dry weight) compared to low level (1 kg/fed.) and control. These results were true in both seasons. Moreover, the inoculation of highest level of bio fertilizer 2 kg/fed. of (piogen) significantly increased bulb quality compared low level (1 kg/fed.). It could be concluded that, the best values of which resulted may be attributed to increasing the availability of various nutrients by plant and increasing the resistance of plant to root diseases and reducing the environment pollution by the application of chemical fertilizers (Subba-Ro 1988). The obtained results the effect of inoculation of bio-fertilization on bulb quality of onion were in agreement with that obtained by (Fatma and Shafeek, 2000, Elham, *et al* 2014, Shafeek, *et al* 2016 and Kurrey *et al* 2018).

Effect of amino mix levels:

Data recorded in Table (5) indicated that different bulb characters e,i. (bulb and neck diameter and bulb length at cm and total carbohydrate as mg/100g DW) are influenced by various amino acid mix treatments. Whereas, the highest values of its parameters were obtained significantly increased with the high level of amino mix (2 cm/L) followed in descending order by that plants spraying by low level (1cm/L) followed by control treatment (foliar spraying with water). These finding were true in both experimental seasons. The statistical analysis within different treatments was great enough to reach the 5% level. It be concluded that, improvement in bulb quality due to the application of amino acid may be due to providing readily source of growing substances which form the constitutes of protein in the living tissues (Ghaith and Galal 2014). Our results are in harmony with those mentioned by Khalilzadeh *et al* (2012).

Table 5: Effect of soil inoculation by N-fixing bacteria with foliar spray of amino mix on bulb quality of onion plants during 2017 and 2018 seasons.

Bio fertilizer levels (kg/fed.)	Amino mix levels (cm/L)	2017				2018			
		Diameter (cm)		Bulb length (cm)	Total carbohydrate (g/100 g DW)	Diameter (cm)		Bulb length (cm)	Total carbohydrate (g/100 g DW)
		Bulb	Neck			Bulb	Neck		
Without	0	4.30	1.03	3.87	8.37	4.67	1.13	4.20	8.30
	1	4.60	1.17	4.07	8.80	4.90	1.30	4.30	8.63
	2	4.83	1.17	4.37	9.30	5.10	1.33	4.60	8.77
mean		**4.58**	**1.12**	**4.10**	**8.82**	**4.89**	**1.26**	**4.37**	**8.57**
1	0	5.13	1.27	4.60	9.53	5.60	1.40	5.00	9.17
	1	5.40	1.37	5.00	9.80	5.73	1.53	5.30	9.63
	2	5.70	1.47	5.50	10.33	6.00	1.53	5.90	9.87
mean		**5.41**	**1.37**	**5.03**	**9.88**	**5.78**	**1.49**	**5.40**	**9.56**
2	0	6.07	1.53	5.83	10.73	6.20	1.53	5.83	10.17
	1	6.40	1.63	6.20	11.53	6.47	1.60	6.20	11.03
	2	6.57	1.67	6.50	12.07	6.73	1.63	6.37	11.37
mean		**6.34**	**1.81**	**6.18**	**11.44**	**6.47**	**1.59**	**6.13**	**10.86**
Average	0	5.17	1.28	4.77	9.54	5.49	1.36	5.01	9.21
	1	5.47	1.39	5.09	10.04	5.70	1.48	5.27	9.77
	2	5.70	1.43	5.46	10.57	5.94	1.50	5.62	10.00
LSD at 5% level	Bio	**0.22**	**0.11**	**0.16**	**0.28**	**0.17**	**0.04**	**0.14**	**0.23**
	mix	**0.13**	**0.03**	**0.10**	**0.11**	**0.08**	**0.02**	**0.12**	**0.17**
	interaction	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Effect of the interactions:

The interaction between the inoculations of different levels of bio-fertilizer (piogen) and the foliar application of amino mix are presented in (Table 5). Whereas, insignificant effect was obtained on bulb quality. Generally, the inoculations of high level of bio-fertilizer (piogen) (2 kg/fed.) with high level of foliar spraying of amino mix (2 cm/L) produced the highest bulb parameters expressed as (bulb and neck diameter and bulb length at cm and total carbohydrate as mg/100g DW).

