BIOMASS CHARACTERISTICS OF HENBANE *Hyoscyamus albus* L. UNDER WATER STRESS AS EFFECTED AMINO ACID (Ornithine) AND HUMIC ACIDS

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ABSTRACT

A Plastic house experiment was conducted at College of Agriculture - University of Baghdad, and applied according to Randomized Complete Block Design (R.C.B.D) using split- split plot design. The experiment included three factors. The water stress factor represents the main plots (50% and 100% of the field capacity) and are symbolized by W_1 and W_2. The sub-plots include Humic Fertilizer (Disper Humic) with four levels (0, 40, 80, 120 kg.h^{-1}), which is characterized by (H_1, H_2, H_3, H_4), and sub-sub-plots include the amino acid (Ornithine), with three concentrations (0, 200, 250 mg L^{-1}) and are symbolized (O_1, O_2, O_3). Results indicated the triple-interaction between the studied factors (250 mg L^{-1} Ornithine and 120 kg.h^{-1} humus fertilizer and irrigation level of 100%) significantly gave the highest main stem lenght, stem diameter, number of branches, leaf area, the percentage of relative water content in the leaves, total chlorophyll content of leaves, dry weight of vegetative growth and root at flowering and fruiting stage (43 cm, 121.3 dis^2 plant^{-1}, 193.7 mg 100g^{-1}, Fresh weight, 66.25 g plant^{-1}, and 29.79 g plant^{-1}, 86.98% respectively).

Keywords: *Hyoscyamus albus*, biomass characteristics, water stress, humic acid.

INTRODUCTION

Solanaceae has passesses several of plants that have medical, agricultural and economic importance (Martin *et al.*, 2013), One important medicinal plant belongs to this family is white henbane (*Hyoscyamus albus* L.), due to its medicinal importance, whether in folk medicine or constitutional medicine. Although it is considend as a toxic plants and drugs due to different plant parts (leaves, roots and floral tips) contain effective alkaloids such as hyoscyamine and Scopolamine (Sweta and Lakshmi, 2015), which is one of the most important drugs because of its high drug activity (Sobarzo, 2015), white henbane plant or its active ingredients are described as sedative, analgesic, antispasmodic, hypnotic, Wizard for insomnia and anesthetic (Frank and Rene, 2008) and a treatment for asthma and pertussis (Oksman, 2007). World Health

Organization (WHO) estimates that about 80% of the world's population currently uses traditional herbal remedies for healing. For example, in some Latin American countries, 71% of the population of Chile uses traditional medicine. In China, 40% of the population uses medicinal plants in health care, and Africa. 80% of the population uses traditional medicinal plants and is the only source of medicines.

The growth of vegetative, fruit crops and secondary metabolites is influenced by many factors including amino acid and bio-fertilization and organic fertilization (Dewick, 2009). Many studies have shown that the spray of amino acids to plants has a significant role in stimulating physiological and biochemical processes. Where they co-construct and promote the work of many enzymes and enzymatic compounds, which in turn stimulates better plant growth (Nobel, 2009). Some plant species exhibit tolerance to water stress (drought), but the intensity of this tolerance varies from one plant type to another within dry and semi-arid zones (Amrhein *et al.*, 2012), Many studies indicated that water stress causes many physiological and chemical changes in the plant. Which reduce the growth of the plant, especially the reduction of the leaf size, stem elongation, roots expansion and low efficiency of water use and also inhibits the division and elongation of cells (Disante *et al.*, 2011 and Hammad *et al.*, 2014), leads to the closure of stoma, low rates of transpiration and causes a decrease in metabolic activities such as photosynthesis and respiration and absorption of ions, transportation, carbohydrates, nutrient metabolism and growth catalysts, and the discouraging events enzymatic, but it stimulates the plant for the production of secondary metabolic compounds (Aslan *et al.*, 2017). Humic acids (Humic and Fulvic) are a part of humic substances that are biochemically active in soil and plants and which can be applied to the soil in liquid or solid form and can be directly applied to the plant via foliar nutrition. Humic acids possess adsorbable growes that easily penetrate plant's cellular membranes due to containing two different types of components, one of which is hydrophobic and the other is hydrophilic part (Al-Shater *et al.*, 2010 and Lyons and Genc, 2016), which affects plant growth directly and indirectly, Many studies have attracted the relationship of positive correlation between the application of humic acid and the biomass of the plant (Safai *et al.*, 2017). In turn leads to extract the largest amount of Tropane alkaloids. The aim of the study was to determine the response of white henbane to the interaction effect of the spray of ornithine and humic acids on largest biomass of thewater-stress white henbane.

