Effect of Planting Dates on Growth and Yield of Wheat *Triticum aestivum* L. in Diyala Governorate

Othman Nassef Jassim1, Nabeel Ibrahim Mohammed2, Ghuffran Ali Hussien3

College of Agriculture - Diyala University – Iraq

E-mail: Othmanjasim@uodiyala.edu.iq

Abstract

The study was conducted during the winter season 2022-2023 in a farmer's field in Baladruz District, Diyala Governorate. Four varieties of wheat (Triticum aestivum L.) were used (IPA 99, ADNA, Al-Faris, and Baghdad) under the influence of three planting dates (11/5, 11/20, 5/12), to determine the effect of planting dates on growth traits and yields. Randomized Completely Block Design used with three replications. The date 5/11 gave the highest average for leaf area traits (38.1 cm2), the number of seeds per spike (49.0), and the weight of 1000 seeds (43.7 g). While date 5/12 gave the lowest average for leaf area traits (26.3 cm2), plant height (59.1 cm), number of seeds per spike (41.5), weight of 1000 seeds (34.1 g), biological yield (13.3 g), individual plant yield (5.5 g), and harvest index (40.7%). The varieties differed significantly in the studied traits, where (ADNA) cultivar giving the highest value for the traits of number of shoots/plant (7.7), spike length (12.1 cm), number of grains per spike (54.4), biological yield (21.5 g), and individual plant yield (9.8 g). Al-Faris variety gave the highest averages for leaf area (35.4 cm2), plant height (68.6 cm), and weight of 1000 seeds (3.53 g). The overlap between the varieties and planting dates was significant, as the (ADNA) variety planted on 5/11 gave the highest plant height (74.7 cm), the number of grains per spike (63.3), the biological yield (24.3 g), and the individual plant yield (11.6 g). While the variety IPA 99, which planted on 5/12, gave the lowest average for leaf area traits (16.4 cm2), plant height (56.0 cm), spike length (8.5 cm), weight of 1000 seeds (19.4 g), individual plant yield (5.0 g), and harvest index (34.6%.(

Keywords : Bread wheat, varieties, planting dates

Introduction:

wheat Triticum aestivum L. is one of the most important cereal crops in the world and is known as the king of grains. Its grains contain all the essential nutrients, including carbohydrates (60-80%, mainly starch), proteins (8-15%), sufficient amounts of all essential amino acids (except lysine, tryptophan and methionine), fats (1.5-2%), and water about 12%. (2). The economic yield of any crop is affected by the genetic factor represented by the varieties, as well as the environmental factors represented by temperature, humidity, and photoperiod resulting from the difference in planting dates,

ISSN 2072-3857

which play a major role in influencing the characteristics of the crop and its components. (16), Therefore, the appropriate planting date ensures the appropriate requirements for temperature and photoperiod for the different stages of plant growth (14). The variation in genetic factors of varieties and their interaction with environmental factors leads to differences in the extent of their response to environmental conditions and the resulting variation in the expression of their performance during the various stages of growth and their impact on yield. In many studies, clear differences were found in the behavior of varieties in terms of growth and production due to the change in planting date (21.(

In recent decades, attention has focused on developing new varieties of wheat that are adapted to environmental conditions and have high productivity according to their genetic composition, as well as following optimal scientific cultivation methods and growth factors for the success of its cultivation. The key to good management is planting at the ideal time, which means placing the crop in specific climatic and environmental conditions through which the highest regulation of the relationship between source and outlet is achieved, giving the highest biological and economic yield. Early planting of wheat in relation to the ideal sowing date exposes the crop to high temperatures that accelerate plant growth and development, and, thus shorten the shooting stage by stimulating the crop and entering the elongation phase more quickly, in addition to its effect on the processes of leaf expansion and shoot development as means of increasing yield (26.(

Many wheat varieties have been registered and approved during the last period in Iraq. They were distinguished by their efficiency in production, their tolerance to some environmental conditions, and their resistance to some pests. Hence, the aim of this study was, i.e. the extent of the variety's ability to adapt to the appropriate date for planting it, and the effect of this on the traits of growth and yield, and knowing the productive efficiency of a number of wheat varieties at different stages of time.

