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THE EFFECT OF SPRAYING NANO POTASSIUM, ARGININE AND TRYPTOPHAN ON SOME VEGETATIVE AND QUALITATIVE TRAITS OF EGGPLANT PLANT *SOLANUM MELONGENA*

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Abstract

This study was conducted in Najaf province in 2019 agricultural season to determine the effect of spraying eggplant (Hybrid Egg-plant Aswad) with three concentrations of nano potassium (0, 1.5 and 3 gm.L^{-1}) and amino acids (tryptophan and arginine 50mg.L^{-1} for each). Results showed that the 3gm.L^{-1} concentration of nano potassium was significantly higher in all studied traits when it gave the highest average of plant height, number of main branches, average of leave area, leaves content of total chlorophyll, fruits content of total amino acids and total yield compare to control treatment. The spraying of arginine was gave the highest average of all above traits in comparison with control. While the interaction between 3g.L^{-1} concentration of nano potassium and the amino acid (arginine) treatments gave the highest average in all studied traits.

***Keywords*:** *Solanum melongena*, arginine, tryptophan acid, total chlorophyll.

Introduction

Eggplant (*Solanum melongena* L.) is a vegetative crop belongs to Solanaceae which considered an important economic plant family that include more than 75 genera and 2000 species widespread globally (Choudhury, 1976). This plant is originally come from wild species in middle India and South East China then from there, its cultivation spread to Africa, Spain and other regions worldwide (Zeven and Zhukovsky, 1975). Eggplant is considered a tropical crop and in Iraq cultivated in summer in open fields and greenhouses. Solanaceous vegetables particularly eggplant are produced fruits that used in cooking, canned and pickled due to its contents of biological compounds such as phenols and phytochemicals which make it a rich source for human feed (Barreira *et al*., 2008; Gorinstein *et al*., 2009; Muller *et al*., 2011; Gull *et al*., 2012). It also contains many nutrients such as vitamins, amino acids, rutin and solanine (Ayaz *et al*., 2015; Gurbuz *et al*., 2018).

Potassium is one of the essential elements that affect most chemo-biological and physiological processes in plant such as growth and metabolism, and the lack of potassium fertilization increase the possibility of infection by different diseases and pests that cause damage to plant under stress conditions (Wang *et al*., 2013). Potassium has an important role in plant including activating enzymes, protein formation, photosynthesis, controlling osmotic in plant, stoma movement, transfer of energy, moving through cortex, making balancing between positive and negative ions and resistant to stress (Marschner, 2012).

Amino acids especially arginine have many roles in a lot of biological processes as a free or one of proteins components and considered important and active in all growth stages (Aspinall and Paleg, 1981). Arginine is one of essential proteins components and enters in nucleotides and many coenzymes (Hassan, 2010). Tryptophan is important and essential amino acid in producing enzymes and stimulating its activities (Zeiger and Taiz, 2002), and there were many pathways to build IAA in plant start with tryptophan (Zeiger and Taiz, 2006). Many studies found that tryptophan works to improve and increase vegetative plant growth due to the increasing of IAA inside plant (Abou Dahab and AbdEl-Aziz, 2006). The aim of current study is to determine the effect of spraying eggplant with three concentrations of nano potassium, amino acids (tryptophan and arginine) and their interaction to improve plant growth, increase yield and its effect on qualitative traits of fruits.