MATERIALS AND METHODS

Experiment was carried out at one of the greenhouses of the Protection Department - College of Agriculture - University of Baghdad, and was applied according to Rondomized Complet Block Design (R.C.B.D) using split-split plot Design, with three replicates. The treatments and their replicates resulted in 72 experimental units. The soil of the greenhouses was prepared by tilling, smoothing and leveling. The soil was then divided into plots with a width of 0.50 m and a height of 0.30 cm and a length of 2.5 m, left a distance of 1 m between the plots and a distance of 1.5 m between experimental units within the single plot. The seeds of the white henbane plant were obtained from the Medicinal and Aromatic Plants Unit, College of Agriculture, University of Baghdad, where they were cultivated on 1/12/2016 in Cork dishes. After the seedlings became 8 cm high, they were cultivated in the greenhouse on 1/2/2017. With double lines so that the distance between the double lines is 0.20 m and the distance between one plant and another within a line of 0.50 m. Drip irrigation system was used with discharge rate of 4 liters hr^{-1}, and the fertilization process was conducted uniformly for all treatments. The experiment consisted of three factors: the water stress level was distibnted in main plots with two levels (50 and 100% field capacity) and is symbolized by W_1 and W_2 respectively. The sub-plots include Humic fertilizer (Disper Humic) produced by the Spanish company Eden containing humic acids (Humic and Fulvic acid), where used four levels (0, 40, 80 and 120 kg h^{-1}) is symbolized by (H_1, H_2, H_3, H_4), the sub-sub-plots included the amino acid (Ornithine e) with three concentrations (0, 200 and 250 mg L^{-1}) and are symbolized (O_1, O_2, O_3). Ornithine was spray in three periods, taking into account the position of insulation to prevent the arrival of spray to neighboring units, and the period between addition and another was 15 days, the first addition after a month of seedlings cultivating in the greenhouse, while humic fertilizer was applied to the soil in four periods, the period between the addition and another is 15 days, according to the recommendation of the company producing fertilizer, and the first addition after 21 days of seedlings cultivating in the greenhouse. The results were statistically analyzed using the program Genstat and the averages for all indicators of the study were compared by the least significant difference (LSD) at the probability level of 0.05 (Al-Rawi and Abdullah, 2000).

Measured Traits

Five plants were selected randomly from the experimental unit for the purpose of conducting the required measurements at the fruiting stage (seed composition) on 1/6/2017.

leaf area (dm^2): The leaf area was measured on the basis of the dry weight of the leaves, taking 25 pieces of leaves of the selected plants, with a known area 2 cm^2 $plot^{-1}$ by leaf borer and then dried the leaves at a temperature (70) m until the stability of weight, and then weighed and calculated the leaf area $Plant^{-1}$ using the equation.

$$\textbf{Leaf area plant}^{-1} = \frac{\textbf{Sample discs area (The dry weight of discs} \times \textbf{Dry weight for the remaining leaves)}}{\textbf{The dry weight of discs}}$$

The dry weight of the total vegetative and the root system: The same selected plants to measure the traits above were used from each experimental unit, where the total vegetative was separated from the root system. The root system was extracted by a cylinder (Boham, 1979), using a cylinder with a diameter of 20 cm and a height of 40 cm. It was cultivated in the soil to the depth of the cylinder previously referred after determining the root system of the plant in the middle of the cylinder. The total root system was extracted with soil and then washed with normal water to remove the soil residue, and then published on a plastic plates until the stability of weight (Al-Sahaf, 1989) and then calculated dry weight for it.

