Effect of Planting Dates on Yield Attributes of Wheat Genotypes under Rainfed Conditions of Pothwar

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Abstract

Yield attributes in different wheat genotypes were monitored under the influence of three Planting windows. The field experiment was carried out at National Agricultural Research Center (NARC), Islamabad, Pakistan during Rabi season 2021-22, to study the effect of three sowing dates 25th November, 10th December and 25th December on different genotypes of wheat. Sowing dates significantly affected the number of fertile tiller m^{-2}, plant height, spike length, 1000 grain weight and grain yield. In case of planting window, significantly maximum grain yield obtained was 5587.8 kg ha^{-1} when crop was sown on 25th November against minimum grain yield 4480.5 kg ha^{-1} in case of late sowing while maximum numbers of tillers were observed in NR-546 and minimum number of tillers were obtained in Markaz-2019. The overall findings concluded that the effect of sowing dates was significant as early and late sowing of the crop as it directly effects on yield attributes.

Key words: Sowing dates, tillers, yield, wheat, genotypes

Introduction

Wheat is the ruling crop in the world as well as in Pakistan. Nowadays the major task of wheat agronomists is to enhance the productivity of wheat crop. The productivity of wheat crop can be improved by development in the components of production technology like improvement in management practices. It is most essential staple food crop of the world. Wheat is therefore,

wholesome food for the people of Pakistan and thus tenanted a median position in forming agriculture policies and dominates in all crops in acreage and production. During 2021-22, agriculture sector recorded a remarkable growth rate of 4.40 percent and transcended the target of 3.5 percent. This growth rate is navigated by availability of certified seeds and thus high yield. Moreover, major food crops shared a 19.44 percent to the valve addition in agriculture sector and 4.41 percent to gross domestic production. In addition to this, area on which wheat was sown during 2022-23 was 9043 thousand hectares. This area contributed to the production of 27.634 million tones with an average yield 2490 kg ha^{-1} (Economic survey of Pakistan, 2022-23). Furthermore, it is considered as a major source of nutrition for humans and livestock (Shewry *et al*., 2009). Likewise, wheat is a winter crop and has its own demands for growth and development. Temperature and light for growth and flowering has contributed to this cause (Dabre *et al*., 1993). Moreover, to get appropriate yield of wheat crop, sowing time and varietal choice plays major role in a country like Pakistan where climatic swings vary throughout the country (Ali *et al*., 2010). In addition to this, many factors are responsible for low yield and in among those factors, time of sowing of wheat crop matters a lot. In the same way, early sowing of wheat crop produces weak plants with fragile root system as temperature is above the optimum threshold (Tahir *et al*., 2009). However, late sowing of wheat crop results formation of poor tillers. Moreover, in late planting wheat crop may be of short duration that may break out from high temperature and grain filling stage (Phadnawis and Saini, 1992). Late sowing of wheat contributed in reduction of yield which may be caused by the yield attributes like number of tillers, number of grain per spike and ultimately grain yield (Tahir *et al*., 2009). Early sowing increases plant population per unit area, plant height, spike length, number of spikelet's per spike, 1000 grain weight and consequently grain yield (Shafiq, 2004). Hence, many varieties with high yield and general cultivation have been recommended in the past. But, now due to climate changes and changes in edaphic factors has resulted in decreased yield potential of those varieties. Therefore, selection of those genotypes that can withstand the changing edaphic and environmental factors are needed in order to increase the yield of wheat crop per hectare. Keeping this in view, the present study was conducted to evaluate the effect of different sowing dates on wheat crop productivity at NARC, Islamabad.

Materials and Methods

A field experiment was conducted to evaluate the effect of different sowing dates on different wheat genotypes. Experiment was carried out at National Agriculture Research Center (NARC) Islamabad, Pakistan during Rabi season 2021-22. The experiment consisted fifteen genotypes of wheat such as NR-546, NR-549, NR-550, NR-552, NR-556, NR-555, NR-577, NR-558, NR-564, NR-560, NARC-Super, Pakistan-13, Borloug-2016, Zincol-2016 and AZRC Dera with three planting windows viz 25th November, 10th December and 25th December. The experiment was laid out in randomized complete block design with split plot arrangement having three replications. The nitrogen and phosphorous was applied in the form of DAP and Urea @ 27.7 kg ha^{-1} each. The fertilizer was applied at the time of sowing. The crop was sown with a crop planter on a well prepared seedbed using a seed rate of 112.5 g per plot. All the agronomic practices were kept normal and uniform for all the treatments. The observation recorded included number of fertile tillers (m^{-2}), plant height (cm), spike length (cm), 1000-grain weight and grain yield (kg ha^{-1}). The data collected was then analyzed statistically by using Statistics 8.1 software and means were compared using least significant difference test at 5% probability level (Steel *et al.,* 1997).

Results and Discussion

Data of sowing significantly influenced the growth parameters; plant height, spike length, number of tillers m^{-2}, thousand grain weight and yield.

Plant height (cm)

The data on plant height revealed that the sowing dates have significantly affected the height of the crop plant. Significantly maximum plant height (98.31 cm) was recorded when crop was sown on 25th November while minimum plant height (94.15 cm) was recorded when crop was sown on 10th December. The crop sown on 25th December showed average plant height (95.30 cm). Moreover, candidate line NR-556 produced tallest plant (100 cm) while candidate line NR-560 gave shortest plants. However, the interaction between sowing dates and genotypes was found to be non-significant. Ahmad, 1991 stated that the difference in height of the crop may be due to their genetic makeup. It has been clearly observed that the crop sown early has more plant

height as compared to the one sown late. Early sown crop must have enjoyed the healthier environmental conditions and growing period. Shahzad *et al*., (2002) has also supported our results.

