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EFFECT OF SEED QUANTITIES AND LATE PLANTING DATES ON GROWTH TRAITS OF THREE CULTIVARS OF BREAD WHEAT (*TRITICUM AESTIVUM* L.)

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Abstract

The field experiment was conducted in Al-Hashemite district, 30 km south of the center of Babylon province, during both seasons 2020-2021 and 2021-2022. In order to know the extent of the response and influence of the growth traits of three cultivars of bread wheat cultivated with three planting dates and using three quantities of seeds. The randomized complete block design (RCBD) was used with a split-split plot arrangement and with three replicates, where the cultivars (Rasheed and bohuth 22 and Babylon 113) occupied the main plots, and the planting dates (12/15, 12/25 and 1/4) occupied the secondary plots while the quantities of seeds (120, 180 and 240) kg / ha occupied the sub-sub plot. The cultivar Rashid excelled in traits of the number of days up to 50% flowering and the number of days until physiological maturity for the both study seasons, with averages of (99.19 and 99.70) days and (126.40 and 128.51) days. It also excelled in plant height and flag leaf area for the second season, with an average of (104.02) cm and (43.94) cm², respectively. The first date excelled (12/15) and recorded the highest values in all the studied traits. The amount of D1 seeds achieved the highest average number of days up to 50% flowering for the first season with an average of 95.70 days. It also recorded the highest average number of days to physiological maturity. The flag leaf area reached (124.66 and 126.44) days and (49.99 and 39.92) cm² for both seasons, respectively. While the quantity of D3 seeds excelled in the plant height trait and recorded (96.36 and 98.66) cm for the two seasons, respectively. The cultivar Rashid, grown at the first date, gave the highest mean of the traits of the number of days until physiological maturity for the first season and the flag leaf area for the second season. It recorded (132.11) days and (47.50) cm².The interaction of the first date with the amount of seed D1 in the number of days was superior to 50% flowering for the first season with an average of (99.67) days.

Keywords: seed quantities, growth, bread wheat, *Triticum aestivum* L.

Introduction

The wheat crop, *Triticum aestivum* L., is one of the most important and most cultivated and produced grain crops in the world, where its economic importance lies in the fact that it is the main food for most of the earth's population. Wheat is also a major source of carbohydrates because it contains a high percentage of starch, in addition to containing quantities of fats, vitamins, some mineral salts, and essential amino acids that humans need in their diet (Al-Younis, 1992). Because of its strategic role in achieving food security, it is considered one of the most important small grain crops in the world, which made it occupy the first place in the list of consumer food commodities, as wheat grains provide an adult with more than 25% of his protein need and more than 50% of his energy need (2013, Saudi)The variation in the genetic factors of cultivars and their interaction with environmental factors leads to differences in the extent of their response to environmental conditions and the consequent variation in the expression of their performance during the different stages of growth and their impact on yield (Mohamed, 2000).Therefore, the appropriate planting date secures the appropriate needs in terms of temperature and photoperiod for the different stages of plant growth (Refay, 2011)The seeding rates per unit area are considered one of the most important agricultural production inputs for all crops and cereals in particular, because of their close relationship with the nature of plant growth and the exploitation of the surrounding environmental factors and their repercussions on its productive capacity. The economic yield per unit area is a collection of individual plant yields that form the total plant density of the crop in the field. Optimal plant density often aims at distributing the number of plants per unit area to complete their life cycle until maturity and harvesting, which must be homogeneous in growth and give the final yield the plant density. The required must be achieved in the yield and not at the beginning of the growth of the crop, because the yield is aim (Al-Maeeni and Mohsen, 2016).The amount of seed means the number of seeds that must be distributed on a unit area to ensure obtaining the target plant density that leads us to harvest and collect the yield. Therefore, all the surrounding conditions, planting date, and field practices that accompany the process of planting crops, including the wheat crop, are what will control the amount of seed that must be distributed to unit area when cultivated. Therefore, this study came to determine the best seeding rate that can reduce the impact of the delay in the planting date, as well as the extent to which the cultivars under study respond to the late planting dates and their interacting with the seeding rates.