Materials & Methods:

The experiment was carried out in a farmer's field in Baladruz district, Diyala governorate, Iraq. Four varieties of wheat were implemented: IBA99, ADNA, Al-Faris, and Baghdad, in order to determine the effect of planting dates on the growth traits and yield of the above-mentioned varieties. The study conducted during the winter season (2022-2023) in clay soil. Three planting dates were used {November 5, November 20, December 5}. The experiment was carried out using a randomized complete block design with three replications for each date, and soil and crop preparations practices were also carried out according to scientific recommendations. The land was plowed in two perpendicular plows

using a rotary plow, and it was harrowed, leveled, and divided into plots. The area of each plot was 2 m². Each plot included ten lines, and the distance between one line and another was 10 cm. Seeds were planted in the lines with a distance of 10 cm between one seed and another. The experiment was fertilized with super Phosphate and urea fertilizer {N ratio = 46%} and according to scientific recommendations. The experiment involved the measurements of the traits of leaf area (cm²), plant height (cm), number of effective shoots, spike length (cm), number of grains per spike, weight of 1000 grains (g), biological yield (g/plant), and plant yield, Individuals (g/plant), harvest index. Data were analyzed for the studied traits according to a randomized complete block design (R.C.B.D.), and the averages of the genotypes were tested using the Duncan polynomial method (12 .(

Results and Discussion:

Flag leaf area (cm2 (

Table 1. shows that planting on the first date of 5/11 gave the highest average of the flag leaf area, reaching (38.16 cm2), which was superior to the other dates. The reason for the difference in the flag leaf area within the planting dates is that the earlier date may give more time for the development of plant's cells. The plant elongates and then increases the leaf area (17). This result is consistent with what was found by (27), (11), and (23), who explained that planting dates and temperatures have an effect on the flag leaf area. Table (1) shows that the two varieties, Al-Faris and Baghdad, did not differ significantly from each other, and they gave the highest averages for flag leaf area, amounting to (35.44 and 35.22 cm2), respectively. The wheat varieties, IBA 99 and ADANA, gave the lowest average for the same trait, amounting to (30.20 and 26.88 cm2), respectively. The reason for the differences in the area of the flag leaf is attributed to their differences in genetic attributes and the difference of these attributes in the period from planting to 100% flowering, which includes the growth and expansion stage of flag leaf. Regarding the interaction between dates and varieties, the Baghdad variety grown in 5/11 gave the highest average leaf area, reaching (40.33 cm2). The average leaf area of the cultivar IBA 99 grown at the third planting date (5/12) was 16.40 cm2, which is the lowest average compared to the rest of the cultivars. The reason for the difference in wheat varieties during planting dates in this regard may be due to the nature of the varieties in their response to climatic factors during leaf formation (21.(

ISSN 2072-3857

Table 1. effect of planting dates, varieties, and their interaction on flag leaf area (cm^2).

Means	Planting date			Varieties
	12\5	11\20	11\5	
30.20b	16.40e	34.85bc	39.37a	IBA99
26.88b	18.06e	24.95d	37.62ab	ADANA
35.44a	35.33abc	35.66abc	35.33abc	Al-Faris
35.22a	35.66abc	30.66cd	40.33a	Baghdad
	26.36c	31.53b	38.16a	Means

Plant height

The results in Table 2. show that planting on the first planting date of 5/11 gave the highest average of plant height of (70.55 cm), which was significantly superior to the third planting date of 5/12, which gave plants with an average height of (59.10 cm). The reason was attributed to the delay in planting which exposing plants to the negative impact of high temperatures in the branching and elongation stages, which leads to the plant accelerating towards stopping vegetative growth and heading towards flowering. Thus, the elongation period is shortened and the plant's height is reduced. These results are consistent with what was observed by (17) who indicated a gradual decrease in the height of wheat plants due to the delay in the planting date. The varieties IBA99, ADNA, and Al-Fares did not differ significantly from each other in plant height and gave values of (66.3, 64.95 and 68.66 cm), respectively, while the Baghdad variety differed significantly from the rest of the varieties and gave the lowest plant height of (63.0 cm). Table 2. indicates that the ADANA variety, planted on the first planting date 5/11, achieved the highest plant height of (74.70 cm), while the IBA99 variety, planted on the third planting date of 5/12, had the lowest average plant height of (56.0 cm). The reason for the difference between wheat varieties in plant height over planting dates may be due to the difference in the length of the petioles, especially the upper petioles as a result being affected by the genetic attributes of the varieties that are affected by environmental conditions, especially temperature (22). These results agreed with what was found by (24) and (21) who indicated that the height of wheat varieties varied with changing planting date

.

