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EFFECT OF THE SPECIFIC WEIGHT OF SEEDS FROM DIFFERENT PLANTING DATES ON GROWTH AND YIELD OF FOUR CULTIVARS OF BARLEY (*HORDEUM VULGARE L.*)

Ahmed Jassim Shamkhi and Yahia K. Ghllab

Field Crops Department, Faculty of Agriculture, University of AL-Muthanna, Iraq
rizaahmed501@gmail.com

ABSTRACT

A field experiment was carried out in the Shafi'i district (10 km west of the Qadisiyah governorate center), during the winter agricultural season for the year 2019-2020, to study the effect of three specific weights of seeds which resulting from different planting dates (15.10, 01.11 and 15.11) for four cultivars of Barley (Samir and Ibaa 99, Buraq and Ibaa 265) in growth and yield, the field experiment was carried out by randomized complete block design (RCBD) for factorial experiments with three replications. The results of the field experiment showed that most of the studied traits were significantly affected by the specific weight and the cultivars as it gave the high specific weight of the seeds resulting from the third date (15.11) the highest average for flag leaf area of (31.16 cm²) and the number of spikes (332.8 spikes. m²), and the biological yield (20.91 t. ha⁻¹) and there were no significant differences between the specific weights in the weight characteristic of 1000 grains. As for the effect of the cultivars, the cultivar Ibaa 265 exceeded in most of the studied traits as it gave the highest average number of spikes (401.0 spikes. m²), and the grain yield (5.051 t. ha⁻¹), the cultivar Buraq was superior in the characteristic of plant height and 1000 grains of weight, as it gave the highest averages of (96.11 cm and 54.46 g) respectively, and the results indicated that there were significant differences between the treatments, as the interaction exceeded (Specific weight of seeds resulting from the third date x cultivar Ibaa 265) in most of the studied traits.

Keywords: seeds, planting dates, growth, barley, *Hordeum vulgare L.*

Introduction

Barley (*Hordeum vulgare L.*), one of the Poaceae family, is an important winter cereal crop cultivated in large areas in most parts of the world, and it ranks fourth after wheat, rice and yellow corn in grain production and its important uses as a fodder crop (F.A.O, 2008). Its high nutritional value characterizes barley because it contains a high percentage of protein and amino acids. It is also distinguished by its rapid growth and resistance to salinity and drought, so it is cultivated in most Iraqi provinces (Al-Baldawi *et al.*, 2014). The area planted for the year 2018 of the barley crop reached (601) thousand acres and the production of barley was (191) thousand tons, where the yield of one acre reached (317.1 kg). The Qadisiyah Governorate occupied the first place in terms of production, which was estimated at (65) thousand tons, or (33.9%) of the total production (Agricultural Statistics Directorate, 2018).

The specific weight of seeds is considered one of the quality factors for seeds, as it is related to the size and strength of the embryo and the size of carbohydrates stored in the endosperm of the seed. The greater the volume of this storage, the faster and stronger the seedlings grow and appear on the surface of the soil faster than those with less stock (Jallow *et al.*, 2009). The specific weight is one of the most determining physical properties of the quality of the grains and their suitability for processing, as it gives an initial idea of the extent to which the natural ripeness and fullness of the

grains are complete. Therefore the grains of high specific weight is preferred. It is influenced by several factors such as the degree of maturity of the grains, their water content and the degree of their infestation with insects and diseases, in addition to Due to its size and shape, the closer the seed is to the spherical shape, the higher its specific weight (Al-Masry and Al-Khayat, 1992).

The Seed vitality is an indicator for measuring specific properties of the seeds, and it is related to the ability of the seeds to produce seedlings that can emerge from the soil to form healthy, fast and regular plants. Full emergence seedlings lead to the production of a high quantity of seeds, and that the selection of seeds is one of the most basic requirements for a successful field establishment. , Since its ability to germinate and establish strong seedlings in a wide range of environmental conditions is a prerequisite for achieving high production of grain, as low-quality seeds significantly affect the failure of germination or give a non-homogeneous appearance of plants in the field because they are very sensitive to adverse conditions and stress outcome as a result of the environmental conditions surrounding these seeds (ISTA, 1987).

This study aims to know the effect of the high specific weight of seeds which resulting from different planting dates on the strength and vitality of the seeds and the production of more productive plants compared to the plants resulting from the cultivation of seeds of low specific weight.