MATERIALS AND METHODS

A field experiment was coundected in the Hashemite district, 30 km south of the center of Babylon provainc with the aim of knowing the extent of the response and influence of the growth and yield traits, its components and the qualitative traits of three cultivars of bread wheat cultivated with three relatively late planting dates through the use of three different amounts of seed during both winter seasons (2021-202 and 2021-2022).Representative soil samples were taken at a depth of (0-30) cm for the purpose of conducting some chemical and physical analyses, as shown in Table (1.(

Table (1) Some chemical and physical properties of the experimental field soil before planting during both seasons

2022-2021	2021-2020	traits
4.82 $Ds.m^{-1}$	3.93 $Ds.m^{-1}$	EC
7.5	7.3	PH
1.7	1.4	O. M%
42 ppm	35 ppm	N
13 ppm	9.2 ppm	P
194 ppm	180 ppm	K
Soil Separates		
132 g . kg^{-1}		clay
344 g . kg^{-1}		sand

524 g . kg-¹	silt
silt loam	soil texture

experiment factors

The experiment involved studying three factors:

The first factor is the categories: it included three categories: Rushd, Research 22, and Babel 113, which are symbolized by symbols (V1, V2, and V3) respectively, and they occupied the main plots. The second factor, planting dates: three relatively late planting dates were applied (December 15, December 25, and January 4), which were symbolized by (1P, P2, and P3) in succession, and sub plots were occupied. The third factor, seeding quantities: three seeding quantities (120, 180, 240) kg / h were used, and they were symbolized by symbols (S1, S2, S3) respectively, and the most important sub plots were taken. The experiment was applied in a split split plot arrangement, according to The Randomized Complete Block Design (RCBD), with three replicates. thus the total experimental units became (3 x 3 x 3 x 3) = 81 experimental units. Land preparation and service operations were coundected, including plowing, smoothing, and leveling, and then the field land was divided according to the design used. The rest of the other crop service operations, such as irrigation, fertilization and weeding, were carried out whenever needed and according to scientific recommendations. The maximum and minimum temperatures and their averages were recorded during the two growing seasons, Table (2).

Table (2) The maximum and minimum temperatures and their averages during the two growing seasons

2022-2021			201-2020			Months
average	lower temperatures	Great temperatures	average	lower temperatures	Great temperatures	
12.54	5.51	19.57	12.97	5.82	20.12	December
9.22	1.60	16.84	11.94	3.92	19.97	January
13.93	6.17	21.69	14.27	7.36	21.19	February
15.21	6.88	23.54	17.70	9.99	25.42	March
23.44	14.40	32.49	24.70	16.11	33.30	April
25.65	17.80	33.51	30.84	20.87	40.82	Mays

studied traits

1- The number of days from cultivation to 50% flowering. 2- The number of days from cultivation to physiological maturity.

3- Plant height cm. 4- The flag leaf area. cm².

Results and discussion

1- The number of days from cultivation up to 50% flowering:

It is noted from the results in Table (3) that there is a significant effect of cultivars and cultivation dates in the cultivar and for both seasons of the study, while the effect of seed quantities and their interaction with agricultural dates was significant for the first season only, while the rest of the two- and three-way interactions were For the studied factors is not significant and for both seasons .Table (3) shows that the cultivar Rashid was significantly excelled on the two cultivars, bohuth 22 and Babylon 113, by giving it the highest average number of days to reach 50% flowering, with an average of (99.19, 99.70) days for both seasons, respectively, followed by the cultivar Research 22, with an average of (94.11 and 94.07) for both seasons, respectively and with a significant difference from the Babylon 113 cultivar, which recorded the lowest average number of days (92.37 and 92.51) days for both seasons, respectively. The difference in cultivars in this trait may be due to their genetic difference in the amount of their response to temperature and the length of the photoperiod, and that early and late flowering and other stages of crop growth are genetically determined traits. This result agreed with what was reached by (EL-Saadony, 2021), who indicated that the cultivars differ in the time required for flowering due to the different genetic factors for each cultivar. The results showed that there was a significant effect of the planting dates on this trait. Plants planted in the first date (P1) achieved the highest average number of days to reach 50% flowering, with a significant difference from the second (P2) and third (P3) dates, with an average of (99.26 and 99.48) days for both seasons, respectively .While the second date (P2) needed fewer days than the first date to reach this stage, with an average of (96.04 and 96.14) days for both seasons, respectively, which differed significantly from the third date (P3), whose plants reached 50% flowering early. It needed (90.37 and 90.66) days for both seasons, respectively. The reason for the short length of this period may be due to the last two appointments, especially the third appointment (P3).Compared to the first date, the effect of high temperatures, Table (2), and an increase in the length of the photoperiod in increasing the speed of all vital activities that take place inside the plant, which prompted it to speed up towards flowering or the reason may be due to the fact that the first date is the earliest of the dates, and thus the vegetative growth stage took a longer period and more days, and as wheat is one of the long-day plants, it does not flower until the photoperiod lengthens to a certain extent. Even for late date plants, so the number of days decreases with the late planting date. This result is consistent with what was reached by (Anjum et al., 2021), who stated that the delay in planting wheat led to a reduction in the number of days from planting to flowering due to the association of this stage with climatic factors, especially temperature and photoperiod.The effect of the seed quantities was significant for the first season only if the quantity of seed D1 recorded the highest average number of days, amounting to 95.70 days, without a significant difference for the amount of seed D2, which averaged 95.52 days, while the quantity of seed D3 recorded the lowest average for this trait, amounting to 94.44 days. This result agreed with what was obtained by (Youssef et al., 2015), who indicated that the trait of the number of days to flowering was affected significantly by the difference in seeding rates for the first season only and was not significant for the second season.There was a significant effect of the overlap between planting dates and seed quantities for the first season. Plants planted in the first date P1 with seed quantity D1 gave the highest average number of days amounted to (99, 67) days, and did not differ significantly from seed quantities D2 and D3 for the same date .In the third date, the plants took a shorter period to reach 50% flowering, and recorded the lowest average number of days in this date when the amount of D3 seeds amounted to (89.44) days. The reason for this discrepancy between the interaction factors may be due to the difference and variance of temperature and photoperiod for each of these dates and their impact on the different growth stages of the crop due to the different planting date. This result agreed with the findings of (Al-Azzawi, 2005).

Table (4) Effect of cultivars, planting dates, seed quantities and the interactions between them on the average number of days from planting up to 50% flowering for the seasons 2020-2021 and 2021-2022

2022 - 2021					2021 – 2020				
cultivar * Planting dates	**Seeding average kg/h**			**cultivar * Planting dates**	**Seeding average kg/h**			**Planting dates**	**cultivar**
V*P	D3 240	D2 180	D1 120	V*P	D3 240	D2 180	D1 120	P	V
102.88	103.00	103.00	102.66	102.44	102.33	102.67	102.33	P1 12/15	**V1 Rashid**
101.33	101.33	101.33	101.33	100.89	100.33	101.00	101.33	P2 12/25	
94.88	94.66	94.66	95.33	94.22	93.67	94.00	95.00	P3 1/4	
98.88	98.66	98.66	99.33	98.67	98.00	98.67	99.33	P1 12/15	**V2 bohuth 22**
94.44	94.00	94.33	95.00	94.44	93.67	94.67	95.00	P2 12/25	
88.88	89.00	88.66	89.00	89.22	87.67	90.67	89.33	P3 1/4	
96.66	96.66	97.00	96.33	96.67	95.67	97.00	97.33	P1 12/15	**V3 Babylon 113**
92.66	92.66	92.66	92.66	92.78	91.67	93.00	93.67	P2 12/25	
88.22	88.00	88.33	88.33	87.67	87.00	88.00	88.00	P3 1/4	
n.s	n.s			n.s	n.s			L.S.D5%	
average cultivar				**average cultivar**					
99.70	99.66	99.66	99.77	**99.19**	98.78	99.22	99.56	V1	**cultivar * seeding rate V*D**
94.07	93.88	93.88	94.44	94.11	93.11	94.67	94.56	V2	
92.51	92.44	92.66	92.44	**92.37**	91.44	92.67	93.00	V3	
0.774	n.s			1.217	n.s			L.S.D5%	

date average				**date average**					
99.48	99.44	99.55	99.44	**99.26**	98.67	99.44	99.67	P1	**Planting date * seeding average P * D**
96.14	96.00	96.11	96.33	96.04	95.22	96.22	96.67	P2	
90.66	90.55	90.55	90.88	90.37	89.44	90.89	90.78	P3	
0.968	n.s			1.128	1.310			L.S.D5%	
	95.33	95.40	95.55		94.44	95.52	95.70	**average seeding rate**	
	n.s				0.531			L.S.D5%	

2- Number of days from cultivation until physiological maturity:

The data in Table (4) indicate that the number of days from planting until physiological exudation was significantly affected by each of the cultivars, agricultural dates, and seed quantities for both seasons, and the overlap of cultivars and agricultural dates for the first season only, while the rest of the overlaps were insignificant for both seasons. The cultivars differed significantly among themselves in the number of days from cultivation to physiological maturity. The cultivar Rashid (V1) was significantly excelled on both cultivars, Bohuth 22 and Babel 113. Its plants needed more days to reach this stage, with an average of (126,407 and 128,519) days for both seasons, respectively, followed by Bohuth 22 (V2), which gave an average of (123,704 and 126,185) days for both seasons, respectively. While the cultivar Babylon113 (V3) needed fewer days to reach physiological maturity, and the lowest average for this trait was (121.33 and 123.00) days for both seasons, respectively.The reason for the discrepancy between the cultivars may be due to the different susceptibility of the genetic makeup of the cultivars in their adaptation to temperatures that excelled the optimal limit for their growth requirements, which affects the maturity of the leaves, and this effect is reflected in the variation in the length of this stage.This result agrees with what was mentioned by (Al-Ghanmi, 2021), who indicated that the genotypes of wheat differ in the length of the period from cultivation to physiological maturity. The planting dates differed significantly in the number of days needed to reach physiological maturityThe results indicate that the plants grown in the first date (P1) took more days to reach physiological .maturity and achieved the highest average of (128.88 and 131.37) days for both seasons, respectively. While the second date, P2, recorded an average of (124.77 and 126.66) days for both seasons, respectively. The reason for this difference may be due to the different temperatures and the length of the photoperiod, which affect the delay or enlargement of plants in reaching this stage. The rise in temperatures in late dates leads to the acceleration of plants in completing their life cycle and the occurrence of premature aging.This result agreed with what was mentioned by (Al-Baldawi, 2006).The result in table (4) indicates that there is a significant effect of increasing the quantities of seeds in this trait, as it was noted that the plants cultivated with high amounts of seeds have reached the stage of physiological maturity in a shorter period than those cultivated with low quantities of seeds,As the use of the amount of seed 120 kg / h (D1) led to a lengthening of the period required to reach physiological maturity, and its plants gave an average of (124.66 and 126.44) days for both seasons in succession, with a significant difference from the quantities of seeds D2 and D3, which did not differ significantly between them for the second season only, and which were reduced The period required to reach this stage, as the amount of D2 seeds gave an average of (123.70) days, while the amount of D3 seeds recorded the lowest average, amounting to (123.07) days for the first season. In the second season, they averaged (125.88 and 125.74) days, respectively. This difference may be due to the fact that increasing the amount of seed leads to increased competition for light and other growth factors by the active parts (the spike and its parts with the flag leaf), which prompts the plants to accelerate the formation of grains and maturity (Al-Habib, 2004), and this result agreed with what he found Both (AL-Haiti and Alubaidi, 2021). The interaction for each of the cultivars and planting dates had a significant effect on this trait, as the cultivar Rashid, which was grown in the first date, gave the highest average, as its plants needed to reach this stage (132.11) days, with a significant difference from all the overlaps of other varieties and dates, followed by the cultivar Bohuth 22, which was also grown in the first date. with an average of (128.22) days. It is noted from the table that this period decreased gradually with the delay of the planting date and for all the cultivars overlapping with it, down to the lowest average when the cultivar Babylon113 overlapped on the third date reached (115.44) days.The excelled of these combinations may be due to the excelled of their factors individually, which are mentioned above, for the reasons explained for each of them. This result agreed with what was reached (Shah et al., 2006).

Table (5) The effect of cultivars, planting dates, seed quantities and the interactions between them on the average Number of days from cultivation until physiological maturity for the seasons 2020-2021 and 2021-2022.

