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Effect Of Different Sowing Dates On New Wheat Genotypes Under Thal Irrigated Conditions

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Abstract

A field experiment was conducted at at Agronomic Research karor Lal Essan, Layyah to analyses the effect of different sowing dates on wheat verities. Six sowing dates viz. 1st November (D1), 11th November (D2), 20th November (D3), 30th November (D4), 10th December (D5), 20th December (D6) were tried on Six wheat varieties: Akbar-19 (V1), FSD Live 16005, FSD Line 1653, Bhakkar Star-19, Fakhare Bhakkar, and Azri Line 15137. The layout system was RCBD split plot design with three replications (6m × 135m = 8.1m). R×R 22.5cm and No of Rows/plant 05 and spare 01 rows after each verity. Path width 1m Sowing dates and varieties were randomized in main (Sowing Date) and sub-plots (Verities). The sowing dates significantly affected germination count per unit area. The variety TWS-15137 has the highest biological yield (20576) while minimum recorded by Akbar (18656). The 11th November shows the highest yield while st December has the minimum yield Germination was higher TWS-1537 (24691 kg/ha) in November 11th sowing which statistically at par with Fakhare Bhakkar-17 (24691). Bhakkar star-19, subhani 21, andakbar-19 shows non-significant. Whereas the Variety TWS-1437 shows the significant effect with fakhre Bhakkar-17. The data regarding 1000-grain weight indicated that 1000-grain weight was significantly affected by sowing times. The crop sown on 1st November produced significantly heavier grains (44.72 g) than that of the crop sown on 11th November (43.61g), 30th November (43.05 g) and 1st December (41.66 g). Significantly maximum plant height (109.38 cm) was obtained when crop was sown on 1st November against the minimum plant height (102.42 cm) in case of 20th December sowing. the variety the TWS-15137 which was sown on the 11th November has the highest number of tillers/m2 (370) and Dilkahs-21 which was sown on 20th December has the lowest no of tillers per meter square (229). It was concluded that maximum growth was analyzed in early sowing with different varieties. This data is very helpful for the farmers in planning of wheat growing with early sowing dates.

1. Introduction

The government of Pakistan is still needed to improve its wheat production by permuting farmers to high yielding and new with different genotype varieties. The previous research has shown that a slow growth rate in new wheat crop variety replacement by farmers in Pakistan (Joshi, Rehman et al. 2017). To produce more food

from less water in arid and semi-arid areas is a challenge for today's agriculture (Mahmood, Rafique et al. 2021, Rebi, Rehman et al. 2021).

Wheat is the major food crop as well as one of the main agricultural products in Pakistan (Rebi, Ahmed et al. 2021, Rebi, Kashif et al. 2022). Wheat is not just an essential part of the Pakistani diet, but also absolutely critical to the country's economy and to the farmers who cultivate it (Ali, Liu et al. 2017). The government of Pakistan's goal to achieve self-sufficiency in wheat production just became more attainable with the release of five new wheat varieties. These new seeds could help the country's 8.8 million hectares of wheat-farmed area become more productive, climate-resilient and disease-resistant — a welcome development in a region where new climate change scenarios threaten sustained wheat production (Erenstein, Chamberlin et al. 2021).

Most wheat used for food requires processing. The grain is cleaned and then conditioned by the addition of water so that the kernel breaks up properly. In milling, the grain is cracked and then passed through a series of rollers (Papageorgiou and Skendi 2018). As the smaller particles are sifted out, the coarser particles pass to other rollers for further reduction. About 72 percent of the milled grain is recovered as white flour. Flour made from the whole kernel is called graham flour and becomes rancid with prolonged storage because of the germ-oil content retained (Yang, Zhou et al. 2021). White flour, which does not contain the germ, preserves longer. Inferior and surplus wheats and various milling by-products are used for livestock feeds.

