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Impact of different levels of seed quantities on the growth traits of six barley Hordeum vulgare L. genotypes.

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Abstract

The experiment was carried out during the agricultural season (2023-2024) in Al-Muthanna Governorate, at one of the agricultural fields belonging to a farmer, to study the effect of different levels of seed quantities on the growth and yield of six barley genotypes. The experiment included two factors, the first factor, three seed quantities (80, 100, and 120 kg/ha-1). The second factor is six types of barley: (Exad 60, Russian, G9, G8, G7, and Ibaa 265). The experiment was applied using a split-plots design, using a randomized complete block design (R.C.D.B) with three replicaties. Seed rates were set in the main plots and varieties in the sub plots. The results of the experiment showed the superiority of the genotype (Ibaa 265) in the characteristics of the tiller number (240.83 tillers), while the variety (Gzmeab) excelled in leaf area (18.01 cm2), and plant height, the two genotypes G6, G3, and G2 were superior, with averages reaching 92.19, 89.32, and 88.02 cm, respectively. The G5 genotype also recorded the highest growth rate of the crop in the elongation stage (19.18 gm/m2/day), the same genotype gave the highest average relative growth rate (0.27 gm/m2/day). The results also showed that there was a significant interaction between the two factors, as the combination (G3×100 kg/ha-1) was given the highest average for the flag leaf area (20.32 cm2). As for the number of strands, the combination S1 (G6X), giving it the highest average (272.92 tiller m-1).

Key words: seed quantities, growth traits, barley Hordeum vulgare L., genotypes.

Introduction

Barley, also known as Hordeum vulgare L., is the fourth most widely cultivated crop in the world, following wheat, rice, and maize in terms of both the quantity and the location of its cultivation. The crop is characterised by its tolerance to harsh conditions and low nutritional requirements, it has rapid growth and maturity faster than wheat, therefore, it is grown in large areas in the central and southern regions, due to the importance of the barley crop, cultivating the appropriate genetic compositions is an important factor in increasing economic production. Most breeding and improvement programs focus on developing varieties that are more genetically stable and can be adopted in agriculture [1].

The study and identification of distinct genotypes with good behavior, by a wide range of environmental variation and the extent to which specific genetic structures adapt to suitable and unsuitable environments. The ideal variety often shows low variation due to genetic-environment interference. New genotypes can be evaluated by comparing them with local varieties, in terms of its resistance to agricultural pests and different environmental conditions [2].

[3] observed during their study of two types of barley that the RD-2751 variety was significantly superior to the rest of the varieties, it gave the highest average of 691.7 tillers /m2. As [4] pointed out during his study of three barley varieties that excelled in the RD-2553 genotype, with the highest average for this trait, amounting to 111.7 tillers/ m2, compared to the other two varieties. [5] confirmed in a study of three varieties: Abu Ghraib 244 and Abu Ghraib 256, and the Samir variety is superior to the Abu Ghraib 244 variety in terms of flag leaf area, with an average of 26.62 cm2.

The number of tillers per unit area depends on the number of main branches and the number of fruitful or productive shoots per plant, The number of fruitful tillers increases as seed rates decrease, in dense crops, the percentage of fruitful seedlings decreases, but in low-density crops, 100% of the tillers are fertile and bear ears, a direct relationship between seed quantities and plant height. Seed quantities are agricultural operations that significantly influence the majority of growth characteristics, including the growth stages of the seed and the accumulation of carbon metabolism products. This impacts the quality and vitality of the seed. The significance of seed quantities in the growth and production of dry matter is that they ensure that the dry matter is evenly distributed among the parts of a single plant, thereby increasing the yield components. Furthermore, the higher the seed rate, the greater the plant height [6].

Several growth indicators and the yield of six distinct barley genotypes were the subjects of the experiment, which was carried out with the purpose of evaluating the influence that varying amounts of seed quantities had on these factors.

Methods and Materials:

The purpose of the field experiment was to investigate the impact that varying amounts of seed quantities had on the growth and yield of six different barley genotypes grown on clay soil. The experiment was undertaken out in Al-Muthanna Governorate, which is located in one of the Remember the (Table 1)

Table (1) soil study properties.

Items	Value	Unit
EC	6.2	ds. m^{-1}
pH	7	
Available nitrogen	17.7	mg kg^{-1}
Available phosphorus	28.7	
Available potassium	121.5	
Soil structure		
Sand	270	gm kg^{-1} soil
Silty	600	
Clay	130	
Soil texture	Silty loam	

The experiment included a study of two factors: The first is three quantities of seeds at a rate of (80, 100, and 120 kg ha-1), which represent (S1, S2 and S3) respectively, the second factor included six barley genotypes (Exad 60, Russian, G7, G8, G9, Ibaa 265), which represent (G1, G2, G3, G4, G5 and G6). Through the use of a split plot design with three repetitions, the experiment was carried out. The main plots consisted of the seed quantities, while the sub plots were comprised of the genetic structures. Earlier than planting, every single soil service and fertilisation was carried out successfully.