Materials and Methods

Complete block randomized design RCBD was used to conduct an experiment in private field in Babylon province in 2019 season. Field was prepared by tilling and levelling the soil then sterilized with 1% Beltannol after that, the area was divided into three blocks each block contains nine experimental units. Each experimental unit measured 7.5m area and contains 15 plants, the distance between plants was 50cm on rows and 100cm between these rows. Seedlings of eggplant (Hybrid Egg-plant Aswd) produced by HUIZER company were moved to field in 29/3/2019. The experiment was arranged with three replicates for each treatment and two main factors, the first factor was spraying eggplant with three concentrations of nano potassium (0, 1.5 and 3 g.L^{-1}) and the second factor was spraying eggplant with 50mg. L^{-1} of tryptophan and arginine. Three sprayings of these factors were applied during the agriculture season, the first spray was applied in 24/4/2019 for the first factor then the second spray was applied in 7/5/2019 and the third spraying applied in 22/5/2019. For the second factor, sprayings were applied for the first time in 23/4/2019 then in 6/5/2019 and the last one in 21/5/2019. The least significant difference (L.S.D.) was used to compare means at 5% level of significance (P>0.05) (Al-Rawi and Khalf, 2000). Data of plant height (cm), number of main branches (brabch.$plant^{-1}$), the average of leave area (cm^2.$plant^{-1}$), and total yield (ton. H^{-1}) were recorded. Leaves content of total chlorophyll (mg.$100g^{-1}$ fresh weight) and amino acids in fruits were measured using Hcini *et al*. (2013) procedure.

Discussion and Results

Results showed that spraying eggplant with 3gm.L^{-1} concentration of nano potassium was excelled other treatments significantly in vegetative characteristics (plant height, number of main branches and the average of leave area) which recorded 94.56cm, 6.200 branch.$plant^{-1}$ and 146.8 cm^2.$plant^{-1}$ respectively compare to 90, 11, 5.840 and 125.5 in control treatment (Table 1). While in amino acids treatment, the spraying of 50mg.L^{-1} concentration of arginine was significantly increased in vegetative characteristics and reached 96.56cm, 6.389 branch.$plant^{-1}$ and 154.4 cm^2.$plant^{-1}$ in comparison with 88.00, 5.540 and 120.0 respectively in control. The interaction between 3g.L^{-1} concentration of nano potassium and the amino acid (arginine) treatments was reached the highest average in vegetative characteristics and gave 99.33cm, 6.733 branch.$plant^{-1}$ and 167.5 cm^2.$plant^{-1}$ respectively compare to 82.00, 3.353 and 110.2 in control treatment.

The reason for this significant increasing on vegetative characteristics of eggplant may because the mineral potassium is one of essential nutrients that plant cannot survive without it. Moreover, this element play important role in the growth and the development of plant (Tang *et al*., 2015). In addition, potassium is considered vital elements to complete the function of many plant enzymes as there were 60 enzymes need this element to be activated (Hawkesford *et al*., 2012). It is also essential in the formation of many proteins and nucleic acids which reflect positively in improving and increasing vegetative plant growth (Al-Sahaf, 1989). The significant effect of amino acids particularly arginine may be due to the role of these acids which considered nitrogen source to build proteins, enzymes and supplying energy that encourage the vegetative and root growth (Abdel-Aziz and Balbaa, 2007).

Table 1 : The effect of spraying nano potassium, amino acids (tryptophan and arginine) and their interaction on plant height, number of main branches and the average of leave area of eggplant.

Amino acids (mg. L^{-1})	**Plant height (cm)**			**Amino acids average**
	Nano potassium (gm. L^{-1})			
	0	1.5	3	
Control	82.00	91.33	90.67	88.00
Tryptophan	93.67	95	93.67	94.11
Arginine	94.67	95.67	99.33	96.56
Nano potassium average	90.11	94.00	94.56	
LSD (P≤0.05)	Nano K Amino acids interaction 1.743 1.743 3.019			
Number of main branches (branch $plant^{-1}$)				
Amino acids (mg. L^{-1})	0	1.5	3	Amino acids average
Control	3.353	5.600	5.667	5.540
Tryptophan	6.000	6.167	6.200	6.122
Arginine	6.167	6.267	6.733	6.389
Nano potassium average	5.840	6.011	6.200	
LSD (P≤0.05)	Nano K Amino acids interaction 0.1728 0.1728 0.2993			
Leaf area (cm^2. $Plant^{-1}$)				
Amino acids (mg. L^{-1})	0	1.5	3	Amino acids average
Control	110.2	123.8	125.9	120.0
Tryptophan	128.3	134.2	147.2	136.6
Arginine	138.1	157.5	167.5	154.4
Nano potassium average	125.5	138.5	146.8	
LSD (P≤0.05)	Nano K Amino acids interaction 8.02 8.02 13.88			

