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Application of Nitrogen, Tryptophan and Their Relation on Growth, Yield and Some Chemical Constituents in Green Onion

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ABSTRACT

Field experiments were carried out at the experimental Station of National Research Center Nubaria region, Behira Government, Egypt, to investigate the effect of different levels of nitrogen fertilizer, tryptophan and their interaction on the growth, productivity and some chemical constituents of green onion plant (Allium cepa L. cv. Giza 6)at 48 and 63 days after sowing (stage A and B respectively). Obtained results indicated that both nitrogen and tryptophan application significantly promoted the growth criteria of green onion: shoot length, white part length, bulb diameter, number of leaves, fresh and dry weight of onion plant at two vegetative stages. The increase in growth criteria was concomitant with increases in photosynthetic pigments, oil percentage, absorbed nitrogen, total nitrogen, total protein, total free amino acids and indoles content. Also, the results cleared decrease in the total soluble salts (TSS). It was noted that 30kgfed^{-1}nitrogen and 50 mg/L tryptophan caused the highest increases in all examined growth parameters of onion plants at both growth stages. It means that tryptophan amino acid application reduced recommended nitrogen dose at rate 75% and consequently reduced nitrogen accumulation and cost.

Keywords: Tryptophan, Nitrogen, Green onion, growth, amino acids

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INTRODUCTION

Onion (*Allium cepa. L*) belongs to the family *Alliaceae*. Onion plant is cultivated for ultimate uses as green and bulbs. Additionally, it has medicinal properties in the treatment and prevention a number of serious diseases [1-2] that attributed with onion biochemical constituents.

Nitrogen (N) alters plant composition much more than any other mineral nutrient as it is an indispensable elementary constituent of many organic metabolites including amino acids, proteins, nucleic acids, and phytochromes[3]. Thus, N is the motor of plant growth and makes up1 to 4% of dry matter of the plants. It is widely accepted that crops grown on soils deficient in N, exhibit very distinctive N-deficiency symptoms such as poor growth, chlorosis, necrosis and causes disorder in many physiological/biochemical characteristics of plants[4].The use of N-fertilizers along with other nutrients has been suggested to enhance the crop productivity[3].

Nitrogen sources significantly influence N uptake efficiency in crop plants. Nitrate-based fertilizers often include excessive nitrate content in the edible part of vegetables[5-6]. Whereas, Jilani *et al*.[7] found that onion varieties responded to N application for improving plant growth. Aliyu *et al*.[8] and Al-Fraihat[9] revealed that N application significantly affected plant height, number of leaves per plant, percentage bolters, crop growth rate and individual bulb weight of onion plant. The role of nitrogen levels has been associated with so many significant increase in the plant growth and total yield of onion[10,11] garlic[12,13] and potatoes[14] Squash[15]. All vegetative growth parameters were significantly increased gradually by increasing the level of nitrogen fertilizer application[16]. Insufficient available N leads to reduced growth, reduced light interception, limited yield and early crop senescence. On the other hand, excessive available N can result in reduced and delayed yield and reduced dry matter content[17].

Bioregulator substances were shown to enhance the biosynthesis of certain chemical constituents in plants. In this respect, the amino acids which have a high integrity with different metabolic pools in plants were used to promote plant growth[18]. Whereas, the link of tryptophan to the biosynthesis of auxins, the phytoalexin camalexin, phenyl propanoids and other related natural products in plants were reported [19]. Studies have proved that amino acids can directly or indirectly influences the physiological activities of plant growth and development. Among the plant growth hormones, auxin is well known for growth and development of plants. Therefore, exogenous application of L-tryptophan has been reported to improve the growth and yield of various crops[20,21]. Additionally, Sivasankari *et al*.[22] found that the supplementation *Vigna unguiculata* (L.) Walp with 5 ml crude IAA (2mg/ml of tryptophan) dynamically enhanced the plant growth parameters after 15 days.

Many studies reported that the foliar application of amino acids caused an enhancement in plant growth, fruit yield and its components as cucumber[23], garlic[24] and onion[25, 26].

Thus, the study was carried out to investigate the interactive effect of different nitrogen fertilizer levels in combination with foliar spray of tryptophan on the growth, productivity and some chemical constituents of green onion plant.

