PERFORMANCE OF DIFFERENT WHEAT VARIETIES/LINES AS AFFECTED BY DIFFERENT PLANTING DATES AND SEEDING RATES UNDER HIGH RAINFALL AREA OF POTOHAR

Sikander Khan Tanveer[1]*, Imtiaz Hussain[2], M. Asif[2], M.Y. Mujahid[2], Sher Muhammad[1], Maqsood Qamar[2] and M. Asim[2]
[1]Directorate of Organic Farming, NARC, Park Road, Islamabad
[2]Wheat, Barley and Triticale Programme NARC, Park Road, Islamabad
*Corresponding author's e-mail: sikandar73@hotmail.com

Use of suitable variety, optimum planting time and seed rate play an important role in getting the maximum yield of wheat crop. The study was conducted to find out the most suitable wheat variety, optimum planting time and economically suitable seed rate under the rain fed conditions of Potohar region during 2004- 2005 to 2005 - 2006 at NARC, Islamabad. Wheat varieties/line tested were NR-234 (advance line), Wafaq-2001, Margalla-99 and G.A 2002 were sown during mid of November and mid of December, using the four different seed rates i.e. 80, 100, 120 and 140 Kg ha^{-1}. The lay out design used was RCBD split-split arrangement with three replications having 25 cm row spacing. All other agronomic, cultural and plant protection measures were kept at par. Various parameters including number of plants m^{-2}, plant height, spike length, spikelets $spike^{-1}$, number of tillers m^{-2}, 1000 - grain weight, biological yield, grain yield and harvest index were studied. Due to the better yield components maximum grain yield (3.23 t ha^{-1}) was recorded in the crop planted during the mid of November as compared with the crop planted during the mid of December having grain yield of 2.31 t ha^{-1}. Significant differences in grain yields were also recorded due to the different wheat varieties/line but no differences in grain yields were recorded due to the different seed rates.

Key words: Wheat, planting time, varieties, seed rates, yield, yield components, rainfed area

INTRODUCTION

Wheat (*Triticum aestivum* L) is the staple food of Pakistan and wheat straw is the major cattle fodder in the entire country. The better production from rainfed areas of Pakistan can reduce the differences between self-sufficiency and import for the country. This goal can be achieved by using the suitable wheat variety, planting of crop at the optimum time and use of appropriate seeding rate. There are many factors responsible for low yield, such as planting times, selection of unsuitable varieties, inappropriate seeding rates, improper planting geometry and soil type etc. Among all these agronomic practices, sowing time is the most powerful factor that influences the yield. In late planted wheat, yield decreases (Razzaq *et al*., 1986) due to reduction in tillering period and increased risk of hot weather during critical period of grain filling (Bahera *et al.*, 1994). Under late planting condition higher seed rates are used to compensate the reducing component of yield. Optimum seed rate is an important requirement for economic yield from an area. Greater plant population is attained by higher seed rates but it gives poor growth and development of that crop. Use of low seed rates does not produce required number of plants in the field that could efficiently utilize light, water and nutrients and thus results in low yield. Use of extensive seed rate may cause lodging, exhaustion of nutrients and water before maturity and may provide a favorable condition for insects and diseases. Thus planting of wheat at optimum seed rate is very important for economic yield. Ayaz *et al.* (1999) reported that as the seed rate increases number of grains per spike decreases. Marwat *et al. (*1989) reported that the number of plants emerged, grain yield and number of grains per square meter increased with the increased seeding rates, however spike length and the number of grains per spike showed negative behavior to increasing seeding rates. Seeding rate is variety specific, owing to each variety has its own genetic potential for tillering and the supply of limiting resources such as water, light, and nutrients affect the form and parameters of the yield- density relationships.

MATERIALS AND METHODS

The study was conducted during the years 2004-05 to 2005-2006 at NARC, Islamabad to find out the effects of different planting dates i.e. mid of November and mid of December and seeding rates i.e. 80, 100, 120,140 Kg ha^{-1} on the yield and yield components of wheat varieties/ line i.e NR-234 (advance line), Wafaq-2001, G.A-2002, Margalla-99. The lay out design used was RCBD split-split arrangement with three replications, having planting dates in the main plots, varieties in the sub plots, and seeding rates in the sub-sub plots. Crop was planted by keeping the line to line distance of 25 cm apart. Fertilizer was applied at the

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Table 1.

Planting
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Table 2.

