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Effect of glutamic acid and N fertilization levels on growth, yield and nutrients content of wheat plants.

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Abstract
Field experiments were conducted in the winter season of 2019 with the aim of determining the effect of spraying glutamic acid with nitrogen fertilization on the growth, productivity and nutritional status of wheat plants, (*Triticum aestivum L*., cv. Sakha 69). The experimental treatments consisted of spraying glutamic acid at three different concentrations, (50, 100; 200 ppm) with nitrogen fertilization at three rates(80, 100; 120 kg N fed^{-1}).
The results indicated that spraying with high concentration of glutamic acid (200 ppm) with a higher rate of nitrogen fertilization (120 kg N fed^{-1}) gave the best and highest values for both growth and yield characteristics of wheat. It was also found to increase nitrogen fertilization rates from 80 to 120 kg N fed^{-1} with increasing concentrations of spraying with glutamic acid from 50 to 200 ppm, which led to the enhancement and improvement of the physiological characteristics of wheat plants, as the green pigments and carotenoid values increased in wheat leaves, and the content of protein and carbohydrate in wheat grains also improved greatly Non-significant effects of the different experimental treatments appeared on the content of the N, P and K in wheat leaves.
Spraying with glutamic acid on wheat plants with an optimal level of nitrogen fertilization gave great results on the growth and yield of wheat and also improved the nutritional status of wheat plants.

Keywords: Glutamic acid, N fertilization, wheat, growth, yield, nutrients content

Introduction
Wheat is one of the world's most commonly consumed cereal grains especially Egypt. The many species of wheat together make up the genus *Triticum*; the most widely grown is common wheat (*T. aestivum*). The Egyptian wheat production ranged between 7.2 and 8.9 million metric tons in 2010 and 2019 respectively (Ibrahim and Said 2020).
Nitrogen is one of the essential elements determining the growth of all plants. Nitrogen is absorbed into plant tissues in two forms, which are nitrate and ammonium (Ali *et al*., 2000). All biochemical processes that occur in plants are governed primarily by nitrogen and its associated components making it essential for the growth of all plants, (Ghobadi *et al*., 2010).
The amino acids play an important role in the building processes inside different plants as well as in the metabolism process, as amino acids greatly affect plant growth, which is reflected in the quality of the resulting crop. Many physio-chemical properties of plant cells are influenced by amino acids (Marschner, 2011). Amino acids have various important biological functions in plant cells such as optimizing the elements uptake, vitamin biosynthesis, creating higher tolerance to environmental stresses (Hatamian and Salehi, 2017, Hussain *et al*., 2018 and Bashir *et al*., 2018). Glutamine is the main amino acid involve in many metabolic reactions in plants including neutralizing the produced H^+ in ammonium fed plants and higher tolerance to stress conditions (Cao *et al*., 2010). The study aims to affect the growth, yield and nutritional status of wheat plants by spraying with different levels of glutamic acid with different rates of nitrogen fertilization under loamy sand soil conditions.

Material and Methods:
A field experiment was conducted on loamy sand soil at the Ismailia Agricultural Research

Station planted with wheat (*Triticumaestivum L., cv* Sakha 69) in winter 2019. Some physical and chemical properties of the cultivated soil were evaluated in samples taken before wheat cultivation according to standard procedures reported by Cotteine (1980), to be shown in (Table, 1).

Table 1: Physical and chemical properties of soil before wheat cultivation.

Soil property	Value	Soil property	Value
		pH (1:2.5 soil suspension)	8.1
Sand Silt Clay Texture	84.1 5.70 10.2 Loamy sand	EC (dS m^{-1}), soil paste extract	1.20
		Soluble ions (mmol L^{-1})	
		Ca^{++}	6.12
		Mg^{++}	4.60
$CaCO_3$ %	2.00	Na^{+}	1.54
Organic matter%	0.03	K^{+}	0.52
Available N (mg kg^{-1})	61.4	CO_3^{--}	nd.
		HCO_3^{-}	1.10
Available P (mg kg^{-1})	3.15	Cl^{-}	0.96
		SO_4^{--}	9.60
Available K (mg kg^{-1})	6.10		