Materials and Methods

A field experiment was carried out during the winter agricultural season 2019-2020 in Shafi'i sub-district (10 km from the center of Qadisiyah Governorate) to study the effect of the specific weight of seeds which resulting from different planting dates on the growth and yield of four cultivars of barley, which obtained from the College of Agriculture, Al-Muthanna University. The specific weight seed before planting was measured by a hectoliter device in (the General Company for Grain Trading, Diwanayah branch). The field experiment was carried out according to the design of the RCBD complete randomized sectors with three replications according to the factorial experiments; the first factor is four cultivars of barley (Samir, Ibaa 99, Buraq, Ibaa 265) which symbolled by (V), and the second factor was three specific weights and symbolized by the symbol (W), the number of experimental units was (36).

Random samples of field soil were taken from several different areas at a depth of (0-30 cm before planting). They were mixed to form a composite sample, then graded, milled, and passed through a sieve with a diameter of (2) mm holes to analyze them and know some of the physical and chemical characteristics of the field soil.

The experiment land was plowed two vertical tillage's using the tipping plow, and then smoothing and levelling operations were performed for the soil. The land was divided according to the design used into slabs with an area of 4 m² (2 m x 2 m) leaving an area (2 m) between the experimental units and space (1.5 m) between the repeaters. The quantity of seed is 120 kg. ha⁻¹ (General Authority for Agricultural Research, 2011), seeds were planted on 01.11. 2019, all test plots were fertilized at once according to the fertilizer recommendation for the barley crop.

The following characteristics were studied: plant height cm, flag leaf area cm², number of spikes m², the weight of 1000 grain g, grain yield t. ha⁻¹, and biological yield t. ha⁻¹, and the statistical analysis was conducted using the (SPSS 20) program.

Results and Discussion

Plant Height (cm)

The results of Table (1) indicated the superiority of the specific weight of the seeds which resulting from the first date ((15.10) in significance, as the highest average plant height was recorded (92.96) cm compared to the specific weight of the seeds resulting from the second date (01.11), which recorded the lowest average for the characteristic, It reached (88.69) cm, the reason may be due to the superiority date of planting, as it is an early date, as the speed of emergence and growth compared to other dates that encountered a relatively low temperature during the germination period, this result agreed with Al-Qaisi (2005).

As for the effect of the cultivars, the cultivar Buraq recorded the highest rate of plant height, which reached (96.11) cm compared to the rest of the cultivars (Samir, Ibaa 99 and Ibaa 265), which recorded the lowest average for this characteristic (93.44, 89.67 and 84.27) cm respectively, this may be due to the difference in the genetic differences between the cultivars that interaction with the environmental factors and affects the growth traits in a different way depending on the extent to which those traits are related to

the genetic factor and are affected by the environmental conditions accompanying it in its various stages of growth in plant height.

The results indicated that there is a significant interaction between the specific weight and the cultivars, as the specific weight of the seeds resulting from the first date exceeded ((15.10) for the cultivar Buraq significantly, as the highest average for the trait was recorded (99.65) cm compared to the specific weight of the seeds resulting from the second date ((01.11) For the cultivars Ibaa 265, which scored the lowest average for this trait of (82.29) cm, the reason for the superiority in this interaction may be attributed to the same reasons when discussing the results of the factors which are alone.

Table 1 : Effect of specific weight and cultivars on plant height (cm).

V	W			Mean V
	W1	W2	W3	
Samir	98.18	94.48	87.65	93.44
Ibaa 99	89.85	87.49	91.68	89.67
Buraq	99.65	90.49	98.18	96.11
Ibaa 265	84.13	82.29	86.38	84.27
Mean W	92.96	88.69	90.97	
L.S.D _{0.05}	V	W	W × V	
	2.904	2.515	5.029	

Flag leaf area (cm²)

The results of Table (2) showed that the specific weight of the seeds which resulting from the third date (15.11) was significant, as the highest average for the flag leaf area was (31.16) cm² compared to the specific weight of the seeds resulting from the first date (15.10) and the specific weight of the resulting seeds from the second date (01.11) which recorded the lowest average for this trait was (29.53 and 27.99) cm², this may be due to the superiority of the plants produced from the largest seeds (size) in the speed of their growth as well as the large size of the endosperm as the volume of food storage in the seeds of high weight level is reflected in the behavior of the plant, as it was more active, faster-growing, more elongated and cell division. This result is consistent with what Hamzah (2006) found when he found the superiority of white corn plants resulting from seeds of size (4.0-3.6) mm significantly in the average leaf area and its evidence.