Studied traits:

1. Plant height (cm): After the plant reaches the flowering stage, plant height was measured using a metric ruler, for ten plants from each experimental unit, randomly from the soil surface level to the end of the spike without the stem.

2. The area of the flag leaf When it was at the point of complete flowering, it was measured with a ruler, and 10 plants were selected at random from the range of the centre lines for each experimental unit. The equation is as follows:

Flag leaf area = leaf length × maximum width × 0.75

3. Tillers number (m2): The tillers number from each experimental unit was calculated from the midlines at the fully mature stage and converted to a square meter basis.

4. Crop growth rate: A reading was taken from the branching stage to the elongation stage at a pace of fifty centimetres from each experimental unit. The reading was then calculated using the equation that is presented below:

CGR=(A/1)(W2-w1/t2-t1

5. Relative rate of growth: The following equation was used to get the value of the expression:

RGR=Logw2-logw1/t2-t [7]

Results and discussion

1. Plant height

Table (2) show that despite the fact that there were substantial differences between the genotypes in terms of plant height, there was no significant effect of seed amounts or interaction between the two research components on this characteristic. A considerable rise in plant height was observed for the genotypes (G6, G3, and G2), which resulted in the highest averages of 92.19, 89.32, and 88.02 cm, respectively, according to the findings. While the G4 genotype produced the smallest average plant height of 81.62 cm, it was significantly superior to the other compositions. The reason for the difference between the varieties may be due to their differences in genetic structures in terms of the length and number of the phalanges, reflected in the height of the plant. This result agreed with what was mentioned with [8] and [9], who found differences in the genetic structures of the varieties regarding plant height.

Table (2): The effect of different seed quantities and varieties and Canceled interaction between them on plant height of barley crop (cm)

Genotypes	Seed quantities			Mean
	S1	S2	S3	
G1	85.20	77.80	83.17	82.06
G2	82.23	96.43	85.40	88.02
G3	84.70	94.10	89.17	89.32
G4	80.90	84.60	79.37	81.62
G5	83.90	82.20	79.90	82.00
G6	88.43	95.80	92.33	92.19
Mean	84.23	88.49	84.89	
$L.S.D_{0.05}$	S	G	G × S	
	N.S	6.049	N.S	

2. Flag leaf area (cm2)

Table (3) shows that the G2 genotype was considerably superior to the other variations, as it produced the greatest average for this characteristic, which amounted to 18.01 cm2. This was in contrast to the G4 variety, which produced the lowest average for the flag leaf area, which was 12.95 cm2. It is possible that the genetic characteristics of each variety, as well as the characteristics of the variety's growth and its tolerance to the environmental circumstances that are present in the surrounding area, are the reasons for the differences that were seen between the varieties that were researched. This result agreed with the findings of [10], as we showed the differences between the varieties in the area of the flag leaf. There was also a significant effect of the interaction between genotypes and seed quantities. The G2 genotype with the amount of seed (100) kg ha-1, represented by the combination (G2), while the G5 genotype with the amount of seed (100 kg ha-1) represented by the combination (G5), this result agreed with what was found [11].

Table (3) Effect of seed quantities and varieties and their interactions on flag leaf area.

Genotypes	Seed quantities			Mean
	S1	S2	S3	
G1	17.43	18.52	14.44	16.80
G2	16.85	20.32	16.87	18.01
G3	10.93	17.66	15.27	14.62
G4	14.63	10.43	13.80	12.95
G5	16.75	14.19	13.05	14.66
G6	15.12	15.32	13.84	14.76
Mean	15.28	16.07	14.55	
$L.S.D_{0.05}$	S	G	G × S	
	N.S	1.347	2.775	

3. Tillers number m2

Table (4) the G6 genotype achieved the highest average for this characteristic (240.83 tillers m-2), whereas the G5 genotype recorded the lowest average (164.58 tillers m-2). This implies that genotypes have a considerable effect on the trait. The genetic nature of the variations varies in terms of their capacity to tiller, which is the basis for the differences that exist between the varieties in this particular feature. This result agreed with what was found by [12] in terms of the differences between the studied varieties in their ability to be fragmented. As for the interaction between genotypes and seed quantities, it was significant for the number of seeds. The G6 genotype outperformed the seed quantity (80 kg ha-1) represented by the combination (G6×S1) with an average of 272.92 tillers m-1.

Table (4): The effect of seed quantities and varieties and their interactions on the number of tillers.