nd: not detected

Three level of glutamic acid (50, 100; 200 ppm) as combined with three rates of nitrogen fertilization (80, 100; 120 kg N fed^{-1}). Plant samples were dried at 65C° for 48 hrs, ground and wet digested using H_2SO_4: H_2O_2 method (Cottenie, 1980). The digests samples were then subjected to measurement of N using Micro-Kjeldahle method; P was assayed using molybdenum blue method and determined by spectrophotometer and K was determined by Flame Photometer (Chapman and Pratt, 1961). Leaf chlorophyll reading (mg/100 mg DW) according to (black 1965).

Results and Discussions:

The data in Table (2) illustrate the response of wheat plants to spraying glutamic acid at its three different concentrations with different rates of nitrogen fertilization. The high spray rates of glutamic acid showed a significant effect on the growth and yield of wheat, especially with increased nitrogen fertilization. More clearly, the higher values of both the straw yield (6.25 ton fed^{-1}) and the grain yield (2.88 ton fed^{-1}) could be obtained using a higher spray concentration of glutamic acid (200 ppm) with a higher fertilization rate of nitrogen fertilization (120 kg fed^{-1}). Also, the same previous treatment can obtain higher values for each plant height, Photosynthetic capacity and grain index (81.4 cm, 5.62 g/cm^2 and 49.2 g, respectively).

Table 2: The effect of glutamic acid concentrations and N fertilization rates on growth and yield of wheat plants.

Treatments		Yield ton fed^{-1}		Plant height	Photosynthetic capacity *	Grain index
N fertilization rate (kg fed^{-1})	Glutamic acid (ppm)	Grain	Straw	cm	g/cm^2	g
80	50	2.61	5.72	76.7	3.44	38.2
	100	2.64	5.88	78.7	3.66	40.0
	200	2.69	5.92	79.8	3.97	40.4
100	50	2.67	5.80	79.1	4.41	39.3
	100	2.72	5.90	79.8	4.43	40.2
	200	2.75	6.00	80.2	4.46	41.2
120	50	2.71	6.00	79.7	5.01	46.5
	100	2.82	6.16	80.3	5.43	48.0
	200	2.88	6.25	81.4	5.62	49.2
$LSD_{0.05\%}$						

*Photosynthetic capacity = flag leaf weight (g)/flag area (cm^2)

Nitrogen is one of the major nutrients which lessen the yield of wheat if not applied in convenient amount as it is needed for swift growth of plants and to get high production (Ali *et al*., 2000). Nitrogen is the main component and major constituent of plants especially in living tissues formation. To get the maximum yield of wheat, application of nitrogen in adequate amount is considered as a key to success (Ma *et al*., 2010). Many researchers have studied and discussed the increase in the productivity of various crops as a result of spraying amino acids such as (Souri *et al*.,2017 and Basanth and Mahesh, 2018). The yield improvement is due to increased green matter synthesis and photosynthesis rates, increased protein synthesis as well as tolerance to harsh climatic conditions (Khan *et al*., 2012 and Souri and Hatamian, 2019).

The results in Table (3) illustrate the effect of experimental treatments on some physiological properties of wheat plants. It was found that increasing the nitrogen fertilization rate from 80 to 120 greatly improved the physiological characteristics of wheat plants, and this is evident with increasing the concentration of spraying with glutamic acid. The highest values of chlorophyll a and b and carotenoid were obtained in wheat leaves, as well as the grain content of proteins and carbohydrates, with the addition of the highest levels of nitrogen fertilization (120 kg fed^{-1}) and glutamic acid (200 ppm).

Table 3: Effect of glutamic acid concentrations and N fertilization rates on some physiological properties of wheat plants.

