Effect of two oat cultivars and different spraying concentrations of some amino acids on the yield characteristic and their components

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Abstract:

A field experiment was conducted during the 2021-2022 season in the fields of the Agricultural Research Station affiliated to the College of Agriculture - University of Basra, 30 km north of the center of Basra provaince, with the aim of studying the effect of spraying levels of amino acids on yield traits and its components of two cultivars of oats (*Avena sativa* L.).Two cultivars of oats (Shifaa and Ganzania) and six treatments were studied for spraying amino acids (50 mg L^{-1} L-tryptophan, 100 mg L^{-1} of L-tryptophan, 50 mg L^{-1} of L-Glysine, and 100 mg L^{-1} of L- Glysine, 50 mg L^{-1} of L-Lysine, and 100 mg L^{-1} of L-Lysine) with control treatment without spraying.The experiment was applied using the randomized complete block design (R.C.B.D), with split plot arrangement, with three replicates .The results showed that the cultivars differed significantly among themselves in most of the traits of the study. The cultivar Shifa was excelled in the number of panicles, the weight of 1000 grains, and the grain yield, with an increase of 8.85%, 31.54%, and 4.89%, respectively, compared with the cultivar Ganzania. As for the treatments of spraying amino acids, they showed a significantly excelled when spraying tryptophan at a concentration of 50 mg L^{-1}, and gave the highest mean of the number of panicles, the number of grain in the sepals, and the grain yield. We conclude from this study that amino acids play an important role in plant growth. Spraying tryptophan at a concentration of 50 mg L^{-1} with Shifa cultivar gave a significant increase in the number of panicles.

Keywords: oats, cultivars, amino acids

Introduction:

Oat (*Avena sativa* L.) is a winter grain crop belonging to Poaceae family and its importance comes through its multiple uses.As oats are used in the human diet and are used in the manufacture of bread and pasta because they contain a high percentage of vitamins and unsaturated fatty acids (1). In addition, grains contain a high percentage of antioxidants, which many studies have confirmed their beneficial effect on cardiovascular diseases, diabetes, and obesity compared to other grains (7, 8). Oats is also considered one of the important crops globally, but in Iraq it is cultivated in a very limited manner and its production rate is still low compared to global production. Choosing the right cultivar is the basis for successful cultivation and is equally important compared to other production factors such as the use of fertilizers. (3) Found in their field study that was coundected during two seasons in Iraq to compare three cltivars of oats (Shifa, Hamel and Pimula) that the cultivar Shifa excelled in grain yield. (5) Also found that when cultivating two cultivars of oats (Shifaa and Ganzania), the cultivar had excelled in most components of yield, grain yield, and protein percentage. (1) Showed significant differences between the cultivars in yield traits when cultivating four oat cultivars, where the cultivar gave a higher mean recovery of number of peduncles and the weight of 1,000 grains. (4) During their study in Iraq to compare three cultivars of oats (Genzania, Hamel, and Carloup) concluded that Shifa had superiority in number of grains in the panicles , the weight of one thousand

grains, and the grain yield. Iraqi soils suffer from low fertility and high salinity, and the increased use of chemical fertilizers leads to increased environmental pollution, which is reflected in human health, which requires searching for new and safe materials that increase the yield and do not negatively affect the environment, and among these materials are amino acids.The plant can produce amino acids, but this synthesis requires a lot of energy, so the use of amino acids as a spray on the plants shoots provides the plant with energy. In addition to increasing the development and construction of amino acids, especially in critical times or adverse environmental conditions for plant growth (11, 10). (2) indicated, during their study on wheat yield, that there was a significant increase in the number of spikes, the number of grains per spike, and the grain yield when plants were sprayed with tryptophan.This is similar to what (9) found during his study on the wheat crop, as he indicated that there was a significant increase in the number of grains per spike when plants were sprayed with tryptophan. (6) also found the difference of amino acids (tryptophan, glycine and lysine) in their effect on the components of wheat yield. The treatment of spraying with the amino acid tryptophan at a concentration of 50 mg L-1 was superior in the number of spikes, grain yield and protein percentage. The average number of spikes, the highest average grain yield, and the increase in the percentage of protein.Because of the lack of studies on effect of amino acids on oat productivity in the salt-affected soils of southern Iraq, this study was conducted, which aims to know the effect of oat cultivars and concentrations of spraying of amino acids and the interaction between them on the yield traits and its components of the oat crop.

