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EFFECT OF SPRYING AMINO ACIDS ON THE GROWTH AND CONTENT OF THE LEAVES DATURA PLANT GROWN DIFFERENT DISTANCES

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Abstract

The study aims to increase the active substance of the Datura plant grown at different distances by using spray different concentrations of amino acids. The field experiment was carried out in the experimental station of the College of Agricultural Engineering Sciences / University of Baghdad during the two summer seasons of 2018 and 2019, following the Randomized Complete Block Design and three replicates. The study consisted of two factors: The first factor amino acid spray treatments includes, Lysine amino acid concentration 25 and 50 ppm, Tryptophan amino acid concentration 25 and 50 ppm these treatment occupied the main plots, the second factor the distances between planting (50, 60 and 70 cm) these treatment occupied the sub-plots. The results showed that there were significant differences between amino acid spray treatments, The spray treatment T50 ppm superior in giving it the highest rate in the number of branches(21.58 and 24.24), the number of leaves (95.85 and 99.12), the percentage of nitrogen in the leaves (2.70 and 2.86%), the content of the leaves of chlorophyll a (14.96 and 15.66 *m*ico cm^{-2}), chlorophyll b(9.72 and 10.40 *m*icro cm^{-2}) the leaf area (1877.36 and 1948.06 cm^2) which was reflected in an increase in the dry weight of the leaves (33.81 and 38.71g), the yield of the leaves (762.27 and 873.60 $K.h^{-1}$) as a result of this an increase in the percentage of alkaloids in the leaves (5.32 and 5.46%). The distance is 70 cm between plants significantly superior and gave the highest averages in the number of branches (21.55 and 23.83), the number of leaves (96.50 and (99.28), the percentage of nitrogen (2.72 and 2.90),the content of the leaves of chlorophyll a (15.04 and 15.52 *m*icro cm^{-2}), chlorophyll b (9.48 and 10.42 *m*icro cm^{-2}), the leaf area (1876.74 and 1950.19), the dry weight of the leaves (33.06 and 37.75 g) which resulted in an increase in the percentage of alkaloids in the leaves (5.52 and 5.59%), while the distance of 50 cm between the plants significantly superior in the highest yield of leaves (832.28 and 964.38 kg h^{-1}). The results indicated that there was a significant interaction between amino acid spray treatments and the distances between plants in the studied characteristic.

Keywords: Amino acids, growth, leaves Datura plant

Introduction

Medicinal plants important in agricultural and industrial production and human health, despite the technological and quantitative advances in the manufacture of medicinal chemical drugs that have effective and rapid effects in treating many diseases, but they may be a double-edged weapon because their materials are extracted from abnormal sources and that have side effects, datura plant which the family *Solanaceae*, there are three types of datura in Iraq, which are *D. stramonium, D. metel* and *D. innoxia*, which are characterized by morphological and chemical differences. This plant is a major source of the most important alkaloids, essential oils, phenols and tannins (Waza *et al.*, 2015). The quality or quantity of alkaloids varies with different species and for one species they differ plant parts and the different stages of growth and development of plant life (Al-Naimi, 2000). The main site for the creation of alkaloids is the roots, and through them they are transferred to the plant parts. The percentage of alkaloids varies according to the members of the plant according to different scientific references and is affected by the genotypes and stage of plant growth and environmental factors (Philipova and Berkovb, 2002). Datura has many medicinal and pharmaceutical properties as it enters in the synthesis of a number of pharmaceutical preparations, including in the treatment of respiratory and digestive system diseases and in the manufacture of analgesic drugs for nervous system pain, rheumatism, and stomach and intestinal cramps, and this is useful for treating stomach ulcers because it reduces gastric secretions and in the treatment of fistulas and abscesses such as heart and abscesses Palpitations, hypertension, pain reliever for kidney and urinary tract (Soni *et al.*, 2012). To increase production, it is necessary to use safer agricultural methods, as plant growth is affected by the surrounding conditions, starting with soil and crop service, and the distance between plants is one of the matters that must be taken care of and that is reflected in its content of the active substance. Recently, it spread the use of growth stimulants to improve the performance and growth quality of plants. These stimulants are synthetic, Its composition depends on stimulating growth regulators, including what is naturally dependent on plant extracts and extracted in a safe way called "amino acids." Amino acids have important roles, as they are an important bio-stimulant that absorbs and moves quickly within the different parts of the plant because of its direct impact on the enzymatic activity in plants and helps open the stomata in the leaves and easily and quickly absorb them due to their small molecular size and thus increasing the absorption of efficiency. In addition, it provides the plant energy that complements the activity that the plant performs to compensate for the lost energy during the demolition and respiration process. It has a direct and indirect impact on the physiological activity of the plant and it is one of the main components in the process of protein synthesis and the importance of this is due to several plant functions as it works on building the plant structure and on the processes of nutritional conversion within the plant in what is known as metabolism. It works to balance the elements inside the plant, as it is a starting material for the formation of plant hormones and growth regulators. One of these acids is tryptophan and lysine, as tryptophan stimulates the formation of natural oxins, which have role in stimulating the growth of roots in

