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Effect of Different Planting Dates, Seed Rate and Nitrogen Levels on Wheat

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Abstract: An experiment was conducted at Malakandher Research Farms NWFP Agricultural University Peshawar, Pakistan during 2000 to study the effect of different planting dates, seed rates and nitrogen levels on wheat variety Fakhare Sarhad. Analysis of the data revealed that days to emergence, emergence m^{-2}, tillers m^{-2}, days to heading and plant height was significantly affected by different planting dates, seed rates and nitrogen levels while the effect of planting dates and nitrogen levels was significant on days to maturity, 1000 grain weight and grain yield. Early sowing (25th October) had significantly maximum tillers m^{-2}, days to heading, days to maturity, plant height and grain yield. Among seeding densities higher seed rate (100 or 125 kg ha^{-1}) had more days to emergence and tillers m^{-2}. Plots treated with 160 kg N ha^{-1} recorded maximum days to emergence, emergence m^{-2}, tillers m^{-2}, days to maturity, plant height and grain yield.

Key words: Planting dates, seed rates, nitrogen levels, wheat

Introduction

Wheat is the most widely cultivated of all the cereal and is a major source of nourishment. Wheat requirements in Pakistan are growing at an exorbitant rate due to her rapid expansion in population. Wheat occupies 1st position by covering about 68% of the annual food production in the country. Wheat is sown in winter months in Pakistan and has its own definite requirements for temperature and light. Too early sowing produces weak plants with poor root system. In addition, during too early sowing the temperature is above the optimum, which deals to irregular germination caused by frequent death of embryos and decomposition of endosperm due to bacteria or fungi. (Percival, 1992). Late planting results in poor tillering and more chances of winter injury (Joshi *et al*., 1992). Rajput and Verma (1994) observed that normal sowing gave higher grain yields than late sowing. Similarly late-planted wheat may suffer from rain during spring, which impaired grain quality. Seed rates above the optimum level impose nutrients, light, moisture stresses and hence adversely affect crop yield while seed rate below optimum level usually have lower yield. When wheat is planted later than normal dates, an increase in seeding density is considered advisable. For growing healthy plants, there is a need to provide balanced nutrients for which an integrated management is an essential part. Higher doses of N increased lodging while no N application decreased the yield, tillering, spike length and number of grains $spike^{-1}$. (Rathi and Singh, 1973). Sud and Arora, 1990 concluded that increasing N rate increased number of tillers $plants^{-1}$ and ears number m^{-2} but number of grains ear^{-1} and 1000 grain weight were not changed. Late sowing and higher n rates reduced 1000 grain weight, high N rate increased lodging and diseases incidence but also increased protein yield, grain protein and dry gluten content (Mazurek and Kus, 1991). Nass *et al.* (1990) found that grain yield increased with increasing in nitrogen application. Grain yield, spikes m^{-2} and lodging increased with increasing N rate.

Ayoub *et al.* (1994) and Shah (1997) investigated that split application of N fertilizer has been found effective in increasing crop yields compared with full application of N fertilizer.

Keeping in view the role of optimum sowing time, seed rate and balanced dose of fertilizer, particular N, the present research was conducted to study the effect of different planting dates, seed rate and nitrogen levels on the yield and yield components of wheat.

Materials and Methods

An experiment entitled "Effect of different planting dates, seed rate and nitrogen levels on wheat", variety Fakhare Sarhad was conducted at Malakandher Research Farms of NWFP Agricultural University, Peshawar, Pakistan during 1999-2000. The land was thoroughly prepared as required for wheat sowing. The experiment was laid out in Randomized Complete Block Design (RCB), with split plot arrangement. The experiment was replicated four times having sub plot size of 1.2x5 m^2. Planting dates were allotted to main plots, while combination of seed rates and fertilizer levels were kept in sub plot. The following treatments were used in the experiment.

Planting dates:

D_1=25th October　　D_2=10th November　　D_3=25th November

Seed rate:

S_1=75 kg ha^{-1}　　S_2=100 kg ha^{-1}　　S_3=125 kg ha^{-1}

Fertilizer levels:

F_0=Control　F_1=120 kg N ha^{-1}　F_2=140 kg N ha^{-1}　F_3=160 kg N ha^{-1}

In case of fertilizer application, a basal dose of 60 kg P_2O_5 ha^{-1} was applied in the form of Single Super Phosphate while N was applied in the form of Urea. Before sowing soil N content was estimated to 12%. After harvesting of the different sub plots were found to be N_0=0.07, N_1=0.08 N_2=0.08 and N_3= 0.09%. Standard agronomic practices were followed throughout the growing season. Data were recorded on days to emergence, emergence m^{-2}, tillers m^{-2}, days to heading, days to maturity, plant height, 1000 grain weight and grain yield.

