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## Effectiveness of Foliar Enforcement by Amino Acids and Bio Potassium Fertilizer On Growth, Yield and Bulb Goodness of Garlic Plants Under Latterly Reformed Soil

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### ABSTRACT

The foliar spraying of amino mix and the supplement of bio-potassium fertilizer (potassine) of garlic plants were performed during the two seasons of 2014 and 2015 at the experimental agriculture station of National Research Centre at Noharia (Arenaceous soils). The substantial acquired returns could be abridged as dependent: Foliar sprinkle of amino mix 3 times, onset 45 days after garlic cloves planting with 10 days period at a high level (2 %) acquired an boost in plant growth measure if liken with the minimize level (1 %) and without splash (control). Furthermore, the biggest bulb yield as tons/fed. and better physical possession of bulb (fresh and dry weight), acquired when amino mix spatter 3 times at high level (2 %). Also, the acquired conclusion recorded the highest nutritional amount of garlic bulb tissues were recorded with splash of amino mix at the higher concentration. With increasing the supplement of bio-potassium rate (Potassine) up to 2 kg/fed. produced the strength plant growth of garlic and the elevated yield of bulbs which have the superior physical possession and the towering nutritional values (N, P and K) all of them were obtained if liken with the slash bio-potassium rates (1 kg/fed.) and without bio potassium fertilizer. The interaction during the two empirical operators, i.e. amino mix and bio potassium fertilizer had no significant influence on garlic plant growth individuality, total bulb yield and its ingredient as well as its nutritional values.

**Keywords:** Garlic, Growth, Yield and its ingredient, amino mix, bio-potassium.

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## INTRODUCTION

Garlic (*Allium sativum* L.) is one of the essential vegetable crops grown in Egypt for native consuming and exportation. However, it is cultivated for its aroma and pharmaceutical possession; with the last steadily emerge worldwide [1]. Subsequently, improving garlic yield and increasing bulb goodness is fundamental target for producers.

Amino acids are the essential active ingredients for the operation of protein structure. In this respect the amino acids which have a high safety with various metabolic pools in plants were utilized to elevate plant growth [2]. Also, [3] specified relate of methionine to the biosynthesis of growth regulating materials, e.g. cytokinins, auxins and brassino steroids in plants. Moreover, fasten of tryptophan to the biosynthesis of auxins, the phyto alexin camalexin, phenyl propanoids and other concerning inbred output in plants was newly notified [4]. Studies have demonstrated that amino acids can immediately or indirectly effectiveness the physiological performance of plant growth and evolution. According to Sarojnee *et al.* [5] amino acids can increasing fertilizer absorption, improve uptake of nutrients and water, reinforce the photosynthetic average and dry matter sections and hence increase yield and quality. Many writers found that, the foliar enforcement of amino acids can promoted plant growth, fruit yield and ameliorate its quality in garlic [6], in potato [7] and in green bean [8]. Furthermore, amino acids are also utilized to relieve the negative belongings of some environmental exertion e.g. salinity [9 and 10]. However, [11] reported that sprinkle amino acid at a concentration of 200 ppm increased plant contents of N, P, K and some micro nutrients than the other treatments. In addition, the aforesaid treatments increased vegetative growth and fruit physical and chemical individuality of cantaloupe. In the same respect, [12] indicated that amino acid level of 150 ppm on onion plants generated the highest leaves fresh weight/plant, number and weight of bulbs/m<sup>2</sup>, total yield (ton/fed.) and average weight of bulb (g). Also, foliar application of 200 ppm overruns other five levels in the proportion of N, protein, TSS, and dry matter. However, [13] reported that onion plants comply invariably with the application of amino acids. Also, growth, output and quality of onion plants were reinforce by the application of Superbiomine, pepton and Amino-power. In addition, [14] indicated that foliar spraying of amino acid on garlic plants effectively produced the tallest plant, high number of leaves per plant compared to control treatment in both seasons. Also, the application of amino acid showed the heaviest bulb weight (67.7, 72.0 and 69.5, 66.6 g) in the first and second season, respectively.