Materials and methods:

A field experiment was coundected during the 2021-2022 season in fields of Agricultural Research Station affiliated to College of Agriculture - University of Basra, 30 km north of the center of Basra provainc. The experiment was applied using the Randomized Complete Block Design (R.C.B.D.) arrangement of split plot with three replicates and included two factors, the first includes the cultivation of two cultivars of oats (Shifaa and Ganzania), which took the following symbol(V1 and V2), and the second factor includes spraying six treatments of amino acids with the control treatment, namely: without spraying an amino acid (A0)spraying 50 mg L^{-1} of L-Tryptophan (A1), spraying 100 mg L^{-1} of L-Tryptophan (A2), spraying 50 mg L-1 of L-Glysine (A3), spraying 100 mg L^{-1} of L - Glysine (A4), 50 mg L^{-1} spraying of L-Lysine (A5) and 100 mg L^{-1} spraying of L-Lysine (A6)Amino acids occupied the main plots, while the cultivars occupied the sub-plot. Random soil samples were taken from the field before planting, dried and passed through a 2 mm sieve, and some physical and chemical properties of the soil were estimated (Table 1)

Table (1) some of the chemical and physical properties of the study soil before cultivating

Objective	**Value and unit**	**Objective**		**Value and unit**
pH	7.60	E.C.		4.16 ds m^{-1}
Available N	42 mg kg^{-1} soil	Soil separators	Sand	278.40 g kg^{-1} soil
Available P	18.25 mg kg^{-1} soil		Silt	308.90 g kg^{-1} soil
Available K	137.4 mg kg^{-1} soil		Clay	412.70 g kg^{-1} soil
Organic matter	3.20 g kg^{-1} soil	Soil texture		Clay loam

Soil service operations were conducted from two perpendicular tillage, smoothing and leveling, after which the field was divided into three sectors, each sector containing 14 experimental units, the area of the experimental unit is 6 square meters (3m x 2m), the number of lines inside the board is 12 lines, and the distance between the lines is 15 cm .The distance between each experimental unit and another is 1m and between one sector and another 1.5m to ensure that spray mist does not reach from one treatment to another. Phosphate fertilizer was added at an average of 100 kg P2O5 ha^{-1} and potassium fertilizer at an average of 60 kg Kha^{-1} .Oat grain were sown on 11/15/2021, with a seeding rate of 100 kg ha^{-1}, and the method used in irrigation was flood irrigation. Service operations were carried out by continuous removal of weeds from the field. Amino acids were sprayed on the vegetative of plants, according to the studied concentrations at three growth stages according to the scale of (15) They are the (tillering ,Booting , flowering) stage, and they were sprayed using a portable sprinkler with a capacity of 16 liters, and the control treatment was sprayed with distilled water only. The following traits have been studied:

1-Number of panicles (panicles.m^{-2}):

The number of dahlias per plant harvested was calculated from the square meter area of each experimental unit.

2-The number of grains per panicles (grain $panicle^{-1}$)

It was calculated by randomly taking ten bunches from the square meter area of each experimental unit after these bunches were drained and cleaned manually, and according to the number of grains as an average per bucket.

3- The weight of 1000 grains(g):

It was calculated by taking a random sample of grains per square meter for each experimental unit, mixing it, then counting 1000 grains, and calculating the weight using a sensitive electronic balance.