EXPERIMENTAL SECTION

The experiments were conducted to study the interactive effect of different nitrogen fertilizer levels in combination with foliar spray of tryptophan on the growth, productivity and some chemical constituents of green onion plant. Onion bulbs (*Allium cepa* L.) cv. Giza 6were secured from Agricultural Research Centre, Cairo, Egypt. The treatments consisted of three levels (30, 60 and 120kg fed^{-1}) of nitrogen as ammonium sulphate (20.5%N), tryptophan amino acid concentrations (25, 50 and 75 mgL^{-1}), their interaction and control treatment. Ammonium sulphate fertilizer was added to the soil after 20 days from planting. Green onion plants were sprayed by the tryptophan amino acid after 30 days from planting.

Onion bulbs were sown under drip irrigation system at 4October in two seasons 2014 and 2015, respectively in National Research Center farm Nubaria region, Behira government, Egypt. Onion bulbs (1cm) diameters were planted on ridges (1m) width and length (8m) using four rows/ ridge at distance of 2.5 cm between plants. Each plot includes 4 ridges and the plot area was $16m^2$. The experiment was arranged as split plot design with three replications. Phosphorous fertilizer as calcium super phosphate (15.5 P_2O_5) was added pre-sowing at recommended rate 200 Kg/fed and potassium sulphate (48% K) at rate50 Kg/fed after20days from planting.

Growth measurements

The growth criteria such as shoot length, length of white part, bulb diameter, number of leaves, fresh and dry weight of plant as well as green onion yield kg/m^2 were recorded at two vegetative stages (48 and 63 days from planting namely A and B respectively). The previous characters were taken from 10 plants per replicate.

Biochemical constituent's determination

Photosynthetic pigments were determined in fresh leaves according toWettstein[27]. Total soluble solids were determined in fresh juice using Refractometer (Shibuya-0-32, Japan). Onion plants were dried in oven at $70^{O}C$ and then finally grind for determination of total nitrogen on the basis of Kjeldal-N, total protein and adsorbed nitrogen[28], Nitrate [29], free amino acid[30], total indoles[31]. Fixed oil content was determined as adopted by the methods of A.O.A.C.[32]with Soxhelt apparatus using petroleum ether (40- 60^{o}).

Statically analysis

Combined analysis of the data for two growing seasons was carried out according to M state programme[33]and the values of least significant differences (L.S.D. at 5 % level) were calculated to compare the means of different treatments.

RESULTS AND DISCUSSION

Effect of nitrogen fertilizer, tryptophan amino acid and their interaction on vegetative growth characters of green onion plant

Effect of nitrogen fertilizer on vegetative growth characters

Data given in **Table (1)** show the effect of the nitrogen levels on green onion growth characters as expressed as shoot length, white part length, bulb diameter, leaves number, fresh and dry weight/plant were significantly varied at two vegetative growth stages. Nitrogen level (30kgfed^{-1}) gave the highest values of growth criteria of green onion plant at both growth stages. The increment of growth characters resulted from 30kgfed^{-1} nitrogen treatment was evaluated to be 26%,15%,9%,15%, 75% and 51%, respectively for shoot length, white part length, bulb diameter, leaves number, fresh and dry weight of green onion plant at 48 days from sowing. In addition, different levels of nitrogen fertilizer significantly increased the yield of green onion plant (kg/m^2) at two growth stages as presented in. These results showed that nitrogen level (30kgfed^{-1}) was sufficient to produce the highest values of green onion plant weight. These changes might be due to the activities of N-assimilatory enzymes and changes in plant hormone status[34] that reflect on increasing yield of green onion. These results were in agreement with Jilani *et al*.[7] who found that N application improved plant height, number of leaves per plant, percentage bolters, crop growth rate and individual bulb weight of onion plant as well as periwinkle plant[35].

Nitrogen is an important macronutrient to ensure plant growth and development as it is a component of proteins and nucleic acids, as well as many co-factors and secondary metabolites. Plants have the potential for adaptation to reduced nitrogen availability by increasing the capacity for nutrient acquisition and by alteration of whole-plant morphology and metabolism, such as increasing the root/shoot ratio or accumulation in leaves[36].Nitrogen supply involved in protein synthesis as proteins with functions in central metabolism and hormone metabolism[37].

Effect of tryptophan amino acid on vegetative growth characters

Concerning tryptophan amino acid application, growth characteristics (shoot length, white part length, bulb diameter, fresh and dry weight plant)shown in **(Table, 1)**as well as yield of green onion plant/m^{2}were significantly increased with increasing tryptophan amino acid concentration till 50 mg l^{-1}at two vegetative growth stages.

