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Response of oat crop (*Avena sativa* L.) to spraying with Zinc and Amino acids

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ABSTRACT

The field experiment was conducted at the Second Research Station of the College of Agriculture, Al- Muthanna University, site within longitude of 45.25^{o} east and latitude 31.39^{o} north for the 2024- 2025 planting season to a chive the true impact concentration of zinc element, amino acids, in addition to the effect of interaction between them that enhances the development and productivity of Oat crop. A factorial experiment was conducted using the Randomized Complete Block Design (RCBD) approach, with three replicates. Zinc was applied at tow concentration 0 and 2 g/L. Amino acid were applied at three concentrations 0, 1, 1.5 g/L by spraying the plants until saturated. The findings indicated that a concentration of amino acid at 1.5 g/L superior averages for the following traits, number of tillers per m^{2} , number of panicles per m^{2} and grain yield tons ha^{-1} (286.5, 245.7 and 2.79 tons ha^{-1}). Conversely, at a concentration of amino acid 1g/L was superior for the trait number of grain per panicle 41.00. Additionally, the results revealed no significant differences regarding Zinc application or the interaction between the experimental factors.

Keywords: Oat crop, Zinc nutrition, Amino acid nutrition,

INTRODUCTION

Oats (*Avena sativa* L.) are annual grasses belonging to the Poaceae family. Oats rank as the seventh most commercially significant and prolific cereal crop, following wheat, rice, barley, maize, sorghum and millet. They are used as a winter cereal crop in numerous countries. Research indicates that Oats were cultivated in antiquity throughout several

global areas (Soratto *et al*., 2012). Oats are utilized in the alimentation of both humans and animals. The nutritional significance of Oats stems from their abundance of essential elements. Moreover, Oats are abundant in glucan, protein, fat and carbohydrate (Ahmad *et al*., 2014). Oats has numerous nutritional and health advantages. Consequently, the grains are combined with wheat to produce bread. Research indicates that Oats are advantageous for cardiovascular health as thy aid in lowering detrimental cholesterol levels in the bloodstream (Peterson, 2004). They are extensively utilized in the infant nutrition sector and contribute to enhancing the immune system. They include antioxidants to safeguard cells. The Committee for the study and development of Medicinal plants at the University of Wurzburg designated it as the premier medicinal crop globally (Mayer, 2017). Notwithstanding the global significance of Oats, its yield in Iraq remains markedly constrained.

Multiple studies have demonstrated that Zinc is a vital element for both plants and animals, and its lack has resulted in decreased food yields and quality (Sarwar, 2011). It is crucial for the synthesis of chlorophyll, proteins and lipids. It has an important physiological function in activating enzymes and producing hormones, including RNA, polymerases. Increasing calcium levels in agricultural soils leads to a decrease in the ability of plant roots to absorb zinc as is the case in Iraqi soils. Consequently, the application of supplementary zinc is an expedient method for rectifying zinc shortage in plants (Soetan *et al*., 2010).

Amino acids positively influence plant yield. Use of amino acids sprays during the plant life cycle, especially in the elongation, flowering stage, enhances physiological and biochemical processes, as these acids are integral to protein synthesis. They are thought to facilitate cell division and syntheses some natural growth hormones, including indol acetic acid (IAA) and gibberellin (GA_3), hence enhancing productivity and quality (Ahmed *et al*., 2007).

Materials and methods

Experimental Site

A field experiment was held in the agricultural Research fields affiliated with the College of Agriculture- Al- Muthanna University, site within longitude of 45.25^{o} east and latitude 31.39^{o} north, in the winter planting season 2024- 2025. The aim was to determine the response of Oat crop to zinc and amino acid spraying. A composite sample of field soil was collected and analyzed in the laboratories of the Department of soil and water Sciences, Al-Muthanna University.

Table1: Shows the physical and chemical characteristics of the soil.

Property	Value
ECe	4.67
pH	8.03
Soil components %	
Sand	46.87
Silt	15.63
Clay	37.50
Soil texture : Sandy loam soil	

Study factors

The two factors of the experiment are:

First factor amino acids:

- Spraying with distilled water, symbolized by A_0
- Amino acid concentration 1 g/L, symbolized by A_1
- Amino acid concentration 1.5 g/L, symbolized by A_2

Second factor zinc:

- Spraying with distilled water, symbolized by Z_0
- Zinc concentration 2 mg/L, symbolized by Z_1

The studied traits:

1- **Leaf Area (cm^2):** Estimated according to the equation: Total Leaf Area (cm^2) = Max Length × Max Width × 0.75 . (Thomas, 1975)**.**

2- **. Number of tillers (tiller m^2):** The number of tillers was counted in a middle row of each experimental unit after excluding the guard plants.

3- **Number of panicles per square meter (panicle m^2):** Their number was calculated in the area of the middle lines of the experimental unit, then the area was adjusted to square matres.

4- **Number of grains per panicle (grain $panicle^{-1}$):** The number of grains per panicle was calculated from the average number of grains of ten panicles taken randomly.

5- **Weight of 1000 grains (g):**

6- **Grain yield (ton ha^{-1}):** Total grain yield was estimated for the total plants harvested from the two middle rows of each experimental unit and then weighed using a sensitive balance.