Microbial fertilizer is one road that organic farmers are ambidextrous to augmentation yield and quality of crops without a great exploitation of money and business. Moreover, microbial fertilizer competence scours the environment and promotes the profitable capability of land by reducing neutralize of chemical fertilizer consuming [15]. Different reports reported that the inoculation of some plants with bio-fertilizer particularly or in amalgamation with mineral fertilizers increased plant growth, yield and chemical synthesis [16]. Potassium play an important function of advancement of enzymes performance and promote the translocation of absorb and protein structure. Many examiners indicated that the vegetative growth of garlic plants and minerals uptake was increased with growing the level of N, P and K fertilizers [17]. Bio fertilizer enforcement was hence the opposition of plant to root disease and minimize the environmental contamination from chemical fertilizer enforcement [18]. The fecundation with potassium dissolving bacteria led to upgrade plant growth and yield of garlic plants [19] reflected increases in the microbial intensity of the root zone, total bacterial numeration, total fungal; actinomyces and azotobacter as well as potassium dissolving bacteria recorded higher numeration in the root zone when the plants were sprayed with bio-fertilizers liken with mineral fertilizer treatments. However, bio potassium fertilizers have advantageous resumption to increase population of soil microorganisms, especially in the surface stratum of root rhizosphere, that inspire materials which catalyze plant growth [20]. Also, they added that, potassium dissolving bacteria assemble the adequacy to fetch insoluble K in soluble forms nominate organic acid. Such acid reduce the pH and bring about the disintegration of constraint various forms of potassium and play then preparation for mounting plants. Furthermore, [21] found that utilized bio-fertilizers (potassaiumage) increased macro mineral in plants. Also, bio fertilizers combined with mineral fertilizer at recommended dose acquired the highest amounts of plant growth as well as total yield advantage. Other interest of these treatments encompasses reduction the cost of chemical fertilizers, and reduced pollution of the production with nitrate content. Moreover, [22] reported that application of bio-enriched treatments increased vegetative growth of garlic plants i.e. plant length, number of leaves per plant, fresh and dry weight of whole plant as well as chemical composition and yield of garlic plants. Many investigator indicated that application of non symbiotic potassium dissolving bacteria with combine minerals or organic fertilizers led to get better

vegetables growth, yield and quality of several economic vegetables like garlic [19, 23, 24 and 25], Onion [12 and 26], Potato [16] and Legumes [27 and 28].

Therefore, this research aims to improving plant growth, yield and bulb quality by foliar spraying of amino mix and decreasing neutralize of main mineral fertilizers (N, P and K) and potential to reduce and remove the contamination of environment by application of bio fertilizers in production of garlic plants under sandy soil conditions.

### MATERIALS AND METHODS

Two field experiments were carried out at the experimental station of National Research Centre at Nubaria, Behira Governorate, Egypt during the two growing seasons of 2014 and 2015 in order to study the effect of inoculation with potassium dissolving bacteria (potassine) with foliar application of different level of amino acid (Amino-mix) on plant vegetative growth, total yield and its components as well as bulb quality of garlic plants (*Allium sativum* L.) cv. Chinese. The experimental trails were conducted in sandy soil using drip irrigation system. Chemical analysis and physical properties of 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	Hco <sub>3</sub>	Cl
1.7	2.8	7.02	0.527	0.982	0.31	1.30	0.566

Phosphorus (P<sub>2</sub>O<sub>5</sub>) and potassium (K<sub>2</sub>O) were applied 50 and 100 kg/fed. each at the time of soil preparation. The chemical constituents of Amino-mix are shown in Table (2).

