Plant Archives Vol. 20, Supplement 2, 2020 pp. 990-995 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

RESPONSE OF FIVE BREAD WHEAT CULTIVARS TO LATE PLANTING CONDITIONS UNDER MIDDLE REGION OF IRAQ

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Abstract

A field experiment was carried out in two seasons 2014-2015 and 2015-2016 at the field farm, Al-Mouradia Station, Ministry of Agriculture, Babil, Iraq at latitude 32◦ 31N and length 44 21E above sea level under irrigated conditions to know the response of several varieties of wheat under different Late planting dates. Use a randomized complete sectional design in the arrangement of breakout boards with three replications. The cultivation dates (December 15, December 22 and December 30) occupied the main panels while the categories (Rashid, APA-99, Abugraib-3, Latifya and Cham-6) occupied the secondary plates, the results showed superiority (D1) in most characteristics The study gave the best height of 85.53 and 85.79 cm, the flag leaf area 40.97 and 40.95 cm^2, the chlorophyll content 40.83 and 41.29 SPAD, the length of spike 11.90 and 12.57 cm, the number of spikes 446.9 and 447.9 spike M^2, the number of grains 34.21 and 34.39 grains, and the grain yield of 4.72 and 4.69 tons.$^{-1}$ for the two seasons in succession, while the Rashid category exceeded flag leaf area 40.61 and 41.19 cm^2, the content of chlorophyll 40.83 and 41.29 SPAD, the length of the spike 12.07 and 12.34 cm, the number of spikes 453.8 and 458.6 spike.m^2 and the number 33.90 and 34.39 grains and 4.56 and 4.51 tons.h^{-1} for the two seasons in succession. Interference between cultivation dates and varieties had a significant effect on trait characteristics, as (D1) of the Rashid variety gave the best yield of 5.57 and 5.56 tons.h^{-1} for the first date and the same variety did not differ from (D2) while the (D1) of the cultivar showed the lowest average of 1.53 tons.h^{-1} for the first season and class Iba-99 in the second season amounted to 1.83 tons.h^{-1}. Through the results, we note that delaying the date of planting leads to a 16% decrease in yields for each week of delay.

***Keywords*:** Bread wheat, late planting, middle region of Iraq

Introduction

Wheat is an important cereal crop in Iraq and the world. It is grown under wide variation in environmental conditions among and within the season, this one of the most important constraints affecting yield potential (Murung and Madanzi, 2010). A lot of states including Iraq to achieve at least their self-sufficiency in food grain instead of imported it by increasing production vertical and horizontal and therefore should be adjusted the inputs management practices (Anderson and Garlinge, 2000).

The key to maximizing wheat yields can be achieved in tow related decisions selected the appropriate cultivar and planting it at the appropriate time to meet optimal germination, emergency, establishment, growth, development, tillering capacity and number of fertile tillers (Shirinzade *et al*., 2017; El- Nakhlawy *et al*., 2015; Ortiz *et al*., 2012).

The optimal planting date of wheat in the middle and south regions of Iraq is from 15th November to 15th December (Mohammed, 2000). Sometimes the growers have to wait because rainfall happened in this duration and the land becomes excessively moist on what causes abstract cultivation practices so that the soil gets proper moisture suitable for machine movement. Another major reason is the water scarcity leading to the allocation of irrigation water spaced intervals, in these cases. the farmers have to suffer yield losses due to delay sowing after 15th December (El-yuonis, 1993).

The seasonal sequences of conditions plant that associated with planting date a major role in determining the effect of source-sinking manipulation on yield components and photosynthetic characteristic of wheat cultivars (Bijanzadah and Eman, 2010).

The optimum planting date of the chosen right variety plays a vital role in manipulating source and sink relationships which is the most important subject in plant physiology (Venkateswarlu and Visperas, 1978). More changes in planting date of wheat change wheat yield through the number of tillers and spikes and spike growth (Bassu *et al*., 2010).

