# Season Response of Bread Wheat Cultivars (Triticum Aestivum L.) to Different Planting Dates Under Samawa Desert Condition

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## Abstract

A field experiment was carried out in Samawa desert (70 km west of Samawa city, Al-Muthanna governorate), during the 2018-2019 and 2019-2020 agricultural seasons, to study the response of three Iraqi cultivars of wheat (Tamooz2, Ibaa99, Abu Ghraib3) to three planting dates (November 15, 1st December and December 15) under Samawa desert conditions. The results showed the superiority of Tamooz2 cultivar in all traits of the yield components, it gave the highest averages of grain yield, which amounted 5.75 and 5.89 tons/ha$^{-1}$, weight of 1000 grains, which amounted 29.79 and 31.06 gm, and the number of grains per spike, which amounted 73.02 and 73.76 for the 2019 and 2019-2020 seasons, respectively. The date of December 15th also surpassed in the traits of grain yield, weight of 1000 grains, number of spike grains, and the highest grain yield reached 5.62 and 5.58 tons/ha$^{-1}$ for the two seasons 2018-2019 and 2019-2020, respectively, and the combination (Tamooz 2 x December 15) gave superiority over the other combinations in terms of grain yield which amounted 6.05 tons ha$^{-1}$ (2018-2019 season) and Ibaa99 × December 1 gave the highest grian yield about 6.10 tons $^{ha-1}$ (2019-2020 season).

Key word: Wheat, Planting dates, Samawa desert, Yield components.

## 1. Introduction

Wheat crops (*Triticum aestivum* L.) is one of the most important and most productive cereal crops in most countries of the world, therefore, plant breeders seek to create and develop Cultivars of wheat that are characterized by high production, good quality and are suitable for the different environmental conditions, which have a significant impact on the quantitative traits [1]. The wheat crop suffers from low production in Iraq, especially in Al-Muthanna Governorate, Its average production is 89,309 tons per year, which is low compared to the other governorates, which hinders the achievement of self-sufficiency [2] The date of planting is of great importance factor to determine the appropriate environmental conditions for plant growth, such as temperature, lighting duration, humidity, as the nature of growth and flowering is affected by the environmental factors surrounding the plant, which affects its growth and consequently the quantity and quality of the yield, which affects the date and duration of vegetative and reproductive growth[3] and positively on grain yield and bread quality, because it contributes to a better adjustment of functions and environmental conditions [4] as the date of planting and the accompanying conditions environmental influence on flowering growth, because these factors affect the biosynthesis of hormones and the speed of their transition from leaves to the flowering meristem. The three cultivars responded differently to the four planting dates, the planting date (November 30) achieved the highest grain yield (2.629 tons/ha$^{-1}$) for the Iraqi cultivar Bohouth22 [5]. [6] indicated that the traits of vegetative growth were significantly affected by planting dates, as the cultivar Ibaa99 was superior in the traits of plant height, number of tillers and spike length over on the other cultivars.
Several studies indicated a decrease in the number of grains in the spike, the quantity of yield and the qualitative traits of several Cultivars of wheat when planting was delayed [7]. Cultivars differed in growth traits and yield according to their genetic structures, as the results of [8], showed the difference in genotypes in vegetative growth traits and yield components, spring wheat cultivars and late dates are superior in plant height, number of tillers/plant$^{-1}$, flag leaf area , spike length, weight of 1000 grain, number of grains per spike, and grains yield. [9] indicated the influence of planting date and the genotypes used on all vegetative growth traits and yield traits, the results of the study conducted by[10,11] showed that there is an effect of the late planting date on the grains spike$^{-1}$, 1000-grain weight, and therefore the grain yield. It was found [12] that the normal cultivation history gave the highest yields of grain.

The results of [13] when sowing wheat seeds on November 20 in both seasons showed the highest grain yield (7752.5, 6970 kg $ha^{-1}$) respectively, while the lowest yield was observed in the late sowing The date, 20 December. Because of the lack of studies and research related to this crop in the conditions of Al-Muthanna Governorate, this study aimed to find out the effect of three planting dates on the growth and yield of wheat under the conditions of the Samawa desert region.