4- Grain yield (mega grams ha^{-1}):

It was calculated from the grain weight of the harvested sample from the square meter area after separating the straw by the threshing process, then the weight of the harvested area was converted to H-1 tons based on 15.5% moisture and according to the following equation: (Al-Sahoki, 2009)

[100 x (original moisture grain weight) / (84.5)] = grain yield

5- The percentage of protein in grains (%):

The percentage of protein was estimated in the laboratories of the Department of Soil Sciences and Water Resources - College of Agriculture / University of Basra by taking 0.2 g of the crushed grain sample after passing it on a sieve with a diameter of openings (1 mm), then the samples were digested by adding a mixture of concentrated sulfuric acid and perchloric acid with heating until A clear solution was obtained according to the method of Cresser and Parssons (1979), then the percentage of nitrogen was estimated using the Micro-kjeldahl device, then the percentage of protein was calculated according to the following equation:% protein = % nitrogen x 6.25 (Hart and Fisher, 1971). Data were collected and analyzed using the Genstat statistical program, and the least significant difference test (L.S.D) was used to compare the means (13).

Results and discussion:

1-Number of panicles (panicles.m^{-2}):

The results in Table (2) showed a significant difference between the two cultivars in the average number of panicles, where the cultivar Shifa (V1) excelled and gave the highest average of 275.81 panicles .m^{-2}, while the cultivar Ganzania (V2) gave the lowest average number of panicles amounting to 253.38 panicles m^{-2}. The reason

may be due to a difference in the nature of the genetic makeup .This result agrees with the results of (3) who indicated that oat cultivars differed among themselves in the average number of panicles .It is also noted from the results of Table 2 that spraying with amino acids had a significant effect on this trait, as it was excelled on spraying with tryptophan at a concentration of 50 ml L^{-1} (A1) and gave the highest average number of panicles of 284.33 panicles.m^{-2} .While the control treatment (A0) gave the lowest mean of 252.83 panicles.m^{-2}. The results of the same table also show that there is a significant effect of the interaction between the two factors in the average number of panicles, where the combination (A1×V1) excelled and recorded the highest average of 296.00 Dm^{-2}, while the combination (A0×V2) recorded the lowest average of 243.33 panicles .m^{-2}.

Table (2) effect of spraying amino acids on the number of panicles (panicles .m^{-2}) of two oat cultivars

Cultivars / Amino acids	Shafa (V_1)	Genzania (V_2)	Average of Amino acids
No spray of amino acids (A_0)	262.33	243.33	**252.83**
L-Tryptophan 50 mg L^{-1} (A_1)	296.00	272.67	**284.33**
L-Tryptophan 100 mg L^{-1} (A_2)	288.33	248.33	**268.33**
L-Glycine 50 mg L^{-1} (A_3)	263.33	249.67	**256.50**
L-Glycine 100 mg L^{-1} (A_4)	278.67	265.67	**272.17**
L-Lysine 50 mg L^{-1} (A_5)	266.00	248.67	**257.33**
L-Lysine 100 mg L^{-1} (A_6)	276.00	245.33	**260.67**
Average of cultivars	**275.81**	**253.38**	
$LSD_{0.05}$	Cultivars	Amino acids	Interaction
	0.95	2.82	3.20

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2The number of grains per panicles (grain panicle^{-1})

The results in Table (3) show that the two cultivars differed significantly in the average number of grain in panicles , where the cultivar Ganzania (V2) excelled and gave the highest average of 53.83 grain .panicles $^{-1}$, while the cultivar Shifa (V1) gave the lowest average number of grain in panicles of 45.16 grain .panicles $^{-1}$. The reason for this is due to the genetic difference of the two cultivars, where the panicles in the cultivar Ganzania is longer than the cultivar Shifa, which was reflected in the increase in the number of grains in panicles. These results agree with (4), who indicated that the cultivar Ganzania was excelled on other cultivars in the average number of grains per panicles. Also, from the same table, it is clear to us that there are significant differences when spraying amino acids with different concentrations, where the spraying treatment with tryptophan at a concentration of 50 ml L^{-1} (A1) excelled and gave the highest average number of grains in panicles , which reached 53.47 grains (Dl-1), while the contol treatment gave (A0) The lowest mean was 45.35 grains . panicles $^{-1}$.The reason for this may be due to the positive effect of tryptophan in building nucleic acids, DNA, RNA and proteins necessary for the formation of enzymes necessary for vital activities and increasing the process of cell division, which leads to an increase in flowering.The results in Table (3) also indicate that there is a significant effect of the interaction between the two factors on the average number of grains in panicles , where the combination (A1 × V2) excelled and recorded the highest average of 59.57 grain.panicles $^{-1}$, while the combination (A0 × V1) recorded the lowest average of 40.97. grain.panicles $^{-1}$.