Table 2. Effect of planting dates, varieties, and their interaction on plant height (cm).

Means	Planting dates			Varieties
	12\5	11\20	11\5	
66.35ab	56.00f	74.00ab	69.06abcde	Aba99
64.95ab	56.83f	63.33cdef	74.70a	Adna
68.66a	64.00bcdef	72.00abc	70.00abcd	Al-Faris
63.00b	59.60ef	60.93def	68.46abcde	Baghdad
	59.10b	67.56a	70.55a	Means

Number of effective tillers

The results in Table 3. showed that planting dates did not significantly affect the number of tillers/plant, meaning that the environmental conditions were fairly equal during the three dates (8). The results of Table 3. showed that there were some significant differences between the averages of the varieties, as the ADANA variety recorded the highest rate of (7.73), which did not differ significantly from the variety of IBA 99, which gave a rate of (7.38). The two varieties, Al-Faris and Baghdad, did not differ significantly to each other either, and they gave the lowest average for the number of tillers.plant-1 amounting to .(

(3.53 and 4.44), respectively. Also, the results of the table indicating that the interaction of varieties and planting dates was somehow significant, as the IBA 99 variety and the ADANA variety, planted on the second and third planting dates of 11/20 and 12/5, gave the highest averages, reaching (8.50 and 8.00), respectively. The two varieties, Al-Faris and Baghdad, grown on the three dates, did not differ significantly to each other and gave the lowest average. The variation between varieties in this trait may be due to a difference in their genetic structure (18; 19

ISSN 2072-3857

Table 3. Effects of planting dates, varieties, and their interaction on the number of tillers.plant^{-1}.

Means	Planting dates			Varieties
	12\5	11\20	11\5	
7.38a	7.66ab	8.50a	6.00bc	IBA99
7.73a	8.00ab	7.86ab	7.33ab	ADANA
3.53b	3.20d	3.86d	3.53d	Al-Faris
4.44b	4.33cd	3.86d	5.13cd	Baghdad
	5.80a	6.02a	5.50a	Means

Spike length (cm (

The averages presented in Table 4. indicate that there are no significant differences between the three planting dates. The same table shows that the ADANA variety was significantly superior to all varieties, achieving a value of (12.11) cm for the spike length attribute, while the two varieties IBA99 and Al-Fares recorded the lowest value for the trait, amounting to (9.16, 9.52) cm, respectively. There was a significant interaction between the varieties and planting dates for spike length (cm), as the ADANA variety planted on the first planting date of 11/5 was significantly superior and achieved a value of (12.66 cm), and it did not differ significantly with the second and third planting dates of 20/11 and 5/12. The latter variety did not differ significantly with the Baghdad variety grown at the same date, in which the average trait reached (96.10 cm). On the other hand, the varieties IBA99 and Al-Fares, grown at the second and third planting dates of 20/11 and 5/12, gave the lowest value for the trait, amounting to (9.0, 8.5, 9.5, 9.0 cm), respectively. The inconsistency between the varieties in this trait may be due to a difference in their genetic composition (18, 19

Table 4. Effects of planting dates, varieties, and their interaction on spike length (cm).

Means	Planting dates			Varieties
	12\5	11\20	11\5	
9.16c	8.50c	9.00c	10.00bc	IBA99
12.11a	12.33a	12.33a	12.66a	ADANA
9.52c	9.03c	9.53c	10.00bc	Al-Faris
10.76b	10.00bc	10.33abc	10.96ab	Baghdad
	9.96a	10.30a	10.90a	Means