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

Elements (g/100cm <sup>3</sup> )	Value	Amino acid	Value	Amino acid	Value	Vitamin (mg/100cm <sup>3</sup> )	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	Glycine	50	Histidine	12	Folic	4.2
Ca	0.025	Alanin	100	Lucine	40	Pantoithinic	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	cysteine	44	-	-	-	-

Each experiment included 9 treatments which were the combinations between two levels of potassium dissolving bacteria (1 and 2 kg/fed.) plus control treatment without bio-potassium fertilizer with foliar spray of two levels of amino acid (Amino-mix) at rate of 1 and 2% plus control treatment (foliar spraying with water). The normal agriculture practices for garlic production under drip irrigation system were followed according to the recommendations of Ministry of Agriculture. The organic manure fertilizer were applied during soil preparation. But the chemical phosphorus and potassium fertilizer were added at rate of 200 and 150 kg/fed. as calcium super phosphate and potassium sulphate respectively. Phosphorus and potassium fertilizer were applied once time during soil preparation for planting. The experimental design was split plot design with 3 replications, where the amino acid treatments were assigned in the main plots and bio potassium fertilizer treatments were devoted randomly within the subplots. The garlic cloves of Chinese cv. was planted on the second week of November in both seasons of 2014 and 2015. The gloves were sown at 20 cm distances on the two sides of each ridge. After 3 months from planting samples of garlic plants from the three replicates were taken and vegetative growth characters were measured (plant length, number of leaves, fresh and dry weight of whole plant). At harvesting stage after 5 months and after curing period (15 days) the

total yield per feddan as ton were account also the average weight of bulbs, bulb diameter, number of cloves/ bulb and weight of clove was recorded. The percentage of nitrogen, phosphorus and potassium content in tissues of garlic cloves were determined depending on the methods which were described by Jackson [29], Troug and Moyar [30] and Brown and Lilleland [31], respectively. In addition, the protein percentages in tissues of garlic cloves were calculated by multiplying nitrogen content by 6.25. All data values were subjected to the analysis of variance according to Gomez and Gomez [32].

## RESULTS AND DISCUSSION

### Plant growth characters:

**Effect of amino mix levels:** The consequence in Table (3) fundamentally particular that, foliar spray with amino mix for all levels grant the utmost significant rising in plant growth personality i.e. plant length (cm), number of leaves as well as fresh and dry weight of garlic plant compared without amino mix splash (water). However, foliar dust of amino mix at higher level (2%) significantly improved plant growth symbol of garlic plants pursue in downhill order by that plants dust by amino mix at (1%) keep track of foliar splatter with water (control). Moreover, most of plant growth persona significantly increased amidst high and low levels of amino mix. These previous data were fully in both experiential seasons. It could be concluded that, amino acids can directly or indirectly effectiveness the physiological activities of plant growth and growing. Amino acids which have a high safety with different metabolic betting in plants were utilized to elevate plant growth [2].

**Table (3): Effect of levels of amino mix and bio potassium fertilizer on growth characters of garlic plants during 2014 and 2015 seasons.**