Table (3) effect of spraying amino acids on the number of grains in panicles(grain.panicles $^{-1}$) for two cultivars of oats

Cultivars / Amino acids	Shafa (V_1)	Genzania (V_2)	Average of Amino acids
No spray of amino acids (A_0)	40.97	49.73	**45.35**
L-Tryptophan 50 mg L^{-1} (A_1)	47.37	59.57	**53.47**
L-Tryptophan 100 mg L^{-1} (A_2)	45.07	55.37	**50.22**
L-Glycine 50 mg L^{-1} (A_3)	46.73	51.73	**49.23**
L-Glycine 100 mg L^{-1} (A_4)	44.43	56.13	**50.28**
L-Lysine 50 mg L^{-1} (A_5)	47.60	54.93	**51.27**
L-Lysine 100 mg L^{-1} (A_6)	43.93	49.33	**46.63**
Average of cultivars	**45.16**	**53.83**	
$LSD_{0.05}$	Cultivars	Amino acids	Interaction
	0.86	1.17	1.91

3- The weight of 1000 grains(g):

The results in Table (4) show that the two cultivars differed significantly in the average weight of 1000 grains, where the Shifa cultivar (V1) excelled and gave the highest average of 33.66 gm, while the cultivar Ganzania (V2) gave the lowest average weight of 1000 grains amounted to 25.59 gm. The reason for this may be due to the decrease in the number of grains in panicle, which leads to a decrease in competition between the grains, and thus an increase in the weight of the grain. It is noted from Table (4) that there are significant differences when spraying amino acids at different concentrations.The treatment of spraying with glycine at a concentration of 100 ml L^{-1} (A4) excelled and gave the highest average yield for the weight of 1000 grains, which was 32.12 gm.While the control treatment (A0) gave the lowest mean of 24.29 gm. The reason for this is due to the role of glycine inside the plant, as it helps to increase photosynthesis, and it also works to reduce the speed of nutrient deficiency because it works to absorb them easily and use them directly in the manufacture of proteins and thus increase the weight of the grain. Also from the same table, it is noted that there is a significant effect of the interaction between the two factors in the weight of a thousand grains, where the combination (A4×V1) excelled and recorded the highest average of 36.44 g, while the combination (A0×V2) recorded the lowest average for this trait, amounting to 23.49 g.

4- Grain yield (mega grams ha^{-1}):

The results in Table (5) show that the two cultivars differed significantly in grain yield, where the cultivar Shifa (V1) excelled and gave the highest average of 3.65 tons ha^{-1}, while the cultivar Ganzania (V2) gave the lowest average grain yield of 3.48 mega grams ha^{-1}. This may be due to the excelled of Shifa cultivar in the number of panicles (Table 2) and the weight of one thousand grains (Table 4), which resulted in an increase in the total grain yield.The results of Table 5 also indicate that spraying with amino acids had a significant effect on this trait, where spraying with tryptophan at a concentration of 50 mg L^{-1} (A1)was excelled and gave the highest average grain yield of 3.81 mega grams ha^{-1}, while the control treatment (A0) gave the lowest average of 2.94 mega grams ha^{-1}.The reason may be attributed to the role of tryptophan acid in improving and increasing vegetative growth, which resulted in an increase in the number of panicles of treatment A1 (Table 2), which is one of the most

important components of the yield and thus an increase in grain yield. The results of Table (5) also show that there is a significant effect of the interaction between the two factors on the grain yield, where the treatment of the interaction between the cultivar Shifa and spraying of lysine with a concentration of 50 mg L^{-1} (A5×V1) excelled and recorded the highest average of 3.85 mega grams ha^{-1}, while the combination recorded (A0×V2) the lowest average was 2.93 mega grams ha^{-1} .