Results of Table 2 also showed that spraying eggplant with 3gm.L^{-1} concentration of nano potassium was excelled other treatments significantly in total leaves content of chlorophyll, fruits content of total amino acids and total yield which amounted 70.83 mg.100gm^{-1} fresh weight, 8.68% and 92.8 ton.h^{-1} respectively in comparison with 43.29 mg.100gm^{-1}fresh weight, 5.66% and 72.3 ton.h^{-1} for control treatment. While in amino acids treatment, the spraying of 50mg.L^{-1} concentration of arginine was significantly increased in total leaves content of chlorophyll, fruits content of total amino acids and total yield which amounted 74.38 mg.100gm^{-1} fresh weight, 9.68% and 99.9 ton.h^{-1} in comparison with 46.63, 4.99% and 64.1 respectively in control. The interaction between 3g.L^{-1} concentration of nano potassium and the amino acid (arginine) treatments was reached the highest average in the above traits and gave 91.17 mg.100gm^{-1} fresh weight, 11.32% and 105.3 ton.h^{-1} respectively compare to 33.23, 3.79 and 50.0 in control treatment.

This increasing may occurred due to the role of potassium in activating chlorophyll enzymes that help to build chlorophyll stain and prevent the decomposition of new chlorophyll molecule (Abu Dahi and Al-Younes, 1988). The nano potassium affected fruits content of total amino acids because it has an important role in photosynthesis during plant growth which leads to increasing vegetative and qualitative traits (Sekhon, 2014). Amino acids affected total leaves content of chlorophyll, fruits content of total amino acids due to physiological role of these acids that can decrease osmotic pressure when amino acids increase result

in improving the ability of cells to absorb water and nutrients (Claussen, 2004; Amini and Ehsanpour, 2005).

Potassium has significant effect on increasing total yield by transporting photosynthesis products from leaves to fruits led to increase fruits weight (Ahmad and Butt, 1999; Jones, 2004). While arginine improve chlorophyll formation which also led to improve yield qualitative (Yagi and Al-Abdulkareem, 2006).

Table 2 : The effect of spraying nano potassium, amino acids (tryptophan and arginine) and their interaction on total chlorophyll, proportion of amino acids in fruits and total yield of eggplant.

Amino acids (mg. L^{-1})	**Total chlorophyll content of leaves (mg. 100 gm^{-1}. fresh weight)**			**Amino acids average**
	Nano potassium (gm. L^{-1})			
	0	1.5	3	
Control	33.23	49.80	56.84	46.63
Tryptophan	44.75	60.20	64.46	56.47
Arginine	51.89	80.07	91.17	74.38
Nano potassium average	43.29	63.36	70.83	
LSD (P≤0.05)	Nano K Amino acids interaction 2.532 2.532 4.386			
Total amino acids content of fruits (%)				
Amino acids (mg. L^{-1})	0	1.5	3	Amino acids average
Control	3.79	5.73	5.45	4.99
Tryptophan	5.83	8.57	9.27	7.89
Arginine	7.36	10.37	11.32	9.68
Nano potassium average	5.66	8.22	8.68	
LSD (P≤0.05)	Nano K Amino acids interaction 0.802 0.802 1.390			
total yield (ton. $hectare^{-1}$)				
Amino acids (mg. L^{-1})	0	1.5	3	Amino acids average
Control	50.0	68.0	74.3	64.1
Tryptophan	72.0	80.7	98.7	83.8
Arginine	94.8	99.6	105.3	99.9
Nano potassium average	72.3	82.8	92.8	
LSD (P≤0.05)	Nano K Amino acids interaction 10.68 10.68 18.50			

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