Amino mix Levels %	Bio potassium Levels Kg/fed.	2014 season				2015 season			
		Plant length (cm)	No. of leaves	Leaves weight (g)		Plant length (cm)	No. of leaves	Leaves weight (g)	
				Fresh	Dry			Fresh	dry
0	0	52.00	6.67	75.03	9.39	51.00	5.67	75.77	9.40
	1	54.33	7.00	77.00	9.63	54.67	7.00	77.70	9.59
	2	55.00	7.67	80.15	10.05	56.67	8.00	78.67	10.17
<b>Mean</b>		<b>53.78</b>	<b>7.11</b>	<b>77.39</b>	<b>9.69</b>	<b>54.11</b>	<b>6.89</b>	<b>77.38</b>	<b>9.72</b>
1	0	55.33	7.67	94.86	11.86	56.00	8.00	82.33	11.51
	1	58.33	8.33	94.91	11.87	59.67	9.00	90.01	11.71
	2	63.33	9.33	96.49	12.06	62.33	10.00	91.40	11.91
<b>Mean</b>		<b>59.00*</b>	<b>8.44*</b>	<b>95.42*</b>	<b>11.93*</b>	<b>59.33*</b>	<b>9.00*</b>	<b>87.91*</b>	<b>11.71*</b>
2	0	56.33	8.00	95.40	11.93	56.00	8.33	94.36	11.70
	1	59.67	9.00	96.73	11.80	60.33	10.00	98.00	12.45
	2	63.00	9.67	99.29	15.00	66.33	11.00	103.27	14.67
<b>Mean</b>		<b>59.67*</b>	<b>8.89**</b>	<b>97.14**</b>	<b>12.91**</b>	<b>60.89**</b>	<b>9.78**</b>	<b>98.55**</b>	<b>12.94**</b>
average	0	54.56	7.44	88.43	11.06	54.33	7.33	84.16	10.87
	1	57.44*	8.11*	89.55*	11.10	58.22*	8.67*	88.57*	11.25
	2	60.44**	8.89**	91.98**	12.37**	61.78**	9.67**	91.11**	12.25**
LSD at 5% level	Amino	<b>2.28</b>	<b>0.42</b>	<b>1.53</b>	<b>0.97</b>	<b>1.43</b>	<b>0.72</b>	<b>2.17</b>	<b>0.79</b>
	bio	<b>1.56</b>	<b>0.42</b>	<b>0.71</b>	<b>0.75</b>	<b>1.25</b>	<b>0.43</b>	<b>1.61</b>	<b>0.59</b>
	interaction	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>

Amino acids assistance to increase chlorophyll levels in plant major to higher measure of photosynthesis. Which lead to increase carbohydrates content they include structurally polysaccharides of plant, fundamentally cellulose, hemicelluloses and pectin and lignin which deem an important thematic compound of plant that improvement in growth characters and yield [33]. Also, amino mix has business as chelating labor on micronutrients, while applied with each other with micronutrients, the assimilation and transportation of micronutrients internal the plant is plain [34]. Also amino acids are foundation pushing active ingredients in the procedure of protein building [12]. Conformable inference registration by Turkey [35], El-Ghamry *et al.* [36] and Abdel-Mawgoud *et al.* [8] reported that, amino acid mix reflected the highest amount for plant growth of vegetable crops.

**Effect of bio potassium dissolving bacteria:** The results explain in Table (3) for influencing of the studied bio-potassium bacteria fertilizer treating on garlic plant growth parameters i.e., plant length (cm), number of leaves, fresh and dry weight of leaves per plant. However, increase level of bio-potassium fertilizer significantly improved all plant growth parameters of garlic plant parallel without bio potassium fertilizer. These outcomes were right in both seasons. Newly, inoculation soil by highest concentration of bio potassium fertilizer (2kg/fed.) significantly increased garlic plant growth parameter draw an analogy depressed level (1kg/fed.). These superiority may be indicated to potassium dissolving bacteria microorganisms on soil inoculation, in the first place, strengthened the rhizosphere with these bacteria. Moreover, the microbial bio potassium inoculation encourage plant growth each immediately, by produce plant hormones and ameliorative nutrient uptake, or indirectly, by volatile the microbial neutralization in rhizosphere in corroboration of the advantageous microorganisms [37]. Do it another way, potassium bio-fertilizer bacteria (potassien) raise the plant growth by the main role of bio fertilizers in transmit un soluble potassium in the soil to soluble form (potassiumage) available to absorption and up take by plants [38]. Lately, this beneficial business was appropriate with those acquired with [15, 16, 19 and 21].

**Effect of the interaction between amino mix and bio potassium bacteria levels:**

The consequence on Table (3) reflected that implementation of highest level of amino mix (2%) with higher concentration of bio fertilizer (2kg/fed.) generated the highest garlic plant growth parameters draw an analogy other treatments in both seasons. However, the statistical analysis of the gained data discovered that the variance during diverse levels of bio-potassium dissolving bacteria with inoculation by amino mix treatments were not suitable to scope the 5% level of significant on plant growth in both seasons.

