Effect of different sowing dates on yield components of wheat (triticum aestivum L.) cultivars in Lorestan provience, Iran

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ABSTRACT

A study was undertaken to determine the effects of sowing dates on growth and yield components of different wheat cultivar in Iran. The trial was laid out in RCBD with split plot arrangement having three replications during 2011-12 and at Boroujerd, Iran. Five sowing dates i.e. October 31, November 15 and 30, December 15 and 30 were in main plots, whereas five wheat cultivars (Pishgam, Parsi, Bahar, Sivand and Pishaz) were in sub plots. Results shows that the effect of sowing date was significant on all parameters excluding HI. the effect of cultivars was significant on all parameters excluding 1000 grain weight. Maximum number of grain per spike related to Pishtaz cultivar. However, Maximum HI related to Pishgam and Bahar cultivars. Parsi cultivar  has the highest seed yield (10.23 ton/ha) and the Pishtaz cultivar has the lowest seed yield (8.59 ton/ha). The highest seed yield for sowing date (10.15 ton/ha) gave at November15 sowing date and the lowest seed yield (6.1 ton/ha) gave at December30 sowing date. The Parsi cultivar gave highest yield for sowing dates but Pishgam cultivar was better for sowing in November15 and Bahar cultivar was better for sowing in December15.

Keywords

Wheat
yield and sowing date

Introduction

Wheat (Triticum aestivum L.) is an important food crop grown during the winter season. Importance of wheat crop may be understood from the fact that it covers about 42% of total cropped area and 32% of total rice (Oryza sativa L.) area in rice-wheat system in South Asia (Iqbal et al., 2002). In wheat uniform stand establishment and early vigor are the principal determinant of crop performance (Chivasa et al., 1998). Amongst the factors limiting the uniform stand establishment poor quality seed (Radford, 1983), poor seedbed preparation (Joshi, 1987), low moisture (Harris, 1996), conventional sowing (Radford, 1983), late sowing and sub-optimum temperature at sowing (Farooq et al., 2008) are more important in our region. Late planting affects the growth, yield and quality of wheat, because early sowing produces higher yields than late sowing due to longer duration. Temperatures below or above normal alter plant functions and productivity. In late planted wheat, low temperature prevailing during germination substantially affects the germination and seedling emergence. Germination is a critical process, as temperature below 12°C result in poor and uneven emergence (Timmermans et al., 2007). Therefore, the rate of emergence and final emergence percentage are important factors in determine the crop potential in various temperature of wheat production.

In late planting season, temperature of soil can be expected to be below 10°C, which affects the seed germination and stand establishment. Generally wheat like other cool season crop is seeded early to take maximum period for growth and development toward maturity before the (possible) heat stress. However, mid-season seeding of winter wheat for any locality is usually most favorable, whereas late sown wheat suffers more winter injury, which produces fewer tillers and may ripen in lower grain weight and number of grains per plant (Razzaq et al., 1986). The genotypic response of wheat to planting dates varies for yield contributing characters due to different genetic potential. The decline becomes prominent in the cultivars requiring more days for heading under normal planting. Increase in temperature cause shortens of heading period (Tashiro & Wardlaw, 1999). Similarly, cultivars matured earlier when planted late, indicating the forced maturity due to high temperature.
When optimum condition was provided by the wheat cultivar, grain filling period was higher as compared to late sown condition under high temperature stress at maturity.

Therefore this study was planned to examine effect of different sowing dates yield component wheat cultivars.

Materials And Methods

In order to study effect of different date sowing on seed yield of different common wheat (*triticum aestivum* L.) cultivars an experiments was conducted under temperate condition in station of agricultural farm in Lorestan provience (Boroujerd station), Iran during 20011–2012. The soil type was a clay loam, pH of 7.9 and EC = 0.40 d s m⁻¹. The Boroujerd region has a continental semi-arid climate with annual precipitation of 369 mm. About 50% of this falls during the wheat and barley growing period. The experimental design was a split-plot with three replications. There were twelve rows in each plot; rows were 1 m long with 0.2 m row spacing. Treatments in main plots were including five date of sowing consist of October 31 (*A₁*), November 15 (*A₂*), November 30 (*A₃*), December 15 (*A₄*) and December 30 (*A₅*) and treatments in sub plots were including five cultivars consist of Pishtaz (*B₁*), Bahar (*B₂*), Pishgam (*B₃*), Parsi (*B₄*) and Sivand (*B₅*). At maturity, two outer rows for each plot, 25 cm from each end of the plots, were left as borders and the middle 1 m² of the two central rows were harvested. Each sample was oven dried at 80°C and grain yield measured. Then yield components of cultivars were determined. Data were analyzed with Proc GLM procedure, SAS (SAS Inst., 1994) statistical software.