The increment of growth characters resulted from the treatment with tryptophan at 50 mg l^{-1}was evaluated to be 14%, 10%, 22%, 15%, 69%, 54% respectively, for shoot length, white part length, bulb diameter, leaves number, fresh and dry weight of green onion plant at 48 days from sowing. Tryptophan amino acid is a source of nitrogen and a precursor of indole acetic acid in plant tissue that effect on green onion plant growth criteria as shown by Xu *etal*.[38] and Henry and Jefferies[39].

Table (1): Effect of nitrogen fertilizer and tryptophan on plant growth characters and green yield of green onion plant at two vegetative stages (Combined data of two seasons)

Treatments		Shoot Length (cm)		White part Length (cm)		Bulb Diameter (cm)		Number of Leaves		Fresh Weight (g/plant)		Dry Weight (g/plant)		Green Yield (Kg/m^2)	
		A	B	A	B	A	B	A	B	A	B	A	B	A	B
Nitrogen	Control	34.95	36.17	5.16	5.81	1.27	1.31	4.97	4.97	9.37	10.77	1.07	1.12	1.53	1.73
	30 kg/fed	43.98	46.22	5.95	6.02	1.38	149	5.72	5.43	16.37	17.93	1.62	1.66	2.63	2.78
	60 kg/fed	36.92	43.03	4.98	5.48	1.09	1.38	5.12	5.40	9.44	16.55	0.86	1.43	1.50	2.65
	120 kg/fed	34.68	42.78	4.54	5.15	1.07	1.35	4.98	5.18	8.50	14.22	0.77	1.36	1.35	2.28
L.S.D at 5%		**1.12**	**3.59**	**3.59**	**0.09**	**0.06**	**0.06**	**0.34**	**0.36**	**0.84**	**1.14**	**0.06**	**0.12**	**0.11**	**0.14**
Tryptophan	Control	35.25	37.27	4.856	5.46	1.07	1.28	4.81	5.07	8.05	11.39	0.78	1.04	1.30	1.83
	25 mg/L	36.37	42.38	5.05	5.71	1.15	1.33	5.07	5.00	10.14	13.57	1.01	1.25	1.63	2.18
	50 mg/L	40.19	45.32	5.33	5.80	1.31	1.43	5.53	5.40	13.62	18.46	1.32	1.62	2.18	2.95
	75 mg/L	38.21	43.23	5.19	5.49	1.28	1.49	5.34	5.52	11.86	16.04	1.20	1.55	1.90	2.48
L.S.D at 5%		**1.87**	**2.07**	**2.07**	**0.18**	**0.05**	**0.05**	**0.29**	**0.32**	**0.56**	**1.23**	**0.07**	**0.11**	**0.08**	**0.12**

A = 48 days from sowing B= 63 days from sowing

Effect of interaction between nitrogen fertilizer and tryptophan amino acid on vegetative growth characters of green onion plant

It is obvious from **Table(2)** that nitrogen and tryptophan amino acid interaction had a significant effect on vegetative growth criteria (shoot length, white part length, bulb diameter, leaves number, fresh and dry weight plant) at two vegetative growth stages of green onion plant. Nitrogen and tryptophan amino acid interaction (30 kg Fed^{-1}and 50mgl^{-1}) gave the highest values of most growth criteria. The increment of growth characters resulted from the treatment with tryptophan amino acid concentration was evaluated to be 48%, 29%, 39%,6%, 77% and133% at 48 days from sowing and 46%, 10%, 23%, 14%, 112% and 79% at 63 days from sowing for shoot length, white part length, bulb diameter, leaves number, fresh and dry weight of onion plant compared with control. While, enrichment nitrogen level and tryptophan amino acid concentration led to reduce the plant growth criteria. The results show that this interaction was sufficient to supply onion plant with its requirement of nitrogen to give the best growth. The results were in agreement with Jilani *et al*.[7] who found that onion varieties responded to N application for improving plant growth. Aliyu *et al*.[8] and Al-Fraihat[9]revealed that N application significantly affected plant height, number of leaves per plant, percentage bolters, crop growth rate and individual bulb weight of onion plant.