**Total yield and its composition:**

**Effect of amino mix levels:** Data listed in Table (4) particular that total bulb yield (ton/fed.) of garlic plants are influenced by distinct amino acid mix treatments. While, the major total bulbs yield (ton/fed.) of garlic plants and its ingredient i.e. bulb weight, bulb diameter, clove weight and cloves number were obtained significantly overflowing with high level of amino mix at 2% followed in falling order by that plant spraying of low level (1%) followed by control treatment. These finding were right in simultaneously experiential seasons. Furthermore, uniqueness in total pods yield/fed. by foliar spraying of high level of amino mix amount to 22.60 and 28.92 %,

**Table (4): Effect of levels of amino mix and bio potassium fertilizer on total yield and its components of garlic plants during 2014 and 2015 seasons.**

Amino mix Levels %	Bio potassium Levels Kg/fed.	2014 season					2015 season				
		Total yield (ton/fed.)	Bulb		Clove		Total yield (ton/fed.)	Bulb		Clove	
			Weight (g)	Diameter (cm)	Weight (g)	No. /bulb		Weight (g)	Diameter (cm)	Weight (g)	No. /bulb
0	0	2.80	24.37	1.93	1.40	10.00	2.75	24.27	1.85	1.46	10.00
	1	2.88	27.25	2.13	2.22	11.00	2.87	27.56	2.33	2.07	12.00
	2	3.07	34.33	2.29	2.30	13.67	3.00	33.53	2.77	2.57	14.67
<b>Mean</b>		<b>2.92</b>	<b>28.65</b>	<b>2.12</b>	<b>1.97</b>	<b>11.56</b>	<b>2.87</b>	<b>28.45</b>	<b>2.32</b>	<b>2.03</b>	<b>12.22</b>
1	0	3.15	29.16	2.43	1.61	13.00	3.20	29.37	2.56	1.76	12.67
	1	3.20	32.46	2.60	2.37	12.00	3.28	31.00	2.51	2.20	13.67
	2	3.32	34.60	2.73	2.60	15.67	3.53	35.16	2.90	2.56	15.67
<b>Mean</b>		<b>3.22*</b>	<b>32.08*</b>	<b>2.59*</b>	<b>2.19*</b>	<b>13.56*</b>	<b>3.34*</b>	<b>31.84*</b>	<b>2.66*</b>	<b>2.17</b>	<b>14.00*</b>
2	0	3.38	28.35	2.77	1.70	12.00	3.45	28.62	2.97	1.91	13.00
	1	3.63	32.66	2.98	2.73	14.00	3.72	32.85	2.97	2.50	15.67
	2	3.73	35.57	3.30	2.87	16.33	3.95	34.33	3.47	2.95	17.67
<b>Mean</b>		<b>3.58**</b>	<b>32.19*</b>	<b>3.02**</b>	<b>2.43**</b>	<b>14.11**</b>	<b>3.70**</b>	<b>31.93*</b>	<b>3.14**</b>	<b>2.45</b>	<b>15.44**</b>
average	0	3.11	27.29	2.38	1.57	11.67	3.13	27.42	2.46	1.71	11.89
	1	3.24*	30.79*	2.57*	2.44*	12.33	3.29*	30.47*	2.61*	2.25*	13.78*
	2	3.38**	34.83**	2.78**	2.59**	15.22**	3.49**	34.34**	3.04**	2.69**	16.00**
LSD at 5% level	Amino	<b>0.11</b>	<b>0.60</b>	<b>0.09</b>	<b>0.10</b>	<b>1.13</b>	<b>0.10</b>	<b>1.34</b>	<b>0.16</b>	<b>NS</b>	<b>0.82</b>
	bio	<b>0.05</b>	<b>1.09</b>	<b>0.07</b>	<b>0.06</b>	<b>1.07</b>	<b>0.06</b>	<b>1.15</b>	<b>0.14</b>	<b>0.16</b>	<b>0.55</b>
	interaction	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>