Table (4) Effect of spraying amino acids on the weight of 1000 grains (g) of two cultivars of oats

Cultivars / Amino acids	Shafa (V_1)	Genzania (V_2)	Average of Amino acids
No spray of amino acids (A_0)	25.10	23.49	**24.29**
L-Tryptophan 50 mg L^{-1} (A_1)	33.60	27.85	**30.72**
L-Tryptophan 100 mg L^{-1} (A_2)	35.71	25.91	**30.81**
L-Glycine 50 mg L^{-1} (A_3)	34.14	26.13	**30.13**
L-Glycine 100 mg L^{-1} (A_4)	36.44	27.80	**32.12**
L-Lysine 50 mg L^{-1} (A_5)	36.25	24.09	**30.17**
L-Lysine 100 mg L^{-1} (A_6)	34.37	23.87	**29.12**
Average of cultivars	**33.66**	**25.59**	
$LSD_{0.05}$	Cultivars	Amino acids	Interaction
	0.54	1.72	1.92

Table (5) Effect of spraying amino acids on grain yield (mega grams ha^{-1}) of two cultivars of oats

Cultivars / Amino acids	Shafa (V_1)	Genzania (V_2)	Average of Amino acids
No spray of amino acids (A_0)	2.95	2.93	**2.94**
L-Tryptophan 50 mg L^{-1} (A_1)	3.81	3.82	**3.81**
L-Tryptophan 100 mg L^{-1} (A_2)	3.62	3.18	**3.40**
L-Glycine 50 mg L^{-1} (A_3)	3.82	3.45	**3.64**
L-Glycine 100 mg L^{-1} (A_4)	3.62	3.63	**3.63**
L-Lysine 50 mg L^{-1} (A_5)	3.85	3.65	**3.75**
L-Lysine 100 mg L^{-1} (A_6)	3.84	3.71	**3.77**
Average of cultivars	**3.65**	**3.48**	
$LSD_{0.05}$	Cultivars	Amino acids	Interaction
	0.02	0.05	0.07

5- The percentage of protein in grains (%):

The results in Table 6 show that the two cultivars differed significantly in the average percentage of protein in grains, where the Shifa cultivar (V1) excelled and gave the highest average of 12.53%, while the cultivar Ganzania (V2) gave the lowest average protein percentage of 12.29%. This may be due to the genetic variation between cultivars. It is also noted from the results of Table 6 that spraying with amino acids had a significant effect on this traits, where spraying with tryptophan at a concentration of 50 ml L^{-1} (A1) was superior

and gave the highest average protein percentage of 13.46%, while the control treatment (A0) gave the lowest average of 10.35%. The reason for the increase may be due to the role of tryptophan in increasing the level of endogenous auxin, and then increasing the synthesis and formation of proteins.As auxins work on the distribution of processed food, which leads to an increase in the vital activities of the plant and helps in the absorption and transportation of these elements easier within the plant, which is reflected in an increase in the proportion of protein in grains (12, 14). As for the effect of interference, it was not significant.

Table (6) Effect of spraying amino acids on the percentage of protein in grains (%) for two cultivars of oats

Cultivars / Amino acids	Shafa (V_1)	Genzania (V_2)	Average of Amino acids
No spray of amino acids (A_0)	10.67	10.03	**10.35**
L-Tryptophan 50 mg L^{-1} (A_1)	13.63	13.29	**13.46**
L-Tryptophan 100 mg L^{-1} (A_2)	13.33	13.17	**13.25**
L-Glycine 50 mg L^{-1} (A_3)	12.54	12.35	**12.44**
L-Glycine 100 mg L^{-1} (A_4)	11.30	11.13	**11.21**
L-Lysine 50 mg L^{-1} (A_5)	12.91	12.64	**12.77**
L-Lysine 100 mg L^{-1} (A_6)	13.33	13.45	**13.39**
Average of cultivars	**12.53**	**12.29**	
$LSD_{0.05}$	Cultivars	Amino acids	Interaction
	0.20	0.37	N.S.

conclusion:

Based on the results obtained, it can be concluded that the Al-Shifa cultivar excelled in most yield characteristics, as it gave the best results in terms of number of panicles, weight of 1000 grains, grain yield, and protein percentage. Amino acid spraying plays an important role in plant growth and yield increase, as spraying with tryptophan at a concentration of 50 ml L-1 gave the highest average in most of the yield traits (number of panicles, number of grains in tubes, and grain yield).