## 2. Material and Methods

### *2.1. Experimental location and Soil properties*

A field experiment was carried out in Samawa desert (70 km west of Samawah city, Al-Muthanna governorate) during the two seasons 2018/2019 and 2019/2020, in the sandy soil which its properties are shown in the table No. (1).

### *2.2. Experimental Design and Treatments*

In order to study the effect of three planting dates (November15, 1st December, and December 15) on the growth of The yield of three Cultivars of wheat are Tamooz2, Ibaa99 and Abu Ghraib3 (obtained from the General Directorate for Agricultural Research-Baghdad). The experiment was applied in the manner of factorial experiments using the randomized complete block design (R.C.B.D) and with three replications, after preparing the experiment soil and dividing it according to the design used.

### *2.3. Field Operations*

The seeds of three cultivars were planted in the experimental plots that each included eight lines, each line 2.5 meters long and the distance between one line and another 25 cm and between one plant and another 10 cm , 100 kg/ha of seeds was used, and fertilized the land with super calcium phosphate (45%$P_2O_5$) at a rate of 100 kg/ha, then added at once when planting, and urea (46% N) fertilizer at a rate of 400 kg/ha, and it was added three times, the first at planting and the second after 45 days from planting and the third at the stage of expulsion of the spikes [14]. soil and crop servicing operations were conducted during the growing season as needed.

### *2.4. Studied traits*

All data obtained from ten plants were randomly selected from the middle lines of each experimental unit, and the following traits were measured: Plant height (cm), number of tillers/ $plant^{-1}$, flag leaf area($cm^2$) according to the following equation (leaf area = leaf length x width x 0.74) [15]. spike length (cm), number of grains in the spike, weight of 1000 grains/ g, grains yield kg/$ha^{-1}$.

### *2.5. Statistical Analysis*

After collecting, reducing and tabulating the data, it was statistically analyzed using the GENESTAT program according to the data analysis tool, and the averages of the treatments were compared using the Least Significant Difference (L.S.D) test at the probability level of 0.05 [16].

**Table 1.** Some physical and chemical properties of the experimental field soil .

| Trait | Physical properties | | | | | Chemical properties | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | O.M | CaCo3 | K | P | N total | Silt | Sand | Clay | EC | pH |
| | | | kg/ gm | | | | % | | ds/m | - |
| 2018-2019 | 0.94 | 17.6 | 0.326 | 0.012 | 0.9 | 132 | 712 | 156 | 1.0 | 7.4 |
| 2019-2020 | 1.09 | 16.9 | 0.336 | 0.014 | 1.2 | 130 | 711 | 159 | 0.9 | 7.5 |

## 3. Results

### *3.1. Plant height (cm)*

The results of Table (2) showed a difference between the studied cultivars in plant height in both seasons. The superiority of Ibaa99 cultivar on the other cultivars, with an average of 85.55 and 87.46 cm for the 2018-2019 and 2019-2020 seasons,

respectively, while Abu Ghraib3 gave the lowest average plant height reached 78.27 and 84.84 cm for the 2018-2019 and 2019-2020 seasons, respectively. The average plant height also differed according to the different planting dates, and it was noted that the date (December 15) was significantly superior to the other dates, recording the highest averages of 86.33 and 89.13 cm for the 2018-2019 and 2019-2020 seasons, respectively, while the date (1st December) gave the lowest average of 80.89 cm for the season. The first and the date (November15) averaged 82.73 for the second season. With regard to the effect of the interaction, the combination between the same cultivar (Ibaa-99) with the last date (December 15) showed a significant superiority in plant height, with an average of 88.60 and 94.53 cm for the two seasons 2019-2020, respectively, while the combination (Abu Ghraib3) gave x November15) gave the lowest averages for this trait were 75.27 and 81.27 cm for the 2018-2019 and 2019-2020 seasons, respectively (Table 2).