In general, Nitrate and ammonium can induce direct expression changes in their respective uptake systems and trigger immediate downstream responses involving kinases and transcription factors[40]. In the case of spraying amino acids Talaat and Youssef[41]showed that foliar application of amino acids (Lysine, ornithine, salicylic acid and tryptophan) improved basil plant growth.

Table (2): Effect of interaction between nitrogen fertilizer and tryptophan on green onion plant growth character at two vegetative stages (Combined data of two seasons)

Treatments				Shoot Length (cm)		White Part Length (cm)		Bulb Diameter (cm)		Number of Leaves		Fresh Weight (g/plant)		Dry Weight (g/plant)		Green Yield (Kg/m^2)	
				A	B	A	B	A	B	A	B	A	B	A	B	A	B
Nitrogen	Control	Tryp-ophan	Control	32.20	34.33	4.90	5.67	1.16	1.34	4.67	5.33	7.88	12.07	0.89	1.24	1.3	1.9
			25(mg/L)	35.07	35.67	5.23	6.13	1.27	1.25	4.80	4.67	9.17	11.07	1.06	1.09	1.5	1.8
			50(mg/L)	35.20	36.00	5.27	5.78	1.33	1.23	5.27	4.67	10.41	8.50	1.17	0.88	1.7	1.4
			75(mg/L)	37.33	38.67	5.23	5.69	1.31	1.49	5.13	5.20	10.02	11.42	1.5	1.25	1.6	1.8
	30 kg/fed		Control	40.83	41.07	5.70	5.55	1.09	1.31	4.88	5.33	9.77	13.80	0.95	1.12	1.6	2.2
			25mg/L	41.87	44.53	5.62	6.13	1.32	1.45	5.67	5.00	14.68	14.41	1.48	1.53	2.3	2.3
			50mg/L	47.63	50.00	6.33	6.21	1.51	1.55	6.33	5.33	21.82	20.83	2.07	1.18	3.5	3.3
			75mg/L	43.53	49.27	6.13	6.21	1.61	1.65	6.00	6.07	19.20	20.69	1.99	2.17	3.1	3.3
	60 kg/fed		Control	34.60	35.93	4.67	5.40	0.97	1.25	4.80	4.67	7.09	9.27	0.63	0.83	1.1	1.5
			25mg/L	34.67	45.80	4.86	5.49	1.02	1.38	5.00	5.47	8.58	17.29	0.81	1.38	1.4	2.8
			50mg/L	40.60	49.40	5.47	5.82	1.19	1.50	5.20	6.17	11.45	25.61	1.04	2.22	1.8	4.1
			75mg/L	37.80	41.00	4.93	5.19	1.20	1.36	5.47	5.40	10.62	14.00	0.97	1.28	1.7	2.2
	120 kg/fed		Control	33.37	37.3	4.17	5.23	1.05	1.23	4.93	4.93	7.47	10.42	0.66	0.96	1.2	1.7
			25mg/L	33.87	43.53	4.47	5.10	1.01	1.25	4.80	4.87	8.14	11.52	0.70	0.99	1.3	1.8
			50mg/L	37.33	45.87	5.07	5.38	1.20	142	5.33	5.33	10.82	18.89	1.01	1.57	1.7	3.0
			75mg/L	34.17	44.00	4.47	4.88	1.03	1.49	4.87	5.40	7.59	16.03	0.69	1.50	1.2	2.6
L.S.D at 5%				**3.74**	**4.14**	**0.54**	**0.35**	**0.09**	**0.09**	**0.059**	**0.64**	**1.13**	**2.46**	**0.01**	**0.23**	**0.16**	**0.24**

A = 48 days from sowing B = 63 days from sowing

Effect of nitrogen fertilizer, tryptophan amino acid and their interaction on biochemical constituents of green onion leaf:

Effect of nitrogen fertilizer on photosynthetic pigments of green onion leaf

Photosynthetic pigments (chl. a, b and carotenoid) increase were significantly related to nitrogen level application as shown in **Table(3).**The Highest level of nitrogen (120 kg/fed.) gave the highest values of leave pigments (chl. a, b and carotenoid) at two vegetative stages compared to control. The increment rates were 5.8, 29.1 and 10.2% respectively at vegetative stage. These results arein agreement with Sun *et al*.[42]onChinese chive who stated that nitrogen is the one defined factor to chlorophylls and enzymes biosynthesis. Nitrogen alters plant composition much more than any other mineral nutrient as it is an indispensable elementary constituent of many organic metabolites including amino acids, proteins, nucleic acids and phytochromes[3]. It is widely accepted that crops grown on soils deficient in N, exhibit very distinctive N-deficiency symptoms such as poor growth, chlorosis, necrosis and causes disorder in many physiological/biochemical characteristics of plants[43].