respectively, in the first and second seasons parallel control treatment. The statistical analysis through several treatments was great appropriate to reach the 5% level. However, foliar application of the highest level of amino mix (2%) significantly increased generality individuality of physical bulb of garlic plants parallel low level (1%). Further, physical bulb persona i.e. weight, diameter, weight of clove and number of cloves were also affected by different level of amino mix and display the same direction of total yield as aforementioned before. These increases might be attributing to increase the vegetative growth (Table 3). Also, might be due to providing readily source of mounting material which various forms the example of protein in the living tissues [6] on garlic plants. Our conclusion are in accordance with those above-mentioned by Shalaby and El-Ramady [14] indicated that foliar spraying of amino acid on garlic plants effectively generated the tallest plant, high number of leaves per plant contrast to control treatment in both seasons. Also, foliar application of amino acid reported the biggest bulb weight (67.7, 72.0 and 69.5, 66.6 g) in the first and second season, respectively.

**Effect of bio potassium dissolving bacteria:** The leverage offered in Table (4) recorded that the inoculation soil by bio-potassium bacteria which was previously had highest significant stimulating effects on garlic plant growth had a analogous adequate business on its total yield and award elevation to pronounced improving as compared with non inoculation by bio-potassium bacteria fertilizers. Application bio potassium bacteria fertilizer gives biggest total bulb yield (ton/fed.) as well as the preferable physical ownership of bulb (diameter, weight, number and weight of cloves) in the two studied seasons. However, the inoculation soil with highest concentration of bio-potassium bacteria at 2 kg/fed. significantly increased total yield and its component compared low level (1 kg/fed.). The distinction in total bulbs yield per fed. amount to 8.68 and 11.50%, respectively, in the first and second seasons, respectively. Generally, bio-potassium bacteria fertilization increased the vegetative growth, mineral content and dry matter accumulation. Since yield is the assignment of the growth, photosynthetic performance, mineral imbibitions and dry matter gathering [39]. In addition, the improvement in garlic yield might be the direct effect of the increase in average bulb weight. Outcome reported that bio-potassium bacteria fertilization promote bulb quality by increasing bulb diameter and bulb weight. Similar conclusion was acquired by El-Sheekh [40] on onion and El-Basyouny [41] on garlic.

**Effect of the interaction between amino mix and bio potassium bacteria levels:** The interaction between foliar applications of amino mix and the inoculations soil by various standard of bio-potassium bacteria fertilizer are offered in (Table 4). However, no significant interaction labor was obtained on total yield and its structure in both seasons of studies. Usually, the inoculations soil by highest level of bio-potassium bacteria fertilizer (2 kg/fed.) and high concentration of foliar spraying amino mix (2%) generated the biggest total bulbs yield and its synthesis of garlic plants. Conversely, foliar spraying with water and outwardly bio potassium bacteria fertilizer created minimal total yield and physical bulb personality.

#### **Bulb nutrition value:**

#### **Effect of amino mix levels:**

Data esteem in Table (5) communicated that, foliar spraying of amino mix treatments significantly increased the nutritional value amount of dry bulbs of garlic i.e. percentage of N, Protein, P and K in the two experiential seasons. Concerning in Table (5) found that, increasing the level of amino mix significantly increased nutrition value on cloves tissues of garlic. Moreover, the distinction of nutritional status of cloves acquired with the using high concentration of amino mix at (2%) draw an analogy low level (1%). On the contrary, the little value of nutrition obtained with foliar application of water. In addition, amino mix have action as chelating leverage on micronutrients, while application of with each other with micronutrients, the assimilation and transmission of micronutrients indoor the plant is make easier [34]. The obtained inference is fetching to oneself conclusion with [9, 10 and 11] on vegetable crops.