plants. They are places of creation of alkaloids in the plant Increase in vegetation, growth and early yield. Al-Muhammed and Mushtaq (2016) when sprayed with amino acids 0.55% Glutamic acid, Serin 0.56%, Thrionine 0.45%, Aspartic acid 2.5%, Cystine 0.44%, Valine 0.68%, Proline 0.38%, Alanine 10.0%, Glycine 0.5%, Phenylalanine 0.32%, Tyrosine 0.38%, Isoleucine 0.52%, Methionine 0.18%, Tryptophan 0.2%, Arginine 0.2%, Lysine 0.4%, Histidine 0.12% and at concentrations of 0 (distilled water), 2 and 4 cm^3. $Liters^{-1}$ at a rate of two times after 30 days of farming (after conducting the thinning process) and the second after 60 days of planting, there were significant differences in the indicators of vegetative growth, as spraying amino acids at a concentration of 4 cm^3 $liters^{-1}$ gave the highest averages and the number of leaves in the plant is 108.18 leaves and the number of secondary branches of the plant 4.36 and dry weight of the leaves 38.69 g. Therefore, this study was carried out with the aim of increasing the active substance by using amino acids in different concentrations.

Materials and Methods

A field experiment was conducted at the research station of Field Crop, College of Agricultural Engineering Science –

University of Baghdad–Al–Jaderyah during the summer season of 2018 and 2019. The field was prepared by the plowing twice vertically, using mold board plow and the soil was smoothed and settled then canals were ditched, Datura seeds obtained from the Medicinal Plants Unit of the College of Agricultural Engineering Sciences - University of Baghdad were washed with running water for 24 hours and then soaked in GA3 concentration of 750% American origin 99% (Al-Hatimi and Bashir, 2009) by dissolving ethyl alcohol concentration of 50% and then put on The thermal magnetic mixer until complete melting and at a temperature of 75 °C. Then complete the volume to 1 liter and for 12 hours to remove the germination inhibitors. The experiment was carried Randomized according to the complete block design (RCBD) with split plot order consisted of three replicates, included two factors the first spray amino acid Tryptophan concentration 25 and 50 ppm, gave the codes T25 and T50, Lysine concentration 25 and 50 ppm, gave the codes L25 and L50 in addition to control treatment (without spraying) gave the code C0 The secondary factor is the distances between plants (50, 60, 70) cm. The distance is 60 cm comparison treatment is as recommended by Al-Anbari (1999). Symbols (D1, D2, D3) were given, leaving a space of 1.5 m between the plot to avoid any effect on nearby plots. The indicators of vegetative growth were measured at the beginning of flowering stage, days after 70 from planting, by taking 5 plants randomly from the middle rows for each plot for following characters, Number of branches, Number of leaves mean, Percentage of nitrogen in the leave estimated nitrogen according to the Kildal method using the Micro-Kjeldahl apparatus (Haynes, 1980) was extracted, the content of chlorophyll a and b in the leaves by spectrophotometer at the wavelength of 663 nm for chlorophyll a and 645 nm of chlorophyll b, and then the amount of chlorophyll was estimated by the following formula (Goodwin,1976) and leave area Measured by method (Johanson, 1967), dry weight of leaves, yield leaves :- calculated from the following equation

$$\text{Yield leaves} = \frac{\text{Dry weight of leaves} \times \text{Plant density}}{1000}$$

and Percentage of alkaloids in leaves calculated and expressed as a percentage of weight of sample analyzed (Harborne, 1973; Ijarotimi *et al*., 2013).

