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EFFECT OF LATE PLNTING ON EMERGENCE, TILLERING AND YIELD OF VARIOUS VARIETIES OF WHEAT

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ABSTRACT

A field experiment was conducted to evaluate the effect of late planting on yield of different varieties of wheat, in agro ecological conditions of Bahawalpur zone. The study included four sowing times starting from 1st December to 16th January during the year 2007-08 with an equal interval of fifteen days. Four wheat varieties viz. Inqlab-91, Punjab-96, MH-97 and Bhakkar-2002 were included in the experiment. The experiment was laid out in randomized complete block design with Split Plot arrangement having four replications, keeping sowing dates in main plots and wheat varieties in sub plots. The plot size was 2.4m x 8 m. The data were analyzed statistically using computer statistical program MSTATC. Analysis of variance was applied to test the overall significance of the data. Tukey's honestly least difference test at 5% probability level was used to compare the differences among treatment means. Sowing dates and varieties both significantly affected the germination, tillering and grain yield. Among time of sowing, 1st December sowing gave significantly maximum mean grain yield of 4412 kg ha^{-1} against the minimum mean grain yield of 2197 kg ha^{-1} for 16th January sowing. Among wheat varieties Bhakkar-2002 gave significantly maximum mean grain yield of 3445 kg ha^{-1}, whereas MH-97 was the lowest yielder 3185 kg ha^{-1}. Emergence impaired due to delayed sowing owing to low temperature for germination, resulting in poor stand establishment and reduced the number of productive tillers and ultimately the final grain yield.

Key words: Time of sowing, wheat varieties, germination, tillering and grain yield.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the most important cereal crop in the world. In Pakistan 70-80% wheat is planted after 25th November as most of the wheat area comes after cotton, rice and sugarcane, which is late planting. 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 and temperature below 12°C results in poor and uneven emergence (Timmermans *et al.,* 2007). Therefore, the rate of emergence and final emergence percentage are important factors in determining the crop potential in various temperature of wheat production cropping systems. In late planting season, temperature of soil may be below 10°C, which affects the seed germination and stand establishment. Poor crop establishment results in few tillers and finally decreased grain yield (Farooq *et al.,* 2008). Sowing times (Dec. 1, 15 and 30) and varieties of wheat both significantly affected the number of fertile tillers. Maximum grain yield (4289.54 kg ha^{-1}) was obtained when crop was sown on 1st December against the minimum grain yield (2109.50 kg ha^{-1}) in case of late sowing i.e. 30th December. Among the varieties, Inqlab-91 gave significantly maximum grain yield (3550.44 kg ha^{-1}) while minimum yield (2932.59 kg ha^{-1}) was obtained by AS-2002 (Tahir *et al.,* 2009).

Late sowing of wheat significantly decreased the germination percentage (Hussain, 2007). Sowing of wheat after 15th November decreased the number of fertile tillers and grain yield significantly (Akhtar *et al.,* 2002 and 2006). Maximum number of tillers m^{-2} and grain yield were recorded when wheat was sown on 30th November where as minimum tillers m^{-2} and grain yield were recorded on 15th December (Malik *et al.,* 2009b). Wheat variety Shafaq-2006 exhibited the highest germination count m^{-2} (131.55) while Bhakkar-2002 exhibited the highest number of tillers m^{-2} (370.11) and grain yield (39.58 q ha^{-1}) (Malik *et al.,* 2009a). Among different planting time maximum grain yield of wheat (5600 kg ha^{-1}) was recorded from 10th November sowing while minimum grain yield 4256 kg ha^{-1} was recorded from 25 December sowing in Dera Ismail Khan zone (Baloch *et al.,* 2010). It has been observed that early sowing of wheat gave high grain yield than late sowing due to longer growing period (Tanveer *et al.,* 2003).

Keeping in view all these, this study was conducted to find out the effects of late sowing on germination, tillering and grain yield of wheat crop.

MATERIALS AND METHODS

A field experiment was conducted during the year 2007-2008. It was laid out in randomized complete block design with Split Plot arrangement having four replications, keeping sowing dates in main plots and wheat varieties in sub plots. Plot size was 2.4m x 8m and row to row distance was kept as 30 cm. The land was mechanically ploughed. Irrigation channels in 1 m wide were in between the replications to ensure irrigation of individual plots independently, until crop grew up to the maturity stage. The study included four sowing times starting from 1st December to 16th January with an interval of fifteen days. Four wheat varieties were used in the study viz., Punjab-96, MH-97, Inqlab-91 and Bhakkar-2002.