As for the effect of the cultivars, the cultivar, Buraq, recorded the highest rate of the flag leaf area, which reached (30.48) cm², which did not differ significantly from the cultivar Ibaa 99, which recorded an average of (30.37) cm² compared to the rest of the cultivars (Samir and Ibaa 265) which recorded the lowest average for this trait reached (28.72 and 28.67) cm² respectively, that the reason for the difference in the cultivars between them in the flag leaf area may be due to the difference in the genetic nature of the cultivars (Al-Aseel, 1998).

The results indicated that there was a significant interaction between the specific weight and the cultivars, as the specific weight of the seeds which resulting from the first date (15.10) for the cultivar of Ibaa 265 exceeded the significant, as the highest average for this trait was (35.96) cm² compared to the specific weight of the seeds resulting

from the second date ((1.11) for the same cultivar that scored the lowest mean for the trait, which was (21.33) cm².

Table 2 : Effect of specific weight and cultivars on flag leaf area (cm²).

V	W			Mean V
	W1	W2	W3	
Samir	23.69	27.86	34.62	28.72
Ibaa 99	28.57	32.76	29.77	30.37
Buraq	29.89	30.01	31.53	30.48
Ibaa 265	35.96	21.33	28.72	28.67
Mean W	29.53	27.99	31.16	
L.S.D _{0.05}	V	W	W × V	
	1.540	1.334	2.668	

Number of spikes (m²)

The results of the analysis of variance show that there is a significant effect of the specific weight and the cultivars and the interaction between them in the number of spikes. The results of Table (3) indicated the superiority of the specific weight of the seeds which resulting from the third date ((15.11) significant, as the highest average for the number of spikes was recorded (332.8) Spikes. m² compared to the specific weight of the seeds obtained from the first date (15.10) and the specific weight of the seeds resulting from the second date (01.11) which scored the lowest averages for this trait were (269.1 and 304.6) spike. m². The reason for this may be that the filled seeds are large resulting from the third date, as well as the speed of their germination and the strength of their seedling growth. It achieved significant differences in the characteristic of the number of spikes compared with the lower specific weights.

As for the effect of the cultivars, the cultivar Ibaa 265 recorded the highest average of the number of spikes, which reached (401.0) spike. m² compared to the rest of the cultivars (Samir, Ibaa 99 and Buraq), which recorded the lowest average for this trait, which was (279.6, 275.4 and 252.6) spike. m², respectively. The results indicated that there was a significant of interaction between the specific weight and the cultivars in this characteristic, as the specific weight of the seeds which resulting from the second date exceeded (01.11) for the cultivar Ibaa 265, as the highest average for the number of spikes was (506.9) spikes. m² compared to the specific weight of the resulting seeds from the first date (15.10) for the cultivar Ibaa 99, which scored the lowest average was (211.9) spikes. m².

Table 3 : Effect of specific weight and cultivars on spikes number (spikes. m²)

V	W			Mean V
	W1	W2	W3	
Samir	246.9	231.9	360.1	279.6
Ibaa 99	211.9	244.4	370.0	275.4
Buraq	269.4	235.4	253.1	252.6
Ibaa 265	348.1	506.9	348.1	401.0
Mean W	269.1	304.6	332.8	
L.S.D _{0.05}	V	W	W × V	
	21.36	18.50	36.99	

1000 grains weight (g)

The results of the analysis of variance showed a significant effect for the cultivars and the interaction in the weight of 1000 grains, while the specific weight of the seeds

did not have a significant effect on this trait. The results of table (4) indicated that the cultivar Buraq was superior significantly, the highest average for this trait was (54.46) g, compared to the rest of the cultivars (Samir, Ibaa 99, Ibaa 265) that recorded the lowest average for this trait were (47.40, 50.83 and 46.34) g respectively, the reason for this may be due to the genetic differences for this trait (Juskiw and Anbessa, 2012).

The results indicated that there is a significant interaction between the specific weight and the cultivars in this characteristic, as the specific weight of the seeds which resulting from the third date exceeded (15.11) for the cultivar Buraq in significance, as it recorded the highest average for a 1000-grain reached (56.26) g, compared to the specific weight of the seeds resulting from the first date (15.10) for the cultivar Ibaa 265, which scored the lowest mean for this trait was (43.88) g. This may be due to the fact that the seeds that have vitality and strength subsequently result in higher grain weight, and this is consistent with what Hamzah (2006) concluded that large seeds were significantly superior to the average weight of the seed and also a significant positive correlation was found between the seed size and their resulting grain weight.

Table 4 : Effect of specific weight and cultivars on weight of 1000 grains (g).