Delayed sowing puts adverse effect concerning growth characteristics and physiological process of tested varieties like Crop Growth Rate (CGR), Net Assimilation Rate (NAR), Leaf Area Index (LAI) and growing degree days and photothermal units but the intensity varied among varieties (Ahmed and Farooq, 2013).

Delay in wheat planting can by decrease wheat yield due reduction in days to heading and maturity, plant height, tillers per plant and spike length; It concluded that wheat grow yield and yield component of genotypes were affected significantly by late sowing some of its had better response compared to the others (Khokhar *et al*., 2010).

This study aims to investigate how bread wheat cultivars responded to late planting dates on growth and yield of five bread wheat cultivars under the conditions of the central region of Iraq.

Materials and Methods

Field experiments were carried out during two seasons 2012-2013 and 2013-2014 at experimental farm, Almoradya station, Agricultural research state ministry of Agriculture, Babylon, Iraq on latitude 32◦ 31N longitude 44 21E and 35m above sea level under irrigated conditions. The soil in the field area was a silt clay loam. The zone is arid to semi-arid

with maximum and mean temperature of co and co during winter the annual rainfall range from 90 to 240 mm with relative humidity ranging from 16% to 50% (Table 1).

Table 1 : Some of soil property for field of study

Property	Value	Units
Bulk density	1.24	Mg m^{-3}
Clay	348	g kg^{-1}
EC	3.61	ds m^{-1}
K available	89.53	mg kg^{-1}
N available	29.11	mg kg^{-1}
Organic matter	3.63	g kg^{-1}
P available	8.79	mg kg^{-1}
pH	7.4	-
Sand	**187**	g kg^{-1}
Silt	**465**	g kg^{-1}
Soil texture	Silt clay loam	

The land was prepared with two plowing harrowing and leveling operations, 150kg DAP (18:46:0) buried per sowing. and remaining dose of 125N ha^{-1} was applied in two-time applications the first at tillering (GSZ25) and the second at elongation GSZ38. The experiment designed as RCBD with split plot arrangement having three replications, the sub plot area was 3m× 4m three planting dates i.e. December 15, December 22 and December 30. were applied in main plots, were as five bread wheat cultivars (Rashid, Iba-99, Abu graib -3, Latifya and Cham - 6) were in sub - plots. Sowing was done at seed rate of 140 kg ha^{-1} with 15cm inter-row spacing. Weeding is done by hand and irrigation scheduling was managed to soil moisture content. The studied parameters including plant height , flag leaf area and it's dry weight, chlorophyll content, number of tillers per m^{-2}, number of spike, number of spikelet per spike, spike length (cm), dry weight of stems, leaves and spikes, number of grains per spike, 1000 grains weight (g), grain yield, biological yield and harvest index.

Agronomic Measurements

Ten plants were selected from base to top of spike with meter rod at maturity time from each plot to measure the plant height. The mean values of 10 plants for each plot were determined. A SPAD chlorophyll meter from Minolta (Model 502, Minolta, Ramsey, NJ). was used to measure ten flag leaf Chl A concentration for each subplot (Monje and Bugbee, 1992). Flag leaf area for ten plants were measured according to follow equation (Thomson, 1975)

$$\text{Flag leaf Area} = \text{Length(cm)} \times \text{Width(cm)} \times 0.95$$

At full maturity. three central rows were harvested for each subplot to calculate total above – ground biomass. Spike length the number of spikes. were recorded. The spikes were threshed by hand and grains of each subplot was weighed to calculate grain yield. The thousand – grain weight was obtained by counting out 1000 grains in each subplot with a grain counter and weighing them.

Statistical Analysis

Data were analyzed by using statistical software GenStat and means were tested using LSD on $\geq$ 0.05 probability.

