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Evaluation of the performance of three barley varieties under the influence of nitrogen fertilizer

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Abstract

The study was conducted in the fields of the Department of Agricultural Research / Nineveh during the season. (2023 - 2024). Research included two factors: first: nitrogen fertilizer (fertilized, non-fertilized). Second factor: barley varieties (Rehan, Samir, Amal). The study utilized a completely randomized block design. The global experimental system with three replicates was conducted at the end of the season. The data was analyzed using the SAS program on a computer, with different averages marked with different alphabets, and the results were as follows: The nitrogen fertilizer treatment demonstrated a significant improvement over the non-fertilized. The treatment focuses on average traits. (plant height, spike length, number of spikes m⁻², weight of 1000 grains, and grain yield). The Samir barley variety was significantly superior to the rest of the varieties in terms of characteristics (plant height, 1000 grain weight, and grain yield). The interaction between nitrogen fertilizer treatment and the barley variety Samir demonstrated significant superiority in all studied traits. The aim of the research is to determine the response of the three best varieties to nitrogen fertilizer in terms of growth and productivity.

Keywords: Locations; Barley Varieties; Six-Row barley.

1. Introduction

Barley occupies fourth place after wheat, rice, and yellow corn In terms of cultivated area and global production, Iraq ranks second after wheat in terms of cultivated area and production. Barley is grown on a wide environmental scale compared to other grains, as it was found to grow in widely varying environments in geographical areas. It extends widely from the North Pole to near the equator and from sea level to an altitude of 400 meters in the Himalayas (Jabr, 1997). It is more tolerant to high temperature than wheat, as high temperature does not affect the crop (Younis et al., 1987). Barley is more resistant to drought compared to wheat or oats and is found in areas with a rainfall rate of (400-600) mm annually for the purpose of obtaining the highest limit of grain yield. Given barley's relative tolerance to drought, it can also be grown in areas with a rainfall rate ranging between (200-300 mm) annually. It is also grown in irrigated areas. Barley is also considered one of the important strategic crops. This crop is grown in numerous countries worldwide to produce grains with the aim of using it in making bread, the statement is highly concentrated fodder, or in industry. This crop is widely recognized as one of the crucial fodder crops in green fodder production (Asnawi et al., 2021). The cultivation of barley Iraq is facing numerous challenges that have The increase in yield per unit area was significantly reduced compared to the previous period, international rates, as area harvested from it annually is estimated, the area is approximately 0.13 million hectares with a productivity rate of one ton/ha⁻¹. The decline in the production rate are attributed to several the most significant factor is the deterioration of cultivated varieties due to their prolonged cultivation and failure to maintain their quality purity along with their increased sensitivity to disease (Salbi et al., 2002). One of the most important methods that help increase the productivity rate is the use of improved and newly developed varieties in Iraqi agriculture that are suitable for the environment of the region in which they are

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grown (Soleymani et al., 2011). In addition to the use of nitrogen fertilizers, Nitrogen is a crucial nutrient in fertilization programs as plants require it in higher quantities than other nutrients (Aziz and EL-Ashry, 2009), as this element participates in many vital processes within the plant is being enhanced in its tolerance to extreme environmental conditions. (Barker and Bryson, 2007). Urea fertilizer is the most widely used and highly effective nitrogen fertilizer globally due to its high nitrogen content (46%) and low production costs. (Selim et al., 2010).

2. Material and methods

The study was conducted during the winter agricultural season (2023/2024) at Rashidieh Research Station on (11/21/2023). After preparing the land for cultivation, a germination test was performed for the seeds of the three varieties that were obtained from the Rashedia Research Station, and the germination percentage was (100). %. The land was fertilized with compound fertilizer (diammonium phosphate DAP) at rate of 200 kg. ha⁻¹ In one go, research included two factors, the first was nitrogen fertilizer (fertilized and non-fertilized) and the second was three varieties of barley (Rehan, Samir, Amal). 240 kg.ha⁻¹ of nitrogen fertilizer was added. (urea 46% nitrogen) in two batches (branching and elongation stage). The experiment was conducted using a randomized complete block design (RCBD) The global experimental system is the primary method used to study and understand the world. (Al-Rawi, 2000). three replicates, each replicate included (6) experimental units, each of which had an area of (2m²), The study examined plant height, spike length, seed number, grain weight, and yield at the end of the season using SAS and Duncan's multiple range test.