Results and Discussion

The number of branches in the plant

The results of table 1 show the significant effect of amino acid spraying, the distance between of plant and the interaction between them during the two seasons of the study 2018 and 2019. The plants sprayed with the amino acid T50 gave the highest average number of branches in the plant amounted to 21.58 and 24.24 branches, which differed significantly from the rest of the amino acid spray treatments, especially the control treatment that gave the lowest average of 15.73 and 17.97 branches in the plant. The reason for this may be attributed to the role of amino acids, including tryptophan, in increasing the amount of IAA levels in the side buds as a result of external spraying on the leaves as the next oxine by polar transfer does not enter these buds (Sachs, 1981) and that increasing its levels inside these side buds is a practical result spraying the amino acid tryptophan is the beginning of activity and liberation of the lateral buds from the apical dominance, which stimulated them to grow and encourage vital activities, especially the processes of division and expansion of plant cells, as well as its role in reducing the amount of ABA in the plant, which may have contributed to increasing the stimulation of lateral buds. Consistent with what (Hassan and Farouk found, 2013). Plants planted at a distance of 70 cm gave the highest rate for this trait of 21.55 and 23.83, while the plants planted at a distance of 50 cm gave the lowest average 16.62 and 17.81, this is due to better provision of environmental factors at low densities and less competition for them, which helps to increase plant growth and activity and the spread of a radical root well, thus creating the largest number of peaks, and this in turn works to break the apical dominance and manufacture of oxins and encourage the formation of lateral branches in the plant (Al-Hassan, 2016). The results of the table indicate that the plants of spraying of the amino acid T50 with low densities D3 gave the highest rate of 24.18 and 27.34, while the non-sprayed plants with high densities gave the lowest average of 13.63 and 15.00.

The number of leaves in the plant

The results of table 2 show the significant effect of the two factors of study and their interaction for both seasons. The plants treatment with spraying of the amino acid tryptophan T50 recorded the highest mean in the number of leaves in the plant 95.85 and 99.12, with a significant difference from the control treatment that gave the lowest average of 88.95 and 91.17 and other treatments that did not different significantly between them but different from the control treatment. the reason for this is due to the role of amino acids, such as tryptophan, and its role in the biosynthesis of IAA. This increase in the hormone increases

the cell division and elongation and its large size, which is reflected in the increase in the indicators of vegetative growth in the plant, including the number of leaves. The plants grown at the distance of 70 cm achieved the highest average for this trait of 96.50 and 99.28 leaves per plant compared to the plants grown at the distance of 50 cm that gave the lowest average of 89.19 and 91.41 for the two seasons respectively. The reason is to the fact that the wide space distance between plants has less competition for plant members for the nutrients requirements necessary for plant growth, and therefore growth is good and there is more opportunity to increase the number of leaves, while plants planted at narrow distances suffer from intense competition for growth requirements from water and nutrient. The interaction was significant between the two study factors, as the plants sprayed with the amino acid T50 at the distance 70 cm gave highest average for this trait was 99.38 and 103.27 while the non-sprayed plants (control treatment) at the distance 50 cm gave the lowest average of 83.39 and 86.16 for the two seasons in succession.

The percentage of nitrogen in the leaves

The results of Table 3 show a significant effect of the amino acid spray treatments, distances between plant and the interaction between them in the percentage of nitrogen in the leaves for the two seasons. The sprayed plants with the amino acid tryptophan at the highest concentration T50 gave the highest mean for this trait was 2.70 and 2.86% while the non-sprayed plants (control treatment) gave C0 the lowest average reached 2.35 and 2.43% for both seasons. The reason for the superiority of the spray treatment with amino acids, especially tryptophan at the highest concentration in the leaf content of the elements may be due to its high content of N (Baqer, 2018) in addition to being the initiator of the IAA, which has an important role in the growth and development of the plant being the primary responsible for the elongation and expansion of cells And increasing the elasticity of the cell walls to help them grow in size and thus absorbing water and nutrients and thus positively affecting their content of the elements (Abdel-Kazim and Saleh, 2016). The results of the table showed that the low density plants 70 cm gave the highest average percentage of nitrogen in the leaves 2.72 and 2.90%, while the high density plants gave 50 cm the lowest average was 2.32 and 2.40%. This reason to of competition few between plants for growth factors, including nutrients, and thus an increase in the absorption of elements, including nitrogen, which was reflected in the increased percentage of nitrogen in the leaves. The interaction was significant between the two study factors, where the sprayed plants with the amino acid T50 with the widest distance D3 gave the highest rate for this trait was 2.98 and 3.23 while the control plants with the lowest distance D1 gave the lowest average of 2.07 and 2.22% for the two seasons.

