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Response of Foliar Spraying with Amino Acids and Integrated use of Nitrogen Fertilizer on Radish (Raphanus sativus L.) Plant

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Abstract: This investigation was conducted in the two successive winter seasons of 2013 and 2014 on Radish plants in sandy soil at the green house of the National Research Centre, Dokki, Egypt, to study the effect of amino acids and nitrogen fertilizer on the growth, chemical composition, yield and its quality of Radish plant. The experiment included 10 treatments resulted from spray treatments, viz. amino acids at 500 and 750 ppm and nitrogen fertilizer at rates of 40, 80 and 120 Kg N/fed. A complete randomized block design with three replicates was adopted. Results indicated that spraying the plants with amino acids at higher rate had statistically effect on fresh and dry weight of shoot and root, root length and diameter as well as nutrient content and uptake. Moreover, the highest values of chlorophyll a, b, a+b and carotenoids were obtained from the application of amino acid at the rate 750 ppm with nitrogen fertilizer at 120 Kg N/ fed. Also, nitrogen, phosphorus and potassium content recorded highest significant values in Radish plants with the same treatment. Nitrate accumulation decreased significantly by spraying of amino acid the rate of 750 ppm with nitrogen fertilizer at 40 Kg N/ fed.
Keywords: Amino acids, Nitrogen Fertilizer, Radish, Growth, Yield, Root quality.

Introduction

Nitrogen is an indispensable elementary constituent of numerous organic compounds of general importance (amino acids, proteins, nucleic acids) and it is formation of protoplasm and new cells, as well as, its encouragement for elongation. The need for supplying vegetable crops with organic and inorganic fertilizers was prove to be very essential for the production of higher yield and for improving its quality. Integrated use of chemical fertilizers may be an approach for sustainable production of crops. This may improve the efficiency of chemical fertilizer and thus reduce their use. Integrated use of inorganic and organic fertilizers can improve crop productivity and sustain soil healthy and fertility[15]. Integrated use of chemical fertilizers is beneficial in improving crop yield and available N, P and K in sandy loam soil[13].

Also, amino acids is a well known biostimulant which has positive effects on plant growth, yield and significantly mitigates the injuries caused by a biotic stresses[7]. [6] stated that application of amino acid treatment resulted in significant increase in chlorophyll a and b in Datura leaves while, carotenoids significantly decreased. The effect of amino acids on decreasing nitrate concentrations in cabbage has been reported by [4]. [14] on soybean found that treatments of amino acids significantly improved growth parameters of shoots and fresh weight as well as pod yield. [9] revealed that foliar application with the mixture of amino acids to radish plants increased N content of shoots whereas, NO_3 content reduced by 24-38%. [3] on potato found that spraying of amino acids at 0.25 ml/ L significantly increased vegetative growth expressed as plant height and dry weight of plant. [1] revealed that spraying strawberry plants with amino acids (peptone) at 0.5 and 1.0 g/L significantly

increased total nitrogen, phosphorus and potassium in plant foliage as well as total yield, weight, TSS, vitamin C and total sugars content of fruits compared to control treatment.

Radish is an important vegetable crop grown extensively in Egypt. It is rich in iron, manganese, potassium, vitamin K, phosphorus etc. It is also a good source of vitamin C, foliate and magnesium.

Keeping this in view, the present study was conducted to evaluate the effect of the influence of amino acids and integrated use of chemical fertilizers on growth, yield and its quality of radish.

Materials and Methods

This study was carried out at the green house of the National Research Centre, Dokki, Egypt, during the two successive seasons of 2013 and 2014, to study the effect of foliar spraying with amino acids and integrated use of nitrogen fertilizer on Radish plant. The experimental trails were conducted in sandy soil.

Table 1: Some physical and chemical properties of soil (Mean of two seasons).

Particle size distribution			**Texture class**		**pH (1:2.5)**		**EC (dSm^{-1})**	**CaCO3 (%)**	**OM (%)**
Sand%	**Silt%**	**Clay%**							
70	12	18	Sandy loam		8.27		1.92	3.78	1.37
Cation and Anion (m/L)									
Na^+	**K^+**	**Ca^{++}**	**$CO3^-$**	**$HCO3^-$**	**CL^-**	**$SO4^{--}$**	**N**	**P**	**K**
5.51	1.41	2.62	---	2.12	7.22	1.72	6.35	0.94	16.65

Amino acids (Aa) applied as foliar spray at a rate of (500 and 750 ppm). Amino acids contents,17different amino acids are present viz., Glutammic acids (7.24-9.12%), Tiroanine (3.05-3.56 %), Aspartic acids (3.2-3.45%),Serine(3.76-4.49%), Broline(2.23-3.5%), Licyne (1.87-2.45%),Alanine(2.16-2.20),Cystine(1.87-2.45%),Veline(2.8-3.1%), Methionine(0.23-0.3%),Isoleucine(1.26-1.7%), Leucine(1.98-2.8%) Tyrosine (0.48- 1.02%), Phenylalanine (1.03-1.78), lysine (1.39-2.3%), Histidine(0.42-0.9%.) and Arginine(5.2-6.2%). Among them, Glutammic acids and Arginine are the most revelnt in the biostmulating activity.