The greatest portion of the wheat flour produced is used for breadmaking. Wheats grown in dry climates are generally hard types, having protein content of 11–15 percent and strong gluten (elastic protein) (Saleem, Ahmad et al. 2015). The hard type produces flour best suited for breadmaking. The wheats of humid areas are softer, with protein content of about 8–10 percent and weak gluten. The softer type of wheat produces flour suitable for cakes, crackers, cookies, and pastries and household flours (Xu, Zhang et al. 2020). Durum wheat semolina (from the endosperm) is used for making pastas, or alimentary pastes.

Pakistan has a variable climate, ranging from arid (33-254mm annual rainfall) in the south to humid (1016-2032mm annual rainfall), sub-humid (508-1016mm annual rainfall) and semi-arid (254-508mm annual rainfall) in the north (Rashid, Ayaz et al. 2014). The Indus River that originates from the north along with its tributaries irrigates the great plains of the country including Central Punjab. Chaudhry and Rasul found that about 2/3 of the total agriculture area lies in the arid climate. Although the crop is well adapted to climate between the latitudes of 30° and 60°N and 27° and 40°S, however, it is grown under wide range of climatic conditions from within the Arctic circle to higher elevations near the equator (Torres, Pierantozzi et al. 2017). Research by the International Maize and Wheat Improvement Center (CIMMYT) during the past two decades has shown that wheat production in much warmer areas is technologically feasible. In altitude, the crop is grown from sea level to more than 3,000 m.a.s.l., and it has also been reported at 4,570 m.a.s.l in Tibet. The optimum growing temperature is about 25°C, with minimum and maximum growth temperatures of 3° to 4°C and 30° to 32°C, respectively.

Wheat is adapted to a broad range of moisture conditions and can be grown in most locations where precipitation ranges from 250 to 1750 mm (Kesho, Chala et al. 2020). Classification into spring or winter wheat is common and traditionally refers to the season during which the crop is grown. For winter wheat, heading is delayed until the plant experiences a period of cold winter temperatures (0° to 5°C), Spring wheat, as the name

implies, is usually planted in the spring (can be sown in autumn in countries like Pakistan that experience mild winters) and matures during summer (Monneveux, Jing et al. 2012). Wheat, as a human food is prized for its taste and as source of calories, protein, and certain vitamins and minerals, is the world most important crop. Its importance is derived from the properties of its gluten, a cohesive network of tough endosperm, proteins that stretch with the expansion of fermenting dough, yet hold together to produce a risen" loaf of bread (Arzani 2019). Only the grain of wheat, and to lesser extent the grain of rye, has this property. In addition to its utilization for bread large quantities of wheat are utilized for unleavened bread such as "Chapatti" in Pakistan and India, for pastry products, and for semolina products (Mehfooz, Ali et al. 2018). These uses, combined with its nutritive value and storage quality, have made wheat a staple food for more than one-third of the world's population. In general, hard wheat varieties are used for bread flour and pasta, and soft varieties for cake flour. Low grades of wheat, and by-products of1 the flour-milling, and distilling industries, are used as feed for livestock (Ganesan and Rajauria 2020). A minor amount of wheat is used as a coffee substitute, and wheat starch is employed as a sizing for textile fabrics. The objective of this research is (1) to find the effect of sowing dates on the growth and yield response of wheat (2) to enhance the production of wheat.

2. Material and Method

2.1 Site

This study was conducted at Agronomic Research karor Lal Essan, Layyah. Six sowing dates viz. 1st November (D1), 11th November (D2), 20th November (D3), 30th November (D4), 10th December (D5), 20th December (D6) were tried on Six wheat varieties: Akbar-19 (V1), FSD Live 16005, FSD Line 1653, Bhakkar Star-19, Fakhare Bhakkar, and Azri Line 15137. The layout system was RCBD split plot design with three replications (6m × 135m = 8.1m). R×R 22.5cm and No of Rows/plant 05 and spare 01 rows after each verity. Path width 1m Sowing dates and varieties were randomized in main (Sowing Date) and sub-plots (Verities).