Table (3): Effect of nitrogen fertilizer and tryptophan on leaf photosynthetic pigments content of green onion at two growth stages (Combined data of two seasons)

Treatments		Stage A			Stage B		
		Chlorophyll a (mg/g fresh weight)	Chlorophyll b (mg/g fresh weight)	Carotenoid (mg/g fresh weight)	Chlorophyll a (mg/g fresh weight)	Chlorophyll b (mg/g fresh weight)	Carotenoid (mg/g fresh weight)
Nitrogen	Control	0.214	0.093	0.131	0.242	0.079	0.127
	30 kg/fed	0.273	0.131	0.204	0.250	0.104	0.126
	60 kg/fed	0.301	0.135	0.201	0.236	0.081	0.131
	120 kg/fed	0.247	0.147	0.198	0.256	0.102	0.140
L.S.Dat 5%		**0.009**	**0.001**	**0.009**	**0.031**	**0.009**	**0.009**
Tryptophan	0	0.288	0.129	0.188	0.230	0.087	0.127
	25 mg/L	0.258	0.121	0.177	0.240	0.089	0.130
	50 mg/L	0.258	0.131	0.179	0.239	0.095	0.128
	75 mg/L	0.231	0.125	0.189	0.276	0.095	0.139
L.S.D at 5%		**0.008**	**0.008**	**0.008**	**0.027**	**0.027**	**0.008**

A = 48 days from sowing B = 63 days from sowing

Effect of tryptophan amino acidon leaf photosynthetic pigments of green onion

Data in **Table (3)** indicated that photosynthetic pigments (chl.a, b and carotenoid) were significantly varied with tryptophan treatments at 48 days and 63 days from sowing. The highest values were obtained by tryptophan concentration (75mgl^{-1}).This effect might be due to tryptophan supply as a source of nitrogen and carbon, which reflected on biosynthesis of leaf pigments. Additionally, Abdel Aziz *et al.*[44] appeared that tryptophan and phenylalanine application increased leaf pigments content of *Antirrhinum majus* plants

Table (4): Effect of interaction between nitrogen fertilizer and tryptophan amino acid on leaf photosynthetic pigments content of green onion at two growth stages (Combined data of two seasons)

Treatments				Stage A			Stage B		
				Chlorophyll a (mg/g fresh weight)	Chlorophyll b (mg/g fresh weight)	Carotenoid (mg/g fresh weight)	Chlorophyll a (mg/g fresh weight)	Chlorophyll b (mg/g fresh weight)	Carotenoid (mg/g fresh weight)
Nitrogen	Control	Trypt-phan	Control	0.209	0.086	0.129	0.215	0.063	0.126
			25 mg/L	0.205	0.093	0.131	0.238	0.081	0.130
			50 mg/L	0.264	0.109	0.144	0.199	0.069	0.112
			75 mg/L	0.178	0.083	0.120	0.316	0.099	0.140
	30 kg/fed		Control	0.350	0.151	0.225	0.253	0.092	0.131
			25 mg/L	0.253	0.124	0.181	0.243	0.110	0.118
			50 mg/L	0.227	0.123	0.173	0.269	0.131	0.141
			75 mg/L	0.263	0.128	0.237	0.233	0.082	0.114
	60 kg/fed		Control	0.318	0.150	0.222	0.187	0.063	0.105
			25 mg/L	0.306	0.130	0.183	0.246	0.076	0.140
			50 mg/L	0.293	0.138	0.220	0.263	0.093	0.141
			75 mg/L	0.287	0.124	0.178	0.249	0.091	0.138
	120 kg/fed		Control	0.275	0.122	0.178	0.266	0.124	0.146
			25 mg/L	0.269	0.137	0.212	0.231	0.090	0.132
			50 mg/L	0.248	0.154	0.179	0.223	0.086	0.117
			75 mg/L	0.195	0.165	0.223	0.305	0.107	0.164
L.S.D at 5%				**0.017**	**0.017**	**0.017**	**0.053**	**0.053**	**0.017**

A = 48 days from sowing B = 63 days from sowing

Effect of interaction between nitrogen fertilizer and tryptophan amino acid on leaf photosynthetic pigments content of green onion.