### *3.2. Number of tillers*

The results of the statistical analysis of Table (2) showed the effect of cultivars, planting dates and the interaction between them on the number of tillers plant$^{-1}$ in both seasons, as it was shown that (Ibaa99) outperformed the on the other studied cultivars, with an average of 3.60 and 3.75 for the 2018-2019 and 2019-2020 seasons, respectively. While the cultivar Tamooz2 gave the lowest mean number of tillers, which was 3.42 and 3.60. The results also indicated that the third date (December 15) superiority the average number of tillers reached 3.98 and 4.21 for the 2018-2019 and 2019-2020 seasons, respectively. While the first date (November15) recorded the lowest number of tillers, 3.17 and 3.20 (Table 2). With regard to the interaction, it had a significant effect on the number of tillers, and its results were similar to the effect of the factors, which are single, as the combination (Ibaa 99 x December 15) gave the largest number of tillers amounting to 4.20 and 4.45 for the seasons 2018-2019 and 2019-2020 respectively, while the combination recorded (Tamooz2 x November15), the lowest average for this trait was 2.93 during the two seasons (Table 2), and this shows the stability and ability of the cultivar Ibaa 99 to show this trait (number of tillers) even with different environmental conditions (planting date).

**Table 2.** The effect of cultivars, planting dates and the interaction between them on some growth traits.

| Season | | 2018-2019 | | | | 2019-2020 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Trait | Cultivar | Nov. 15 | Dec. 1 | Dec. 15 | Mean | Nov. 15 | Dec. 1 | Dec. 15 | Mean |
| Plant height cm | Tamooz2 | 84.20 | 81.53 | 88.47 | 84.73 | 83.87 | 82.80 | 87.93 | 84.86 |
| | Ibaa99 | 84.53 | 83.53 | 88.60 | 85.55 | 83.07 | 84.80 | 94.53 | 87.46 |
| | Abu Ghraib3 | 75.27 | 77.60 | 81.93 | 78.27 | 81.27 | 88.33 | 84.93 | 84.84 |
| | Mean | 81.33 | 80.89 | 86.33 | | 82.73 | 85.31 | 89.13 | |
| L.S.D | | 0.77 (for cultivar), 0.82 (for date), 0.98 (for interaction) | | | | 0.81 (for cultivar), 0.74 (for date), 1.22 (for interaction) | | | |
| No. tillers | Tamooz2 | 2.93 | 3.53 | 3.80 | 3.42 | 2.93 | 3.73 | 4.13 | 3.60 |
| | Ibaa99 | 3.47 | 3.13 | 4.20 | 3.60 | 3.33 | 3.47 | 4.45 | 3.75 |
| | Abu Ghraib3 | 3.13 | 3.67 | 3.93 | 3.58 | 3.33 | 3.80 | 4.07 | 3.73 |
| | Mean | 3.17 | 3.44 | 3.98 | | 3.20 | 3.67 | 4.21 | |
| L.S.D | | 0.68 (for cultivar), 0.82 (for date), 0.98 (for interaction) | | | | 0.70 (for cultivar), 0.91 (for date), 1.22 (for interaction) | | | |
| Flag leaf area | Tamooz2 | 40.13 | 42.60 | 42.87 | 41.87 | 41.00 | 44.33 | 44.93 | 43.42 |
| | Ibaa99 | 37.47 | 41.27 | 41.33 | 40.02 | 38.60 | 40.60 | 42.87 | 40.69 |
| | Abu Ghraib3 | 41.67 | 41.33 | 43.67 | 42.22 | 40.07 | 42.27 | 44.00 | 42.11 |
| | Mean | 39.76 | 41.73 | 42.62 | | 39.89 | 42.40 | 43.93 | |
| L.S.D | | 0.82 (for cultivar), 0.93 (for date), 1.18 (for interaction) | | | | 0.69 (for cultivar), 0.71 (for date), 1.32 (for interaction) | | | |
| Spike length | Tamooz2 | 12.27 | 11.40 | 15.07 | 12.91 | 12.33 | 12.64 | 14.59 | 13.18 |
| | Ibaa99 | 12.40 | 12.13 | 12.27 | 12.26 | 13.07 | 12.20 | 13.27 | 12.34 |
| | Abu Ghraib3 | 10.53 | 11.60 | 13.60 | 11.91 | 11.93 | 12.20 | 13.33 | 12.49 |
| | Mean | 12.09 | 11.35 | 13.65 | | 12.44 | 12.16 | 13.73 | |
| L.S.D | | 0.63 (for cultivar), 0.55 (for date), 0.87 (for interaction) | | | | 0.61 (for cultivar), 0.59 (for date), 0.90 (for interaction) | | | |