2.2 Plant height (cm)

Plant height data was measured at maturity by measuring the height with the help of measuring rod from the base of the plant to the tip of spike of ten representative plants in each sub plot randomly.

2.3 Experiment design and Layout:

The experiment was laid out in a RCBD Split plot design with three replications.

SD6						**SD5**						**SD4**						**SD3**						**SD2**						**SD1**						
V8	V3	V1	V2	V6	V7	V8	V3	V1	V2	V6	V7	V8	V3	V1	V2	V6	V7	V8	V3	V1	V2	V6	V7	V8	V3	V1	V2	V6	V7	V8	V3	V1	V2	V6	V7	**R3**
V3	V4	V5	V6	V7	V8	V3	V4	V5	V6	V7	V8	V3	V4	V5	V6	V7	V8	V3	V4	V5	V6	V7	V8	V3	V4	V5	V6	V7	V8	V3	V4	V5	V6	V7	V8	**R2**
V6	V5	V4	V3	V2	V1	V6	V5	V4	V3	V2	V1	V6	V5	V4	V3	V2	V1	V6	V5	V4	V3	V2	V1	V6	V5	V4	V3	V2	V1	V6	V5	V4	V3	V2	V1	**R1**

Office road

V_1: Akbar – 19 D1= 1st Nov Design= RCBD split plot design with three Reps

V_2: Fsd Line D2= 10th Nov Plot size= 6m*1.35* = 8.1m

V_3: Fsd Line—16 D3= 20th Nov

V_4: Bhakkar Star – 19 D4= 30th Nov

V_5: Fakhar e bhaker D5= 10th Dec

V_6: AZRI Line 1 D6= 20th Dec

2.4 Spike Length (cm)

Spikes of ten tillers were randomly selected from each sub plot and were measured with scale in cm from the basal joint of the spike till the terminal spike excluding the awns.

2.5 Observations recorded:

Following observations were recorded during the course of study:

- Plant height cm,
- Spikelets/spike,
- Spike length cm,
- Number of productive tillers m-2,
- Number of grains per spike.
- 1000-grain weight,
- Biological yield,
- Grain yield and
- Harvest index.

2.6 Spikelets Spike-1

Ten spikes were selected randomly from each sub plot and number of spikelet's were counted on each spike manually.

2.7 Grains Spike-1

Ten spikes were selected randomly from each plot and grains spike-1 were counted. The values were averaged to obtain the mean value.

2.8. Number of productive tillers m-2:

Data from one square meter with the help of quadrate was harvested with the help of sickle from each sub plot. After that number of tillers were counted manually from the harvested data of each plot.

2.9 1000-Grain Weight

Thousand grains were counted from threshed clean grains of each treatment and then were counted manually 1000-grain weight of each treatment.

2.10 Biological yield (kg/ha): For recording biological yield meter per square data of each sub plot were harvested at their maturity and the whole material was sun dried. After drying it was weighed by spring balance and was converted to (kg/ha).

2.11 Grain yield (kg/ha):

For recording grain yield data, meter per square with the help of quadrat were harvested from each sub plot with the help of sickle and were sun dried. After threshing the grains were weighed with the help of electronic balance and converted into kg/ha).

2.12 Harvest index:

Harvest index is calculated by dividing grain yield over biological yield and multiplied by 100. The formula is as follows:
HI= grain yield/biological yield*100

2.13 Statistical Analysis:

The data collected on all parameters were analyzed statistically by using Fisher's Analysis of Variance Technique (Steel et al., 1997). Least Significant Difference (LSD) test, at 5% probability level, was applied to compare the treatment's means (Gomez and Gomez, 1999).