Determination of total chlorophyll pigment: Chlorophyll from leaves was extracted (before harvesting) using acetone (80%), then reading the spectroscopy of the sample with the Spectrophotometer at a wavelength of 663 nm for chlorophyll A and 645 nm for chlorophyll B. The amount of chlorophyll ($mg.g^{-1}$) (Goodwin, 1976) through the equation:

$$Total\ chlorophyll\ pigment = 20.2D(645) + 8.02D(663)$$

The relative water content of the leaves (%): A number of soft leaves were taken (the third leaf from the top of the plant) (Taiz and Zeiger, 2002), then took four tablets from the middle with a diameter of 2 cm placed in nylon bags to prevent loss of moisture and weighed after cutting directly, placed in distilled water (Gholami *et al.*, 2014) hours under the lighting and room temperature, then dried the leaves using a filter paper and weighted to represent the full weight and then placed in the oven at a temperature (85 m) for three hours and then take the dry weight (Barnes and Woolley, 1969). It was estimated according to following equation.

$$R.W.C = \frac{FW - DW}{TW - DW} \times 100$$

Where DW = Dry weight (g), TW = Total weight (g), FW = Fresh Weight (g)

RESULTS AND DISCUSSION

Main stem height (cm): Table 1 shows that there was a significant effect when increasing the level of humic fertilizer on height of the main stem of the plant. The H_4 treatment achieved the highest rate in the studied trait of 41.01 cm, an increase of 27% compared to the treatment of H_1, while there was no significant effect between the concentrations of the amino acid (Ornithine) in this trait. Table 1 shows significant effect of the irrigation factor on plant height, the W_1 treatment achieved the highest value of 38.96 cm with a significant increase of 8.1% compared to the treatment of W_2. Results showed that the interaction between the concentrations of Ornithine with levels of humic fertilizer was significant, the highest rate was 41.48 cm for main stem height recorded at H_4O_3, while the lowest value of the H_1O_1 treatment was 28.16 cm.

Table 1. Effect of Ornithine concentrations, humic fertilizer levels and irrigation level and their interactions on the main stem height (cm) of white henbane plant

Irrigation level	Levels of humic fertilizer	Concentration of Ornithine acid			Levels of humic fertilizer × Irrigation level
		O_1	O_2	O_3	
W_1	H_1	32.26	38.09	37.06	35.80
	H_2	38.70	38.98	38.81	38.83
	H_3	39.88	40.98	36.47	39.11
	H_4	40.44	42.80	43.00	42.08
W_2	H_1	24.07	31.30	30.90	28.76
	H_2	35.00	28.37	34.60	32.66
	H_3	32.00	37.53	29.33	32.95
	H_4	40.03	40.17	39.63	39.94
L.S.D		3.082			3.257
Concentration of Ornithine acid × Irrigation level	Irrigation level	Concentration of Ornithine acid			Average level of irrigation
	W1	37.82	40.21	38.84	38.96
	W2	32.78	34.34	33.62	33.58
L.S.D		2.719			4.419
Levels of humic fertilizer × Concentration of Ornithine acid	Levels of humic fertilizer	Concentration of Ornithine acid			Average of humic fertilizer
	H_1	28.16	34.69	33.98	32.28
	H_2	36.85	33.67	36.70	35.74
	H_3	35.94	39.25	32.9	36.03
	H_4	40.23	41.48	41.31	41.01
L.S.D		4.095			2.452

Concentration of Ornithine acid	35.29	37.27	36.22	
L.S.D	N.S			

The results of the same table showed the effect of bi-interaction between the Ornithine concentrations and the level of irrigation in this trait, where the treatment of W_1O_2 excelled by giving the highest value of 40.21 cm followed by W_1O_3 with 38.84 cm, while the lowest value of W_2O_1 was 32.78 cm. The results of the same table showed that the effect of the bi-interaction between the level of irrigation and the levels of humic fertilizer was significant in this trait. The W_1H_4 treatment was excelled by giving the highest rate of this trait was 42.08 cm, while the lowest stem height was 28.76 cm at the treatment of W_2H_1. The same table shows the effect of the triple interaction between the factors studied in the main stem height. The $W_1H_4O_3$ treatment achieved the highest value of this trait reached of 43.00 cm. Increase rate was 33.2% compared to the treatment of $W_1H_1O_1$ which gave 32.26 cm.