Results

number of grain spike

Results showed that the effect of sowing time and cultivars on the number of grains per spike were significant (Table 1). The comparison of the mean values of the number of grain per spike for cultivars showed that Pishtaz cultivar had the highest (40) and the Parsi cultivar had the lowest number of pods per plant (33)(Figure1). The comparison of the mean values of the number of grain per spike for date of sowing showed that 30-Dec sowing date had the highest (40) of it (Figure2).

Table 1. Analysis of variance (mean squares) for yield components of wheat cultivars in different sowing dates

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>number of grain spike</th>
<th>1000 grain weight</th>
<th>seed yield</th>
<th>Biomass yield</th>
<th>HI</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>2</td>
<td>0.04</td>
<td>0.04</td>
<td>0.01</td>
<td>0.08</td>
<td>0.03</td>
</tr>
<tr>
<td>date of sowing (A)</td>
<td>4</td>
<td>1.43*</td>
<td>0.29**</td>
<td>3.11*</td>
<td>0.72*</td>
<td>0.13</td>
</tr>
<tr>
<td>Error a</td>
<td>8</td>
<td>0.32</td>
<td>0.01</td>
<td>0.05</td>
<td>0.22</td>
<td>0.03</td>
</tr>
<tr>
<td>cultivar (B)</td>
<td>4</td>
<td>0.27*</td>
<td>0.09</td>
<td>3.12*</td>
<td>0.87*</td>
<td>0.32*</td>
</tr>
<tr>
<td>A*B</td>
<td>16</td>
<td>0.24</td>
<td>0.17</td>
<td>2.52*</td>
<td>0.56*</td>
<td>0.14</td>
</tr>
<tr>
<td>Error b</td>
<td>40</td>
<td>0.12</td>
<td>0.01</td>
<td>0.07</td>
<td>0.23</td>
<td>0.09</td>
</tr>
<tr>
<td>CV</td>
<td>8.87</td>
<td>5.6</td>
<td>2.12</td>
<td>8.87</td>
<td>7.2</td>
<td>6.65</td>
</tr>
</tbody>
</table>

ns: Non-significant, * and **: Significant at 5% and 1% probability levels, respectively

![Fig 1. Simple mean comparisons for number of grains per spike of wheat cultivars Means by the uncommon letter in each column are significantly different (p<0.05).](image-url)
1000 grain weight

Results showed that the effect of sowing time on the 1000 grain weight was significant only (Table 1). The comparison of the mean values of the 1000 grain weight for date of sowing showed that 15-Dec sowing date had the highest (23g) of it and 30-Nev has the lowest (19g) (Figure 3).

Grain yield

Various wheat cultivars showed difference among the grain yield of wheat on different sowing time (Table 1). The comparison of the mean values for seed yield for shows that Parsi cultivar has the highest seed yield (10.23 ton/ha) and the Pishtaz cultivar has the lowest seed yield (8.59 ton/ha) and the difference was significant (Fig 4). Parsi cultivar was the best among all the cultivars for seed yield. The results were in line with Ansari et al. (1989), Khan et al. (1989), Sandhu et al., (1978), and Tunio et al., (1995).
Biomass yield

Various wheat cultivars showed difference among the biomass yield of wheat on different sowing time (Table 1). The comparison of the mean values for biomass yield for shows that Parsi cultivar has the highest seed yield (34.3 ton/ha) in 31-Oct and the Sivand cultivar has the lowest biomass yield (11.2 ton/ha) in 31-Oct and the difference was significant (Fig5).