3. Results and Discussion

3.1 Biological Yield kg/ha

The Biological yield of crop is always determined by its stand density that is function of its initial germination. The sowing dates significantly affected germination count per unit area. All the verities and sowing date shows significant differences. The variety TWS-15137 has the highest biological yield (20576) while minimum recorded by Akbar (18656). The 11th November shows the highest yield while st December has the minimum yield Germination was higher TWS-1537 (24691 kg/ha) in November 11th sowing which statistically at par with Fakhare Bhakkar-17 (24691). These have the similar results with the findings of (Hussain, Khan et al. 2006, Mukherjee 2012).

VARIETIES	SOWING DATE						MEAN
	1ST NOV. 02-11-20	11th NOV. 4-11-20	30th NOV. 20-11-20	1st DEC. 1-12-20	11TH DEC. 11-12-20	30th DEC. 30-12-20	

Akbar – 2019	18519 g-l	21399 b-f	19753 e-i	18930 f-k	17284 i-m	16049 l-m	18656 c
Dilkash-21	22634 a-d	21811 b-e	19753 e-i	18930 f-k	18930 f-k	17696 i-m	19959 ab
Subhani-21	20576 d-h	23457a-c	20576 d-h	18519 g-l	16872 j-m	16461 k-m	19410bc
Bhakkar Star-19	23457 a-c	22634 a-d	20988 c-g	18519 g-l	16872 j-m	19342 e-j	20302 ab
FakharBhakkar-17	24691 a	20988c-g	18930 f-k	18930 f-k	15226 m	18107 h-l	19479 a-c
TWS – 15137	21399 b-f	24691 a	23868 ab	20576 d-h	16872 j-m	16049 lm	20576 a
MEAN	21879ab	22497 a	20645 b	19067 c	17010 d	17284 d	
LSD $^{5\%}$: SOWING DATE: 1267.0, VARIETIES :1146.8, INTERACTION: 2809.0							

3.2. Spike Length (cm)

More the spike length it contains a greater number of wheat grain which ultimately increase the wheat yield. As below table shows that, the variety Fakhare Bhakkar-17 has the highest spike length (11.06 cm) which statistically at par with Bhakkar star-19(10.85 cm). however, Bhakkar star-19, subhani 21, andakbar-19 shows non-significant. Whereas the Variety TWS-1437 shows the significant effect with fakhre Bhakkar-17 but statistically at par with Akbar-19 and dilkash-21. The sowing date also effect on the spike length of the wheat. The wheat which are sown on 11th November has the longest spike length (11.32 cm) non-significant with 1st November sown. However, 30th December has the shortest spike length (10.36 cm) which are statistically at par 30th November,1st December and 11 December. These results are consistent with the findings of (Tayyar 2010, Tripathi, Chander et al. 2013)

VARIETIES	**Sowing Date**						**MEAN**
	1ST NOV. 02-11-20	**11th NOV. 4-11-20**	**30th NOV. 20-11-20**	**1st DEC. 1-12-20**	**11TH DEC. 11-12-20**	**30th DEC. 30-12-20**	

Akbar – 2019	11 c-g	11 b-g	10 f-g	10 d-g	10 d-g	10 d-g	10bc
Dilkash-21	11 c-g	12 a	10 d-g	10 g	10 d-g	11 d-g	11 a-c
Subhani-21	11 a-f	11 c-g	11 a-e	10 d-g	10 d-g	10 e-g	10bc
Bhakkar Star-19	11 c-g	12 a-c	10 d-g	11 a-d	10 d-g	10 d-g	10 ab
FakharBhakkar-17	12 ab	12 a-c	10 d-g	11 a-e	11 d-g	10 d-g	11.06a
TWS – 15137	11 d-g	11 d-g	10 d-g	10 d-g	10 d-g	10 g	10.44c
MEAN	11 ab	11 a	10 bc	10 bc	10 bc	10 c	
LSD 5%: SOWING DATE: 0.5560, VARIETIES :0.3640, INTERACTION: 0.8917							

3.3. 1000 Grain Weight (g)