The leaf content of chlorophyll a

Table 4 data indicates a significant difference in the effect of spray treatments with amino acids and distances between plants and their interaction in this capacity for both seasons. The treatment of spraying with the amino acid T50 was significantly different from that of other spraying treatments and the control treatment as it gave the highest average of 14.96 and 15.66 *m*icro grams cm^{-2} compared to the comparison treatment that gave the lowest average of 12.97 and 13.04 *m*icro grams cm^{-2}, the increased leaf content of chlorophyll a may be due to its association with nitrogen released from the amino acids, especially tryptophan as nitrogen enters the formation of chlorophylls and to an increase in the percentage of nitrogen in the leaves (Table 3), where Peter and Rosen (2005) emphasized the positive correlation between the concentration of N in the leaves of the plant and its content of chlorophyll. Plants grown gave a distance of 70 cm between the highest average leaf content of chlorophyll a was 15.04 and 15.52 *m*icro grams cm^{-2}, with a significant difference from other distances, especially a distance of 50 cm that gave the lowest average for this trait was 12.90 and 12.84 *m*icro grams cm^{-2}. The interference was significant, and the highest response was achieved when spraying the amino acid tryptophan at a concentration of 50 ppm for plants grown at a distance of 70 cm, which amounted to 16.48 and 17.33 *m*icro grams cm^{-2}, while the lowest response to this trait was when comparing treatment to plants grown at a distance of 50 cm between the inequities that gave 11.51 and 11.88 *m*icro grams cm^{-2} for the two seasons.

The leaf content of chlorophyll b

The results of Table 5 show a significant effect of each of the two study factors and the interaction between them in the leaf content of chlorophyll b. The sprayed plants gave the amino acids, especially the treatment of T50, the highest average of 9.72 and 10.40 *m*icro grams cm^{-2} and a significant difference from other spray treatments that did not different significantly between them, but they all different from the control treatment C0, which gave the lowest average of 8.62 and 9.02 *m*icro grams cm^{-2} for the two seasons respectively. The increase in this may be to the positive effect of foliar spraying with amino acids, especially tryptophanes and its role in the manufacture of chlorophylls and the synthesis of IAA (Barazani and Friedman, 2000). The results of the table show that the plants grown at a distance of 70 cm gave the highest average for this trait of 9.48 and 10.42 *m*icro gram cm^{-2}, compared to which differed significantly from the distances 60 cm and 50 cm, which gave the lowest average of 8.74 and 9.25 *m*icro grams cm^{-2}. The reason for this increase may be due to an increase in the percentage of nitrogen in the leaves (table 3). The interaction was significant between the two factors of the study, as there was a direct increase in the leaf content of chlorophyll b with an increase in the concentration of amino acids, especially T50, at a distance of 70 cm between plants, which gave the highest average of 10.12 and 11.23 *m*icro grams cm^{-2} while the comparison treatment at a distance of 50 cm between plants gave the lowest average for this trait of 8.01 and 8.39 *m*icro grams cm^{-2}.

Leaf area

The results of Table 6 show the significant effect of both study factors and their interaction on the leaf area of the plant and the two seasons of the study 2018 and 2019. The plants sprayed with the amino acid T50 gave an average for this trait of 1877.36 and 1948.06 cm^2 compared to the non-sprayed plants C0 which gave the lowest average of 1862.53