**Effect of bio potassium dissolving bacteria:** All inoculation of bio-potassium bacteria fertilizer levels grant elevation to an increase nutritional amounts of dry garlic cloves liken without inoculation soil highest level of bio-potassium bacteria fertilizer (2kg/fed) gained superior nutritional values of garlic cloves expressed as percentage of N, protein, P and K, keep track of in descending order inoculation soil by (1 kg/fed.) compared without bio-potassium fertilizer meantime the experimental seasons of 2014 and 2015. It could be concluded that, the inoculation by bio-potassium fertilizers play a major key business for selective adsorption of fixed (P, Zn and Cu) and animated (C, S, Ca, K, Mn, Cl, Br, and N) elements to plants [42]. In the same respect, potassium

dissolving bacteria recorded higher counts in the root zone when the plants were sprayed with bio fertilizers compared with mineral fertilizer treatments. It is obvious that bio-potassium bacteria fertilization enriched the root zone by the different micro-organisms. Higher values of total bacterial count, total fungi, Actinomyces, and potassium dissolving bacteria were recorded by bio-fertilization treatments. However, the significant effect of bio potassium fertilizers may be due to the action of various progeny collection of microorganisms such as, nutrient concentrate microorganisms which assistance in increasing the accessibility of minerals and consequently increasing their uptake which play substantial role in the plant absorption rate which in transformation increased N, P and K , T.S.S and carbohydrate. Acquired conclusion are harmonize with those of [43, 44 and 45].

**Table (5): Effect of levels of amino mix and bio potassium fertilizer on bulb nutritional values of garlic plants during 2014 and 2015 seasons.**

Amino mix Levels %	Bio potassium Levels Kg/fed.	2014 season				2015 season			
		%				%			
		N	protein	P	K	N	protein	P	K
0	0	0.39	2.42	0.21	0.59	0.41	2.56	0.21	0.57
	1	0.43	2.69	0.23	0.67	0.44	2.85	0.22	0.64
	2	0.48	3.00	0.26	0.72	0.47	2.96	0.25	0.71
<b>Mean</b>		<b>0.43</b>	<b>2.70</b>	<b>0.23</b>	<b>0.66</b>	<b>0.44</b>	<b>2.75</b>	<b>0.23</b>	<b>0.64</b>
1	0	0.52	3.25	0.27	0.74	0.54	3.40	0.27	0.78
	1	0.56	3.52	0.31	0.79	0.56	3.48	0.29	0.80
	2	0.65	4.04	0.34	0.85	0.64	4.00	0.34	0.84
<b>Mean</b>		<b>0.58*</b>	<b>3.60*</b>	<b>0.31*</b>	<b>0.79*</b>	<b>0.58*</b>	<b>3.63*</b>	<b>0.30*</b>	<b>0.81*</b>
2	0	0.71	4.42	0.34	0.80	0.74	4.63	0.35	0.88
	1	0.77	4.79	0.35	0.88	0.79	4.92	0.39	0.89
	2	0.80	5.00	0.36	0.90	0.83	5.19	0.42	0.93
<b>Mean</b>		<b>0.76**</b>	<b>4.74**</b>	<b>0.35**</b>	<b>0.86**</b>	<b>0.79**</b>	<b>4.91**</b>	<b>0.39**</b>	<b>0.90**</b>
average	0	0.54	3.36	0.27	0.71	0.56	3.53	0.28	0.74
	1	0.59*	3.67*	0.30*	0.78*	0.59*	3.75*	0.30*	0.78*
	2	0.64**	4.01**	0.32**	0.82**	0.65**	4.05**	0.33**	0.83**
LSD at 5% level	Amino	<b>0.10</b>	<b>0.60</b>	<b>0.01</b>	<b>0.02</b>	<b>0.09</b>	<b>0.53</b>	<b>0.01</b>	<b>0.03</b>
	bio	<b>0.02</b>	<b>0.15</b>	<b>0.01</b>	<b>0.03</b>	<b>0.02</b>	<b>0.13</b>	<b>0.01</b>	<b>0.02</b>
	interaction	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>

**Effect of the interaction between amino mix and bio potassium bacteria levels:**

The interaction processing inter different inoculation levels of bio-potassium bacteria fertilizer and foliar implementation of the several levels of amino mix presented in Table (5). Commonly, the statistically analysis of the acquired data found that, the differences within different treatments were no great enough to reach the 5% level of significant These feedback were completely similar in both seasons of 2014 and 2015.

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