Statistical Analysis

The data were analyzed using Genestat, and the means of the coefficients were comparted using the least significant difference LSD tastat the probability level 5% (Al-Rawi and Khalaf Allah, 2000).

Results and discussion

Leaf Area (cm^2)

From the data in table 2, it is clear that there are no significant effects for the above characteristic among that study factors.

Table 2: effect of zinc and amino acids on leaf area (cm^2).

A (g/L)	Z (g/L)		Average A
	Z_0	Z_1	
A_0	12.29	13.26	12.27
A_1	13.26	11.02	12.14
A_2	13.34	12.81	13.08
Average Z	12.26	12.36	
LSD $_{(5\%)}$	A= NS	B= NS	A*B= NS

Number of tillers (tiller m^2)

The number of spikes in a plant is determined by the rate of lateral bud growth, which depends on the variety, seed vigor, sowing depth, plant density, and various environmental factors. It can be concluded that adequate nutrient availability during the early stages of plant development contributes to regulating the number of branches in the plant.

Table (3) shows that there are significant differences with increasing amino acid spray concentration, where 1.5 gL^{-1} recorded the highest for the number of tillers per m^2, reaching 286.5, compared to the lowest average for this trait when the comparison treatment was $0gL^{-1}$, reaching 243.8 (tiller m^2). Amino acids may be thought to promote protein content, cell division and natural plant hormones such as Auxin (IAA) and Gibberellin (GA_3) (Ahmad *et al*., 2014).

Table 3: effect of zinc and amino acids on number of tillers (tiller m²).

A (g/L)	Z (g/L)		Average A
	Z_0	Z_1	
A_0	249.3	238.3	243.8
A_1	261.7	271.7	266.7
A_2	258.7	314.0	286.5
Average Z	256.6	274.8	
LSD $_{(5\%)}$	A= 0.024	B= NS	A*B= NS

Number of panicles per square meter (panicle m²)

Table (4) indicated that there were significant differences with increasing concentration of amino acid spray, as 1.5 gL^{-1} recorded the highest average of 245.7 for the number of panicles per square meter, compared to the comparison, which gave the lowest average at 0 gL^{-1}, reaching 216.0 (panicle m²).

Table 4: effect of zinc and amino acids on number of panicles (panicles m²).

A (g/L)	Z (g/L)		Average A
	Z_0	Z_1	
A_0	216.8	215.2	216.0
A_1	235.4	231.9	233.7
A_2	266.5	264.9	245.7
Average Z	226.2	237.3	
LSD $_{(5\%)}$	A= 0.057	B= NS	A*B= NS

Number of grains per panicle (grain $panicle^{-1}$)

We note in table (5) that there are significant differences with the different amino acid concentrations, as the concentration of 1 gL^{-1} gave the highest average of 41.00 for the trait of number of grains in the vine, comparison to the lowest average for this trait when the comparison treatment was a concentration of 0 gL^{-1}, which amounted to 34,94 (grain $panicle^{-1}$). This may be due to these proteins facilitate several roles within the plants metabolic processes and enhance the pace of carbon metabolism, resulting in elevated by matter content and is subsequent transport, hence augmenting yield (Drecker *et al*., 2000).

Table 5: effect of zinc and amino acids on umber grains per panicle (grain $panicle^{-1}$).

A (g/L)	Z (g/L)		Average A
	Z_0	Z_1	
A_0	36.39	33.50	34.94
A_1	39.94	42.50	41.00
A_2	39.44	38.95	39.20
Average Z	38.59	38.17	
LSD $_{(5\%)}$	A= 0.009	B= NS	A*B= NS

Weight of 1000 grains (g)

The weight of 1000 grains is a very important characteristic and one of the components of the yield, and several factors are responsible for it, the most important of which are environmental conditions. Table (6) indicated that there were no significant differences for all treatments included in the experiment.

Table 6: effect of zinc and amino acids on weight 1000 grains (g).

A (g/L)	Z (g/L)		Average A
	Z_0	Z_1	
A_0	27.5	29.5	28.5
A_1	31.9	31.8	31.8
A_2	31.5	31.5	31.5
Average Z	30.3	30.9	
LSD $_{(5\%)}$	A= NS	B= NS	A*B= NS

Grain yield (ton ha^{-1})

Table (7) indicated that there were significant differences with increasing amino acid spray concentration, as 1.5 gL^{-1} yielded a high average grain yield, reaching 2.79 ton ha^{-1}, compared to the lowest average for this trait at the comparison treatment of 0 g/L, reaching 2.08 ton ha^{-1}. It may be attributed to attributed to the role of amino acid in building chlorophyll and thus stimulating photosynthesis and building carbohydrates. They also participate in encouraging and making enzymatic conjugates (Shafeek *et al*., 2012).

Table 7: effect of zinc and amino acids on grain yield (ton ha^{-1}).

A (g/L)	Z (g/L)		Average A
	Z_0	Z_1	
A_0	1.98	2.17	2.08
A_1	2.68	2.79	2.73
A_2	2.56	3.02	2.79
Average Z	2.41	2.66	
LSD $_{(5\%)}$	A= 0.049	B= NS	A*B= NS

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