Nutrition bulb value:

Effect of bio fertilization:

All inoculation of bio-fertilizer (piogen) application give rise to increasing nutritional values of dry onion bulbs compare without application of bio-fertilizer as shown up in Table (6). However, application of highest concentration of bio-fertilizer (2 kg/fed) acquired the better nutritional values, i.e. (percentage of N, protein, P and K) pursue in descending order inoculation by (1 kg/fed.) pursue

without bio-fertilizer through the experimental seasons of 2017 and 2018. It could be concluded that, the inoculation by bio-fertilizers play a master key function for eclectic adsorption of stationary (P, Zn, Cu) and moveable (C, S, Ca, K, Mn, Cl, Br, and N) elements to plants (Tinker, 1984). These returns are in good conformity by notify before by other interrogator (Fatma and Shafeek, 2000, Elham, *et al* 2014, Shafeek, *et al* 2016 and Kurrey *et al* 2018).

Effect of amino mix levels:

Data respect in Table (6) notify that, foliar application of amino mix treatments significantly improved the nutritional amount of dry onion bulbs e.i. (percentage of N, Protein, P and K) in the two experimental seasons. Regarding in Table (6) reported that, increasing the concentration of amino mix significantly increased nutrition value of seeds tissues of onion bulbs. On the other hand, the superiority nutritional value of dry bulbs gained with the application of high levels of amino mix at (2 cm/L) compared low level (1 cm/L). Conversely, the lowest value of nutrition gained with application of water. In addition, amino mix have business as chelating impact on micronutrients, while used jointly with micronutrients, the assimilation and transmission of micronutrients internal the plant is easier (Ibrahim, *et al* 2010). The acquired conclusion are bring to the himself derivation with ((El-Shabasi, *et al* 2005, Awad *et al* 2007, Shafeek *et al* 2012, Ghaith, and Galal 2014, and Shafeek *et al* 2016) on vegetable crops.

Effect of the interactions:

The interaction treatment between various inoculation levels of bio-fertilizer and foliar application of the distinct levels of amino mix given in Table (6). Generally, the statistically analysis of the gained data reported that, the differences within various treatments were no great enough to extent the 5% level of significant these findings were totally comparable in both seasons of 2017 and 2018.

Table 6: Effect of soil inoculation by N-fixing bacteria with foliar spray of amino mix on bulb chemical quality of onion plants during 2017 and 2018 seasons.

Bio fertilizer levels (kg/fed.)	Amino mix levels (cm/L)	2017				2018			
		%				%			
		N	protein	P	K	N	protein	P	K
Without	0	1.07	6.71	0.51	0.59	1.18	7.61	0.48	0.54
	1	1.13	7.23	0.54	0.67	1.25	7.83	0.50	0.60
	2	1.18	7.38	0.57	0.78	1.30	8.13	0.54	0.64
mean		**1.13**	**7.11**	**0.55**	**0.68**	**1.25**	**7.86**	**0.51**	**0.59**
1	0	1.26	7.90	0.61	0.84	1.36	8.50	0.58	0.73
	1	1.39	8.69	0.63	0.90	1.44	8.98	0.61	0.82
	2	1.47	9.21	0.67	1.01	1.50	9.39	0.64	0.88
mean		**1.38**	**8.80**	**0.64**	**0.92**	**1.43**	**8.96**	**0.61**	**0.81**
2	0	1.53	9.58	0.69	1.12	1.54	9.36	0.66	0.93
	1	1.63	10.19	0.72	1.15	1.59	9.92	0.68	1.07
	2	1.68	10.50	0.74	1.23	1.63	10.19	0.73	1.15
mean		**1.61**	**10.09**	**0.72**	**1.17**	**1.59**	**9.82**	**0.69**	**1.05**
Average	0	1.29	8.06	0.60	0.85	1.36	8.49	0.57	0.73
	1	1.38	8.70	0.63	0.91	1.426	8.91	0.59	0.83
	2	1.44	9.03	0.66	1.00	1.48	9.24	0.63	0.89
LSD at 5% level	Bio	**0.03**	**0.22**	**0.02**	**0.08**	**0.10**	**0.68**	**0.01**	**0.04**
	mix	**0.02**	**0.14**	**0.01**	**0.03**	**0.01**	**0.22**	**0.01**	**0.02**
	interaction	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

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