2022 - 2021					2021 – 2020				
cultivar * Planting dates	Seeding average kg/h			cultivar * Planting dates	Seeding average kg/h			Planting dates	cultivar
V*P	D3 240	D2 180	D1 120	V*P	D3 240	D2 180	D1 120	P	V
133.88	133.66	133.66	134.33	132.11	131.33	132.33	132.66	P1 12/15	V1 Rashid
129.00	129.00	128.66	129.33	126.77	126.33	126.66	127.33	P2 12/25	
122.66	122.33	122.33	123.33	120.33	119.33	120.00	121.66	P3 1/4	
131.55	131.00	131.33	132.33	128.22	127.33	127.66	129.66	P1 12/15	V2

126.88	126.66	126.66	127.33	125.33	124.66	125.33	126.00	P2 12/25	bohuth 22
120.11	120.00	120.00	120.33	117.55	117.00	117.33	118.33	P3 1/4	
128.66	128.66	128.66	128.66	126.33	126.00	126.33	126.66	P1 12/15	V3 Babylon 113
124.11	123.66	124.00	124.66	122.22	121.33	122.00	123.33	P2 12/25	
117.33	116.66	117.66	117.66	115.44	114.33	115.66	116.33	P3 1/4	
n.s	n.s			0.832	n.s			L.S.D5%	
average cultivar				average cultivar					
128.51	128.33	128.22	129.00	126.40	125.66	126.33	127.22	V1	cultivar * seeding rate V*D
126.18	125.88	126.00	126.66	123.70	123.00	123.44	124.66	V2	
123.37	123.00	123.44	123.66	121.33	120.55	121.33	122.11	V3	
1.253	n.s			0.448	n.s			L.S.D5%	
date average				date average					
131.37	131.11	131.22	131.77	128.88	128.22	128.77	129.66	P1	Planting date * seeding averag P * D
126.66	126.44	126.44	127.11	124.77	124.11	124.66	125.55	P2	
120.03	119.66	120.00	120.44	117.77	116.88	117.66	118.77	P3	
0.923	n.s			0.549	n.s			L.S.D5%	
	125.74	125.88	126.44		123.07	123.70	124.66	average seeding rate	
	0.274				0.352			L.S.D5%	

3- Plant height (cm). The data in Table (5) showed that there was a significant effect of the cultivars on trait of plant height for the second season of the study only, while the effect was significant for the planting dates and the quantities of seeds in the trait and for both seasons. The cultivar Rashid (V1) achieved the highest average plant height of 104.02 cm without a significant difference from the cultivar Babylon 113 (V3), which averaged 97.73 cm, which in turn did not differ significantly from the cultivar Bohuth 22 (V2), which recorded the lowest average of 91.22 cm. The reason may be due to the difference in genetic factors between the varieties included in the study and the difference between them in the number of nodes and the length of the phalanges, especially the upper phalanges, which are among the important characteristics in distinguishing the varieties, as well as the environmental conditions, especially the somewhat moderate temperatures during the second season compared to the first season Table (3)This result is consistent with the results of (Abozaytonh, 2020). Table (5) showed that the first planting date P1 gave the highest average plant height of (100.73 and 100.37) cm for both seasons, respectively, surpassing the second dates P2 and the third P3, as the second date P2 recorded an average of (95.33 and 97.63) cm. for the two consecutive seasons, While the third appointment, P3, gave the lowest average (88.13 and 94.98) cm for both seasons, respectively. The reason may be due to the fact that plants planted early (the first date, P1), have obtained a longer growth period as a result of the availability of environmental conditions suitable for their growth, and this was reflected positively on plant height. Also, the delay in the date of planting may lead to exposure of plants to temperatures, light intensity, and photoperiod that negatively affect plant height. Perhaps the reason is that auxin is broken down by photosynthesis, so it was not allowed to work on the elongation of the internodes, thus negatively affecting plant height (Issa, 1990). This result agrees. With the findings of (Hashem and Al-Haidari, 2012) and (Badawi, 2014). There was a significant increase in plant height by increasing the amount of seed, as the amount of seed (240 kg / h D3) achieved the highest average of (96.36 and 98.66) cm for both seasons, with an increase rate of (3.5 and 1.6)% in the first season and (2.1 and 1)%. In the second season compared to the two quantities of seeds (120 D1 and 180 D2) kg / h, which had a significant difference between them with averages of (93.02 and 94.82) cm and (96.64 and 97.68) cm for both seasons, respectively. Increasing the amount of seed means increasing the number of growing plants per unit area, which leads to intense competition between them, and then pushes the plants to elongate their stems to obtain sufficient light, and also that increasing shading between plants leads to a decrease in the ratio of red light to far red (Far Red Light)This ratio is responsible for increasing the plant's height to encourage it to produce gibberellin, which works to elongate the cells (Atiyah and Wajdou', 1999).This result is consistent with what was obtained by (Abdulkerim et al., 2015) who indicated that increasing the seeding rate leads to increased competition and shading between plants, elongation of the internodes and, as a result, plant height.