References:

1-Addaheri, A. M. S.; O. M. Hassan; Q. S. Khalf; M. U. Athab and O. S. Meshal. (2021, November). Potential Role of Cutting Date in Lodging and Yield of Three Oat Cultivars. In IOP Conference Series: Earth and Environmental Science (Vol. 904, No. 1, p. 012021). IOP Publishing.

2-Al-Badrawi, M. M. and S. A. Alabdulla. (2021). Effects of foliar spraying of salicylic acid with tryptophan on yield and quality parameters in wheat. Plant Archives, 21(1): 854-857.

3-Al-Khafaji, Mustafa Jamal, and Muhammad Hathal Al-Baldawi. (2017). Effect of salinity of irrigation water on some growth characteristics and grain yield of some oat cultivars (Avina sativa L.). Al Furat Journal of Agricultural Sciences, 9(4): 902-915.

4-Al-Rawi, D. S. and N. M. Abood. (2021). Response of Oats Cultivars to Spraying with Nano and Mineral Zinc and Potassium on Yield and its Components. In IOP Conference Series: Earth and Environmental Science (Vol. 904, No. 1, p. 012050). IOP Publishing.

5-Alrubaiee, S. H.; H. A. Atab and M. Y. Merhej. (2020). RESPONSE OF TWO OATS VARIETIES TO NUTRIENT SPRAYING. Int. J. Agricult. Stat. Sci. Vol, 16(1), 1381-1384.

6-Baqir, H. A. and M. A. S. Al-Naqeeb. (2019). Effect of some amino acids on tillering and yield of three bread wheat cultivars. Iraqi Journal of Agricultural Science, 50, 20-30.

7-Duda, M.; N. Tritean; I. Racz; R. Kadar; F. Russu; A. Fițiu; E. Muntean and A. Vâtcă (2021). Yield Performance of Spring Oats Varieties as a Response to Fertilization and Sowing Distance. Agronomy, 11(5), 815.

8-Dvořáček, V.; M. Jágr; A. Kotrbová Kozak; I. Capouchová; P. Konvalina; O. Faměra and P. Hlásná Čepková (2021). Avenanthramides: Unique Bioactive Substances of Oat Grain in the Context of Cultivar, Cropping System, Weather Conditions and Other Grain Parameters. Plants, 10(11), 2485.

9-El-Hosary, A. A.; G. Y. Hammam; A. El-Morsi; E. A. Hassan; M. E. El-Awadi and Y. R. Abdel-Baky. (2013). Effect of some bio-regulators on growth and yield of some wheat varieties under newly cultivated land conditions. New York Sci. J, 6(6): 1-11.

10-Mirtaleb, S. H.; Y. Niknejad and H. Fallah. (2021). Foliar spray of amino acids and potassic fertilizer improves the nutritional quality of rice. Journal of Plant Nutrition, 44(14): 2029-2041.

11-Mohamed, H. F.; H. M. Abdel-Lattif and R. M. Abd El-Salam. (2019). Response of some wheat cultivars to foliar application of some nutrient compounds under sandy soil conditions in wadi el-natron. Plant Archives, 19(2): 2301-2314.

12-Mustafa, A.; M. Imran; M. Ashraf and K. Mahmood. (2018). Perspectives of using l-tryptophan for improving productivity of agricultural crops: A review. Pedosphere, 28(1): 16-34.

13-Payne, R. W. (2009). GenStat. Wiley Interdisciplinary Reviews: Computational Statistics, 1(2): 255-258.

14-Ramaih, S.; M. Guedira and G. M. Paulsen. (2003). Relationship of indoleacetic acid and tryptophan to dormancy and preharvest sprouting of wheat. Functional Plant Biology, (30), 939-945.

15-Zadoks, J. C.; T. T. Chang and C. F. Konzak. (1974). A decimal code for the growth stages of cereals. Weed research, 14(6): 415-421.