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Effect of spraying Benzyl adenine (BA) and adding nitrogen fertilizer on yield of *Avena sativa* L.

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Abstract

The field experiment was conducted in the second agricultural research station located in the Al-Bandar area, which is affiliated with the College of Agriculture at Al-Muthanna University. This Study was conducted during the winter season 2022-2023 was conducted during the 2022-2023 winter agricultural season. The experiment investigated the relationship between two factors. The first factor is nitrogen, which was applied at four distinct four levels (0, 40, 80, and 120 kg N ha-1). After emergence, during the elongation stage, and at the Booting stage, nitrogen was applied in three separate batches. Benzyl adenine is the second factor examined in this study. Four Different concentrations of benzyl adenine were applied to the plant at 0, 100, 150, and 200 mg L-1. The benzyl adenine was applied in two Different concentration, with the first batch being applied during the elongation phase and the second batch being applied during the Booting phase. The application consisted of completely saturating the plant with a spray. The experiment was carried out with randomized complete block design using split plot with three replicates. The Main plots were sprayed with varied concentrations of benzyl adenine, while the Sub- plots received varying levels of nitrogen fertilization.

The results showed Significant differences in the Nitrogen application, especially in the Significant of 120 kgN.ha-1 In the following characteristics (number of grains Per panicle, weight of 1,000 grains, grains yield, biological yield), it gave averages of 105.6 grains panicle^{-1}, 38.36 g, 6.27 ton ha-1, 25.41 ton ha-1), and at 40 kg N ha-1, it was greater than the number of panicle of 429.8 m2.

The results also indicated significant effect in the spraying of Benzyl adenine and the highest average treatment of 200 mg L-1 (1,000 grain weight) and gave an average of 37.68 g

The interaction between factors under study showed the combination (120 kg N ha-1 x 200 mg L-1 BA) gave averages of 41.49 g in grain weight.

Introduction

Grain crops are among the oldest crops known to humanity. They have been a primary source of food for centuries. Oatmeal (*Avena sativa* L.), a herbaceous winter plant belonging to the Poaceae family, is ranked seventh in economic importance among grains, following wheat, rice, barley, maize, and sorghum.", (1). It is grown in many countries of the world because of the nutritional importance of its grains, its high content of unsaturated fat, nutrients, calcium, sodium, magnesium, iron and phosphorous, as well as vitamin B, proteins and antioxidants, which can help to reduce the risk of heart attacks and strokes, as well as to distinguish it from others in keeping its grain products with their original elements more than the rest of the grains (2)

The production efficiency of feed and oatmeal can be raised through many agricultural processes, including the use of nitrogen fertilizer, which is an important agricultural factor affecting the production and quality of various crops, including winter grain crops (3), nitrogen is the primary nutrient that significantly influences the production of field crops, the application of appropriate nitrogen levels can lead to increased yields of grain crops(4) .

Growth hormones ‘play important roles in increasing the efficiency and growth of plants and improving their natural products, and there are many research and studies that have indicated that treatment with growth hormones has positive effects on plant growth, increased production and quality of the product, in particular treatment of BA-binzyladine, which belongs to the cytokinin group and its molecular formula C12H11N5, and is one of the most widely used and common cytokinin compounds because of its high bioactivity, persistence and long-term storage potential .(5) .

The objective of this study to determine the optimal level of nitrogen fertilizer and the application of BA (possibly a growth regulator or other chemical) and assess the interaction effects to maximize oatmeal production.

Materials and Methods

Location and season of the experiment

The field experiment was conducted at the second agricultural research station (Al-Bandar) which is associated with the College of Agriculture - Al-Muthanna University. The research station is situated on the banks of the Euphrates River, namely at coordinates 31.32139° N and 45.30407° E. The experiment Conduct during the winter agricultural season of 2022-2023. Random soil samples were collected from the field prior to the planting process, namely at a depth ranging from zero to 30 cm. The laboratory analysis conducted at the Postgraduate Studies, College of Agriculture - Al-Muthanna University, focused on examining the physical and chemical

properties. The obtained results, which are presented in Table (1)

Table (1) some physical and chemical properties of field soil before planting

EC	4.4	Ds m-1	Sand	11.47%
pH	7.8		Silt	35.61%
Available nitrogen	20.3	Mg Kg-1	Clay	52.92%
Available phosphorus	13.2		Soil texture	Clay loam
Available potassium	179.6			

Study factors

Firstly, the experiment involved the application of nitrogen fertilizer at four different levels: 0, 40, 80, and 120 kg N ha-1. The symbols N1, N2, N3, and N4 are represented in consecutive order. Urea fertilizer, containing 46% nitrogen, was used as the nitrogen source. applied in three equally spaced applications the first one was carried out after the emergence of the plants, the second during the elongation stage, and the third at the Booting stage.Secondly, the experiment involved the application of four different doses of Benzyl Adenine, Symbolized as B4, B3, B2, and B1, corresponding to 0, 100, 150, and 200 mg L-1, respectively. Benzyl adenine was applied to the plant to saturation in two separate applications. The first application occurred during the elongation stage, while the second application took place at the Booting stage. The plant growth stages were assessed using a scale (6).