Treatments		Chlorophyll a	Chlorophyll b	Carotenoid	Protein	Carbohydrate
N fertilization (kg fed^{-1})	Glutamic acid (ppm)	mg/100 mg DW			gm/ 100 seed gm	
80	50	6.860	3.323	1.422	11.71	66.20
	100	6.732	3.345	2.323	11.80	68.00
	200	6.973	4.116	2.724	11.85	69.20
100	50	6.292	3.783	1.872	11.90	69.50
	100	6.443	4.202	2.204	12.10	70.00
	200	7.515	4.624	2.336	12.11	70.10
120	50	6.852	4.051	3.006	12.12	70.11
	100	7.917	4.316	2.932	12.40	71.10
	200	7.939	4.875	3.995	12.60	71.10
$LSD_{0.05\%}$		0.0134	0.024	0.026	0.02	0.011

The nitrogen element: is an integral part of the proteins, coenzymes, chlorophyll and nucleic acids. The vital basic activities that occur in plants are mainly for N and its compounds and skills, thus making plant growth (Kutman et al., 2011). Increased protein concentration in vegetarian plants (Amin et al., 2011). Additionally, elevation of leaf chlorophyll could be due to the catalytic effect of amino acids on the synthesis of chlorophyll, (Souri *et al*., 2017 and Fahimi *et al*., 2016).

Through the results from Table (4), the effect of adding different rates of nitrogen fertilization as well as different levels of glutamic acid on the content of wheat leaves of nitrogen, phosphorous and potassium is evident.

Non-significant effects of the different experimental treatments appeared on the content of the three nutrients in wheat leaves, where the slight increase in the nitrogen, phosphorous and potassium content of the leaves was due to an increase in the rate of glutamic acid spraying under different nitrogen fertilization levels.

The application of nitrogen improves the root growth and this will increase the ability

of roots to explore more soil and increases the uptake of nutrients. Zhang *et al.* (2004) reported that added N increased the growth of roots and produced a mass of fine roots. Moreover, the application of nitrogen may be increase the availability of nutrients in soil. Spraying amino acids on plants greatly improves the leaves' content of various nutrients, (Garcia *et al*., 2011 and Pranckietiene *et al*., 2015). Amino acids have affinity with nutrients and some amino acids can make chelates with the nutrients. This characteristic, had been widely used in order to improving the uptake and delivery of nutrients, (Souri and Hatamian, 2019).

Table 4: Effect of glutamic acid concentrations and N fertilization rates on N, P and K content in leaves of wheat.

Treatments		Nutrient content in leaves, (%)		
N fertilization (kg fed^{-1})	Glutamic acid (ppm)	N	P	K
80	50	2.70	0.29	2.84
	100	2.73	0.31	2.86
	200	2.74	0.32	2.86
100	50	2.71	0.29	2.85
	100	2.76	0.32	2.86
	200	2.77	0.33	2.85
120	50	2.71	0.30	2.85
	100	2.76	0.33	2.87
	200	2.76	0.33	2.86
$LSD_{0.05\%}$		0.10	0.04	0.30

References:

1. Amin A.A., F.A.E. Gharib, M. El-AwadiaandE.S.M.Rashad(2011). Physiologicalresponse of onion plants to foliar application of putrescine and glutamine. Scientia Horticulturae, 129:353-360
2. Ali A., M.A. Choudhry, M.A. Malik, R. Ahmad and A. Saifullah (2000). Effect of various doses of nitrogen on the growth and yield of two wheat cultivar. Pak. J. Biol. Sci. 3(6): 1004-1005.
3. Basanth N. and G. Mahesh (2018). Bio-efficacy of Nova Nutri Boost for yieldand yield components in paddy (*Oryza sativa* L.). InternationalJournal of Current Microbiology and Applied Science, 7: 2250-2253.
4. Bashir A., M. Rizwan, S. Ali, M.Z.Zia-urRehman, W.Ishaque, M.A.RiazandA. Maqbool (2018). Effect of foliar-applied iron complexed withlysine on growth and cadmium (Cd) uptake in rice under Cdstress. Environmental Science and Pollution Research, 25: 20691-20699.
5. Black, C. A. (1965). Methods of soil analysis parts. American Society of Agronomy, I. N.C. publisher, Madison, Wisconsin, USA.
6. Cao Y.P.,Z.K.Gao, J.T.Li and G.H.Xu (2010). Wang M., Effects of extraneousglutamic acid on nitrate