Spraying treatments were started after 15 days from transplanting and every 15 days for 3 times through the growth season. Nitrogen applied at rates of 40, 80 and 120 Kg N/fed in the form of urea (46% N) was added in two equal doses. The first one was applied after germination and the other one 10 days later. Potassium fertilizer applied at rates of 50 Kg /fed in the form of potassium sulphate (48%K2O) applied in one dose after thinning. The experiment treatments were arranged in a factorial experiment and laid out in randomized block design with three replicates. Treatment details as follows:

T1: Control (no applied fertilizer)
T2:40 Kg N/fed
T3:80 Kg N/fed
T4:120 Kg N/fed
T5:40 Kg N/fed + 500 ppm amino acid
T6:80 Kg N/fed+ 500 ppm amino acid
T7:120 Kg N/fed+ 500 ppm amino acid
T8:40 Kg N/fed + 750 ppm amino acid
T9:80 Kg N/fed+ 750 ppm amino acid
T10:120 Kg N/fed+ 750 ppm amino acid

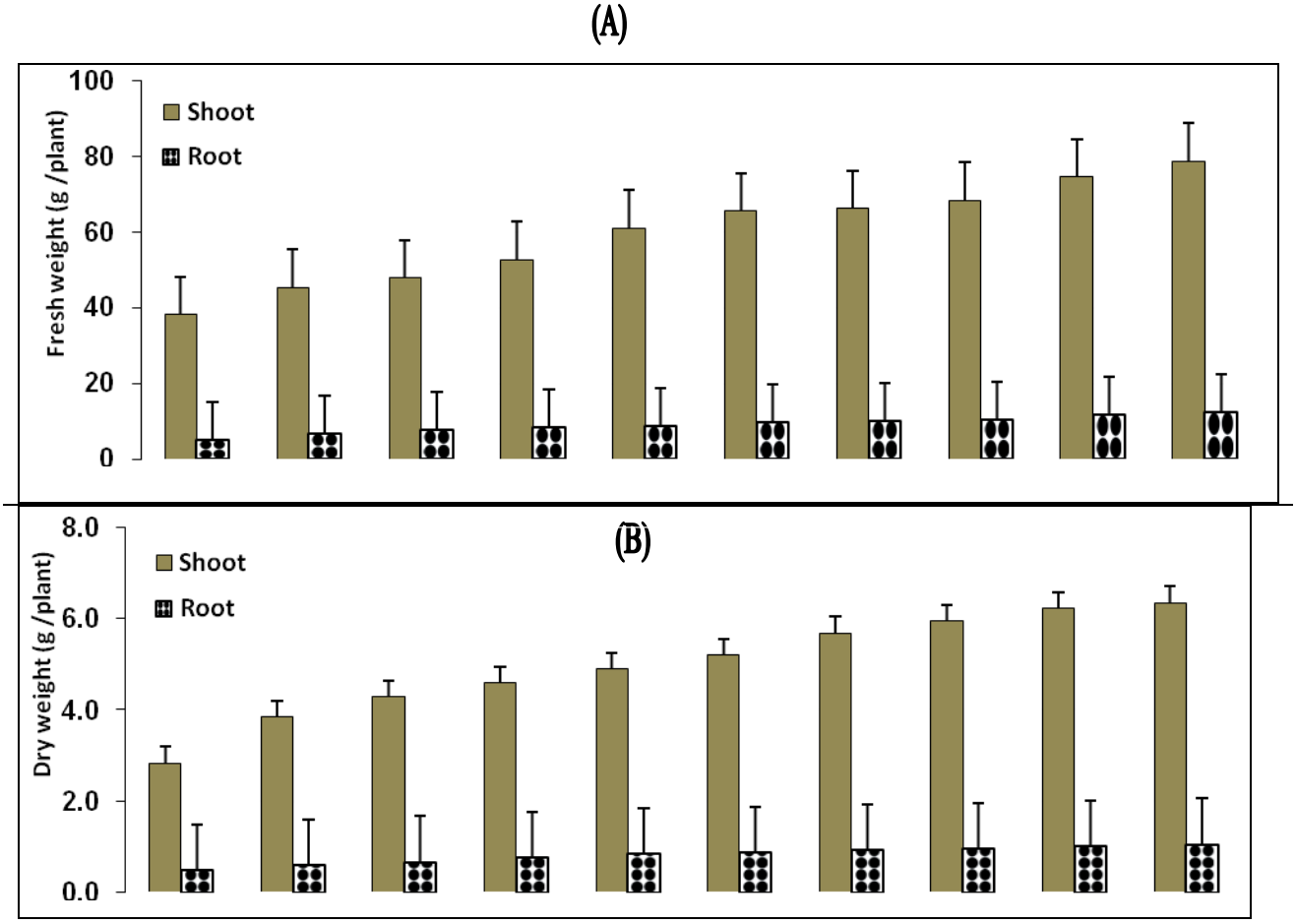
At harvest stage in the two seasons, root dimensions cm (length and diameter) and fresh root and shoot weight (g) were determined. Chlorophyll and carotene was also estimated according to [9].Then, fresh radish samples were oven dried ground and digested for the determination of N, P and K contents as described by [12]. The analysis of variance was carried out according to [6] using MSTAT computer software, after testing the