Factors
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V2
V3
V4
LSD valu
Seeding
S1
S2
S3
S4
LSD value

Table 3. Means of yield and yield components of wheat varieties/line under the different planting dates and seeding rates

Factors	No of plants m^{-2}	Plant height (cm)	Spike Length (cm)	Spike-lets $spike^{-1}$	No of tillers m^{-2}	1000-grain wt (g)	Grain yield T ha^{-1}	Harvest Index%
Planting dates x Varieties/line:								
D1x V1	124.9 ab	97.5 b	11.5 a	20.8 a	253.5 a	41.1 a	4.03 a	37.8 ab
D1xV2	119.4 b	98.5 ab	10.5 c	19.3 c	238.5 a	36.1 b	2.98 bc	29.8 de
D1xV3	130.3 a	99.7 a	11.0 b	20.5 ab	235.8 a	32.3 c	2.66 d	28.2 e
D1xV4	130.8 a	95.9 c	11.0 b	20.8 a	230.5 a	36.1 b	3.26 b	33.0 c
D2x V1	66.6 c	91.3 d	11.0 b	20.0 b	164.0 b	40.3 a	2.83 cd	40.4 a
D2xV2	66.3 c	91.2 d	9.2 e	17.5 e	172.3 b	36.5 b	2.29 e	36.1 bc
D2xV3	67.8 c	92.1 d	9.7 d	18.3 d	152.8 b	32.9 c	1.99 e	31.7 d
D2xV4	73.3 c	88.5 e	10.3 c	19.2 c	175.2 b	33.4 c	2.14 e	32.1 d
LSD value	8.752	1.576	0.3432	0.6711	25.28	1.545	62.38	3.33 6
Planting dates x Seed rates:								
D1x S1	112.7 c	97.9 a	11.1 a	20.6 a	227.9 a	36.0 a*	3.11 a	31.9 b
D1xS2	133.0 ab	97.4 a	10.9 a	19.9 a	242.0 a	36.6 a	3.30 a	32.1 b
D1xS3	124.4 b	98.0 a	11.1 a	20.3 a	252.5 a	36.7 a	3.25 a	32.1 b
D1xS4	135.5 a	98.4 a	11.0 a	20.5 a	236.1 a	36.4 a	3.27 a	32.7 ab
D2x S1	62.7 e	90.9 b	10.0 b	18.6 bc	166.8 b	35.8 a	2.24 b	34.6 ab
D2xS2	67.0 de	90.6 b	9.9 b	18.5 c	175.2 b	36.1 a	2.41 b	35.2 ab
D2xS3	71.5 d	90.7 b	10.1 b	19.2 ab	158.4 b	35.5 a	2.30 b	35.9 a
D2xS4	72.8 d	90.9 b	10.1 b	18.8 abc	163.9 b	35.7 a	2.28 b	34.6 ab
LSD value	8.752	1.576	0.3432	0.6711	25.28	N.S	62.38	3.336
Varieties/line x Seed rates:								
V1xS1	79.8 d	93.8 cdefg	11.2 ab	20.3 abc	190.6 ab	41.0 a	3.28 a	38.3 ab
V1xS2	101.6 ab	94.7 bcde	10.9 bcd	19.6 cd	217.5 ab	40.6 a	3.45 a	38.8 ab
V1xS3	100.3 abc	94.9 abcd	11.6 a	21.1 a	219.3 a	40.5 a	3.55 a	41.0 a
V1xS4	101.3 ab	94.5 bcde	11.2 abc	20.6 ab	207.8 ab	40.7 a	3.44 a	38.2 abc
V2xS1	81.1 d	95.3 abc	9.9 gh	18.4 fg	197.5 ab	35.8 bcd	2.44 bcd	32.9 de
V2xS2	95.8 abc	94.0 cdef	9.8 h	18.1 g	202.4 ab	37.1 b	2.73 b	33.5 cde
V2xS3	90.5 bcd	95.4 abc	9.9 gh	18.4 fg	214.3 ab	36.5 bc	2.69 bc	32.3 de
V2xS4	104.1 a	94.6 bcde	9.8 h	18.6 efg	207.3 ab	35.8 bcd	2.67 bc	33.2 de
V3xS1	88.6 cd	96.4 ab	10.4 def	19.3 def	203.5 ab	32.8 cfg	2.33 bcd	30.2 de
V3xS2	99.7 abc	94.6 bcde	10.4 def	19.4 cde	207.0 ab	32.8 fg	2.50 bcd	30.5 de
V3xS3	101.8 ab	95.6 abc	10.2 fgh	19.7 bcd	182.8 b	32.5 g	2.20 d	30.2 de
V3xS4	106.2 a	97.0 a	10.3 efg	19.2 def	183.9 ab	32.4 g	2.26 cd	29.0 e
V4xS1	101.3 ab	92.1 fg	10.7 cde	20.4 abc	197.8 ab	33.9 defg	2.66 bc	31.7 de
V4xS2	100.8 abc	92.7 defg	10.5 def	19.7 bcd	207.4 ab	34.8 cdef	2.75 b	31.9 de
V4xS3	101.3 ab	91.6 g	10.8 bcd	19.8 bcd	205.4 ab	34.9 cde	2.66 bc	32.6 de
V4xS4	104.8 a	92.5 efg	10.8 cde	20.1 bcd	200.9 ab	35.4 bcd	2.73 b	34.3 bcd
LSD value	12.38	2.229	0.4854	0.9491	35.76	2.185	88.22	4.717

*Values followed by same letters within columns with in the same factor are not significantly different (LSD, *P* = 0.05), D1= Planting date First, D2= Planting date Second, V1= NR-234 (advance line), V2= Wafaq-2001, V3= Margalla-99, V4= G.A-2002, S1= Seed rate 80kg/ha, S2= Seed rate 100kg/ha, S3= Seed rate 120kg/ha and S3= Seed rate 140kg/ha