The data in **Table (3)** revealed that the nitrogen and tryptophan amino acid interaction significantly enhanced leaf pigments (Chl. a, b and carotenoids) content at two vegetative stages. Increasing nitrogen level led to increment chlorophyll a and b contents of onion leaf. The increment in photosynthetic pigments (Chl. a, b and carotenoid) content were related to nitrogen and tryptophan application. The effect of the nitrogen and tryptophan amino acid interaction on biochemical constituents was varied in both growth stages and related to the requirements and physiological metabolism according to growth stages. This might be due to the fact that nitrogen and tryptophan effect on enzymes and hormones. Nitrogen is an important macronutrient to ensure plant growth and development as it is a component of proteins and nucleic acids, and many co-factors and secondary metabolites or accumulation in the leaves[36]. Fan *et al.*[45] cleared that the increasing chlorophylls content in barley due to the uptake of radiolabelled amino acids which increase some tissue pools of amino acids. Higher relative water content, leaf membrane stability index, chlorophyll and potassium content were significantly found in plants treated with salicylic acid and tryptophan compared with other treatments and control plants[46].

2.4.Effect of nitrogen fertilizer on biochemical constituents of green onion plant.

Nitrogen application significantly enhanced the biochemical constituents (oil, absorbed nitrogen, total nitrogen, total protein, free amino acid and indoles) of green onion plant at 48days and 63 days from sowing**(Table, 6 and 7).** On the other hand, TSS and nitrate were significantly reduced with increasing nitrogen application. The increments in leaf onion biochemical constituents were related to the growth stage. The resulted data showed that the increase in rates of oil, total nitrogen, free amino acids and indoles were (23.7, 126.1, 122.7 and 31.3%) respectively at 63 days from sowing. This effect might be due to the uptake and assimilation of N by roots where the N status of plants is somehow sensed and can feedback to regulate different processes. As NO^{3-} is assimilated via conversion to nitrite, NH^{4+} and then into amino acids, so it was suggested that the internal pools of downstream N metabolites such as amino acids within plants may indicate N status by providing a signal that can regulate N uptake and the assimilation by the plant[47]. Liu *et al.*[48]showed that the total nitrogen concentration in soil and the nitrate concentration in lettuce increased as the amount of nitrogen fertilizer increased. While, Sun *et al.*[42] and Zhou *et al.*[49] showed that the mixed $NO^{3-}$and NH^{4+} nutrition is documented to be superior over individual $NO3^-$ or $NH4^+$ sources. But the optimal proportion of $NO^{3-}$to $NH^{4+}$for plant growth depends on plant species, environmental conditions, developmental stage and the total concentration of supplied nitrogen [50].

Effect of tryptophan amino acid on biochemical constituents of green onion plant

The tryptophan amino acid application significantly increased the chemical constituents (TSS, total nitrogen, free amino acid, indoles and nitrate content of green onion plant at two growth stages as shown in **(Table, 6 and 7).**Most of the chemical constituents were more affected with tryptophan concentration ($50mgL^{-1}$).This effect might be due to nitrogenous compounds assimilation of tryptophan to the others compounds as precursors for a wide range of secondary metabolites that produced through the shikimate pathway followed by the branched aromatic amino acid metabolic pathway. Additionally, carbon skeleton of the aromatic amino acids is converted to the free amino acids. In the same time, nitrogen-containing ring of tryptophan is converted to indole acetic acid or niacin vitamin[51].

Table (6): Effect of nitrogen fertilizer and tryptophan on biochemical constituents of green onion plant at 48 days from sowing (Combined data of two seasons)