and 1934.10 cm^2, this is due to the role of amino acids, including tryptophan, in facilitating the process of nutrient absorption and direct use in the manufacture of proteins and thus increasing the content of chlorophyll (Table 4 and 5) and then the photosynthesis process with high efficiency, which leads to increase in the representations that are used in leaf growth (Boras *et al*., 2011), where they indicated the contribution of foliar feeding with amino acids in increasing leaf area. The wide distance between plants gave 70 cm the highest average for this trait was 1876.74 and 1950.19 cm^2, and a significant difference from the narrow distance between plants 50 cm, which gave the lowest average of 1861.92 and 1933.86 cm^2. The reason for this is due to the few of competition between plants for both nutrients, water and light, and its reflection on the increased leaf area. The interaction was significant between the two study factors. The plants sprayed with the amino acid tryptophan T50 at a distance of 70 cm gave the highest average of 1882.72 and 1956.70 cm^2, while the non-sprayed plants gave the control treatment C0 at the distance of 50 cm lowest average of 1852.87 and 1923.43 cm^2.

Dry weight of the leaves

The results of Table 7 show significant effect of the amino acid spray treatments, the distance between plants, and the interaction between them two seasons of the study. The plants spray with the amino acid T50 gave the highest mean for this trait was 33.81 and 38.71 g $plant^{-1}$ compared to the control treatment C0 which gave the lowest average of 30.52 and 34.92 g $plant^{-1}$ for the two seasons respectively. This superiority is due to the effect of this treatment significantly in increasing the content of chlorophyll a and b in the leaves (Table 4 and 5). This means raising the efficiency of photosynthesis with increasing representations of this process, which was well used to increase the growth of the leaves and is represented by the increase in the leaf area (Table 6) Which means increased interception of sunlight, all of these factors combined led to an increase in the dry weight of the leave. Plants at low densities 70 cm gave the highest average dry weight of the leaves was 33.06 and 37.75 g $plant^{-1}$, while the plants at the high density 50 cm recorded the lowest average of 31.21 and 36.17 g $plant^{-1}$. This is due to an increase in some growth indicators, including the number of branches, the number of leaves and the leaf area (Table 1, 2 and 6), which results in increased production of photosynthesis rates and thus an increase in the dry weight of the leaves. The results of the table show the significant effect of the interference between the two factors of the study, the dry weight of the leaves increased when spray amino acids, especially tryptophan, at the highest concentration of T50 when plants grown at distance of D3, which gave the highest average of 34.95 and 39.64 g $plant^{-1}$. While the non-sprayed plants gave acid amino control treatment C0 when plants grown at a distance of D1 which gave lowest average for this trait was 29.05 and 33.47 g $plant^{-1}$.

Yield of leaves

Table 8 shows that the treatments of amino acids spray and grown distances and their interaction significantly affected in this trait and for the two seasons of the study 2018 and 2019. Plants sprayed with amino acids recorded a significant difference from the control treatment, especially the T50, which different significantly from the rest of the spray treatments, which did not differ morally, and which gave the highest average for this trait was 762.27 and 873.60 kg h^{-1} compared to the control treatment that gave the lowest average 686.80 and 787.30 kg h^{-1} for the two seasons. This increase is due to the superiority of the treatment given in T50 the highest dry weight of the leaves (Table 7) which is reflected in the increased yield of the leave. The results of the table show that the grown plants at the highest density 50 cm gave the highest mean in the yield of leaves 832.28 and 964.38 kg h^{-1} compared to the grown plants at the lowest density of 70 cm that gave the lowest rate for this quality reached 628.22 and 717.26 kg h^{-1}. This is due to the fact that the increase in the number of plants per unit area that resulted at the distance D1 compensated for the increase in the yield of the leaves despite the superiority of the distance D3 in giving them the highest dry weight of the leaves. As for the interaction, it was significant between the two study factors, plants sprayed with the amino acid T50 at the high density D1 gave the highest average of 871.40 and 1005.80 kg h^{-1} while the non-sprayed plants gave the control treatment C0 at the lowest density D3 the lowest average was 607.60 and 678.50 kg h^{-1}.