Experiment design

The experiment was carried out with randomized complete block design using split plot with three replicates. The maim plots were designated for the establishment of nitrogen fertilization levels, while the sub-plots were assigned for the application of benzyl adenine spraying treatments. Consequently, the total number of experimental units was determined to be 48,

Field operations

Plowing, smoothing, and leveling procedures were executed, followed by the division of the land into panels with an area of 2 square meters, as per the designated layout. Certain sectors exhibit a spatial separation of 0.5 meters, while others possess a gap of 1 meter between them. On October 25, 2022, a total of 120 kg ha-1 (7) of oat seeds were sown. The application of fertilizer was performed during the planting process, with the adding fertilizer of triple superphosphate fertilizer (P2O5 46%) at a rate of 90 kg p ha-1 as a phosphorus source (8), and potassium sulphate (K2O% 50) at a quantity of 40 kilogram K ha-1 as a potassium source (7). Irrigation and weeding procedures

were implemented when deemed essential.

studied characteristics

1 number of Panicle (m^{-2}) **:**The quantification of Panicle was conducted throughout the harvest period, specifically within a one square meter area for each experimental unit.

2 number of Grains (Grains Panicle-1)**:** The average number of Grains was estimated for 10 Panicle selected valleys from the area of the square metre gathered.

3 Weight of 1,000 Grains(g) : The weight of 1000 grains is randomly measured by the product of the grain from each experimental unit and utilizing the delicate balance.

4 Grains Yield (tons ha-1): A measure of the amount of square metre area collected and converted on the basis of Mecha Gram ha-1.

5 Biological yield (tons ha-1): A measure of the same area as the yield of the grain per experimental unit when the complete plant (the hay + the grain) was weighed and then converted to Mecha Gram ha-1.

6 Harvest index (%) : Calculation of the harvest index according to the following equation(9)

Harvest index =Weight of Grains\ Biology yield. × 100

Statistical analysis

The data underwent statistical analysis using the Genstat statistical tool, employing an analysis of variance approach to assess all research features. The arithmetic means were afterwards compared using the least significant difference (L.S.D) method at a significance threshold of 0.05.(10)

Results and discussion

Number of Panicle (m^{-2})

The results of the statistical analysis, as shown in table 2, showed that there was a Significant effect of the nitrogen compost addition in the character of the number of functionaries per square metre, but the spraying of Benzyl and the overlap between nitrogen compost and the spraying of Benzyl were not Significant. The treatment (40 kg N ha-1) was greater than the average of 429.8 D-2, whereas the comparative Control treatment (0 kg N ha-1) was lower at 370.2 D-2. The explanation may be attributed to the role of nitrogen in enhancing the vegetative development of plants, as well as to the fact that its addition minimizes the mortality of combustion and so increases the number of fertile metals in the unit of area .

Table 2: Effect of spraying Benzyl adenine (BA) and nitrogen fertilizer on the number of Panicle (m^{-2}).

Nitrogen (kg N ha-1)	Benzyl adenine (mg L-1)				Average
	0	100	150	200	
0	283.7	357.7	410.3	429.0	370.2
40	403.3	449.0	414.3	452.3	429.8
80	445.7	405.7	417.0	438.3	426.7
120	412.3	411.3	438.3	412.3	418.6
Average	386.2	405.9	420.0	433.0	
L.S.D (N)	42.55	L.S.D(BA)	N.S	L.S.D (N×BA)	N.S

Number of grains (Grains Panicle-1)

The results of Table 3 demonstrated that Adding nitrogen fertilizer effect significantly, with 120 kg N1 being treated with an average of 105.6 Grains Panicle-1, while the Control treatment (0 kgN1) produced an average of 68.4 Grains Panicle-1.

The difference may be attributed to the function of nitrogen in contributing to enhanced Photosynthesis and its products, as well as to the availability of sufficient quantities of nitrogen, which has decreased competition amongst plants for nutrients.(13) .

Table 3: Effect of spraying Benzyl adenine (BA) and nitrogen fertilizer on number of Grains (Grains Panicle-1)

Nitrogen (kg N ha-1)	Benzyl adenine(mg L-1)				Average
	0	100	150	200	
0	61.9	76.0	73.9	63.0	68.7
40	68.9	77.2	73.9	74.4	73.6
80	86.5	97.2	79.8	82.1	86.4
120	105.6	107.0	107.8	102.0	105.6
Average	80.7	89.3	83.8	80.4	

L.S.D (N)	5.31	L.S.D (BA)	N.S	L.S.D (N×BA)	N.S

Weight of 1000 Grains (g)

The results of Table 4 showed that nitrogen compost Fertilizer have a Significant effect on this characteristic, with an average of 120 kg N ha-1 (38.36 mg) and a lower average of 34.00 mg (0 kg N ha-1).