3. Results and discussion

3.1. Plants height (cm)

Table (1) indicates that the results suggest that nitrogen fertilizer treatment the treatment that was Fertilized was found to be significantly more effective than the non-fertilized treatment in average plant height, with an increase rate of (10.11)%. Difference may be due to the fact that nitrogen fertilizers work to encourage an increase in the shoots, including plant height, through the role of the nitrogen element, which plays an important role in the process of cell division and thus their elongation (Hussain et al., 2006 and Hamid et al., 2017), and that the barley variety Samir The plant variety was found to be significantly superior in terms of average plant height compared to other varieties for the three varieties was (108.9, 121.4, and 115.5) cm. respectively. This could be due to the variation in genetic structure between these different varieties , which caused these differences to appear in the plant height (Al-Dulaimi et al., 2015). The interaction between fertilized treatment and barley variety Samir recorded the highest plant height, reaching (128.3) cm. Thus it was significantly superior to the lowest height was observed in all interactions. (104.6) cm in the interaction between the non-fertilized treatment and the barley variety, Reyhan. note from the table reveals a significant advantage of the fertilized treatment over non-fertilized treatment for all varieties..

Table 1 Presents the impact of nitrogen fertilizer., varieties and their interaction on plant height (cm).

Treatments		Barley varieties			Average fertilizer
		Rehan	Samir	Amal	
Nitrogen fertilizer	Fertilized	113.3 c	128.3 a	121.0 b	120.8 a
	Non- fertilized	104.6 d	114.6 c	110.0 cd	109.7 b
Average varieties		108.9 c	121.4 a	115.5 b	

The means with different letters differ from each other significantly at the 0.05 probability level

3.2. The spike length (cm)

Table (2) indicates that the nitrogen fertilization treatment significantly outperformed the non-fertilized treatment in the average spike length characteristic, as the length in the two treatments reached (8.38 , 6.77) cm . This could be attributed to the fact that nitrogen fertilizers work to encourage and increase vegetative growth, and this leads to an increase in the area of photosynthesis, which reflects positively on many growth and yield characteristics, including spike length. This result agreed with (Hamid et al., 2017). The barley variety Samir (which did not differ from the variety Amal) the statement was found to be significantly superior to the original. variety Reyhan average spike length with an increase rate of (61.29)%. This may be due to the correlation between this trait with genetic factors that differ from one

variety to another, which caused this increase. The interaction between the fertilized treatment and the barley variety Samir resulted in recording the largest spike length, which reached (10) cm, which allowed it to outperform all interactions in the average spike length, while the interaction between the non-fertilized treatment and the barley variety Reyhan achieved the lowest average spike length characteristic, which it reached(5.33cm.) .

Table 2 Presents the impact of nitrogen fertilizer., varieties and their interaction on spike length (cm)

Treatments		Barley varieties			Average fertilizer
		Rehan	Samir	Amal	
Nitrogen fertilizer	Fertilized	5.83 cd	10.00 a	9.33 a	8.38 a
	Non- fertilized	5.33 d	8.00 b	7.00 bc	6.77 b
Average varieties		5.58 b	9.00 a	8.16 a	

The means with different letters show significant differences at the 0.05 probability level.

3.3. Number grains. spike⁻¹

Although there was a significant difference in the average spike length characteristic with different nitrogen fertilization treatments (Table 2), the difference did not reach significance in the average grain number characteristic spike⁻¹ (Table 3), as the number of grains in the two treatments reached (64.77 and 62.33) grains. spike⁻¹ respectively. We note in the same table that the difference in varieties was accompanied by a difference in the average of this trait, but this difference also did not reach the point of significance, as it amounted to the number of grains. spike⁻¹ for the three varieties (63.83, 64.16, and 62.66) grain, respectively. The results of table (3) also indicate that the intervention between the nitrogen fertilization treatment and the barley variety Samir caused the largest number of grains to be produced Spike reached (67.00) grain. Spike⁻¹, the lowest number of grains per spike was achieved when interacting between the non-fertilized treatment and the barley variety Amal, as it reached (59.00) grains. Spike⁻¹, as the interaction between the two factors in factorial experiments is considered more important than the main factors involved in the experiment, regardless of their significance or non-significance (Al-Rawi, 2000).

Table 3 Presents the impact of nitrogen fertilizer., varieties and their interaction on the number of grains. Spike⁻¹

Treatments		Barley varieties			Average fertilizer
		Rehan	Samir	Amal	
Nitrogen fertilizer	Fertilized	61.00 ab	67.00 a	66.33 a	64.77 a
	Non- fertilized	66.66 a	61.33 ab	59.00 b	62.33 a
Average varieties		63.83 a	64.16 a	62.66 a	

The means with different letters show significant differences at the 0.05 probability level.

3.4. Number Spikes. m⁻²

Table (4) indicates a variation in the average characteristic of the number Spikes. m⁻² The fertilized treatment showed a significant improvement compared to the non-fertilized treatment, the nitrogen fertilized treatment demonstrated a significant improvement over the non-fertilized treatment in this characteristic with an increase rate of (60.36)%. The reason for this may be attributed to the positive effect of nitrogen fertilization on vegetative growth characteristics, which is reflected in yield characteristics, including this trait (Hamid et al., 2017). The table's results indicate that significant superiority of the two varieties Reyhan and Samir (which did not show any significant difference) over the variety Amal in the average number spikes. m⁻², as number Spikes for three varieties reached (336.3, 319.6, and 297.8) spikes. m⁻², respectively. This result was identical to what was obtained by many researchers who obtained significant differences between the barley varieties studied (Al-Obaidi, 2013). As for the interaction between the two factors, it is shown in table (4), where the interaction between the fertilization treatment and the two varieties (Rehan and Samir) achieved the highest number of ears per square meter, as the number reached (431.0 and 408.3) spikes.m⁻² was thus significantly superior to all interactions, while the interaction between the non-fertilized treatment and the Samir variety recorded the lowest number of spikes (231.0) spike. m⁻², and note from the table demonstrates a significant

superiority of the nitrogen fertilization treatment over the non-fertilized treatment under all varieties included in the study.