Standard dose of NPK fertilizer (120-80-60 kg ha^{-1}) was applied as blank application. Nitrogen was applied to the plants in splits i.e. ½ at sowing and ½ at first irrigation. The whole phosphorous and potassium was applied at sowing time. The nitrogen, phosphorous and potassium were used in the form of Urea, Diammonium phosphate (DAP) and Sulphate of potash (SOP). Irrigation was applied as and when required. Weedicide (Puma super) @ 1250ml ha^{-1} was applied to control the narrow leaf weeds after first irrigation. The source of irrigation was tube well. The crop was sown with single row hand drill using seed rate @ 125 kg ha^{-1}. All other agronomic practices were kept uniform for all the treatments. The following observations were recorded during the course of study including germination percentage, days to emergence, number of fertile tillers and grain yield. After emergence germination was evaluated m^{-2}.Daily count of emerged seedlings from three central rows of each plot with one meter length was counted until the number of plants emerged reached to a constant level. These data was converted into per square meter. From each plot, numbers of productive tillers were determined by counting them from an area of one m^{-2}.

For grain yield an area of 14.4 m^2 was harvested from each plot at random avoiding the border effects. Then sun-dried wheat was threshed and grain yield was recorded from each plot. The grain yield was expressed in kg ha^{-1}. The data were analyzed statistically using computer statistical program MSTATC .Analysis of variance was applied to test the overall significance of the data, Tukey's honestly least difference test at 5% probability level was used to compare the differences among treatment means (Steel *et al.,* 1997).

RESULTS AND DISCUSSION

Germination percentage: The effect of treatments on germination percentage is presented in table 1. The data revealed significant effect of sowing time on germination percentage as Ist December sown crop gained more germination percentage than the January sowing. 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 and temperature below12°C results in poor and uneven emergence. In 1st December sowing, mean maximum germination was recorded (85.81%) whereas, significantly lowest value were recorded (80.06%) on 16th January sowing. The wheat variety Inqlab-91 significantly gained more mean germination (83.81%), whereas lowest mean germination (81.81%) was recorded by wheat variety MH-97. Interaction between sowing time and wheat varieties affecting germination percentage was also significant. Ist December sowing crop significantly gained more germination % age than January sowing and this response was greater in MH-97 (87.75%) as compared to other varieties included in the experiment. Significantly lowest germination was obtained in 16th January by maximum varieties. It is obvious from the data presented in table1 that this parameter significantly decreased in January sowing as decreasing temperature effects germination at late sown crop. These results are in line with the findings of Farooq *et al.* (2008) who reported that in late planting season, temperature of soil may be below 10°C, which affects the seed germination and stand establishment. Poor crop establishment results in few tillers and finally decreased grain yield

Days to emergence: The data presented in table 2 revealed significant effects of sowing time on days to emergence, as Ist December sown crop gained mean minimum 6.5 days for emergence, whereas, significantly mean maximum 11.25 emergence days were recorded by 16th January sowing. Regardless of the sowing time, the wheat variety Inqlab-91 significantly gained more mean days (9.68) whereas lowest mean days for emergence (8.87) were recorded by wheat variety MH-97. Interaction between planting time and varieties was also significant, reflecting better sowing time for all the varieties included in the experiment. Timmermans *et al*. (2007) also reported similar results that in late planted wheat, low temperature prevailing during germination substantially affects the seedling emergence.

Number of fertile tillers m^{-2}: Data regarding number of fertile tiller m^{-2} are presented in Table 3 showed that the December sowing wheat crop significantly increased the number of tillers m^{-2} as compared to January sowing. The significantly mean maximum number of fertile tillers 347.4 $m^{-2,}$ were recorded in Ist December sowing, whereas lowest number of tillers m^{-2} were recorded in 16th January sowing (306.6 m^{-2}).This showed that plant population decreased significantly in January sowing, as

temperature gradually increased in late sowing and sensitivity to high temperature also increased.

Regardless of planting time the wheat variety Bhakhar-2002 significantly enhanced the mean number of fertile tillers 335m^{-2} compared with other varieties. Lowest number of mean fertile tillers m^{-2} was produced by wheat cv. Inqlab-91 (322.5 m^{-2}). The interaction between sowing time and wheat varieties was also significant. Highest fertile tillers (355.5 m^{-2}) were obtained by wheat variety Bhakhar-2002 in 16th December sowing followed non significantly by Ist December sowing by same variety which produced (353.5 m^{-2}) lowest fertile tillers (342.5 m^{-2}) were recorded by wheat genotype Inqlab-91 on same planting time. This parameter significantly decreased in January sowing. In case of delayed sowing the temperature was not according to the tillering requirement which results in less number of tillers m-^{2}. These results are in conformity with the findings of Tahir *et al.* (2009) who stated that sowing times (Dec. 1, 15 and 30) and varieties both significantly affected the number of fertile tillers. Farooq *et al.* (2008) also confirmed that by late planting season, temperature of soil may be below 10°C, which affects the stand establishment results in few tillers.

Grain yield kg ha^{-1}: 1st December sowing resulted in the highest mean grain yield of 4412 kg ha^{-1} (Table 4). Further delay in sowing reduced the yield of all varieties included in the experiment significantly. Lowest grain yield (2197 kg ha^{-1}) was obtained from 16th January sowing.

The data showed significant differences for all wheat varieties at different sowing dates. The thorough scrutiny of the data revealed a superiority of Bhakar-2002 over others which gave mean grain yield of 3445 kg per hectare, whereas MH-97 was the lowest yielder (3185 kg ha^{-1}).