Harvest index

Results showed that the effect of cultivars on HI was significant only (Table 1). The comparison of the mean values of the HI for cultivars showed that Pishgam and Bahar cultivars had the highest (22%) and the Sivand cultivar had the lowest HI(18%)(Figure6).

Conclusion

Simple mean comparisons for grain yield of wheat in different date of sowing shows that the highest seed yield (10.15 ton/ha) gave at Nevember 15 sowing date the lowest seed yield (6.1 ton/ha) gave at December 30 sowing date and difference was significant. The decrease in seed yield was closely associated with lower 1000- seed weight with late sown crops, as was reported by Darwinkel et al, (1977). The time from sowing to anthesis was longer in the late sown crop, as compared to the earliest sown, presumably due to relatively lower temperatures during anthesis of the late sown crop. Green et al. (1985) stated that crops sown at different dates pass through each developmental stage under different environmental conditions. Thus, the late sown crops in this study passed through cooler temperatures, and were associated with late flowering. Ishag and Mohamed (1995) reported that phasic development stages of wheat are affected by genetic and environmental factors. Sowing date had a great effect on the duration of grain filling. Late sown crops (early and mid- August) were severely affected by frost damage during the second and third weeks of November in both seasons and at the two sites.

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**Fig 5.** Interaction effect of sowing date and cultivars on biomass yield of wheat
Means by the uncommon letter in each column are significantly different (p<0.05).

**Fig 6.** Simple mean comparisons for HI of wheat cultivars
Means by the uncommon letter in each column are significantly different (p<0.05).
The analysis of variance in shows that the effects of sowing date and cultivar was significant at 5% level (Table 1). Interaction effect of sowing date and cultivars on seed yield of wheat shows that the highest seed yield (11.43 ton/ha) gave at November 15 sowing date for Pishgam cultivar and difference of it between other sowing dates was significant for this cultivar. The lowest seed yield (7.44 ton/ha) gave at December 15 sowing date for Pishgam cultivar and difference of it between other sowing dates was significant for this cultivar and difference was significant (Fig3). However for Pishtaz cultivar highest seed yield (9.97 ton/ha) gave at October 31 sowing date and lowest seed yield (7.66 ton/ha) gave at December 30 sowing date. In Bahar cultivar highest seed yield (10.89 ton/ha) gave at December 15 sowing date and lowest seed yield (8.64 ton/ha) gave at November 30 sowing date. Parsi cultivar has high seed yield in December 30, October 31 and November 30 respectively and for December 15 and November 15 gave a lowest seed yield. Sivand cultivar gave highest and lowest seed yield in October 31 and December 30 respectively (Fig 3). These results suggest that cultivars should be chosen to suit the seasonal break, which may vary from October to December. Under late sowing, early germination and seedling growth are very important for better stand establishment of wheat crop. This might be due to the ability to tolerate low temperature during the germination. Benjamin (1990); Stewart et al. (1990) reported that low temperature during the germination and early seeding has detrimental effect on the crop establishment and productivity. Tillering starts after the completion of the germination and reaches to the maximum at the end of the vegetative growth stage. Maximum number of productive tillers contributes to the highest yield. However, for late sown condition, Bahar and Pishgam cultivars produced more productive tillers due to better germination and stand establishment as compared to other cultivars those had poor stand establishment. Poor emergence and stand establishment result in fewer fertile tillers (Farooq et al., 2008). The pattern of the tillering is affected by the sowing dates due to change in temperature and contribution of tillers to grain yield is maximum during the early planted crop and decreased with delayed planting.

The early sowing resulted in better development of the grains due to longer growing period. As timely planted wheat had more time for the dry matter accumulation to produce the higher seed yield (Spink et al., 2000; Shahzad et al., 2002). It can be concluded that early sowing in November is optimum at elevations of seed yield of wheat cultivars. However, at the higher elevation, the sowing date can be extended to the latest week of November. Parsi cultivar gave highest yield for sowing dates but Pishgam cultivar was better for sowing in November 15 and Bahar cultivar was better for sowing in December 15. However, for gave of highest seed yield we should sowing these cultivars in those dates.

References