Results and Discussion

Plant height (cm)

The results of Table (2) showed a significant effect of planting dates on plant height and the best average record at (D1) was 85.53 and 85.79 cm and differed significantly from the rest of the planting dates for both seasons in succession, as the same table showed that the Cham-6 variety gave the highest height of 83.14 and 83.81 cm and did not differ significantly from cultivar Latifya and Abu Ghraib-3 for the two seasons sequentially, while Iba-99 gave the lowest mean of 70.50 and 71.82 cm in the two seasons. As for the overlap, it gave Cham-6 at (D1) the highest average of 91.65 and 91.60 cm. It differs significantly with Latifya cultivar for the same appointment, and for both seasons respectively. The height of the crop is greatly controlled by the genetic makeup that is strongly associated with this trait of the variety. This is the reason for the difference between the study varieties in this trait and this is confirmed by Al-Baldawi, (2006). There is also an effect of environmental conditions, the most important of which are ideal thermal conditions that encourage the growth and division of plant cells and consequently elongation. Salami is greater and this increases the height of the plant and this is what Rakeshkumar Sharma (2003) and Asseel *et al*. (2018) indicated that the ideal time for planting is better than the late dates in plant height. Also, the different taxa in this trait are due to Javid Iqbal and others 2012.

The flag leaf area cm^2

The results of Table (2) show that (D1) recorded the highest flag leaf area in the two seasons amounted to 40.97 and 40.95 cm^2 respectively, and differed significantly from the rest of the varieties in both seasons, while (D3) recorded the lowest average of the two seasons of 31.04 and 30.88 cm^2 in succession, and the overlap has achieved The cultivar Rashid at (D1), the best flag leaf area reached 45.17 and 46.17 cm^2 for the two seasons in succession that the reason for the decrease in the leafy area in (D3) is the high temperature in the critical period of vegetative growth and thus increased stress and increased breathing and this is reflected in the paper area in general and the science paper in the form Especially this is consistent with Al-Hassan, (2007) and between the same table that the category Rashid gave the highest area 40.61 and 41.19 cm^2 did not differ significantly from class Iba-99 and in the two seasons respectively and with the same response, the reaction was to this characteristic, as the cultivar Rashid in (D1) gave the best area of 45.17 and 46.17 cm^2 in the two seasons in succession. Also, the different varieties in the flag leaf area due to the difference in the genetic makeup in addition to the conditions that are ideal for dividing and elongating the cells of the science paper and this is what is reached by the mechanism (Al-Asil, 1998).

Chlorophyll content (SPAD)

The date of cultivation had a significant effect on this trait, as Table (2) indicated that (D1) scored the highest chlorophyll content 40.83 and 41.29 SPAD and did not differ significantly from (D2) while (D3) gave the lowest chlorophyll content 31.33 and 30.93 SPAD and in the two seasons respectively In the same table, it was found that the Rashid cultivar gave the highest chlorophyll content 40.80 and 40.69 SPAD and did not differ significantly with Iba-99

and Abugraib-3 while the Cham-6 cultivar gave the lowest chlorophyll content of 33.70 and 33.92 SPAD for both seasons respectively. While the category Rashid surpassed (D1) in this trait and gave 45.47 and 46.80 SPAD and did not differ significantly with Iba-99 class for the same dates due to low chlorophyll content due to not having enough time for each stage of vegetative growth necessary to increase photosynthesis efficiency and net increase The inaccessible representation which forces the varieties to complete the growth period early and this affects the efficiency of green tissues on the production of chlorophyll that affects the metabolism of the metabolic resources to the estuaries (pills) Dhyani *et al.* (2013) and Hassanein *et al*. (2012) and the difference between the varieties between them In the content of chlorophyll is due to the difference in Genotype This is what he found (Gutierre *et al*., 2010).