ISSN 2072-3857

Number of grains per spike

Data in Table 5. showing a difference in the Means of the number of grains per spike at different planting dates, as the first date of 5/11 exceeded and gave the highest value of (49.0 grains.spike-1), while the third planting date of 5/12 gave the lowest value of (41.5). Seed/spike), and the reason for the decrease in the number of grains per spike at late dates is attributed to the high temperatures that are not suitable for pollination and fertilization, the reduction of the critical period for flowering, the lack of green space, the decrease in photosynthesis, and the shortening of the period for the formation of spikelets and florets, and this is consistent with what was indicated by (9). The same table indicates the significant superiority of the ADANA variety in the average number of grains per spike (54.4 grains.spike-1), and AL-Fares variety gave the lowest average for the same characteristic, amounting (34.5 grains.spike-1). The reason for the difference in the varieties of wheat included in the study in this characteristic is the variation in the number of spikelets. This result agreed with (4) and (9) that wheat varieties differ among themselves in the number of grains per spike. Table 5. shows that the ADNA variety, planted at the first planting date of 5/11, was significantly superior in number of grains per spike to the rest of the varieties planted at all dates, and gave an average of (63.3 grains/spike), while the Al-Faris variety, grown at the third planting date, 5\12 gave the lowest average was (26.0 grains.spike-1), The reason for this decrease in the number of grains in the spike is attributed to the unsuitability of climatic factors for the different stages of plant growth and the nature of the response of the varieties to these conditions. This result agreed with (4), who showed the difference between the varieties planted at different dates in their production of dry matter and found a significant positive correlation between number of grains per spike and grain yield

Table 5. effect of planting dates, varieties, and the interaction between them on the number of grains per spike .

Means	Planting date			Varieties
	12\5	11\20	11\5	
46.71b	48.04cd	50.41bc	41.69def	IBA99
54.44a	44.33cde	55.66b	63.33a	ADANA
34.55c	26.00g	34.66f	43.00cde	Al-Faris
44.77b	47.66cd	38.66ef	48.00cd	Baghdad
	41.50c	44.84b	49.00a	Means

ISSN 2072-3857

Grains Wight 1000 (g (

The weight of a thousand grains is considered one of the most important technological indicators taken into account by the country's standard specifications and an important component of productivity, which is associated with the number and weight of grains per spike and the number of spikes per unit area. The number of grains and the weight of a thousand grains are also among the most important characteristics associated with improving production (8). The results of Table 6. showed that there were differences that reached the level of significance for the planting dates, and the first date, 5/11, gave the highest value for the trait, amounting to (43.7 grams), significantly superior to the two dates, 20/11 and 5/12. Al-Fares wheat variety was significantly superior compared to the rest of the varieties, achieving a value of (53.3 grams) per thousand grains. While the variety IBA99 recorded the lowest value for the trait, amounting to (25.5 g). A significant interaction was found between the varieties and planting dates for the weight of 1000 grains, as AL-Fares variety planted on the first date 5/11 was significantly superior and achieved a value of (60.0 g). While the IBA 99 variety, grown in 5/12, gave the lowest value for the trait, amounting to (19.4 grams). The variation between varieties in this trait may be due to a difference in their genetic composition, the length of the grain filling period and other attributes of the crop, and the high efficiency of the varieties in exploiting the products of photosynthesis and produce a larger amount of dry matter and harnessing it to the flowers and grains, which led to an increase in the percentage of fertile florets, and then to increased grain number, size, and degree of filling (18; 19.(

Table 6. effect of planting dates, varieties, and their interaction on the weight of 1000g.

Means	Planting date			Varieties
	12\5	11\20	11\5	
25.5d	19.40g	26.20f	30.60e	IBA99
33.48c	23.93f	34.40e	42.13d	ADANA
53.33a	51.00bc	49.00c	60.00a	Al-Faris
46.07b	42.43d	53.36b	42.434	Baghdad
	34.19c	40.74b	43.79a	Means