Leaf area (dm^2 $plant^{-1}$): Statistical analysis in Table 2 shows the moral effect the humic fertilizer on the leaf area of the plant. The H_4 treatment achieved the largest leaf area of 85.83 dm^2 $plant^{-1}$ with 36% increase compared with the H_1 treatment, while Ornithine concentrations did not have any significant effect on this trait. It is noted from the results of the same table that the level of irrigation has a significant effect in this indicator, as the treatment of W_1 gave the highest rate of 92.19 dm^2 $Plant^{-1}$ with increase rate was 76.4% compared to the treatment of W_2. The same table shows the binary effect between the concentrations of Ornithine with the humic compost levels on this trait. The interaction treatment (H_4O_3) gave the highest rate of this trait was 91.73dm^2 $plant^{-1}$ compared with the treatment of H_1O_1, which gave the least leaf area of (58.04 dm^2 $plant^{-1}$). The same table shows the highest value of this trait within the bi-interaction between the irrigation level and the concentrations of the Ornithine acid in the interaction treatment W_1O_3 was (93.91 dm^2 $plant^{-1}$). While the lowest value for leaf area in the treatment of W_2O_2 which reached of (51.02 dm^2 $plant^{-1}$). The same table indicates the significant interaction effect between the irrigation parameters and the humic compost levels in the studied trait. W_1H_4 treatment excelled on the rest of the treatments by giving it the largest leaf area of (111.92 dm^2 $plant^{-1}$), with an increase ratio of 37.5% compared to the treatment of W_1H_1, which gave (81.35 dm^2 $plant^{-1}$). The same table shows the triple effect of the studied factors in this trait. The two treatments ($W_1H_4O_3$, $W_1H_4O_2$) gave the largest leaf area of (121.33, 119.60 dm^2 $plant^{-1}$) with an increase of 61.6% and 59.2%, respectively compared to the treatment of comparison $W_1H_1O_1$ which gave 75.08 dm^2 $plant^{-1}$.

Table 2. Effect of Ornithine concentrations, humic fertilizer levels and irrigation level and their interactions on the leaf area (dm^2 $plant^{-1}$) of white henbane plant

Irrigation level	Levels of humic fertilizer	Concentration of Ornithine acid			Levels of humic fertilizer × Irrigation level
		O_1	O_2	O_3	
W_1	H_1	75.08	78.30	90.68	81.35
	H_2	91.14	73.47	89.99	84.87
	H_3	98.25	104.27	69.36	90.63
	H_4	94.82	119.60	121.33	111.92
W_2	H_1	41.00	45.28	48.18	44.82
	H_2	65.23	37.06	53.33	51.87
	H_3	54.59	60.81	42.30	52.57
	H_4	56.17	60.93	62.13	59.74
L.S.D		13.544			11.093
Concentration of Ornithine acid × Irrigation level	Irrigation level	Concentration of Ornithine acid			Average level of irrigation
	W1	89.82	93.91	92.84	92.19
	W2	54.25	51.02	51.49	52.25
L.S.D		4.567			3.264
Levels of humic fertilizer × Concentration of Ornithine acid	Levels of humic fertilizer	Concentration of Ornithine acid			Average of humic fertilizer
	H_1	58.04	61.79	69.43	63.09
	H_2	78.19	55.27	71.66	68.37
	H_3	76.42	82.54	55.83	71.60
	H_4	75.50	90.27	91.73	85.83
L.S.D		10.489			8.998
Concentration of Ornithine acid		72.04	72.47	72.16	
L.S.D		N.S			

Chlorophyll Content (mg g^{-1}): Results indicated in Table 3 that the H_4 treatment was excelled among the levels of humic fertilizer by giving the highest significant increase in chlorophyll content of 134.05 mg g^{-1}, with an increase of 51% compared with H_1 treatment. The concentrations of Ornithine acid also a significantly influenced on the content of leaves of chlorophyll. The O_3 treatment was significantly excelled in this trait by giving of 123.68 mg g^{-1} compared to the O_1 treatment, which gave 104.06 mg g^{-1}. As shown in the same table, there is a significant effect of irrigation level in this indicator. Treatment

100% field capacity (W_1) achieved the highest chlorophyll value of 142.99 mg g^{-1} with an increase of 72.8% compared to irrigation level 50% field capacity. Table also showed the effect of positive interaction between the concentrations of Ornithine and humic fertilizer levels. The H_4O_3 treatment showed the highest increase in leaf content of chlorophyll (151.85 mg g fresh substance^{-1}), while the lowest value of this trait to the H_1O_1 treatment of 82.93 mg g^{-1}.