Spike length (cm)

The results of Table (2) indicate a gradual decrease in the length of the spike by delaying the date of planting, as it showed that (D1) gave the highest length of spike 11.90 and 12.57 cm and did not differ significantly from (D2) and in both seasons sequentially and the reason is the short period between the two dates which did not affect a significant moral On supplying the spike with the necessary metabolic materials, while (D3) gave the lowest average length of the spike 6.35 and 6.46 cm for the two seasons in succession, the Rashid category also gave the best length of 12.07 and 12.34 cm. 99 The lowest mean spike length was 7.96 and 8.64 cm in the two seasons, respectively. As for the interference, the variety Rashid at (D1) gave the best spike length 14.80 and 16.13 cm and did not differ significantly from (D2) for the same variety. The reason for forming the best spike length in (D1) is the optimal conditions for the climate in the emergence and development of spikelets and thus their number and taking Sufficient time to produce dry matter, which ultimately is reflected along its length by Shirpukurkar *et al*. (2008), and the reason for short spike in (D3) is the variation of temperature in the expulsion phase of the spikes and thus reduced the number of days of this stage (Baldawi, 2006 and Farooq *et al*., 2018)

Table 2 : Effect of Planting date on plant height, Flag Leaf area, Chlorophyll content and Spike Length of wheat cultivars.

Spike Length (cm)		Chlorophyll content (SPAD)		Flag Leaf area (cm^{-2})		Plant Height (cm)		Cultivars	Planting date
S2	S1	S2	S1	S2	S1	S2	S1		
16.13	14.80	46.80	45.47	46.17	45.17	84.02	83.36	Rashid	D1
10.38	9.78	44.67	43.33	42.67	34.33	79.48	78.48	Iba-99	
11.75	12.26	39.60	40.27	39.47	40.13	85.81	85.48	Abugraib– 3	
13.22	12.55	37.37	38.03	40.27	39.27	88.00	88.67	Latifya	
11.37	10.11	38.03	37.03	36.17	36.93	91.65	91.65	Cham-6	
12.79	12.79	42.03	43.03	40.80	41.40	75.26	75.92	Rashid	D2
10.27	9.27	40.60	39.60	39.53	40.53	71.38	70.38	Iba-99	
12.04	11.38	36.20	37.53	35.57	36.23	78.04	78.38	Abugraib–3	
11.85	11.95	34.67	36.00	36.63	35.97	82.25	81.92	Latifya	
10.17	9.47	35.90	34.90	33.37	33.03	85.22	84.55	Cham-6	
8.09	8.63	33.23	33.90	36.60	35.27	68.92	66.92	Rashid	D3
5.26	4.83	30.67	31.67	34.40	33.73	62.98	62.64	Iba-99	
6.98	6.38	31.60	31.27	30.43	31.10	69.38	68.04	Abugraib– 3	
7.43	6.76	31.30	30.63	28.77	29.77	72.02	71.02	Latifya	
4.54	5.14	27.83	29.17	24.20	25.33	74.55	73.22	Cham-6	
								LSD 0.05	
12.57	11.90	41.29	40.83	40.95	40.97	85.79	85.53	D1	
11.42	10.97	37.88	38.21	37.18	37.43	78.43	78.23	D2	
6.46	6.35	30.93	31.33	30.88	31.02	69.57	68.37	D3	
								LSD 0.05	
12.34	12.07	40.69	40.80	41.19	40.61	76.07	75.40	Rashid	
8.64	7.96	38.64	38.20	38.87	39.20	71.28	70.50	Iba-99	
10.26	10.01	35.80	36.36	35.16	35.82	77.74	77.30	Abugraib– 3	
10.83	10.42	34.44	34.89	35.22	35.00	80.76	80.54	Latifya	
8.69	8.24	33.92	33.70	31.24	31.77	83.81	83.14	Cham-6	
								LSD 0.05	

S1: Season 2012/2013 , S2: Season 2013/2014
Dates of planting (D): D1: December 15, D2: December 22, D3: December 30

Number of spikes m^2

Late planting dates significantly affected the number of spikes. As shown in Table (3), (D1) achieved the highest average number of spikes, amounting to 446.9 and 447.9 spike.m^2 for the two seasons in succession and differed significantly from the other dates, while (D3) gave the lowest average of 363.3 and 378.1 spike.m^2 for the two seasons in a row, and from the same table, we note that the Rashid category gave the best average for this quality 453.8 and 458.6 spike.m^2 and did not differ significantly from cultivar Abu Ghraib-3, while cultivar gave APA-99 the lowest mean