The percentage of alkaloids in the leaves

The results of the averages of table 9 indicate a significant effect of both spraying amino acids and the distances between plants and their interaction in the percentage of alkaloids in the leaves of plants and for both seasons of the study. The amino acid spray treatments were all significantly superior to the control treatment, whereas the T50 amino acid treatment was significantly superior to other spray treatments and the control treatment that gave the lowest average for this trait was 4.87 and 4.96%, while the T50 spray treatment gave the highest average of 5.32 and 5.46% For the two seasons. This increase is due to the addition of amino acids sprayed on the plant, including tryptophan at the concentration 50 ppm which led to an increase in the internal content of amino acids and nitrogenous bases, which led to an increase in the percentage of nitrogen in the leaves (Table 3), which may directly or indirectly affect biosynthesis process of several alkaloid compounds Aniszewski , 2007). The results of the table show the significant effect of the distances between plants. The grown plants at a distance of 70 cm gave the highest rate for this trait of 5.52 and 5.59%, while the plants grown at a distance of 50 cm gave the lowest average percentage of alkaloids in the leaves amounted to 4.74 and 4.81% for the two seasons respectively. The increase is due to the exploitation of the basic elements, especially nitrogen, in the synthesis of the protein that converts to the amino acids that are considered the starting agents for the synthesis of alkaline compounds, and to the superiority of treatment D3 in giving it the highest proportion of nitrogen (Table 3). The interaction was significant between the two study factors, as the plants sprayed with the amino acid T50 at the distance of 70 cm between the plants gave the highest average of 5.70 and 5.83% while the non-sprayed plants gave the control treatment C0 at the distance of 50 cm between the plants the lowest average for this trait was 4.34 and 4.48%.

Table 1 : Effect of amino acid spray and the distance between plants on the number of branches per plant for the two seasons.

Amino acid spray treatments ppm	2018			Mean
	D1	D2	D3	
Control (C0)	13.63	15.73	17.80	15.73
Lysine (L25)	16.88	19.27	22.00	19.27
Lysine (L50)	16.75	19.26	21.91	19.26
Tryptophan (T25)	16.94	19.20	21.86	19.20
Tryptophan (T50)	18.90	21.58	24.18	21.58
L.S.D 0.05		0.54		0.42
Mean	16.62	18.85	21.55	
L.S.D 0.05		0.24		
Amino acid spray treatments ppm	**2019**			**Mean**
	D1	**D2**	**D3**	
Control (C0)	15.00	18.37	20.55	17.97
Lysine (L25)	18.00	22.32	23.87	21.40
Lysine (L50)	17.98	22.27	23.79	21.35
Tryptophan (T25)	17.89	22.16	23.61	21.22
Tryptophan(T50)	20.18	25.20	27.34	24.24
L.S.D 0.05		0.72		0.60
Mean	17.81	22.06	23.83	
L.S.D 0.05		0.32		

Table 2 : Effect of amino acid spray and the distance between plants on the number of leaves per plant for the two seasons.

Amino acid spray treatments ppm	2018			Mean
	D1	D2	D3	
Control (C0)	83.39	90.18	93.27	88.95
Lysine (L25)	90.00	92.98	96.64	93.21
Lysine (L50)	90.18	92.85	96.70	93.24
Tryptophan (T25)	89.90	93.12	96.50	93.17
Tryptophan (T50)	92.47	95.69	99.38	95.85
L.S.D 0.05		1.73		1.47
Mean	89.19	92.96	96.50	
L.S.D 0.05		0.77		
Amino acid spray treatments ppm	**2019**			**Mean**
	D1	**D2**	**D3**	
Control (C0)	86.16	92.00	95.35	91.17
Lysine (L25)	92.29	95.91	99.31	95.84
Lysine (L50)	91.88	96.12	99.27	95.76
Tryptophan (T25)	92.35	96.26	99.19	95.93
Tryptophan(T50)	94.38	99.70	103.27	99.12
L.S.D 0.05		1.13		1.05
Mean	91.41	96.00	99.28	
L.S.D 0.05		0.51		

Table 3 : The effect of amino acid spray and the distance between plants on the ratio of nitrogen to leaves (%) for the two seasons.