### *3.3. Flag leaf area ($cm^2$)*

The results of Table (2) showed the difference between the studied Cultivars in the flag leaf area , and the cultivar Abu Ghraib3 registered superiority over on the other cultivars reached 42.22 $cm^2$ in the first season, and the cultivar Tamooz-2 gave the highest average for the flag leaf area, which amounted 43.42 $cm^2$ for The second season (2019-2020) , while the cultivar Ibaa99 gave the lowest averages of the flag leaf area, which were 40.02 and 40.69 cm2 for the seasons 2018-2019 and 2019-2020 respectively (Table 2), and the late date (December 15) showed superiority to all other dates in the flag leaf area reached 42.62 and 43.93 cm2 for the 2018-2019 and 2020 seasons respectively, while the early planting date (November15) gave the lowest averages for this trait, which were gave 39.76 and 39.89 cm2 for the seasons 2018-2019 and 2019-2020 respectively (Table 2). With regard to the interaction between the two factors, the combination (Abu Ghraib3 x 15 December 1) gave the highest average of the flag leaf area amounted 43.67 cm 2 for the first season 2018-2019 and the combination (Tamooz2 x 15 December) gave the highest average of 44.93 cm 2 in the second season 2019-2020, while the combination (Ibaa99 x 15 December) gave the lowest averages for this trait, which were 37.47 and 38.60 cm2 for the two seasons, respectively (Table 2).

### *3.4. Spike length*

As for the results of planting dates, they were identical during the two seasons, as the date (December 15) superiority on the on the other dates and averaged 13.65 and 13.73 cm for the 2018-2019 and 2019-2020 seasons, respectively, while the date (1st December) gave the lowest averages of 11.35 and 12.16 cm for seasons 2018-2019 and 2019-2020 respectively (Table 3).As for the interaction, the combination (Tamooz2 x December 15) gave the highest average spike length of 15.07 and 14.59 cm for the 2018-2019 and 2019-2020 seasons respectively, while the combination (Abu Ghraib3 x 1st December) in season 2018-2019 and the combination (Abu Ghraib x November 15) in the 2019-2020 season, gave the lowest averages for this trait were 10.53 and 11.93 cm for the two combinations, respectively (Table 2).

### *3.5. Grains number in the spike*

Tamooz-2 cultivar gave superiority over all cultivars in the 2018-2019 and 2019-2020 seasons, with an average of 73.02 and 73.76 grains/$spike^{-2}$ for the two seasons, respectively, while Abu Ghraib3 gave the lowest averages for this trait, reached 63.22 and 64.11 grains/spikes for the 2018-2019 and 2019-2020 seasons, respectively (Table 3). The date (December 15) was significantly superior to all other dates in both seasons, as it averaged 71.78 and 73.37 grains/ $spike^{-2}$ for the 2018-2019 and 2019-2020 seasons, respectively, while the date (December 1st) gave the lowest averages for this trait, reached 65.55 and 67.67. A grain/ $spike^{-2}$ for the 2018-2019 and 2019-2020 seasons, respectively. As for the interaction, the combination (Tamooz2 x December 15) in season 2018-2019 and the combination (Tamooz2 x 1st December) in season 2019-2020 gave the highest average number of spike, which were 76.27 and 76.87 grains/$spike^{-2}$ for the two combinations, respectively, while the combination (Abu Ghraib3 x 1st December) gave the lowest averages for this trait, which were 56.33 and 58.13 grains/$spike^{-2}$ for the two seasons, respectively (Table 3).