contents and quality of Chinese chive. Acta Horticulturae, 856: 91–98.
7. Chapman, H.D. and R. E. Pratt (1961). Methods of analysis for soil, Plants and Water.Dept. of Soil, Plant Nutrition, Univ. of California. U.S.A.
8. Cotteine, A. (1980). Soil Management for Conservation and Production. New York, pp. 245-250.
9. Fahimi F., M.K. Souriand F. Yaghobi(2016). Growth and development ofgreenhouse cucumber under foliar application of Biomin andHumifolin fertilizers in comparison to their soil application andNPK. Journal of Science and Technology of Greenhouse Culture, 7: 143-152
10. Garcia A.L., R. Madrid, V. Gimeno, W.M. Rodriguez-Ortega, N. Nicolas and F. Garcia-Sanchez (2011). The effects of amino acids fertilizationincorporated to the nutrient solution on mineral compositionand growth in tomato seedlings. Spanish Journal of AgriculturalResearch, 9: 852-861
11. Ghobadi, M., M. E. Ghobadi and S. S. Sayah (2010). Nitrogen application management in triticale under post-anthesis drought stress. Word Acad. Sci. Eng. Technol. 70: 252-254.
12. Khan A.S., B. Ahmad, M.J. Jaskani, R. Ahmad and A.U. Malik (2012). Foliar application of mixture of amino acids and seaweed(*Ascophylumnodosum*) extract improve growth and physicochemicalproperties of grapes. International Journal of
13. Agriculture and Biology, 14: 383-388
14. Hatamian M. and H.Salehi (2017). Physiological characteristics of two rosecultivars (*Rosa hybrida* L.) under different levels of shading ingreenhouse conditions. Journal of Ornamental Plants, 7(3), 147-155.
15. Hussain A., Ali S., Rizwan M., Zia-urRehman M.Z., Hameed A., Hafeez F., Alamri S.A., Alyemeni M.N., Wijaya L. (2018). Role of zinc– lysine on growth and chromium uptake in rice plants underCr stress. Journal of Plant Growth Regulation, 37(4),1413-1422.
16. Ibrahim Kh.A.M. and A.A. Said (2020). Grain yield stability of new bread wheat genotypes (*triticum aestivum* l.) under normal and heat stress conditions. Egypt. J. Agron., 42: 171-184
17. Kutman U. B., Yildiz B. and I. Cakmak (2011). Effect of nitrogen on uptake, remobilization and partitioning of zinc and iron throughout the development of durum wheat. Plant and Soil, 342(1-2), 149-164.
18. Ma B. L., T. Y. WU, N. Tremblay, W. Deen, N. B. Mclaughlin, M. J. Morrison and G. Stewart (2010). On-farm assessment of the amount and timing of nitrogen fertilizer on ammonia volatilization. Agronomy Journal,102(1), 134-144.
19. Marschner; P. (2011). Marschner's mineral nutrition of higher plants (3rded.). Elsevier, London, p. 672.
20. Pranckietiene I., E. Mazuolyte-Miskine, V.Pranckietis, R. Dromantiene, G.Šidlauskasand R.Vaisvalavicius (2015). The effect of amino acids on nitrogen, phosphorus and potassium changes in spring barley under the conditions of water deficit. Zemdirbyste-Agriculture, 102: 265-272
21. Souri M.K. and M.Hatamian(2019). Aminochelates in plant nutrition: a review. Journal of Plant Nutrition, 42: 67-78.
22. Souri M.K., F. YaghoubiSooraki and M. Moghadamyar (2017). Growth and quality of cucumber, tomato, and green bean plants under foliar and soil applications of an aminochelate fertilizer. Horticulture, Environment and Biotechnology, 58: 530-536
23. Zhang, Q. Q., H. L. Xu, Z. L. Fan, M. Ye, P. J. Yu and J. Y. Fu (2013). Impact of Implementationof Large-Scale Drip Irrigation inArid and Semi-arid Areas: CaseStudy of Man as River Valley,Communications in Soil Scienceand Plant Analysis, 44(13):2064-2075.