V	W			Mean V
	W1	W2	W3	
Samir	51.10	47.13	43.98	47.40
Ibaa 99	52.63	50.77	49.09	50.83
Buraq	54.91	52.21	56.26	54.46
Ibaa 265	43.88	48.08	47.05	46.34
Mean W	50.63	49.55	49.09	
L.S.D _{0.05}	V	W	W × V	
	1.808	N.S	3.132	

Grain yield (t. ha⁻¹)

The results of the analysis of variance indicated a significant effect of the specific weight and the cultivars and the interaction between them on the characteristic of the grain yield, as the results of Table (5) indicated the superiority of the specific weight of the seeds which resulting from the second date (01.11) in significance, as the highest average for the grain yield was recorded at (4.446) t. ha⁻¹, compared to the specific weight of seeds produced from the first date (15.10) and the specific weight of seeds resulting from the third date (15.11) which gave the lowest averages for the characteristic was (3.295 and 3.977) t. ha⁻¹. As for the effect of the cultivars, the cultivar Ibaa 265 recorded the highest average of grain yield was (5,551) t. ha⁻¹ compared to the rest of the cultivars (Samir, Ibaa 99 and Buraq), which recorded the lowest averages for the characteristic (3.010, 3.862 and 3.701) t. ha⁻¹, respectively. The reason may be due to the superiority of the cultivar Ibaa 265 in the number of spikes, as it gave the highest average (Table 3) and thus led to an increase in the grain yield.

The results indicated that there was a significant interaction between the specific weight and the cultivars in this characteristic, as the specific weight of the seeds which resulting from the second date (01.11) for the cultivar Ibaa 265 exceeded significance, as the highest average for the grain yield characteristic was (6.740) t. ha⁻¹ compared to the

specific weight of the resulting seeds from the second date (01.11) for the cultivar Samir, which scored the lowest average for the trait was (2.763) t. ha⁻¹, the reason for the superiority of the interaction may be attributed to the same reasons when discussing the results of the factors which were alone.

Table 5 : Effect of specific weight and cultivars on grain yield (t. ha⁻¹)

V	W			Mean V
	W1	W2	W3	
Samir	2.793	2.763	3.473	3.010
Ibaa 99	3.223	4.823	3.540	3.862
Buraq	3.673	3.457	3.973	3.701
Ibaa 265	3.490	6.740	4.923	5.051
Mean W	3.295	4.446	3.977	
L.S.D _{0.05}	V	W	W × V	
	0.4158	0.3601	0.7202	

Biological yield (t. ha⁻¹)

The results of the analysis of variance showed a significant effect of the specific weight and the cultivars and the interaction between them on the characteristic of the biological yield. The results of Table (6) showed the superiority significant of the specific weight of the seeds, which resulting from the third date (15.11) as the highest average of the biological yield was recorded (20.91) t. ha⁻¹, which did not differ significantly from the specific weight of seeds which resulting from the first date (15.10), which gave an average of (19.74 t. ha⁻¹) compared to the specific weight of seeds produced from the second (01.11) that recorded the lowest average for this trait was (18.70) t. ha⁻¹ and this result were consistent with what Faraj (2015) found, who found a positive and significant correlation between most of the characteristics of vegetative growth and the biological yield of barley.

As for the effect of the cultivars, the cultivar Buraq recorded the highest average of biological yield, which reached (22.19) t. ha⁻¹ compared to the rest of the cultivars (Samir, Ibaa 99 and Ibaa 265), which recorded the lowest averages for the characteristic (15.86, 20.28 and 20.81) t. ha⁻¹, respectively.

The results indicated that there was a significant interaction between the specific weight and the cultivars in this characteristic, as the specific weight of the seeds which resulting from the first date (15.10) for the cultivar Ibaa 265 exceeded significance, as the highest average for the biological yield trait was recorded (23.47) t. ha⁻¹ compared to the specific weight of the seeds obtained from The second appointment (01.11) for the cultivar Samir, which scored the lowest average for this trait, was (13.57) t. ha⁻¹.

Table 6 : Effect of specific weight and cultivars on biological yield (t. ha⁻¹)

V	W			Mean V
	W1	W2	W3	
Samir	15.93	13.57	18.06	15.86
Ibaa 99	16.34	22.84	21.66	20.28
Buraq	23.21	21.29	22.07	22.19
Ibaa 265	23.47	17.11	21.85	20.81
Mean W	19.74	18.70	20.91	
L.S.D _{0.05}	V	W	W × V	
	1.870	1.620	3.239	

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