### *3.6. Weight of 1000 grain (g).*

The results showed the significant effect of the Cultivars during the two seasons, Tamooz-2 cultivar gave the highest average weight of a thousand grains, which reached 29.79 and 31.06 g for the 2019 and 2019-2020 seasons, respectively, whileIbaa99 (2018-2019) and Abu Ghraib3 (2019-2020) gave the lowest averages for this trait about 28.29 and 27.85grespectivly. It also showed an effect of dates in both seasons, and the date (December 15) recorded an increase in the weight of 1000 grains, with an average of 29.81 and 31.26 g for the 2018-2019 and 2019-2020 seasons, respectively (Table 3).With regard to the interaction between the two factors, the combination (Tamooz22 x December 15) gave the highest average weight of 1000 grains at 30.77 and 33.73 g for the seasons 2018-2019 and 2019-2020, respectively, while the combination (Ibaa99 × November 15gave the lowest average weight of 1000 grains About 27.07 g for the 2018-2019 season While the second season the interaction Abu Ghraib3 x November15 gave lowest average of 1000 grain about 25.40 g.

### *3.7. Grain yield ton/$ha^{-1}$*

The results showed that the cultivars differed among themselves in the grain yield, as the Cultivar (Tamooz2) recorded the highest average grain yields of 5.75 and 5.89 tons/$ha^{-1}$ in the two seasons 2018-2019 and 2019-2020, respectively, while the Cultivar Abu Ghraib3 gave a decrease in the grain yield that Their averages reached 4.78 and 4.92 tons $ha^{-1}$ for the seasons 2018-2019 and 2019-2020 respectively (Table 3). The reason for the superiority of these two cultivars in grain yield is due to their superiority in the two components of yield: number of grains per spike and grain weight (Table 3).The planting date (December) showed an increase in the average grain yield compared to the average yield during the date of (November 15),

as the date (December 15) was superior to the other dates in the grain yield, which averaged 5.62 and 5.58 tons/ha$^{-1}$ for the 2018-2019 and 2019-2020 seasons, respectively. While the date (November 15) gave the lowest averages of 5.20 and 5.45 tons/ha$^{-1}$ for the 2018-2019 and 2019-2020 seasons, respectively. The reason for the superior date (December 15) in grain yield is due to its superiority in the two components of yield, the number of grains and the weight of 1000 grains (Table 3).

It was also found from the results of the interaction that all cultivars recorded the highest averages of grain yield when planted on the date (December 15), but the highest averages recorded by Tamooz-2 were 6.05 ton ha$^{-1}$ (2018-2019 season), while the second season the combination Ibaa99 with December 1$^{th}$ gave highest yield about 6.10 ton ha$^{-1}$, while the cultivar Abu Ghraib3 gave planted on the date of (November 15) gave the lowest average of 4.49 tons/ ha$^{-1}$ for the 2018-2019 season, while the same cultivar planted on the date (December 1$^{st}$) gave the lowest average yield of 4.58 tons ha$^{-1}$ (Table 3), and we can explain this is based on what was mentioned in the discussion of the individual factors.

**Table 3.** Effect of cultivars, planting dates and the interaction between them on yield and its components.

| Season | | 2018-2019 | | | | 2019-2020 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Trait | Cultivar | Nov. 15 | Dec. 1 | Dec. 15 | Mean | Nov. 15 | Dec. 1 | Dec. 15 | Mean |
| No. grain in spike | Tamooz2 | 74.73 | 68.07 | 76.27 | 73.02 | 68.33 | 76.87 | 76.07 | 73.76 |
| | Ibaa99 | 60.68 | 72.27 | 71.47 | 70.78 | 74.47 | 68.00 | 73.33 | 71.93 |
| | Abu Ghraib3 | 65.73 | 56.33 | 67.60 | 63.22 | 63.53 | 58.13 | 70.67 | 64.11 |
| | Mean | 67.04 | 65.55 | 71.78 | | 68.78 | 67.67 | 73.37 | |
| L.S.D | | 1.12(for cultivar), 1.06 (for date), 1.56 (for interaction) | | | | 1.24(for cultivar), 1.13 (for date), 1.87 (for interaction) | | | |
| Weight of 1000 grain gm) | Tamooz2 | 29.20 | 29.40 | 30.77 | 29.79 | 28.13 | 31.33 | 33.73 | 31.06 |
| | Ibaa99 | 27.07 | 28.80 | 29.73 | 28.29 | 31.07 | 30.27 | 30.60 | 30.65 |
| | Abu Ghraib3 | 29.07 | 29.73 | 28.93 | 29.24 | 25.40 | 28.67 | 29.47 | 27.85 |
| | Mean | 28.45 | 29.31 | 29.81 | | 28.20 | 30.09 | 31.26 | |
| L.S.D | | 0.68 (for cultivar), 0.82 (for date), 0.98 (for interaction) | | | | 0.70 (for cultivar), 0.91 (for date), 1.22 (for interaction) | | | |
| Grain yield ton/ha | Tamooz2 | 5.28 | 5.92 | 6.05 | 5.75 | 5.83 | 5.83 | 6.02 | 5.89 |
| | Ibaa99 | 5.83 | 5.51 | 5.77 | 5.70 | 5.52 | 6.10 | 5.85 | 5.74 |
| | Abu Ghraib3 | 4.49 | 4.81 | 5.03 | 4.78 | 5.03 | 4.58 | 5.14 | 4.92 |
| | Mean | 5.20 | 5.41 | 5.62 | | 5.46 | 5.50 | 5.58 | |
| L.S.D | | 1.71 (for cultivar), 1.01 (for date), 1.61(for interaction) | | | | 1.68 (for cultivar), 0.89 (for date), 1.03 (for interaction) | | | |