367.1 and 370.4 spike.m^2 for two seasons in succession. The interference between the class Rashid at (D1) gave the best number of spikes 484.3 and 490.3 spike.m^2 for the two seasons in succession, the reason for the decrease in the number of spikes is attributed to the decrease in the number of days needed for the reproductive total and thus the short period required to supply the components of the crop, including the number of spikes with metabolic materials to reach an ideal outcome and the decrease, death or incomplete growth of the branches may be a reason for the small number of spikes Mechanism (Al-Baldawi, 2006 and Asseel 2018).

The number of grains spike

The results of Table (3) show that (D1) achieved the highest number of pills per spike was 34.21 and 34.39 pills and for the two seasons in succession and differed significantly from other dates while (D3) gave the lowest average number of pills per spike 26.11 and 26.37 pills for the two seasons in succession that exceeded (D1) in The number of grains is due to its superiority in the length of the spike (Table 2), and the suitability of environmental conditions has increased the growth, development and emergence of spikelets, and may be due to the high temperature during the period of fullness of the grain, which affects the intensity and rate of fullness, and this is reflected in the number of grains, which Hashem found, (2011) It was reached by EL-Sarag and others (2013), as the same table indicated that the Rashid category exceeded the rest of the cultivar and in the two seasons and gave 3 3.90 and 34.39 sequentially, while the Cham-6 cultivar gave the lowest mean, and for both seasons, with an average of 28.36 and 28.12 in succession, as the interference between (D1) of the Rashid cultivar yielded the best number of pills 37.10 and 36.57 tablets. Among them in the number of grains is due to the genetic variation between the varieties and this is confirmed by (Malik and others 2009 and Farooq and others 2018).

Weight of 1000 seed (g)

The results of Table (3) shows that absence of significant differences between the three cultivation dates and the two seasons respectively, as the results of the same table indicate the absence of significant differences between the varieties in weight of 1000 seed and in the two seasons respectively. While the overlap between the date of cultivation and cultivars was significant, despite varying rates, if the Iba-99 variety was given in (D2) and the first was the best weight for the pill reached 35.20 and 33.20 g. The low number and number of spikes, as the lack of these components makes it easier for the crop to be compensated by converting its resources into less grains and thus increasing their weight. These results are consistent with El-sarag (and Ismaeil 2015). Also, some varieties have shown a lesser impact on the weight of the pill and this is due to the strong relationship of this trait to genetic makeup (Ortiz *et al*., 2012).

Grain yield tons.h^{-1}

It is noted from the averages of Table (3) that there is a decrease in the Grain yield whenever the date of planting is later than the ideal date if (D1) gives the best cereal yield with an average of 4.72 and 4.69 tons.h^{-1} for the two seasons in succession and differed significantly from the rest of the dates while the lowest Grain yield was in (D3) reached 2.03 and 2.13 tons.h^{-1} for the two seasons respectively, as the results of the same table shows that there was a significant differences between the cultivars in the Grain yield, as the Rashid category outperformed by giving it the highest average of 4.56 and 4.51 tons.h^{-1} for the two seasons in succession, while the Cham-6 category gave the lowest mean for the two seasons. 2.99 and 3.03 sequentially. As for the interference, the Rashid class was given in (D1) and the second highest mean average of 5.57, 5.56, 5.08 and 4.95 tons.h^{-1} for the first and second dates and in the two seasons respectively. The difference of the yield according to the date of cultivation is due to a change in the characteristics of growth and the yield and under the components as (D3) the yield decreased significantly due to a decrease in the height of the plant and the area of the science leaf and the content of chlorophyll and the length of the spike and the components of the yield as (D3) occurred in the rise in temperature at the time of fertilization causing Miscarriage of a large number of ovaries and the death of pollen, and this reflected negatively on the final quotient and the reason may be the decrease in the yield to high temperature during the filling of the pill and its relationship to the transport of nutrients and the work of enzymes Kumar and others (2013) and the reason may be the decrease in daily temperatures GDD And the thermal photovoltaic units (PTU), which accelerate the physiological development of the crop and reduce the yield of wheat (Amrawat et al. (2013), and the difference of varieties for late or early planting dates is due to their ability to adapt to the variation in temperature and climate prevailing at the study site and during the fertilization and fertilization period, and this is how it works) Others 2010 and Farooq *et al*., 2018).