ISSN 2072-3857

Biological Yield

The results of Table 7. show that there are some significant differences between the planting dates, as the first planting date and the second date did not differ significantly between them, and they gave the highest biological yield, reaching (17.8 and 16.3 grams) respectively. They were superior to the third planting date, 5/12, which gave the lowest yield of (13.3 grams). This is due to the short number of days from planting to maturity to the last date, which means a short period of photosynthesis, the amount of materials formed, and the formation of growths and shoots, especially since there is a relationship between the biological yield and both the number of shoots and the height of the plant. From the results of Table 7, it is clear that the variety ADANA gave the highest value for the average biological yield, amounting to (21.5 grams), while the two varieties, Al-Faris and Baghdad, did not differ significantly between them and were given the lowest value for the biological yield trait, reaching (13.3 and 12.3 grams), respectively. The reason is due to the difference between varieties in the efficiency of forming a vegetative cover to intercept sunlight and accumulate dry matter, and thus their difference in net photosynthesis per unit area (25). The results of the same table indicated that the interaction of varieties and planting dates was somewhat significant, as the ADANA variety, planted on 11/5 and 11/20, was significantly superior and gave values of (24.3 and 23.3 g) respectively, while the Baghdad variety, grown on the third planting date, gave 5\ 12 The lowest rate was (10.8 grams) and did not differ significantly from the first and second planting dates. The increase in the biological yield of plants grown at the first date is due to the environmental conditions being suitable for the different stages of plant growth, which resulted in vegetative growth that is more efficient in intercepting solar radiation during the growing season, which increased the nutrients deposited in all parts of the plant, and this was represented by an increase in the height of the plant and the number of shoots, and this was in keeping with This result is in line with the results of previous researchers, including (17.(

Table 7. Effect of planting dates, varieties, and their interaction on biological yield (g).

Means	Planting Dates			Varieties
	12\5	11\20	11\5	
16.52b	14.58bcd	17.82b	17.16b	IBA99
21.55a	17.00b	23.33a	24.33a	ADANA
13.00c	11.00d	12.00cd	16.00bc	Al-Faris
12.30c	10.83d	12.33cd	13.73bcd	Baghdad
	13.35b	16.37a	17.80a	Means

ISSN 2072-3857

Grain yield per plant (g(

The grain yield in wheat is determined by a number of interconnected components, namely the number of spike, the number of grains per spike, and the weight of the grain. Each of these three components is affected by genetic and environmental factors and their interactions in the period of emergence and life cycle (18). The results of Table 8. showed that the first planting date, 5/11, gave the highest value for the individual plant yield, amounting to (8.8 grams), and was not significantly superior to the second date, 20/11, which gave a yield amounting to (8.5 grams), and it was significantly superior to the third date, 5/12, which it gave a yield of (5.5 grams). The results of the same table indicate that the ADANA variety gave the highest value for the individual plant yield, amounting to (9.8 g), while the Baghdad variety gave the lowest value for the individual plant yield, amounting to (6.4 g), and it did not differ significantly with the varieties IBA 99 and Al Fares. Table 8. shows that the interaction between planting dates and varieties was significant. The ADANA variety, planted on 11/5 and 11/20, achieved the highest individual plant yield of (11.6 and 11.0 g) respectively. This is attributed to the variety's superiority in most of the yield components and its adaptation to environmental factors. This result is consistent with the findings of (3, 13, 20), who indicated differences between wheat varieties in the grain yield of the plant, while the varieties IBA99, Al-Fares, and Baghdad were grown in 5/12 did not differed significantly among eachother and gave the lowest yield of (5.0 g .(

Table 8. effect of planting dates, varieties, and the interaction between them on the individual plant yield (g).

Means	Planting Date			Varieties
	12\5	11\20	11\5	
7.44b	5.00e	8.00cd	9.33bc	IBA99
9.88a	7.00cd	11.00ab	11.66a	ADANA
6.77b	5.00e	7.33cd	8.00cd	Al-Faris
6.27b	5.00e	7.50cd	6.33de	Baghdad
	5.5b	8.45a	8.83a	Means