The early sowing of wheat resulted in the better development and the growth of the grains due to longer growing period. The data regarding 1000-grain weight indicated that 1000-grain weight was significantly affected by sowing times. The crop sown on 1st November produced significantly heavier grains (44.72 g) than that of the crop sown on 11th November (43.61g) , 30th November (43.05 g) and 1st December (41.66 g). The grain weight decreased significantly with each day delay in sowing. Among the varieties, Fakhre Bhakkar produced maximum 1000-grain weight (48.00 g) which is statistically at par with TWS-1537 (47.66 g). The minimum 1000-grain weight (37.00 g) was produced by Bhakkar Star-19. The interaction between varieties and sowing dates was found to be significant. Fakhare -Bakkhar produced the heaviest 1000- grain weight (48.00 g) when it was sown on 1st November. However, minimum1000-grain weight (37 g) was produced by Bhakkar star-19 when it was sown on 11th December which was statistically at par with Akbar-91 (38.33 g) when it was sown on 11th December. The results are similar with the agreements of (Sacks, Deryng et al. 2010, Zheng, Chenu et al. 2012).

VARIETIES	SOWING DATE						MEAN
	1ST NOV. 02-11-20	11th NOV. 4-11-20	30th NOV. 20-11-20	1st DEC. 1-12-20	11TH DEC. 11-12-20	30th DEC. 30-12-20	
Akbar – 2019	46.333 a-c	46.667 a-c	41.667 a-e	45.000 a-d	38.33 de	38.33 de	42.722 ab
Dilkash-21	42.667 a-e	41.667 a-e	43.333 a-e	40.000 b-e	40.000 c-e	40.667 a-e	41.389 b
Subhani-21	43.333 a-e	45.000 a-d	46.667 a-c	41.667 a-e	41.667 a-e	41.667 a-e	43.333 ab
Bhakkar Star-19	41.667 a-e	43.333 a-e	45.000 a-d	38.333 de	37.000 e	41.667 a-e	41.167 b
FakharBhakkar-17	48.000 a	43.333 a-e	43.333 a-e	45.000a-d	41.667 a-e	46.667 a-c	44.667 a
TWS – 15137	46.333 a-c	41.667 a-e	38.333 de	40.000 b-e	47.667 ab	38.000 de	42.000 ab
MEAN	44.722a	43.611ab	43.056 ab	41.66ab	41.167b	41.056 b	
LSD 5%: SOWING DATE :3.4151 VARIETIES :3.1225, INTERACTION: 7.6486							

3.4 Plant Height (cm)

The data on plant height revealed that both the sowing dates and varieties affected the plant height significantly. Significantly maximum plant height (109.38 cm) was obtained when crop was sown on 1st November against the minimum plant height (102.42 cm) in case of 20th December sowing but it was statistically similar to 11th November sowing (108.72 cm). subhani-21 produced the tallest plants (112.77 cm) which statistically at par with Bhakkar Star-19 (111.23 cm), whereas the lowest plant height of (97.07 cm) was produced in TSW-15137. However, the interaction between sowing dates and varieties was found to be significant. These results are also similar with those reported by (Ahamed, Nahar et al. 2010, Waha, Van Bussel et al. 2012).

VARIETIES	SOWING DATE						MEAN
	1ST NOV. 02-11-20	11th NOV. 4-11-20	30th NOV. 20-11-20	1st DEC. 1-12-20	11TH DEC. 11-12-20	20th DEC. 30-12-20	
Akbar – 2019	106.57	105.20	106.13	102.47	102.27	101.00	103.94 c
Dilkash -21	109.33	111.40	104.30	103.47	100.77	101.43	105.12 bc
Subhani 21	112.77	110.00	108.87	105.87	103.53	101.77	107.13 a
Bhakkar Star-19	111.23	109.90	108.80	105.40	104.03	108.13	107.92 a
FakharBhakkar-17	110.33	108.80	109.13	104.13	103.53	105.13	106.84 ab
TWS – 15137	106.03	107.00	103.23	103.87	102.73	97.07	103.32 c
MEAN	109.38a	108.72 a	106.74 ab	104.20 bc	102.81c	102.42 c	
LSD 5%: SOWING DATE :3.5544, VARIETIES :1.8215, INTERACTION: 4.4617							