Amino acid spray treatments ppm	2018			Mean
	D1	D2	D3	
Control (C0)	2.07	2.37	2.59	2.35
Lysine (L25)	2.29	2.57	2.64	2.50
Lysine (L50)	2.33	2.50	2.71	2.51
Tryptophan (T25)	2.38	2.48	2.67	2.51
Tryptophan (T50)	2.52	2.60	2.98	2.70
L.S.D 0.05		0.13		0.09
Mean	2.32	2.50	2.72	
L.S.D 0.05		0.06		
Amino acid spray treatments ppm	**2019**			**Mean**
	D1	**D2**	**D3**	
Control (C0)	2.22	2.43	2.65	2.43
Lysine (L25)	2.34	2.56	2.83	2.58
Lysine (L50)	2.43	2.63	2.86	2.64
Tryptophan (T25)	2.39	2.54	2.90	2.61
Tryptophan(T50)	2.61	2.74	3.23	2.86
L.S.D 0.05		0.11		0.07
Mean	2.40	2.83	2.90	
L.S.D 0.05		0.05		

Table 4 : Effect of amino acid spray and the distance between plants on the leaf content of chlorophyll a (*m*g cm^{-2}) for the two seasons of the study

Amino acid spray treatments ppm	2018			Mean
	D1	D2	D3	
Control (C0)	11.51	13.12	14.28	12.97
Lysine (L25)	12.79	14.24	14.63	13.89
Lysine (L50)	12.99	13.91	15.01	13.97
Tryptophan (T25)	13.23	13.78	14.81	13.94
Tryptophan (T50)	13.99	15.42	16.48	14.96
L.S.D 0.05		0.56		0.36
Mean	12.90	13.94	15.04	
L.S.D 0.05		0.25		
Amino acid spray treatments ppm	**2019**			**Mean**
	D1	**D2**	**D3**	
Control (C0)	11.88	13.02	14.21	13.04
Lysine (L25)	12.55	13.73	15.17	13.82
Lysine (L50)	13.03	14.07	15.35	14.15
Tryptophan (T25)	12.79	13.59	15.55	13.98
Tryptophan(T50)	13.97	15.68	17.33	15.66
L.S.D 0.05		0.48		0.33
Mean	12.84	14.02	15.52	
L.S.D 0.05		0.22		

Table 5 : Effect of amino acid spray and the distance between plants on the leaf content of chlorophyll b (*m*g cm^{-2}) for the two seasons of the study.

Amino acid spray treatments ppm	2018			Mean
	D1	D2	D3	
Control (C0)	8.01	8.70	9.10	8.62
Lysine (L25)	8.77	9.07	9.38	9.07
Lysine (L50)	8.78	9.10	9.39	9.09
Tryptophan (T25)	8.79	9.03	9.38	9.07
Tryptophan (T50)	9.35	9.69	10.12	9.72
L.S.D 0.05		0.23		0.16
Mean	8.74	9.12	9.48	
L.S.D 0.05		0.10		
Amino acid spray treatments ppm	**2019**			**Mean**
	D1	**D2**	**D3**	
Control (C0)	8.39	9.07	9.71	9.02
Lysine (L25)	9.43	9.53	10.32	9.76
Lysine (L50)	9.33	9.59	10.36	9.79
Tryptophan (T25)	9.34	9.65	10.47	9.82
Tryptophan(T50)	9.85	10.31	11.23	10.40
L.S.D 0.05		0.29		0.25
Mean	9.25	9.60	10.42	
L.S.D 0.05		0.13		

Table 6 : Effect of amino acid spray and the distance between plants in the leaf area (cm^2) for the two seasons.

Amino acid spray treatments ppm	2018			Mean
	D1	D2	D3	
Control (C0)	1852.87	1863.53	1871.19	1862.53
Lysine (L25)	1861.89	1871.22	1876.96	1870.02
Lysine (L50)	1862.04	1869.89	1877.15	1869.69
Tryptophan (T25)	1862.30	1870.25	1875.68	1869.41
Tryptophan (T50)	1870.49	1878.88	1882.72	1877.36
L.S.D 0.05		2.30		1.88
Mean	1861.92	1870.75	1876.74	
L.S.D 0.05		1.03		
Amino acid spray treatments ppm	**2019**			**Mean**
	D1	**D2**	**D3**	
Control (C0)	1923.43	1936.29	1942.57	1934.10
Lysine (L25)	1934.87	1941.94	1950.66	1942.49
Lysine (L50)	1935.00	1942.22	1950.58	1942.60
Tryptophan (T25)	1935.11	1942.17	1950.43	1942.57
Tryptophan(T50)	1940.91	1946.58	1956.70	1948.06
L.S.D 0.05		2.68		2.09
Mean	1933.86	1941.84	1950.19	
L.S.D 0.05		1.20		