Treatments		TSS (%)	Oil (%)	Absorbed Nitrogen (%)	Total Nitrogen (%)	Total Protein (%)	Free Amino Acid (mg/g)	Indoles (mg/g)	No_3 (mg/g)
Nitrogen	Control	10.52	4.33	1.02	0.99	5.97	7.36	18.63	1.36
	30 kg/fed	9.61	5.06	2.85	1.84	11.22	8.84	21.27	1.32
	60 kg/fed	9.17	5.24	2.29	2.67	16.63	13.00	18.88	1.06
	120 kg/fed	8.96	5.53	2.21	2.80	17.52	15.48	18.18	1.15
L.S.D at 5%		**0.81**	**0.22**	**0.05**	**0.09**	**0.44**	**0.49**	**0.36**	**0.09**
Tryptophan	Control	9.22	5.54	1.72	2.23	13.66	8.37	18.15	1.20
	25 mg/L	9.25	4.74	1.99	2.10	13.13	11.85	18.89	1.14
	50 mg/L	9.85	4.74	2.64	2.12	12.93	13.34	20.10	1.42
	75 mg/L	9.94	5.09	2.03	0.186	11.62	11.13	19.83	1.13
L.S.D at 5%		**0.59**	**0.17**	**0.06**	**0.08**	**0.54**	**0.49**	**0.37**	**0.17**

Table (7): Effect of nitrogen fertilizer and tryptophan on biochemical constituents of green onion plant at 63 days from sowing (Combined data of two seasons)

Treatments		TSS (%)	Oil (%)	Absorbed Nitrogen (%)	Total Nitrogen (%)	Total Protein (%)	Free Amino Acid (mg/g)	Indoles (mg/g)	No_3 (mg/g)
Nitrogen	Control	11.20	5.91	1.32	1.19	7.45	6.83	13.43	1.20
	30 kg/fed	10.25	6.66	3.37	2.05	12.84	11.43	16.61	1.06
	60 kg/fed	9.50	7.31	3.78	2.58	16.12	16.50	17.63	1.14
	120kg/fed	10.17	7.04	3.32	2.69	16.59	20.13	16.99	1.17
L.S.D at 5%		**0.03**	**0.78**	**0.11**	**0.13**	**0.91**	**0.94**	**0.57**	**0.12**
Tryptophan	Control	10.17	6.14	1.85	1.89	11.49	12.74	15.32	0.97
	25 mg/L	10.00	6.82	2.88	2.29	14.33	12.06	16.17	1.28
	50 mg/L	10.50	7.15	3.83	2.27	14.24	14.69	17.79	1.26
	75 mg/L	10.45	6.81	3.22	2.08	12.94	15.40	15.38	1.07
L.S.D at 5%		**0.58**	**0.39**	**0.09**	**0.12**	**0.63**	**1.41**	**0.34**	**0.12**

Effect of interaction between nitrogen fertilizer and tryptophan amino acid on biochemical constituents of green onion plant

The biochemical contents (Tss, oil%, adsorbed nitrogen, total nitrogen, free amino acids andNo_3) were significantly varied as a response to N fertilizer and tryptophan amino acid application at both growth stages of green onion plant as shown in **Table (8 and 9)**.The interaction(N fertilizer and tryptophan) significantly increased oil percentage, total absorbed nitrogen, free amino acids ,total indoles and nitrate content compared with control treatment while, TSS, nitrogen percentage and protein percentage significantly decreased. It was noted that the decrease of total protein was related to increase the total free amino acids, total indoles and nitrate content. The results indicated that oil percentage was significantly increased with increment of both the interaction factors. The highest value of oil percentage was obtained by 120kgN and 75 ppm tryptophan. In the same trend, the interaction (60kg N and 50 ppm) gave the highest values of nitrogen percentage and protein contents of onion plant at both stages while, free amino acids, indoles and nitrate contents varied in their response to the interaction. This might be due to growth stage of onion plant. Whereas, the biochemicals synthesis and metabolism of nitrogen and amino acid are varied according to the growth stage of the plant and environmental conditions. These results are in agreement withTao*et al.*[19]who found the link of tryptophan to the biosynthesis of auxins, the phytoalexin camalexin, phenyl propanoids and other related natural products in plants. In this respect, the amino acids which have a high integrity with different metabolic pools in plants were used to promote plant growth[18].El-Tohamy*et al.*[52]reported that the possibility of using slow release N fertilizer such as Ensyabine to maximize growth, yield and quality of bean plants grown under new reclaimed sandy soils provided an efficient way of applying nitrogen to such soils to increase the efficiency of N application and to minimize leaching as well as to prevent environmental pollution by the excess of nitrogen in the soil. This show the benefit of application low dose of N or any source of amino acids on saving the amount of nitrogen application.