Table 3. Effect of Ornithine concentrations, humic fertilizer levels and irrigation level and their interactions on the Chlorophyll content (mg g fresh substance^{-1}) of white henbane plant

Irrigation level	Levels of humic fertilizer	Concentration of Ornithine acid			Levels of humic fertilizer × Irrigation level
		O_1	O_2	O_3	
W_1	H_1	105.60	111.20	115.50	110.77
	H_2	131.10	140.40	155.70	142.40
	H_3	137.10	148.90	166.60	150.87
	H_4	150.50	159.60	193.70	167.93
W_2	H_1	60.26	71.13	68.88	66.76
	H_2	70.82	66.50	77.93	71.75
	H_3	86.66	88.98	101.10	92.25
	H_4	90.47	100.00	110.00	100.16
L.S.D		30.551			26.011
Concentration of Ornithine acid × Irrigation level	Irrigation level	Concentration of Ornithine acid			Average level of irrigation
	W1	131.08	140.03	157.88	142.99
	W2	77.05	81.65	89.48	82.73
L.S.D		19.815			41.527
Levels of humic fertilizer × Concentration of Ornithine acid	Levels of humic fertilizer	Concentration of Ornithine acid			Average of humic fertilizer
	H_1	82.93	91.17	92.19	88.76
	H_2	100.96	103.45	116.82	107.08
	H_3	111.88	118.94	133.85	121.56
	H_4	120.49	129.80	151.85	134.05
L.S.D		25.055			15.729
Concentration of Ornithine acid		104.06	110.84	123.68	
L.S.D		11.247			

Table 3 shows positive interaction between the concentrations of Ornithine acid and the level of irrigation in leaf content of chlorophyll, Where the two treatments (W_1O_3, W_1O_2) excelled by giving it the highest rate of this trait of 157.88 and 140.03 mg g^{-1}, respectively, with an increase of 20.4% and 6.8% respectively compared to the treatment of W_1O_1. The same table indicates the effect of the bi-interaction between the irrigation level and the humic fertilizer levels in leaf content of chlorophyll. The interaction treatment W_1H_4 achieved the highest value of this trait reached of 167.93 mg g^{-1} with an increase of 51.6% compared to the treatment of W_1H_1, which gave 110.77 mg g^{-1}. The statistical analysis showed the effect of the triple interaction between the studied factors in the measured trait. The two treatments ($W_1H_4O_3$, $W_1H_3O_3$) achieved significant superiority with the other three interaction factors by giving 193.7, 166.6 mg g^{-1}, with an increase of 83.4% and 57.7% respectively compared to the control treatment $W_1H_1O_1$, which gave of 105.6 mg g^{-1}.