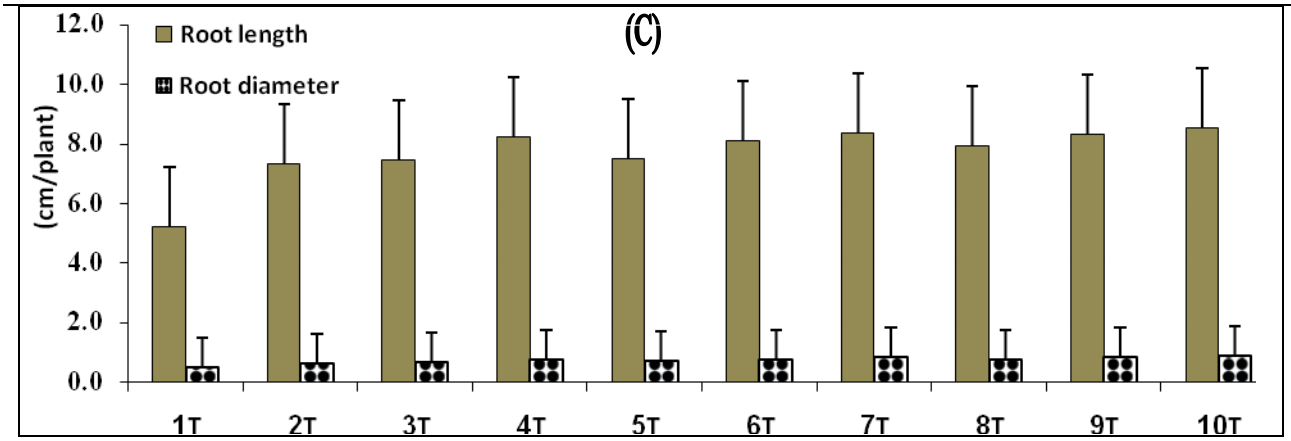
homogeneity of the error according to Bartlett's test. Means of the different treatments were compared using the least significant difference (LSD) test at P<0.05.

Results and Discussion

Vegetative Growth characteristics:-

Data revealed that fresh and dry shoot and root of radish plant at harvest a remarkable increased as affected by amino acids application with different rate of nitrogen fertilizer particularly with application of 120 Kg N/fed and foliar application amino acid at a rate of 750 ppm as compared with control of non fertilizer (Fig. 1).Data also revealed that the same treatment significantly increased of root length and root diameter as compared with control. The regulatory effect of amino acids on growth could be explained by the notion that some amino acids e.g. phenylalanine, gulatumic can affect plant growth and development through their influence on gibberellins biosynthesis [15] .Also, amino total as a source of amino acids may be playing an important role in plant metabolism and protein assimilation which necessary for cell formation and consequently increase fresh and dry mater. However, similar effect and findings about amino acids were reported by [3] on potato and [1] on strawberry.





	T2	**N 40 kg/fed**	**T5**	**N 80 kg/fed**	**T8**	**N 120 kg /fed**
T1 Control	**T3**	**N 40 kg N/fed + (Aa) 500 ppm**	**T6**	**N 80 kg/fed + (Aa) 500 ppm**	**T9**	**N 120 kg /fed + (Aa) 500 ppm**
	T4	N **40 kg N/fed + (Aa) 750 ppm**	**T7**	N **80 kg/fed + (Aa) 750 ppm**	**T10**	N **120 kg /fed + (Aa) 750 ppm**

Fig (1): Yield parameters of radish as affected by different levels of nitrogen fertilizer and amino acid.