Table (8): Effect of interaction between nitrogen fertilizer and tryptophan amino acid on biochemical constituent sofgreen onion plant at 48daysfrom sowing (Combined data of two seasons)

Treatments				TSS (%)	Oil (%)	Absorbed Nitrogen (%)	Total nitrogen (%)	Total Protein (%)	Free Amino Acid (mg/g)	Indoles (mg/g)	No_3 (mg/g)
Nitrogen	Control	Tryptophan	Control	9.73	4.28	0.81	0.87	5.40	6.13	20.03	1.35
			25 mg/L	9.87	4.12	1.11	1.05	6.60	8.73	17.53	1.31
			50 mg/L	10.60	4.58	1.79	1.25	6.87	7.30	16.40	1.39
			75 mg/L	11.87	4.36	0.98	0.80	5.00	7.27	20.57	1.38
	30 kg/fed		Control	10.13	5.33	2.07	2.25	13.93	9.40	18.57	1.22
			25 mg/L	9.33	5.31	2.73	1.90	11.90	7.47	20.67	1.08
			50 mg/L	9.80	5.05	4.00	1.87	11.70	11.07	25.53	1.39
			75 mg/L	9.17	4.53	2.56	1.33	8.33	7.43	20.30	1.60
	60 kg/fed		Control	9.20	6.42	1.87	2.70	16.90	10,63	17.20	1.09
			25 mg/L	8.13	4.51	2.18	2.73	17.10	19.63	17.87	1.21
			50 mg/L	10.00	4.67	2.58	2.65	16.27	12.53	20.63	1.29
			75 mg/L	9.33	5.34	2.52	2.60	16.27	9.20	19.83	0.64
	120 kg/fed		Control	7.80	6.12	2.12	3.10	19.40	7.30	16.80	1.15
			25 mg/L	9.67	5.02	1.90	2.70	16.90	11.57	19.50	0.940
			50 mg/L	9.00	4.84	2.76	2.70	16.90	22.47	17.83	1.01
			75 mg/L	9.38	6.13	2.04	2.70	16.87	20.60	18.60	0.88
L.S.D at 5%				**1.19**	**0.34**	**0.12**	**0.17**	**1.09**	**0.98**	**0.73**	**0.34**

Table (9): Effect of interaction between nitrogen fertilizer and tryptophan amino acid on biochemical constituents of green onion plant at 63 days from sowing (Combined data of two seasons)

Treatments				TSS (%)	Oil (%)	Absorbed Nitrogen (%)	Total Nitrogen (%)	Total Protein (%)	Free Amino Acid (mg/g)	Indoles (mg/g)	No_3 (mg/g)
Nitrogen	Control	Tryptophan	Control	11.00	5.59	1.12	0.90	5.63	7.57	14.87	0.90
			25 mg/L	10.67	6.61	1.53	1.40	8.75	6.50	14.70	1.19
			50 mg/L	11.33	6.39	1.12	1.27	7.92	6.40	11.87	1.58
			75 mg/L	11.80	5.05	1.49	1.20	7.50	6.87	12.30	1.12
	30 kg/fed		Control	8.67	6.28	2.47	2.20	13.75	10.93	16.20	0.75
			25 mg/L	11.33	6.10	3.06	2.00	12.50	8.27	16.60	1.14
			50 mg/L	10.67	6.88	3.93	2.17	13.54	16.30	17.77	1.11
			75 mg/L	10.33	6.86	4.02	1.85	11.56	10.20	15.87	1.23
	60 kg/fed		Control	9.00	6.06	1.79	2.15	13.44	11.43	15.30	0.84
			25 mg/L	8.67	7.29	4.30	3.10	19.38	12.90	17.07	1.16
			50 mg/L	10.00	8.11	5.92	2.67	16.67	18.47	21.67	1.46
			75 mg/L	10.33	7.76	3.11	2.42	15.00	23.20	16.47	108
	120 kg/fed		Control	12.00	6.40	2.03	2.30	13.13	21.03	14.93	1.33
			25 mg/L	9.33	6.78	2.64	2.67	16.67	20.57	16.30	1.62
			50 mg/L	10.00	7.19	4.35	2.97	18.84	17.60	19.87	0.88
			75 mg/L	9.33	7.55	4.25	2.83	17.71	21.33	16.87	0.84
L.S.D at 5%				**1.16**	**0.78**	**0.18**	**0.24**	**1.27**	**2.82**	**0.72**	**0.23**

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