Dry weight of the total vegetative (g plant^{-1}): Table 4 shows the significant effect of the humic fertilizer levels in the dry weight of the total vegetative. The H_4 treatment achieved the highest weight of the studied trait of (49.19 g plant^{-1}) with a significant increase compared to the treatment of H_1, which gave of (40.18 g plant^{-1}). Table indicates the effect of Ornithine acid concentrations in this trait. Two treatments (O_4 and O_3) achieved the highest values reached 48.08, 46.74g plant^{-1}. Results showed that the irrigation factor had a significant effect on the dry weight of the total vegetative. The treatment W_1 achieved the highest dry weight of 53.02 g plant^{-1} with an increase of 41.57% compared to the treatment of W_2. From the same table, it observed significant effect of the interaction treatments between the concentrations of the Ornithine acid and the levels of the addition of the humic fertilizer. The H_4O_3 treatment achieved the highest rate of this trait of 54.76 g plant^{-1} with an increase of 47.56% compared to the control treatment H_1O_1. The effect of the interaction between the concentrations of the Ornithine acid and the level of irrigation in the studied trait was significant. The two treatments (W_1O_3, W_1O_2) achieved the highest value of this trait of 56.82, 54.96 g plant^{-1} respectively with an increase of 20.1% and 16.2% respectively compared to the W_1O_1 treatment. The same table also shows the significant effect of the bi-interaction between the level of irrigation and the concentration of humic fertilizer in the dry weight of the total vegetative. The two treatments (W_1H_4, W_1H_3) achieved the highest value of this trait reached of 58.89, 55.15 g plant^{-1} with an increase of 24.6% and 16.6% respectively compared to the treatment of W_1H_1 which gave of 47.26 g plant^{-1}. The effect of the triple interaction between the studied factors was significant in the dry weight of the total vegetative. The treatment $W_1H_4O_3$ achieved the highest value of the trait (66.25 g plant^{-1}) with an increase of 46.8% compared to the treatment of $W_1H_1O_1$.

Table 4. Effect of Ornithine concentrations, humic fertilizer levels and irrigation level and their interactions on the dry weight of the total vegetative (g Plant^{-1}) of white henbane plant

Irrigation level	Levels of humic fertilizer	Concentration of Ornithine acid			Levels of humic fertilizer × Irrigation level
		O_1	O_2	O_3	
W_1	H_1	45.13	46.73	49.92	47.26
	H_2	45.31	53.18	53.84	50.78
	H_3	51.15	57.05	57.25	55.15
	H_4	47.57	62.86	66.25	58.89
W_2	H_1	29.09	34.73	35.45	33.09
	H_2	36.33	39.62	38.48	38.14
	H_3	36.30	40.84	40.17	39.10
	H_4	36.35	38.88	43.27	39.50
L.S.D		11.480			6.462
Concentration of Ornithine acid × Irrigation level	Irrigation level	Concentration of Ornithine acid			Average level of irrigation
	W1	47.29	54.96	56.81	53.02
	W2	34.52	38.52	39.34	37.46
L.S.D		5.121			2.937
Levels of humic fertilizer × Concentration of Ornithine acid	Levels of humic fertilizer	Concentration of Ornithine acid			Average of humic fertilizer
	H_1	37.12	40.73	42.68	40.18
	H_2	40.82	46.40	46.16	44.46
	H_3	43.73	48.95	48.71	47.13
	H_4	41.96	50.87	54.76	49.20
L.S.D		8.117			5.186
Concentration of Ornithine acid		40.90	46.74	48.08	
L.S.D		4.278			

Dry weight of the root (g plant^{-1}): Results in Table 5 show that increased levels of humic acid (humic fertilizer) significantly affected the dry weight of the root system. The H_4 treatment achieved the highest increase of 20.44 g plant^{-1} with an increase of 48.9% compared to H_1, while there was no significant effect between the concentrations of Ornithine in this trait, while the irrigation level had a significant effect. The treatment W_1 achieved the highest dry weight of the root reached of 20.21 g plant^{-1}. Which was significantly excelled compared to W_2, which gave 12.98 g Plant^{-1}. Results of the same table showed the effect of positive interaction between levels of humic compost and Ornithine acid concentrations in the studied trait. The two treatments (H_4O_3, H_4O_2) achieved the highest rate of this trait of 22.59, 21.35 g plant^{-1} with a significant increase of 64.4% and 55.3% compared to the treatment of H_1O_1. The same table indicates that the interaction between the level of irrigation and the concentration of Ornithine acid has a significant effect on the root weight of the plant. The two treatments (W_1O_3, W_1O_2) achieved the highest values of 21.07, 20.96 g plant^{-1} significantly excelled higher with the rest of the transactions except for W_1O_1. The effect of the interaction between the level of irrigation and the levels of humic fertilizer was significant. The treatment W_1H_4 achieved the highest dry weight of root reached of 25.79 g plant^{-1} with an increase of 54.2% compared to the treatment of W_1H_1 of (10.73 g plant^{-1}). The effect of the interaction between the three factors studied in this trait was significant. The two treatments ($W_1H_4O_3$, $W_1H_4O_2$) achieved the highest increase in this trait of 29.79, 27.71 g plant^{-1} with a significant increase of 82.5% and 69.8% respectively, compared to the control treatment $W_1H_1O_1$.