The interaction between sowing date and cultivar was also significant. 1st and 16th December sowing gave significantly more grain yield than January sowing. This response was greater in Bhakkar2002 which produced 4503 kg per hectare grain yield when sown on 1st December. Actually in December sowing temperature is some what normal for anthesis and grain filling. But in January sowing i.e. after 16th January temperature shoot up and rises above normal at anthesis and grain filling period which reduced plant life cycle and consequently the grain yield. These results are in line with those of Tahir *et al. (*2009) who reported that sowing times (Dec. 1, 15 and 30) and varieties of wheat both significantly grain yield. Maximum grain yield (4289.54 kg ha^{-1}) was obtained when crop was sown on 1st December against the minimum grain yield (2109.50 kg ha^{-1}) in case of late sowing i.e. 30th December. Iqbal *et al.* (2001) reported a yield reduction of 27 and 52% by sowing wheat crop on December, 15 and 31 respectively compare to December 1st sowing. Farooq *et al. (*2008) also confirm that by late planting season, temperature of soil may be below 10°C, which affects the stand establishment results in few tillers and finally decreased grain yield.

Table: 1. Germination %age as influenced by planting time of different wheat varieties during the year 2007-08.

Germination % age	1st Dec.	16th Dec.	1st Jan.	16th Jan.	Mean
Inqlab-91	85.00 ^{abcd}	84.75 ^{bcd}	83.00 ^{cdef}	82.50 ^{defb}	83.81 ^{a}
P-96	84.50 ^{bcd}	82.75 ^{cdef}	80.50 ^{fg}	79.50 ^{g}	81.81^{c}
MH-97	87.75 ^{a}	85.50 ^{abc}	79.50 ^{b}	79.00 ^{g}	82.94^{ab}
Bhakkar-2002	86.00 ^{ab}	83.75 ^{bcde}	81.00 ^{efg}	79.25 ^{g}	82.50^{bc}
Mean	85.81^{a}	84.19^{b}	81.00^{c}	80.06^{d}	

Any two means not sharing the common letters differ significantly from each other at p 0.05
HSD at 0.05 for sowing date (S) = 0.80 HSD at 0.05 varieties (V) = 0.88
HSD at 0.05 for interaction (S x V) = 1.46

Table:2. Days to emergence as influenced by planting time of different wheat varieties during the year 2007-08

Varieties	1st Dec.	16th Dec.	1st Jan.	16th Jan.	Mean
Inqlab-91	6.75 ^{e}	9.00 ^{d}	11.00 ^{b}	12.00 ^{a}	9.69^{a}
P-96	6.75 ^{e}	9.00 ^{d}	11.00 ^{b}	11.00 ^{b}	9.44^{ab}
MH-97	6.00 ^{e}	8.50 ^{d}	10.00 ^{c}	11.00 ^{b}	8.87^{c}
Bhakkar-2002	6.50 ^{ef}	9.00 ^{d}	11.00 ^{b}	11.00 ^{b}	9.37^{b}
Mean	6.5^{d}	8.87^{c}	10.75^{b}	11.25^{a}	

Any two means not sharing the common letters differ significantly from each other at p 0.05
HSD at 0.05 for sowing date (S) = 0.15 HSD at 0.05 varieties (V) = 0.22
HSD at 0.05 for interaction (S x V) = 0.35

Table: 3. Number of fertile tillers as influenced by planting time of different wheat varieties during the year 2007-08.

Varieties	1st Dec.	16th Dec.	1st Jan.	16th Jan.	Mean
Inqlab-91	342.5 abcd	335.5 abcde	312.5 def	299.0 f	322.5b
P-96	344.5 abc	337.5 abcde	312.5 def	302.5 f	324.3b
MH-97	349.0 ab	351.0 ab	315.3 cdef	307.0 ef	330.6ab
Bhakkar-2002	353.5 a	355.5a	320.5 bcdef	317.0 cdef	335.0a
mean	347.4a	343.6ab	315.1bc	306.6c	

Any two means not sharing the common letters differ significantly from each other at p 0.05
HSD at 0.05 for sowing date (S) = 10.63 HSD at 0.05 varieties (V) = 10.08
HSD at 0.05 for interaction (S x V) = 15.71

Table:4. Grain Yield Kgha^{-1} as influenced by planting time of different wheat varieties during the year 2007-08

Varieties	1st Dec.	16th Dec.	1st Jan.	16th Jan.	Mean
Inqlab-91	4487 ab	4003 abc	2825 de	2248 def	3391 ab
P-96	4339 abc	3796 bc	2661 def	2144 ef	3235 ab
MH-97	4321 abc	3708 c	2613 def	2097 f	3185 b
Bhakkar-2002	4503 a	4059 abc	2919 d	2298 def	3445 a
Mean	4412 a	3891 b	2754 c	2197 d	

Any two means not sharing the common letters differ significantly from each other at p 0.05
HSD at 0.05 for sowing date (S) = 258.10 HSD at 0.05 varieties (V) = 218.118
HSD at 0.05 for interaction (S x V) = 340.97.

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