S3	98.0 a	94.4 a	10.6 a	19.8 a	205.5 a	36.1 a	2.78 a	34.0 a
S4	104.1 a	94.6 a	10.5 ab	19.6 ab	200.0 a	36.1 a	2.78 a	33.6 a
LSD value	6.188	1.115	0.2427	0.4745	17.88	1.092	44.11	2.359

*Values followed by same letters within columns with in the same factor are not significantly different (LSD, *P* = 0.05)
D1= Planting date First, D2= Planting date Second, V1= NR-234 (advance line), V2= Wafaq-2001, V3= Margalla-99, V4= G.A-2002, S1= Seed rate 80kg/ha, S2= Seed rate 100kg/ha, S3= Seed rate 120kg/ha and S3= Seed rate 140kg/ha

Differences in plant heights were recorded non-significant by using the different seed rates but significant differences in plant heights were recorded in the cases of planting dates and varieties/line (Table 2). Statistically significant differences in spike lengths, and spike-lets/spike were recorded in the cases of planting dates, varieties/line and seeding rates (Table 2). The parameters i.e plant height, spikelength and

spikelets/spike were also recorded significantly different in case of planting dates x varieties/line, planting dates x seed rates and varieties/line x seeding rates interactions (Table 3).

Better tillering (239.6 tillers m^{-2}) was recorded in the crop planted during the mid of November as compared with the 166.1 tillers m^{-2} in the crop planted during the mid of December (Table 2), however differences in tillers were recorded non significant in case of varieties/line and seed rates (Table2). This shows that the varieties/line under study have the same tillering capacity and on the other hand as the seeding rate increases due to more competition tillering capacity decreases which ultimately results in minimum differences in tillering (Table 2). These results are confirmed by the findings of Lerner and Satorre (1990) who reported a proportionate reduction in vegetative growth as densities increase above the normal densities, due to increased competition for available resources. Differences in tillering were found statistically–significant different in the cases of planting dates x varieties/line, planting dates x seeding rates and varieties/line x seeding rates interactions (Table3). Better tillering of all varieties/line and all seeding rates was recorded when planted during the month of November as compared to the month of December (Table3). In case of varieties/line x seeding rates interactions, maximum tillering was recorded in the V1x S3 (219.3) while minimum V3xS3 (182.8) (Table3).

Significant differences in 1000-grain weights were recorded due to the different varieties/line (Tables 2), planting dates x varieties/line and varieties/line x seed rates interactions (Table 3), however no differences in 1000-grain weights were observed by using the different planting dates, seeding rates and planting dates x seeding rates interactions (Table 2). Non-significant differences in 1000-grain weights of the crops planted at different dates might be mainly due to the phenomenon of component compensation which shows as number of plants m^{-2} increased, the number of tillers $plant^{-1}$ and spike length decreased as a result of which 1000- grain weight increased. On the other hand in case of low plants population m^{-2}, the number of tillers $plant^{-1}$ and spike length increased which reduced 1000- grain weight. The results are in line with the findings of McLeod *et al.* (1996) who reported that grain weight was not affected by crop density. V1i.e (Advance line NR-234) performed better in terms 1000-grain weight (Tables 2 and 3).

More Grain yield (3.23 t ha^{-1}) in November planted wheat crop was achieved mainly due to greater plant population m^{-2}, better tillering and more spike length as compared with the grain yield (2.31 t ha^{-1}) of crop planted in the mid of December (Table 2). The results are similar to the findings of Qamar *et al.* (2004) who reported that under rainfed condition for better wheat-yield, planting should be completed up to the mid of November, delayed planting could result in lower yield due to shortened duration of wheat- growth period, reduction in grain filling period and lower grain weight. Maximum grain yield of 3.43 t ha^{-1} was recorded in the advance line NR-234 while minimum 2.32 t ha^{-1} in the wheat variety Margalla-99, however grain yield of wheat varieties Wafaq-2001 and G.A-2002 was recoded statistically at par (Table 2). Significant differences in grain yields were also recorded due to the different wheat varieties/line x planting dates interactions in which maximum grain yield was recorded in the advance line NR-234 in the both planting dates as compared with the other varieties (Table 3). Minimum grain yield of the wheat variety Margalla-99 might be due to sever rust attack. The effects of seeding rates on grain yield (Table 2) and planting dates x seeding rates interaction on grain yield were recorded non-significant (Table 3), however in case of varieties/line x seeding rates performance of Advance-line NR-234 was recorded better as compared with the other varieties (Tables 3). The effects of seeding rates on grain yields were recorded non significant mainly due to the mechanism of compensation through tillering, because as the seeding rate is less the duration of tiller production increases and the proportion of tillers which subsequently dies becomes less (Whaley *et al*., 2000).

CONCLUSION AND RECOMMENDATIONS

The study shows that under rainfed condition planting of wheat should be completed during the month of November and seeding rate of 80 Kg ha^{-1} is economically most suitable to get the maximum yield. As far as performance of varieties/line is concerned, NR-234 (advance line) performed better as compared with the other varieties.

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