## 4. Discussion

The findings of the study was confirmed by many researchers, including [17] which indicated that the plant height trait varies according to the genetic structure and the delay in planting date. The reason for the different types of wheat in the plant height trait may be due to the difference in the length of the internodes [18]due to its influence on the genetic structure of the cultivar as well as the desert climatic conditions, this agrees with the results of [19,20] . The results indicated that there was a significant effect of cultivars, planting dates and their interaction on the number of tillers/plant$^{-1}$ in both seasons. and this result agreed with what was mentioned (Ali *et al*., 2004), while the first date (November15) recorded the lowest number of tillers, 3.17 and 3.21 (Table 2), the reason may be that the date (November15) is the earliest date in planting, where temperatures and light intensity as well as the nature of its sandy soil are relatively high in Samawa desert, which it helped to slow the growth rates and consequently fewer tillers compared to the other dates, which encountered a relative decrease in temperatures and better growth in relation to the growth needs of the wheat plant, and this result agreed with the findings of (Ali *et al*., 2004) who found the late dates are superior to the number of tillers/plant$^{-1}$ and the wheat Cultivars are not affected by the number of tillers when planted in the southern regions of the country.

The results showed that the flag leaf area is significantly affected by the different genotypes, and the late date (December 15) showed superiority to all other dates in the flag leaf area for the 2018-2019 and 2019-2020 seasons respectively, while the early planting date (November15) gave the lowest averages for this trait, for the seasons 2018-2019 and 2019-2020 respectively (Table 2). The reason for these results can be attributed to the genetic determinant and its interaction with the climatic conditions, especially the temperature and its role in accelerating the growth, division and expansion of cells and

increasing the flag leaf area, therefore, the climatic conditions accompanying the date (December 15) may be favorable for the growth and expansion of the flag leaf area in terms of more degrees than the expected date (November 15), because of the high temperature in the Samawa desert area and the short period from the beginning of the elongation to the expulsion of the spikes, which is the period simultaneous with the growth and expansion of the flag leaf. The results of Table (2) showed the difference between the studied Cultivars in the flag leaf area , for the seasons 2018-2019 and 2019-2020 respectively (Table 2). The study showed the superiority of two cultivars in grain yield is due to their superiority in the two components of yield: number of grains per spike and grain weight (Table 3). These cultivars were affected by environmental conditions, including temperatures ,which referred to the difference in wheat grain yield by changing the planting date. The planting date (December) showed an increase in the average grain yield compared to the average yield during the date of (November 15), as the date (December 15) was superior to the other dates in the grain yield, 2018-2019 and 2019-2020 seasons, respectively. while the date (November 15) gave the lowest for the 2018-2019 and 2019-2020 seasons, respectively. The reason for the superior date (December 15) in grain yield is due to its superiority in the two components of yield, the number of grains and the weight of 1000 grains (Table 3), and this does not agree with what [4] found,while the planting date (1st December) gave the lowest average grain yield.

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