Table 5. Effect of Ornithine concentrations, humic fertilizer levels and irrigation level and their interactions on the dry weight of the root (g plant^{-1}) of white henbane plant

Irrigation level	Levels of humic fertilizer	Concentration of Ornithine acid			Levels of humic fertilizer × Irrigation level
		O_1	O_2	O_3	
W_1	H_1	16.32	16.35	17.47	16.71
	H_2	18.58	17.44	18.56	18.19
	H_3	19.69	22.32	18.46	20.16
	H_4	19.86	27.71	29.79	25.79
W_2	H_1	11.17	10.10	10.91	10.73
	H_2	12.42	10.58	14.43	12.48
	H_3	13.86	14.70	12.28	13.61
	H_4	14.92	14.99	15.40	15.10
L.S.D		6.176			4.898
Concentration of Ornithine acid × Irrigation level	Irrigation level	Concentration of Ornithine acid			Average level of irrigation
	W1	18.61	20.96	21.07	20.21
	W2	13.10	12.59	13.26	12.98
L.S.D		2.990			3.230
Levels of humic fertilizer × Concentration of Ornithine acid	Levels of humic fertilizer	Concentration of Ornithine acid			Average of humic fertilizer
	H_1	13.74	13.23	14.19	13.72
	H_2	15.50	14.01	16.49	15.33
	H_3	16.77	18.51	15.37	16.88
	H_4	17.39	21.35	22.59	20.44
L.S.D		3.004			2.488
Concentration of Ornithine acid		15.85	16.77	17.16	
L.S.D		N.S			

Relative water content of the leaf (%): Results of the statistical analysis showed no significant effect of the levels of humic compost and Ornithine acid concentration separately in the relative water content in the leaves of the white henbane plant. While the results of Table 6 showed a significant difference in the relative water content of the leaves of the white henbane plant between the irrigation treatments, the irrigation treatment 100% achieved the highest rate of 84.33% with an increase of 33.4% compared to the irrigation treatment 50%. The same table also showed the effect of the bi-interaction between the humic compost levels and the Ornithine acid concentration in this trait, the two treatments (H_4O_3, H_1O_3) achieved the highest relative water content of the leaves reached of 79.54 and 74.96%, respectively. H_2O_2 treatment gave the lowest value of 71.78%.

Table 6. Effect of Ornithine concentrations, humic fertilizer levels and irrigation level and their interactions on the relative water content of the leaf (%) of white henbane plant

Irrigation level	Levels of humic fertilizer	Concentration of Ornithine acid			Levels of humic fertilizer × Irrigation level
		O_1	O_2	O_3	
W_1	H_1	83.12	83.43	83.48	83.34
	H_2	83.34	84.06	85.24	84.21
	H_3	83.21	84.11	86.39	84.57
	H_4	84.08	84.46	86.98	85.17
W_2	H_1	63.19	61.24	66.44	63.62
	H_2	64.37	59.50	61.55	61.81
	H_3	62.03	62.01	60.39	61.48
	H_4	64.27	60.92	72.10	65.76
L.S.D		2.539			1.771
Concentration of Ornithine acid × Irrigation level	Irrigation level	Concentration of Ornithine acid			Average level of irrigation
	W1	83.44	84.02	85.52	84.33
	W2	63.47	60.92	65.12	63.17
L.S.D		2.733			4.281
Levels of humic fertilizer × Concentration of Ornithine acid	Levels of humic fertilizer	Concentration of Ornithine acid			Average of humic fertilizer
	H_1	73.16	72.34	74.96	73.48
	H_2	73.86	71.78	73.40	73.01
	H_3	72.62	73.06	73.39	73.02
	H_4	74.18	72.69	79.54	75.47
L.S.D		5.213			N.S
Concentration of Ornithine acid		73.45	72.47	75.32	
L.S.D		N.S			