Genotypes	Seed quantities			Mean
	S1	S2	S3	
G1	221.67	195.42	198.33	205.14
G2	201.25	231.25	258.33	230.28
G3	225.00	197.92	199.17	207.36
G4	204.17	172.92	185.83	187.64
G5	156.25	165.42	172.08	164.58
G6	272.92	245.00	204.58	240.83
Mean	213.54	201.32	203.06	
$L.S.D_{0.05}$	S	G	G × S	
	N.S	10.911	19.309	

4. Crop growth rate (gm/m^2/day):

Table (5) shows that there was a significant effect of genotypes on the crop growth rate. The G5 genotype recorded the highest growth rate of the crop from the branching stage to the elongation stage (19.18 gm/m2/day), while the G3 genotype recorded the highest rate from the elongation stage to the flowering stage (52.03 gm/m2/day), while the two genotypes G1 and G4 gave the lowest averages, reaching 10.68 and 22.79 gm/m2/day for the two stages, respectively.Table (5) showed that there were no significant differences in the amount of seeds from the branching stage to the elongation stage in the crop growth rate, while the seed quantity S3 gave the highest average of 43.01 gm/m2/day from the elongation stage to the flowering stage, compared to the amount of seed S1, S1 gave the lowest average of 32.69 g/m2/day at this stage.The interaction between the two study factors also significantly affected the crop growth rate for both stages. The combination (1G5 x S) recorded the highest average of (23.28 gm/m2/day) from the branching stage to the elongation stage, while the combination (G2 xS1) gave the lowest average (8.26 gm/m2/day) for this stage, as for the elongation stage until the flowering stage. The G2 genotype with the third level of seed quantity represented by the combination (G2 x S3) recorded the highest average of (64.24 gm/m2/day), compared to the combination (G4 x S1), which gave the lowest average of (18.63 gm/m2/day).

Table (5): Crop growth rate (CGR) (gm/m^2/day) for six barley genotypes at different growth stages according to the effect of seed quantities.

Genotypes	Branching to elongation			Mean	Elongation to flowering			Mean
	Seed quantities				Seed quantities			
	S1	S2	S3		S1	S2	S3	
G1	11.98	8.99	11.06	10.68	25.44	38.38	32.56	32.13
G2	8.26	13.78	10.20	10.75	24.61	45.79	64.24	44.88
G3	11.01	14.38	11.58	12.32	45.40	61.35	49.35	52.03
G4	9.31	8.77	14.04	10.71	18.63	21.58	28.16	22.79
G5	23.28	11.68	22.57	19.18	41.49	29.19	53.81	41.50
G6	16.73	13.59	15.62	15.31	40.58	19.75	29.95	30.09
Mean	13.43	11.87	14.18		32.69	36.01	43.01	
$L.S.D_{0.05}$	S	G	G × S		S	G	G × S	
	N.S	2.418	4.173		6.846	11.439	18.696	

5. Relative growth rate (gm/m/day):

Table (6) indicates that there were significant differences for the genotypes on the relative growth rate for the two stages (from branching to elongation) and (from elongation to flowering). The G5 genotype outperformed the rest of the varieties in the branching to elongation stage and gave an average of 0.27 gm/m2/day, while the G2 genotype gave the lowest average (0.15 gm/cm/day). As for the elongation stage until the flowering stage, the G3 genotype excelled and gave the highest average (0.18 gm/m2/day), compared to the G4 genotype, which gave the lowest average (0.09 gm/m2/day).

Table (6) shows during the transition from the branching stage to the elongation stage, the relative growth rate is significantly impacted by the quantity of seeds. The quantity of seeds exceeded 80 kg ha-1 and gave the greatest average of 0.23 gm/gm/day. On the other hand, the seed quantity of 100 kg ha-1 gave the lowest average of 0.16 gm/gm/day. Despite this, there was no significant effect of seed quantities in the stage of elongation to blooming of the plant.

Table (6) shows that there was a significant difference in the interaction between genotypes and seed quantities from the branching stage to elongation in the relative growth rate. The G5 genotype with the first level of seed quantity represented by the combination (G5 x S1) recorded the highest average of (0.36 gm/gm/day), while the G4 genotype with the second level of seed quantity represented by the combination (G4 x S2) recorded the lowest average, amounting to (0.13 gm/gm/day).

Table (6): Relative growth rate (RGR) (g/g/day) for six barley genotypes at different growth stages according to the effect of seed quantities.

Genotypes	Branching to elongation			Mean	Elongation to flowering			Mean
	Seed quantities				Seed quantities			
	S1	S2	S3		S1	S2	S3	
G1	0.20	0.16	0.14	0.17	0.11	0.14	0.11	0.12
G2	0.15	0.17	0.14	0.15	0.11	0.16	0.21	0.16
G3	0.19	0.21	0.16	0.19	0.18	0.20	0.17	0.18
G4	0.17	0.13	0.21	0.17	0.09	0.09	0.09	0.09
G5	0.36	0.14	0.31	0.27	0.11	0.11	0.15	0.12
G6	0.30	0.17	0.24	0.24	0.12	0.08	0.10	0.10
Mean	0.23	0.16	0.20		0.12	0.13	0.14	
$L.S.D_{0.05}$	S	G	G × S		S	G	G × S	
	0.021	0.028	0.047		N.S	0.043	N.S	

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