Table 7 : Effect of amino acid spray and the distance between plants on dry weight of leaves (g^{-1}) for the two seasons

Amino acid spray treatments ppm	2018			Mean
	D1	D2	D3	
Control (C0)	29.05	30.52	31.98	30.52
Lysine (L25)	31.41	31.64	32.78	31.94
Lysine (L50)	31.45	31.62	32.81	31.96
Tryptophan (T25)	31.47	31.63	32.80	31.97
Tryptophan (T50)	32.68	33.81	34.95	33.81
L.S.D 0.05		0.74		0.55
Mean	31.21	31.84	33.06	
L.S.D 0.05		0.33		
Amino acid spray treatments ppm	**2019**			**Mean**
	D1	**D2**	**D3**	
Control (C0)	33.47	35.59	35.71	34.92
Lysine (L25)	36.55	36.60	37.81	36.99
Lysine (L50)	36.53	36.63	37.79	36.98
Tryptophan (T25)	36.56	36.62	37.80	36.99
Tryptophan(T50)	37.72	38.78	39.64	38.71
L.S.D 0.05		0.86		0.78
Mean	36.17	36.84	37.75	
L.S.D 0.05		0.39		

Table 8 : Effect of amino acid spray and the distance between plants in the leaves yield (kg h^{-1}) for the two seasons.

Amino acid spray treatments ppm	2018			Mean
	D1	D2	D3	
Control (C0)	774.60	678.20	607.60	686.80
Lysine (L25)	837.60	703.10	622.80	721.17
Lysine (L50)	838.60	702.70	623.40	721.57
Tryptophan (T25)	839.20	702.90	623.20	721.77
Tryptophan (T50)	871.40	751.30	664.10	762.27
L.S.D 0.05		21.09		14.98
Mean	832.28	707.64	628.22	
L.S.D 0.05		9.43		
Amino acid spray treatments ppm	**2019**			**Mean**
	D1	**D2**	**D3**	
Control (C0)	892.50	790.90	678.50	787.30
Lysine (L25)	974.60	813.30	718.40	835.43
Lysine (L50)	974.10	814.00	718.00	835.37
Tryptophan (T25)	974.90	813.80	718.20	835.63
Tryptophan(T50)	1005.80	861.80	753.20	873.60
L.S.D 0.05		16.26		14.51
Mean	964.38	818.76	717.26	
L.S.D 0.05		7.27		

Table 9 : Effect of amino acid spray and the distance between plants on the percentage of alkaloids in leaves (%) for the two seasons.

Amino acid spray treatments ppm	2018			Mean
	D1	D2	D3	
Control (C0)	4.34	4.93	5.33	4.87
Lysine (L25)	4.77	5.11	5.51	5.13
Lysine (L50)	4.82	5.10	5.54	5.15
Tryptophan (T25)	4.76	5.10	5.50	5.12
Tryptophan (T50)	5.02	5.25	5.70	5.32
L.S.D 0.05		0.14		0.09
Mean	4.74	5.10	5.52	
L.S.D 0.05		0.06		
Amino acid spray treatments ppm	**2019**			**Mean**
	D1	**D2**	**D3**	
Control (C0)	4.48	5.01	5.39	4.96
Lysine (L25)	4.82	5.21	5.59	5.21
Lysine (L50)	4.80	5.22	5.53	5.18
Tryptophan (T25)	4.82	5.23	5.59	5.21
Tryptophan(T50)	5.13	5.42	5.83	5.46
L.S.D 0.05		0.10		0.08
Mean	4.81	5.22	5.59	
L.S.D 0.05		0.04		

Conclusions

Response of the Datura plant to the addition of amino acids lysine and tryptophan, which indicates the role of these acids in increasing the efficiency of necessary process within the plant and the need to add them when available to increase percentage of the active substance in the leaves. The effect of lysine acid at the two concentrations used did not differ, which indicates the possibility of using any of the concentrations to obtain similar results that exceed the tryptophan at the high concentration, indicating the need for the plant and its response, which may be due to its low of concentration in the plant. The increase in the percentage of alkaloids by increasing the distance between plants means that the plant has benefited from a decrease in competition by increasing the exploitation of basic elements, especially nitrogen, and thus affecting its content of active substances.

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