The reason may be due to the role of nitrogen in increasing the vegetable total, which in turn leads to an increase in the photosynthesis of the plant, thus shifting these products from source to endocrine and increasing the weight of the grains in it(14). This finding was consistent with the following.(15)

The results of the same table (4) indicate that the treatment was higher (200 mg L-1) than the average of 37.68 g compared with the Control treatment (0 mg L-1), which gave the lowest average (35.14 g). because of an increase in the amount of flag leaf with this treatment that helps to increase the output of the Photosynthesis of the grain and thus increase the weight of the grains.

The interaction between study factors nitrogen fertiliser and Benzyl spray led to positive results, with the combination (120 kg N ha-1 x 200 mg L-1) over the rest of the combinations and the highest average (41.49 g), while the Control (0 kg N ha-1 x 0 mg L-1) gave the lowest value in the same capacity (32.95 g).

Table 4: Effect of spraying Benzyl adenine (BA) and nitrogen fertilizer on Weight of 1,000 Grains (g)

Nitrogen (kg N ha-1)	Benzyl adenine (mg L-1)				Average
	0	100	150	200	
0	32.95	34.21	34.43	34.40	34.00
40	33.93	35.45	37.36	36.73	35.87
80	37.70	37.22	35.10	38.11	37.03
120	35.97	36.37	39.61	41.49	38.36
Average	35.14	35.81	36.62	37.68	

L.S.D (N)	1.604	L.S.D (BA)	1.125	L.S.D (N×BA)	2.357

Grains Yield (tons ha-1)

The results of Table 5 demonstrated that nitrogen compost addition has a Significant impact in this aspect, with 120 kg N ha-1 having been treated at an average of 6.270 ton ha-1 while the Control treatment (0 kg N ha-1) offered the lowest average of 3.945 ton ha-1.

The potential rationale behind the impact of nitrogen on promoting vegetable growth could be attributed to the observed improvement in yield, as well as the augmentation in grain count within the panicle and the subsequent enhancement in grain weight, which can be attributed to the supplementary nitrogen input. This is compatible with (16 and 17).

Table 5: Effect of spraying Benzyl adenine (BA) and nitrogen fertilizer on Grains Yield (tons ha-1)

Nitrogen (kg N ha-1)	Benzyl adenine (mg L-1)				Average
	0	100	150	200	
0	3.977	4.443	3.520	3.840	3.945
40	4.577	4.507	4.540	4.933	4.639
80	5.190	5.343	5.380	5.527	5.360
120	6.160	5.930	6.213	6.777	6.270
Average	4.976	5.056	4.913	5.269	
L.S.D (N)	1.1813	L.S.D (BA)	N.S	L.S.D (N×BA)	N.S

Biological yield (tons ha-1)

The results of Table 6 demonstrated that nitrogen additions have a Significant influence on this character, with a treatment of 120 kg N ha-1 with an average of 25.41 ton ha-1 whereas a treatment of 0 kg N ha-1 with a lesser average of 14.72 ton ha-1. This may be owing to the role of nitrogen in boosting green and vegetable growth, which is Agree with (18).

Table 6: Effect of spraying Benzyl adenine (BA) and nitrogen fertilizer on Biological yield (tons ha-1)

Nitrogen (kg N ha-1)	Benzyl adenine (mg L-1)				Average
	0	100	150	200	
0	15.98	16.06	13.74	13.07	14.72
40	18.76	22.44	24.00	21.48	21.67
80	22.45	22.31	23.75	23.85	23.09
120	25.86	24.30	23.93	27.55	25.41
Average	20.76	21.28	21.36	21.49	
L.S.D (N)	7.119	L.S.D (BA)	N.S	L.S.D (N×BA)	N.S

Harvest index (%)

The findings of the statistical analysis indicated that there was no Significant influence on the addition of nitrogen and the spraying of Benzyl and The interaction between study factors in the harvest index, as shown in the table(7) .

Table 7: Effect of spraying Benzyl adenine (BA) and nitrogen fertilizer on Harvest index (%)

Nitrogen (kg N ha-1)	Benzyl adenine (mg L-1)				Average
	0	100	150	200	
0	25.17	27.81	25.68	29.41	27.02
40	26.00	20.51	19.26	22.82	22.15
80	23.16	24.49	23.22	23.51	23.60
120	24.09	24.43	26.74	24.75	25.00
Average	24.60	24.31	23.73	25.12	
L.S.D (N)	N.S	L.S.D (BA)	N.S	L.S.D (N×BA)	N.S

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