ISSN 2072-3857

Harvest Index%

Harvest index is considered as one of the most important indicators for evaluating the efficiency of a variety. It is also utilized as an indicator of selection between different genotypes. Furthermore, harvest index one of the important alternatives through which breeders seek to increase the final yield of grain crop outputs. Harvest index clearly highlights the role of plant parts above the soil surface in distributing metabolites (15 and 19). Table (9) shows that the second planting date, 20/11, achieved the highest harvest index rate of (53.86%) and did not exceed the first planting date, 5/11, which gave a harvest index rate of (51.0%), while the third planting date 5/12 gave the lowest percentage (40.7%). It could be noticed from Table 9. that planting at the appropriate time resulted in an increase in the number of branches and the weight of a thousand seeds, thus increasing the size of the outfalls, which encouraged the transfer of more products of photosynthesis and their contribution to increasing the grain yield at a higher rate than their transfer to other parts of the plant that participate in the total dry matter yield, thus, the harvest index eventually increased. This result is consistent with the results of (21), (10), (5), and (6), who indicated that creating environmental conditions suitable for the growth and formation of plant organs may enable it to achieve an increase in grain yield higher than the increase in dry matter weight. Results of table (9) shows that the two varieties Baghdad and Al-Fares did not differ significantly from each other and achieved the highest percentage of harvest index reaching (52.3 and 50.8) respectively, outperforming the two varieties IBA99 and ADANA, which achieved a percentage of (44.8 and 45.9%) respectively. The table also shows that the interaction between the varieties and dates The cultivation was significant, as the two varieties Baghdad and Al-Faris, planted on the second planting date 20/11, achieved the highest percentage of harvest index, reaching (60.7 and 58.0%), respectively, and they did not differ significantly from the ADANA variety, planted on the first date 5/11, which gave a percentage of (52.9%). While the varieties IBA99 and ADANA, planted at the third planting date 5/12, gave the lowest harvest index percentage, reaching (34.6 and 37.3%), respectively. The superiority of these varieties in this trait is attributed to their superiority in individual plant yield, and this result is consistent with the results of (1, 3, and 13), who indicated that the increase in harvest index is due to the increase in grain yield

.

Table 9. effect of planting dates and varieties and the interaction between them on the harvest index %.

Means	Planting dates			Varieties
	12\5	11\20	11\5	
44.82b	34.63d	45.13cd	45.70cd	IBA99
45.95b	37.36d	47.60bc	52.90abc	ADANA
50.88ab	45.00cd	58.00abc	49.66bc	Al-Faris
52.33a	46.16bc	60.73a	46.10bc	Baghdad
	40.78b	53.86a	51.09a	Means

Conclusion :

The results obtained in this study showed that the varieties were variable in their response to planting dates. Different planting dates led to an increase or decrease in crop growth periods, which affected the components of the yield. Three varied planting dates were used. The first planting date, 5/11, recorded a slight superiority over the rest of the planting dates. The reason may be that the environmental conditions were fairly similar in terms of the average values of the studied traits, as the ADANA variety outperformed for most of the studied traits. During the three dates distributed over the course of a month, different results may be obtained when studying other dates or studying the same dates for several seasons .

ISSN 2072-3857

References :

-1

Abdelhamed, Z.A. 2016 . Analysis of the genetic pathway coefficient for several cultivars of bread wheat and their effect on seed quantity. Al-Furat Journal of Agricultural Sciences . 8(4):213-223.

-2 Ahmad, G., M.Ishaq, S. Khan, R. Ali, K. Afridi, I. A. Khalil and I.A. Shah, 2015. Performance of newly developed wheat advanced lines evaluated under different planting dates for important traits. Euro. Acad. Res .10:12598-12614.

-3Al-Asil, A.S.M., D.S.M. Al-Obaidi and M.H.M. Al-Qadi. 2018. Response of bread – wheat cultivars Triticum aestivum L to four planting dates . Tikrit University Journal of Agricultural Sciences 18(2)41-53.

-4Al-Azzawi, Omar Muhammad. 2005. Determining the climatic requirements of bread wheat varieties through the influence of planting dates. MSc thesis - College of Agriculture. Baghdad University.

-5Al-Baldawi, Muhammad Hadhal Kazem Muhammad. 2006. The effect of planting dates on grain filling duration, growth rate, yield and its components in some bread wheat varieties. PHd dissertation. faculty of Agriculture. Baghdad University.

-6Al-Hassan, Muhammad Fawzi Hamza. 2007. Pattern and branching ability of five varieties of wheat (Triticum aestivum L.) as a result of planting date and its relationship to grain yield and its components. faculty of Agriculture. Baghdad University.

-7Ali, Salim Mahdi Al-Aseel, Dawoud Salman Madab, and Muhammad Hamdi Mahmoud. 2018. Response of bread wheat (Triticum aestivium L.) varieties to four planting dates. Tikrit University Journal of Agricultural Sciences. Volume (18) Issue (2.(

-8Al-Jayashi .M.T, Ali A.S. H and Alyaa M. A. 2021. Effect of Planting Dates on Growth and Yield of Four Cultivars of Wheat. Second International Conference for Agricultural Science. IOP Publishing. 1-7.