Table 3 : Effect of Planting date on 1000-grain weight, No.of spike per (m^{-2}),grain yield, No.of grain per spike, and of wheat cultivars.

Grain yield (ton.ha^{-1})		1000-grain weight (g)		No.of grain per spike		No.of spike per (m^{-2})		Cultivars	Planting date
S2	S1	S2	S1	S2	S1	S2	S1		
5.56	5.57	31.83	31.57	36.57	37.10	490.3	484.3	Rashid	D1
4.63	4.41	35.20	33.20	33.73	33.67	416.0	403.3	Iba-99	
4.39	4.67	31.37	31.03	34.07	33.13	448.7	463.0	Abugraib– 3	
4.64	4.78	32.73	31.23	34.13	34.47	438.0	453.3	Latifya	
4.21	4.15	30.87	30.20	33.43	32.70	446.7	430.7	Cham-6	
4.95	5.08	32.33	32.33	36.17	34.83	448.7	460.0	Rashid	D2
4.14	4.02	34.13	33.63	33.97	32.30	383.0	373.3	Iba-99	
3.90	3.94	30.37	30.17	29.20	30.20	435.7	441.3	Abugraib–3	
3.95	3.93	31.07	30.63	31.83	30.60	422.0	429.0	Latifya	
3.33	3.29	30.23	29.30	27.97	28.43	396.3	404.7	Cham-6	

3.03	3.02	28.47	29.77	30.43	29.77	436.7	417.0	Rashid	D3
1.83	1.84	30.03	29.03	27.23	26.97	312.3	324.7	Iba-99	
2.28	2.21	29.03	29.43	24.87	24.20	426.7	408.3	Abugraib– 3	
1.95	1.55	27.10	27.43	26.33	25.67	375.7	317.0	Latifya	
1.55	1.53	27.30	25.97	22.97	23.93	339.0	349.3	Cham-6	
								LSD 0.05	
4.69	4.72	32.40	31.45	34.39	34.41	447.9	446.9	D1	
4.06	4.05	31.63	31.21	31.83	31.27	417.1	421.7	D2	
2.13	2.03	28.39	28.33	26.37	26.11	378.1	363.3	D3	
								LSD 0.05	
4.51	4.56	30.88	31.22	34.39	33.93	458.6	453.8	Rashid	
3.54	3.42	33.12	31.96	31.64	30.98	370.4	367.1	Iba-99	
3.52	3.61	30.26	30.21	29.38	29.18	437.0	437.6	Abugraib– 3	
3.51	3.42	30.30	29.77	30.77	30.24	411.9	399.8	Latifya	
3.03	2.99	29.47	28.94	28.12	28.36	394.0	394.9	Cham-6	
								LSD 0.05	

S1: Season 2012/2013 , S2: Season 2013/2014
Dates of planting (D): D1: December 15 , D2: December 22 , D3: December 30

Conclusion

Finding adaptive varieties for planting at late planting dates and changing the theory that all varieties have the same productivity and can be grown at any agricultural date, as short-lived varieties must be cultivated to suit the late planting date, as we concluded that the date of planting (D1) was the best in most of the growth characteristics As the cultivar Rashid was the highest in terms of the aggregate and its components, therefore we recommend cultivation on time (D1) and for the cultivar Rashid.

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