Spike length

Spike length is an important yield attributing parameter and has direct effect on yield of the plant. Significant difference was analyzed between sowing date and length of spike. When crop was sown on 25th November, 11.06 cm of spike length was recorded as compared to the crop sown on 10th December with spike length of 10.64 cm, while 10.66 cm of spike length was observed in crop sown on 25th December.

Similarly, candidate line NR-555 produced more spike length and less spike length was observed in variety; Zincol-2016. Interaction between genotypes and sowing dates was non-significant.

Sowing dates significantly affected the number of productive tillers. The crop sown on 25th November produced significantly more number of tillers m^{-2} (311.58) as compared to the crop sown on 10th December which produced 217.91 tillers m^{-2}.

Number of tillers

305.00 number of tillers were produced by crop sown on 25th December. Non-significant differences were found between sowing dates and varieties. Therefore, candidate line NR-546 produced more number of productive tillers m^{-2} (312.4) while minimum number of productive tillers was recorded in genotype: Markaz-2019 m^{-2}. Tillers are the productive part of the crop as they are yield indicator. In late sowing, number of productive tillers is less while number of tillers in early sowing has been reported to be higher. These results are in accordance with the finding of Aslam *et al*., (2003) and Shah *et al.*, (2006).

1000 grain weight

The data regarding 1000 grain weight showed that the sowing dates have significantly affected the 1000 grain weight. Crop sown on 25th November significantly gave higher grain 33.178 g while the crop sown on 10th December gave grains 25.622 g. 32.00 g grains were weighed when crop was sown on 25th December. However, interaction between genotypes and sowing dates did

not give significant result. Moreover, among varieties, Markaz-2019 produced higher grain weight (32.00 g) while Zincol-2016, gave less grain weight (28.111 g). Likewise, early sowing has also effected the weight of grains as timely sowing gave better growth and development time to the crop. Grain weight difference among genotypes may be due to their genetic diversity. This was also supported by Spink *et al*., (2000) and Shahzad *et al*., (2002) as they also found that the decrease in weight of the grain is due to late sowing of crop.

Grain yield

The yield of crop is always determined by crop health and yield attributing parameters that is function of its germination. Yield of the crop is result of combined effects of yield reflecting parameters. The result of the grain yield showed that sowing dates has significantly affected the yield of the crop. Likewise, maximum grain yield 5352 kg ha^{-1} was recorded in first sowing date that was 25th November which is due to the more number of tillers under early sowing as compared to the minimum grain yield 4875.6 kg ha^{-1} that was recorded against last sowing date which was 25th December. These results are in agreement with the findings of Akbar *et al*., (2006). Therefore, interaction between varieties and sowing date was not significant. Among genotypes, Zincol-2016 produced higher grain yield 5587.8 kg ha^{-1} while candidate line NR-577 gave minimum yield 4480.5 kg ha^{-1}. This result also justifies the findings of Dokuyucu *et al*., (2004). Nutrients application at the time of sowing has contributed in increasing the yield of the wheat crop with early sowing as longer growing period of the crop while lowest grain yield was recorded when crop was sown late. Similar evidence was also given by Mosalem *et al*., (2006).

Table 1. Effect of sowing date on growth and yield of Wheat Varieties.

Treatments (Sowing dates)	**Plant height (cm)**	**Spike length (cm)**	**Tillers (m^{-2})**	**1000 Grain weight (g)**	**Yield ($kgha^{-1}$**
S_1	98.311 A	11.059 A	311.58 A	33.178 A	5352 A
S_2	95.262 B	10.663 B	305.00 A	32.000 A	4942 AB
S_3	94.152 B	10.640 B	217.91 B	25.622 B	4875.6 B
LSD	2.10106	0.3832	30.933	2.2495	427.15

Wheat crop varieties may show differences within specie against various characters. However,

different cultivars responded to sowing dates that significantly resulted in decrease in the grain yield (Table 2)

Table 2. Effect of sowing dates on growth and yield of wheat varieties

Genotypes	Plant height	Spike length	Tillers	1000 Grain weight	Yield
NR-546	93.58 BC	10.587 BC	312.44 A	29.667 A	4995.1 ABC
NR- 549	98.24 AB	10.607 BC	286.89 AB	31.778 A	4587.7 BC
NR-550	96.67 AB	10.593 BC	266.33 AB	31.111 A	5153.3 ABC
NR-552	97.64 AB	11.073 BC	268.11 AB	30.333 A	5151.7 ABC
NR-556	100.60 A	11.000 AB	302.22 A	29.667 A	4788.6 ABC
NR-555	94.13 BC	11.492 A	269.89 AB	28.333 A	4558.4 BC
NR-577	95.42 BC	11.037 AB	269.22AB	29.667 A	4480.5 C
NR-558	96.11 ABC	10.981 AB	270.11 AB	31.667 A	5211.6 ABC
NR-564	96.91 AB	11.078 AB	289.56 A	31.889 A	5456.3 AB
NR-560	91.72 C	10.922 AB	292.00 A	29.778 A	5066.5 ABC
Narc-Super	95.24 BC	10.431 BC	291.56 A	30.333 A	5100.4 ABC
Pakistan-2013	94.76 BC	10.452 BC	268.67 AB	31.000 A	4688.8 ABC
Borloug-2016	95.43 BC	10.356 BC	276.44 AB	28.667 A	5559.3 A
Zincol-2016	94.56 AB	10.060 C	288.89 A	28.111 A	5587.8 A
Markaz-2019	97.61 AB	11.140 AB	219.11 B	32.00 A	5463.6 AB
LSD (5%)	4.6993	0.8568	69.168	N.S	955.13

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