Table (6) The effect of cultivars, planting dates, seed quantities and the interactions between them on the average plant height (cm) for the seasons 2020-2021 and 2021-2022.

2022 - 2021					2021 – 2020				
cultivar * Planting dates	**Seeding average kg/h**			**cultivar * Planting dates**	**Seeding average kg/h**			**Planting dates**	**cultivar**
V*P	D3 240	D2 180	D1 120	V*P	D3 240	D2 180	D1 120	P	V

108.29	110.17	107.81	106.88	105.84	107.41	105.56	104.55	P1 12/15	**V1 Rashid**
102.97	103.82	103.42	101.67	103.77	105.79	105.07	100.46	P2 12/25	
100.81	101.64	100.79	100.01	90.56	92.48	90.96	88.23	P3 1/4	
92.96	94.14	93.14	91.61	95.61	97.00	95.71	94.12	P1 12/15	**V2 bohuth 22**
91.62	92.26	91.49	91.11	89.70	91.00	88.80	89.28	P2 12/25	
89.09	89.86	89.06	88.34	86.45	88.98	86.27	84.09	P3 1/4	
99.86	101.51	99.69	98.38	100.74	101.47	100.91	99.85	P1 12/15	**V3 Babylon 113**
98.30	98.80	98.57	97.53	92.52	93.25	92.43	91.88	P2 12/25	
95.03	95.73	95.10	94.26	87.40	89.83	87.64	84.73	P3 1/4	
n.s	n.s			n.s	n.s			L.S.D5%	
average cultivar				**average cultivar**					
104.02	105.21	104.01	102.85	100.06	101.89	100.53	97.74	V1	**cultivar * seeding rate V*D**
91.22	92.09	91.23	90.35	90.58	92.33	90.26	89.61	V2	
97.73	98.68	97.97	96.72	93.55	94.85	93.66	92.66	V3	
8.747	n.s			n.s	n.s			L.S.D5%	
date average				**date average**					
100.37	101.94	100.21	98.96	100.73	101.96	100.73	99.51	P1	**Planting date * seeding averag P * D**
97.63	98.29	97.83	96.77	95.33	96.68	95.44	93.87	P2	
94.98	95.74	94.98	94.20	88.13	90.43	88.29	85.68	P3	
2.254	n.s			3.901	n.s			L.S.D5%	
	98.66	97.68	96.64		96.36	94.82	93.02	**average seeding rate**	
	0.551				0.851			L.S.D5%	

Flag leaf area (cm2): The average leaf area was significantly affected in both seasons of the study by each of the planting dates, seed quantities and cultivars, and their interaction with agricultural dates and seed quantities for the second season only. This is according to the results presented in

Table (7).It is clear from the data in Table (7) that there is a significant effect of the cultivars in this trait for the second season only, where the cultivar Rashid excelled on the other two cultivars in terms of significance, by recording the highest average of (43.94) cm^2.While the cultivar bohuth 22 recorded the lowest average for this trait, which amounted to (37.67) cm^2, and it did not differ significantly from the cultivar Babylon 113, which averaged (38.12) cm^2.The reason for this difference between the cultivars for the second season may be due to the nature of their genetic structure and their interaction with the surrounding environmental conditions, and then their differences in growth traits, including the size of the flag leaf, as well as the suitability of average temperatures for the second season, Table (3), compared to the first season, which may have had an impact on the growth of These cultivar are better.