Chemical Constituents

a. Leaf Pigments

Data presented in Table 2 show that spraying the plants with amino acids with different levels of nitrogen fertilizer stimulated the chlorophyll content and its components compared to control treatment. The highest values were obtained from the application of using nitrogen fertilizer at a rate of 120 Kg N/fed and spraying amino acid at a rate of 750 ppm. The increment effect of chlorophyll a, b, a+b and carotenoids by 0.513, 0.225, 0.738 and 0.206, respectively.

These results are confirmed by those recorded by [2] indicated that foliar spraying of amino acids and humic acid on Asparagagus plants increase uptake of macro and micro elements in shoot and rhizome has increased carbohydrates production, chlorophyll and carotenoids in edible stems.

Table 2: Chlorophyll (Chl), carotene and nitrate contents of radish as affected by different levels of nitrogen fertilizer and amino acid.

Treatments		**Chl. a**	**Chl. b**	**Chl. a+b**	**Carotene**	**NO_3 (ppm)**
		(mg g^{-1} fresh weight)				
Control		0.354	0.135	0.429	0.136	125.6
40 Kg N fed^{-1}	**0 Aa**	0.394	0.153	0.547	0.145	136.5
	500 ppm Aa	0.415	0.162	0.577	0.150	134.1
	750 ppm Aa	0.429	0.168	0.597	0.156	135.6
80 Kg N fed^{-1}	**0 Aa**	0.455	0.183	0.638	0.171	166.9
	500 ppm Aa	0.471	0.194	0.665	0.178	163.2
	750 ppm Aa	0.487	0.199	0.686	0.182	155.6
120 Kg N fed^{-1}	**0 Aa**	0.496	0.213	0.709	0.187	186.3
	500 ppm Aa	0.500	0.218	0.718	0.196	173.5
	750 ppm Aa	0.513	0.225	0.738	0.206	171.7
LSD 0.05%		**0.0079**	**0.0036**	**------**	**0.0054**	**16.59**

Aa: amino acid

Data in table 2 indicate that NO3 concentration was significant affected by amino acid and nitrogen fertilizer. The lowest contents were obtained by 134.1 as affected by fertilization radish plants with 40 Kg N fed^{-1} and foliar application of amino acid at a rate 500 ppm .as compared with control plants may be attributed to role of amino acid in decrease of nitrate accumulation. Nearly similar results was obtained by [4] who revealed that slightly higher nitrate content in cabbage was noted after Goteo application. However, there are very few published results of research work on the use of amino acids on nitrate con centrations, therefore, further research is needed, in order to be able to generalize the effect of such growth stimulators substances on quality attributes.

b. Nutrient Content

Data in Table 3 presented the response of nitrogen, phosphorus and potassium contents to different spraying treatments. The obtained results indicate that spraying plants with amino acids at both investigated levels significantly increased N content in the leaf tissues than check ones as well as other spraying treatments, with clear superiority to the higher level .

These results held true in both seasons. The results were agreement with those of [1]about the beneficial effect of amino acids on N content. Regarding the phosphorus content Whereas, opposite results were noticed for the higher level of amino acids while, the lower level did not reflect any significantly effect when compared to those of untreated check plants. [10] and [12] Mean while, the results disagree with those of[1] in concern to amino acid effect. Comparing the effect of different spraying treatments on K content, it could be noticed that, amino acids at the two tested levels did not significantly affect the K content compared to control one. These results held true in both growing seasons.

Table 3: Nitrogen, phosphorus and potassium of radish as affected by different levels of nitrogen fertilizer and amino acid.

Treatments		Nitrogen (%)		Phosphorus (%)		Potassium (%)	
		Shoot	**Root**	**Shoot**	**Root**	**Shoot**	**Root**
Control		1.307	1.653	0.218	1.653	0.474	0.515
Urea 50 (Kg fed^{-1})	**0 (AA)**	1.533	1.813	0.347	0.334	0.544	0.558
	1 (AA)	1.657	1.917	0.389	0.354	0.570	0.623
	2 (AA)	1.833	1.960	0.407	0.375	0.592	0.654
Urea 100 (Kg fed^{-1})	**0 (AA)**	1.890	2.050	0.448	0.392	0.630	0.718
	1 (AA)	1.950	2.113	0.467	0.410	0.662	0.723
	2 (AA)	2.020	2.167	0.486	0.432	0.693	0.59
Urea 150 (Kg fed^{-1})	**0 (AA)**	2.253	2.183	0.488	0.458	0.728	0.776
	1 (AA)	2.230	2.237	0.495	0.465	0.754	0.803
	2 (AA)	2.413	2.303	0.510	0.490	0.785	0.854
LSD 0.05%		**0.0815**	**0.0495**	**NS**	**0.0248**	**0.0209**	**0.0516**