Table 6 showed the effect of the interaction between irrigation level and Ornithine concentrations in this trait. The interaction treatment (W_1O_3, W_1O_2, W_1O_1) were the highest values of 85.52, 84.02 and 83.44%, while the lowest value in treatment W_2O_2 was 60.92. The same table also showed the effect of the interaction between irrigation level and humic compost levels in this trait. The treatment W_1H_4 gave the highest values of measured trait of 85.17 with an increase of 2.2% compared to the treatment of W_1H_1 which gave 83.34% while the lowest relative water content in leaves in treatment W_2H_3 was 61.48%. The same table showed the effect of triple interaction between the studied factors. The highest relative water content in the interaction treatment $W_1H_4O_3$ was 86.98% with an increase of 4.6% compared to the treatment $W_1H_1O_1$ giving 83.12% while the lowest value in the treatment $W_2H_1O_2$ was 61.24%.

It is clearly from the above that the application of humic acid (humic fertilizer) with a level of 120 kg h^{-1} (H_4) has affected studied traits of vegetative growth and may be due to increase the amount of nutrients absorbed by the roots by increasing the length and branched out of the root, which increases the efficiency of the use of fertilizer added (Zederi and Shamsi, 2015) as well as the role of humic acids in the effectiveness of many enzymes, especially the respiratory enzymes in addition to stimulating enzymes of phosphatase, transaminase, invertase and H^+-ATPase and raise the level of protein metabolism and composition of DNA, suggesting that their physiological role is similar to the role of plant hormones (Zandonadi et al, 2013 and Canellas and Olivares, 2014). The results also showed a significant superiority of the irrigation level 100% field capacity in the studied traits compared to the level of irrigation 50% field capacity In the rate of growth and the final size reached by different tissues and organs, it affects carbon metabolism and is related to respiration and absorption of elements from the soil as well as its role in nitrogen and other transformation, cell division and elongation, and flowering and yield (Jaleel et al, 2009).

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صفات الكتلة الاحيائية لنبات السكران الابيض *Hyoscyamus albus* L. تحت شد الماء بتاثير الحامض الاميني Ornithine والاحماض الدبالية

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المستخلص

نفذت التجربة في أحد البيوت البلاستيكية في كلية الزراعة- جامعة بغداد، وطبقت وفق تصميم القطاعات الكاملة المعشاة (RCBD) بترتيب الالواح المنشقة - المنشقة (Split-split plot Design). تضمنت التجربة ثلاثة عوامل، يمثل عامل الاجهاد المائي الالواح الرئيسة بمستويين (50 و 100% من السعة الحقلية) ويرمز لها بـ (W_1 و W_2)، اما الالواح الثانوية فتشمل السماد الدبالي (Disper Humic) باربعة مستويات (0 و 40 و 80 و 120) كغم هـ $^{-1}$ يرمز لها بالرموز (H_1 و H_2 و H_3 و H_4)، أما الالواح تحت الثانوية فتشمل الحامض الاميني Ornithine بثلاثة تراكيز (0 و 200 و 250) ملغم لتر $^{-1}$ يرمز لها بـ (O_1 و O_2 و O_3). اشارت النتائج الى ان التداخل الثلاثي بين العوامل المدروسة $W_1H_3O_3$ (حامض Ornithine 250 ملغم لتر $^{-1}$ والسماد الدبالي 120 كغم هـ $^{-1}$ ومستوى الري 100%) اعطت زيادة معنوية في ارتفاع الساق الرئيس، والمساحة الورقية، ومحتوى الأوراق من الكلوروفيل الكلي، والوزن الجاف للمجموع الخضري والجذري والمحتوى النسبي للأوراق من الماء (%) (43 سم، 121.3 دسم ^{2} نبات $^{-1}$، 193.7 ملغم 100غم $^{-1}$ وزن رطب، 55.45 غم نبات $^{-1}$، 66.25 غم نبات $^{-1}$، 25.86 غم نبات $^{-1}$، 29.79 غم نبات $^{-1}$ و86.98% بالتتابع).

الكلمات المفتاحية: نبات السكران الأبيض، الكتلة الحيوية، الإجهاد المائي، الحامض الأميني أورنثين، الأحماض الدبالية.