Table 4 Presents the impact of nitrogen fertilizer., varieties and their interaction on the number of spikes.m⁻²

Treatments		Barley varieties			Average fertilizer
		Rehan	Samir	Amal	
Nitrogen fertilizer	Fertilized	431.0 a	408.3 a	335.6 b	391.6 a
	Non- fertilized	241.6 c	231.0 c	260.0 c	244.2 b
Average varieties		336.3 a	319.6 a	297.8 b	

The means with different letters show significant differences at the 0.05 probability level.

3.5. Weight 1000 grains (g)

Results table (5) show the significant superiority of the nitrogen fertilization treatment over the non-fertilization treatment in the average weight of 1000 grains, as the difference between them reached (6.33) g. This may be due to the correlation between this trait and various growth and yield characteristics., including the length spike , number of grains spike, which caused a significant increase. The barley variety Samir demonstrated a significant improvement over the other two varieties. (Rehan , Amal) in average characteristic of weight of 1000 grains, in addition to the moral superiority of the variety Reyhan over the variety Amal in the same characteristic. This may be due to the correlation of this trait with various genetic factors between the varieties, which caused this difference in the average weight of 1000 grains (Mousavi et al., 2012). The interaction between nitrogen fertilization treatment and the barley variety Samir resulted in the highest weight of 1000 grains, as it reached (49.66) g , and thus it was significantly superior to all interactions, the interaction between the non-fertilized treatment and the barley variety Amal caused Recording the lowest weight of 1000 grain (28.66) g.

Table 5 Presents the impact of nitrogen fertilizer., varieties and their interaction on the weight of 1000 grains (g).

Treatments		Barley varieties			Average fertilizer
		Rehan	Samir	Amal	
Nitrogen fertilizer	Fertilized	43.00 b	49.66 a	41.00 b	44.55 a
	Non- fertilized	42.00 b	44.00 b	28.66 c	38.22 b
Average varieties		42.50 b	46.83 a	34.83 c	

The means with different letters show significant differences at the 0.05 probability level.

3.6. Grain yield (g⁻²)

Table (6) indicates a significant superiority of the nitrogen fertilizer treatment in the average grain yield trait over the non-fertilized treatment, with an increase rate of (69.86)%. This may be due to the correlation between this trait and various growth and yield characteristics., including spike length , number of spikes.m⁻² .This caused a significant increase in the grain yield, which is the result of the final vital activities that take place within the plant at its various stages, and which are affected by many environmental factors surrounding the plant (Al-Jader, 2024). The table results show a difference in the average grain yield characteristic for the different barley varieties included in the study, as the barley variety Samir demonstrated significant superiority over the two varieties Reyhan , Amal with an increase rate of (6.92 and 43.08)%, respectively. The Reyhan barley variety demonstrated a significant improvement over the other variety Amal in this trait, with an increase rate of (33.82)%. Reason for this may be attributed to the connection of this characteristic with the spike's length. (Table 2) and the characteristic of the number of spikes is expressed as m⁻². (Table 4). This result was identical to what was obtained by (Al-Jubouri et al., 2012 and Ahmed and Muhammad, 2012). The study indicates that the interaction between the two factors has resulted in the interaction between fertilization treatment and the barley variety Samir achieved the highest grain yield. m⁻², as it reached (609.6) g.m⁻², and The interaction was significantly superior to all others , while we note that the interaction between the non-fertilized treatment and the barley variety Amal caused the lowest yield to be recorded, which amounted to (190.6) g.m⁻².

Table 6 Presents the impact of nitrogen fertilizer., varieties and their interaction on grain yield (g.m⁻²)

Treatments		Barley varieties			Average fertilizer
		Rehan	Samir	Amal	
Nitrogen fertilizer	Fertilized	562.0 b	609.6 a	524.3 c	565.3 a
	Non- fertilized	394.6 d	413.3 d	190.6 e	332.8 b
Average varieties		478.3 b	511.4 a	357.4 c	

The means with different letters show significant differences at the 0.05 probability level.

4. Conclusion

We conclude from the results of the current study that enriched nitrogen fertilization leads to increased barley crop production compared to unfertilized fertilization, and that the Samir barley variety was more productive compared to the Amal and Rayhan varieties. The results of this study can be used by farmers to increase production by using nitrogen fertilization enriched on the Samir barley variety.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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