3.5. No of Tillers/m^2

The Sowing dates shows statistically at par but varieties show a significant difference. The variety TWS-15137 have the height no of tillers and Dilkash-21 have the lowest number of tillers while Akbar-19, subhani-21, Bhakhar star-19 and Fakhare Bhakkar-17 are statistically at par. While, the variety the TWS-15137 which was sown on the 11th November has the highest number of tillers/m2 (370) and Dilkahs-21 which was sown on 20th December has the lowest no of tillers per meter square (229). The results of this research are similar with the (Tripathi, Chander et al. 2013).

3.6. Grain Yield

Grain yield of wheat crop is the result of combined effect of various yield contributing components. It is evident from the data that sowing date affected significantly the grain yield. Significantly maximum grain yield (5869.44 kg ha-1) was obtained when crop was sown on 11th November with minimum grain yield (4731.8 kg ha-1) in case of late sowing i.e., 11th December. The grain yield was non significantly affected by various varieties. The

variety Akbar produced significantly maximum yield (6448.3 kg ha-1) followed by Dilkash-21 Subhani-21, Bhakkar star-19, Fakhare Bhakkar-17 and TWS-15137. These result are in good agreements with the (Kerbouai, Cheikh M'hamed et al. 2022).

3.7 Harvest Index

The varieties and sowing dates show non-significant differences. Variety Akbar-19 has the highest harvest index (28.33) while the Variety TWS-15137 has Harvest index is (25.50) which statistically at par with Dikash-21, subhani-21, Bhakkar Star-19 and Fakhare Bhakkar-17. However, the Akbar-19 which are sown on 1st November has highest harvest index (32.00) and the minimum harvest index was shown by the variety Fakhare Bhakkar-17 (21.00). The results of this research are in good agreements with the findings of (Kirby, Appleyard et al. 1985, Porter, Kirby et al. 1987, Mukherjee 2012).

4. Conclusion

An experiment was conducted at at Agronomic Research karor Lal Essan, Layyah to analyses the effect of different sowing dates on wheat verities. Six sowing dates were tried on six wheat varieties: Akbar-19 (V1), FSD Live 16005, FSD Line 1653, Bhakkar Star-19, Fakhare Bhakkar, and Azri Line 15137. The sowing dates significantly affected germination count per unit area. The variety TWS-15137 has the highest biological yield (20576) while minimum recorded by Akbar (18656). The 11th November shows the highest yield while st December has the minimum yield Germination was higher TWS-1537 (24691 kg/ha) in November 11th sowing which statistically at par with Fakhare Bhakkar-17 (24691). Bhakkar star-19, subhani 21, andakbar-19 shows non-significant. Whereas the Variety TWS-1437 shows the significant effect with fakhre Bhakkar-17. The data regarding 1000-grain weight indicated that 1000-grain weight was significantly affected by sowing times. The crop sown on 1st November produced significantly heavier grains (44.72 g) than that of the crop sown on 11th November (43.61g), 30th November (43.05 g) and 1st December (41.66 g). Significantly maximum plant height (109.38 cm) was obtained when crop was sown on 1st November against the minimum plant height (102.42 cm) in case of 20th December sowing. the variety the TWS-15137 which was sown on the 11th November has the highest number of tillers/m2 (370) and Dilkahs-21 which was sown on 20th December has the lowest no of tillers per meter square (229). It was concluded that maximum growth was analyzed in early sowing with different varieties. This is very helpful for the farmers in planning of wheat growing with early sowing dates.

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