This result agreed with what was obtained (Al-Jubouri and Abdel-Karim, 2021). It is also clear from the data of the table that the plants of the first date (P1) were significantly excelled on the plants of the second and third dates (P2 and P3), as they recorded the highest mean leaf area of (49.92 and 41.76) cm^2 in both seasons, respectively.While the plants grown on the third date (P3) recorded the lowest mean (42.72 and 37.64) for the two seasons, respectively. The reason for the decrease in the area of the flag leaf for the late date (P3) is due to the high temperatures that lead to an increase in respiration rates and a decrease in the rate of carbon metabolism, which was negatively reflected on the vegetative traits of the plant, including the flag leaf area. This result agreed with the results of (Al-Kafa'i, 2018). The data also indicate a significant effect of the quantities of seeds in the flag leaf area, where the quantity of seeds (D1) excelled by giving the highest average of (49.99 and 42.92) cm^2 for both seasons, respectively. While the flag leaf area decreased with the amount of (D2) seeding to (45.96 and 39.17) cm 2 for the two seasons, respectively, the amount of seeding (D3) recorded the lowest average for this trait, which reached (43.13 and 36.79) cm 2 for the two seasons, respectively The reason for the decrease in the area of the flag leaf when increasing the amount of seed is due to the increase in competition between plants for growth requirements, and this competition increases with the age of the plant, whether between adjacent plants or between parts of the same plant, which caused a decrease in what is available for the processes of division and elongation, and a decrease in the requirements for building protoplasm and cell walls in new cells and the requirements for their elongation, as a result of the negative effect of increasing the quantities of seeds in the vital processes and because the plant consumes part of the energy and the available food to meet this competition instead Exploiting it for growth and this leads to a decrease in the leaf area of the plant (Laghari et al., 2011).This result agreed with the results of (EL-Hag, 2016). The overlap between cultivars and planting dates had a significant effect on the flag leaf area for the second season only, as the highest average was recorded when the interaction treatment cultivar Rashid with the first date (P1) amounted to (47.50) cm2, while the interaction of the cultivar Babylon 113 with the third date gave the lowest average amounted to (35.70) cm^2 . This result agreed with the results of (Al-Aseel et al., 2018). There was a significant effect of the interaction of each of the cultivars and the quantities of seeds for the traits of flag leaf area, were the cultivar Rashid achieved the highest average for this trait when it interaction with the amount of seeds (D1) which reached (47.85) cm ^{2} , While the two cultivars bohuth 22 and Babylon 113 did not differ significantly when they interaction with the same amount of seed (D1), and the lowest average for this trait was recorded when the cultivar Babylon 113 interaction with the amount of seed D3, with an average of (34.43) cm2. This result agreed with the results of (Badawi et al., 2014).

Table (7) The effect of cultivars, planting dates, seed quantities, and the interactions between them on the average leaf area (cm^2) for both seasons 2020-2021 and 2021-2022.

2022 - 2021					2021 – 2020				
cultivar * Planting dates	**Seeding average kg/h**			**cultivar * Planting dates**	**Seeding average kg/h**			**Planting dates**	**cultivar**
V*P	D3 240	D2 180	D1 120	V*P	D3 240	D2 180	D1 120	P	V
47.50	44.51	46.38	51.62	52.00	49.78	50.89	55.34	P1 12/15	**V1 Rashid**
43.16	40.64	41.80	47.05	49.60	46.81	48.78	53.22	P2 12/25	
41.15	38.06	40.51	44.89	44.18	40.61	44.25	47.66	P3 1/4	
39.31	35.09	39.29	42.88	50.12	44.66	50.80	54.89	P1 12/15	**V2 bohuth 22**
38.99	36.47	38.99	41.53	45.50	42.16	45.42	48.92	P2 12/25	
36.07	33.10	36.25	38.86	43.28	40.54	42.40	46.92	P3 1/4	
38.47	34.93	38.91	41.56	47.63	43.98	48.28	50.63	P1 12/15	**V3 Babylon 113**
38.83	35.17	40.38	40.93	45.13	41.84	45.50	48.07	P2 12/25	
35.70	33.19	36.28	37.63	40.69	37.79	39.97	44.30	P3 1/4	
2.492	n.s			n.s	n.s			L.S.D5%	
average cultivar				**average cultivar**					
43.94	41.07	42.90	47.85	48.59	45.73	47.98	52.07	V1	**cultivar * seeding rate V*D**
38.12	34.88	38.40	41.09	46.30	42.45	46.20	50.24	V2	
37.67	34.43	38.53	40.04	44.48	41.21	44.58	47.66	V3	
2.312	2.289			n.s	n.s			L.S.D5%	
date average				**date average**					
41.76	38.18	41.75	45.35	49.92	46.12	49.99	53.62	P1	**Planting date * seeding averag P * D**
40.33	37.43	40.39	43.17	46.74	43.60	46.57	50.06	P2	
37.64	34.78	37.68	40.46	42.72	39.65	42.21	46.29	P3	
1.182	n.s			2.246	n.s			L.S.D5%	
	36.79	39.94	42.99		43.13	46.25	49.99	**average seeding rate**	

	0.761		0.896	L.S.D5%

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