-9Al-Mohammadi, Hadeel Sabbar Hamad. 2011. Response of bread wheat (Triticum aestivum L.) to planting date in the environment of Anbar Governorate.

-10Al-Moussawi, Mazen Nouri Muhammad Hussein, 2001. The effect of planting dates and seeding rates on the growth, yield and quality of genotypes of durum wheat. PHd dissertation. faculty of Agriculture. Baghdad University.

-11Al-Othmani, Shahira Jari. 1996. The effect of planting date on the growth and yield of rye wheat. PHd thesis, College of Agriculture, University of Baghdad.

-12Al-Rawi, Khashi Mahmoud and Abdulaziz Khalafallah. 1980. Design and analysis of agricultural experiments. Ministry of Higher Education and Scientific Research.

ISSN 2072-3857

-13Al-Tamimi, U.H.T. 2019. Determination of genetic divergence by RAPD technology, cross-breeding (breed x Scout) and somatic crossbreeding in bread wheat. MSc Thesis. faculty of Agriculture. Baghdad University.

-14 Bhatta,M.R. 1992. Variation in morpho-physiological characters of spring wheat evaluated under normal and late planting College, Laguna (Philippines) feb.90 leaves.

-15 Erice, G., Sanz-Sáez, A., Urdiain, A., Araus, J. L., Irigoyen, J. J., and Aranjuelo, I. 2014. Harvest index combined with impaired N availability constrains the responsiveness of durum wheat to elevated CO2 concentration and terminal water stress. Functional Plant Biology, 41, 1138–1147.

-16 Evans,L.,T. I. Wardlaw and R.fischur. 1975. Evans (ed) Crop physiology. Cambridge University press. Cambridge .U.K. pp:116-..118.

-17Hashem, Imad Khalil and Hanaa Khudair Al-Haidari. 2012. Response of some wheat growth traits to planting dates and irrigation periods. Iraqi Agricultural Sciences Journal. 51- 42 (5) 43.

-18Knezevic, D., Radosavac, A., and Zelenika, M. 2015. Variability of grain weight per spike in wheat grown in different ecological conditions. Acta Agriculturae Serbica, 39(2):85-95.

-19Kobataa, T., Koçb, M., Barutçularb, C., Tannoc, K.I., and Inagakid, M. 2018. Harvest index is a critical factor influencing the grain yield of diverse wheat species under rain-fed conditions in the Mediterranean zone of southeastern Turkey and northern Syria. Plant Production Sci., 21 (2): 71 –82.

-20Meleha .A. M. I, A. F. Hassan, M. A. El-Bialy, and M. A. El-Mansoury. 2020. Effect of Planting Dates and Planting Methods on Water Relations of Wheat. International Journal of Agronomy. 1-11.

-21Muhammad, Hanaa Hassan. 2000. Growth, yield and quality characteristics of bread wheat varieties as affected by planting date. PHd thesis, College of Agriculture, University of Baghdad.

-22Muhammad, Labeed Sharif. 2013. Response of some wheat growth characteristics to differences in planting date and their relationship to yield. Tikrit University Journal of Agricultural Sciences. 250-240: (3). 13.

-23Peltonen S.P, F. Forsman. and T . Poutala. 1997. Crop management effects on pre- and post- anthers is chenges in leaf area index and leaf area duration and there contribution to grain yield and yield components in spring cereals.J. of Agron. and crop Sci. Zietschrift fur pflanzenbou. .47-61 :)1(179

-24Pirasteh, B. and J.R. Welsh. 1980. Effect of temperature and the heading date of wheat cultivars under a lengthening photoperiod. Crop Sci. 20 : 453-456.

-25Shirinzadeh, A., Abad, H. H., Nourmohammadi, G., Haravan, E. M., and Madani, H. 2017. Effect of planting date on growth periods, yield, and yield components

of some bread wheat cultivars in Parsabad Moghan. International J. of Farming and Allied Sci.s, 6(4): 109-119.

-26Singh,A., D.Singh., J. Kang and N. Aggarwal. 2011. Management practices to mitigate the impact of high temperature on wheat.IIOAB.J.2(7):11-22.

.

-27Warrington, I.J., R.L. Dunstone and L.M. Green. 1977. Temperature effects at three development stage on the yield of the wheat ear. Aust. J. Agric. Res. 28: 11-27

ISSN 2072-3857