NS : Non-significant **Aa:** amino acid

References

1. Abo Sedera,F. A.,Amany A. Abd El-Latif., L.A.A. Bader and S.M. Rezk 2010. Effect of NPK mineral fertilizer levels and foliar application with humic and amino acids on yield and quality of strawberry. Egyp.J. of Appl. Sci., 25:154-169
2. Cangi,R., C. Tarakcioglu and H.Yasar. (2006): Effect of humic acid application on yield, fruit characteristics and nutrient uptake in Ercis grape (vitis vinifera L.) cultivar. Asian Journal Chemistry. 18:1493-1499.
3. El-Zohiri, S. S. M and Y. M. Asfour 2009. Effect of some organic compounds on growth and productivity of some potato cultivars. Annals of Agric.Sci.,Moshtohor, 47 (3): 403 -415.
4. Gajewski, M., G. Katarzyna and J. Bobruk 2008.The influence of Goëmar Goteo biostimulator on yield and quality of two Chinese cabbage cultivars. Conf.of biostimulators in modern agriculture "vgetable crops". Warsaw pp 23-27.

5. Gomez, K.A. and A.A. Gomez, 1984. *Statistical Procedures for Agriculture Research.* 2nd Edition, John Willy and Sons Inc. New York. Pp: 680.
6. Hussein, M. S., S. E. El-Sherbeny and B. H. Abou Leila 1992. Effect of some basic nitrogen compounds on the growth, photosynthetic pigment and alkaloid content in *Datura metal* L. Egypt. J. Physiol. Sci., 16 (1-2): 141 – 150.
7. Kowalczyk K. and T. Zielony 2008. Effect of Aminoplant and Asahi on yield and quality of lettuce grown on rockwool. Conf.of biostimulators in modern agriculture, 7-8 Febuary 2008, Warsaw, Poland
8. Lichetoenthaler, H.K and A.R. Wellburn, 1983. Determination of total caroteniods and chlorophyll a and b of leaf extracts in different solvents. *Biochem. Soc. Trans*, 11: 591-952.
9. LIU Xing, Q, H.Y CHEN , N.Qin-xue and L. K. Seung 2008. Evaluation of the Role of mixed amino acids in nitrate uptake and assimilationin leafy radish by using 15n-labeled nitrate. A
10. Mancuso, S., Azzarello, E., Mugnai, S., Briand, X.2006. Marine bioactive substances (IPA extract) improve foliar ion uptake and water tolerance in potted *Vitis vinifera* plants. Advances in Horticultural Science 20, 156–161.
11. Motsara, M. R. and Roy, R. N. (2008). Guide to laboratory establishment for plant nutrient analysis. Food and Agriculture Organization of the United Nations, Rome, Italy.
12. Rathore,S.S.R.Chaudhary,G.N.Boricha,A.Ghosh,B.P.Bhatt,S.T.Zodape,J.S.Patolia. 2009. Effect of seaweed extract on the growth, yield and nutrient uptake of Soybean (Glycine max) under rainfed conditions.South African Journal of Botany75:351-355
13. Rautaray, S.K., B.C. Ghosh and B.N. Mittra. 2003. Effect of fly ash, organic wastes and chemical fertilizers on yield, nutrient uptake, heavy metal content and residual fertility in a rice-mustard cropping sequence under acid lateritic soils. *Biores. Tech*., 90: 275-283.
14. Saeed, M. R., A. M. Kheir and A. A. Al-Sayed 2005. Supperssive effect of some amino acids against *Meloidogyne incognita* on Soybeans.J. Agric. Sci. Mansoura Univ., 30 (2): 1097 – 1103.
15. Satyanarayana, V., P.V.V. Prasad, V.R.K. Murthy and K.J. Boote. 2002. Influence of integrated use of farmyard manure and inorganic fertilizers on yield and yield components of irrigated lowland rice. *Ind. J. Plant Nutr*., 25: 2081-2090.
16. Walter, G.R. and E.Nawacki. 1978.Alkaloid biolog and metabolism in plants. Planum, press, N.Y.pp. 152.

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