Days to emergence data was calculated from the date of sowing till the date when 65% plants emerged in each sub plot. Emergence m^{-2} in each subplots was recorded randomly at three different spots with the help of meter rod and then their average was computed using the following formula.

$$\text{Emergence m}^{-2} = \frac{\text{Number of plants}}{\text{Area sampled (Row length x row width)}} \text{ x 1m}$$

Tillers m^{-2} were reordered by counting the number of tillers in one meter length area of the three central rows in each subplot and their mean was then calculated. Days to heading were counted from the date of sowing till when 50% of the spikes had emerged. Plant height was recorded by measuring height of five representative plants in each treatment at maturity from base to the tip of the spike. Maturity was considered to have reached when the spike turned to straw color and was counted from the date of sowing. After threshing 1000 grains in each subplot were randomly picked and then weighed by electronic balance. Grain yield in each subplot was determined and then converted into kg ha^{-1} according to the following formula.

$$\text{Grain yield (kg ha}^{-1}\text{)} = \frac{\text{Grain yield (kg ha}^{-1}\text{)}}{\text{Area sub plot}^{-1}} \text{ x 10000}$$

The data collected during the experiment was analyzed according to RCB design and upon obtaining significant differences Least Significant Differences (LSD) test was applied (Steel and Torrie, 1980).

Results and Discussion

Data concerning to days to emergence is presented in Table 1. Statistical analysis of the data revealed that days to emergence were significantly ($P \leq 0.05$) affected by different sowing dates, seed rates and N levels, while their interaction were non significant. It is clear from the mean values of the data that crop planted on 25th November took maximum days to emergence, while plots sown on 25th October took minimum days to emergence. High temperature during early sowing could be the possible reason for fewer days to emergence in case of 25th October sowing. Joshi *et al.* (1992), Read and Beaton (1963) reported that growth of the late-planted wheat is generally slow because of low temperature. In case of seed rates, plots sown with seeding density of 125 kg ha^{-1} took maximum days to emergence, which was at par with plots sown with 100 kg ha^{-1} (Table 1). More days to emergence in case of high seeding density could be attributed to strong competition for food, light and moisture whereas these requirements were fulfilled in those plots where low seed rates were applied. It can be inferred from the data shown in Table 1 that days to emergence were maximum ion plots treated with N at the rate of 60 kg ha^{-1}, whereas plots fertilized with 120 kg ha^{-1} took minimum days to emergence. Herald *et al.* (1963) reported that fertilizer reduced the total germination of wheat by decreasing temperature of the soil.

Analysis of the data showed that different seeding density, N levels and their interaction had a significant ($P \leq 0.05$) effect on emergence m^{-2}, while sowing dates and other interactions had a non significant effect (Table2). Mean value of the data indicated that maximum seedlings m^{-2} were produced in those plots which were planted at seeding density of 125 kg ha^{-1}, while plots seeded with 75 kg ha^{-1} recorded minimum emergence m^{-2}. The probable reason could be that more seeds sown unit^{-1} on fertile soil had thick population compared to the lower seeding density. Similar results are also reported by Ayaz *et al.* (1997). Emergence m^{-2} was increased with increase in N rates. It can be seen from the mean values of the data shown in Table 2 that highest N levels (160 kg ha^{-1}) gave maximum emergence m^{-2} when compared with the other levels of N. These results are confirmed by Ayoub *et al.* (1994), who reported that tillers m^{-2} increased with increasing N rate. In case of interaction between seed rates and N levels, plots sown with 125 kg ha^{-1} seed rates using 160 kg ha^{-1} recorded in highest emergence m^{-2}.

Mean value of the data shown in Table 3 indicated that tillers m^{-2} were significantly ($P \leq 0.05$) affected by different sowing dates, seed rates, N levels and their interactions. Analysis of the data showed that early sown (25th October) produced maximum tillers m^{-2} and were minimum in late sown crop. These results agree with those reported by Musick and Dusek (1980), Razzaq *et al.*

Table 1: Days to emergence of wheat variety Fakher-Sarhad as affected by sowing dates (D), seed rates (S) and fertilizer levels (F)

		Sowing dates			
		25th October	10th November	25th November	Means
Seed rate kg ha^{-1}	Fert. Levels kg N ha^{-1}		D x S x F		S x F
75	0	7.00	9.50	16.75	11.08
	120	6.00	9.75	16.50	10.75
	140	7.00	10.00	16.50	11.17
	160	7.75	10.25	17.00	11.67
100	0	7.00	10.25	17.25	11.50
	120	7.00	10.25	17.00	11.42
	140	7.50	10.00	17.50	11.67
	160	8.00	10.00	17.25	11.75
125	0	7.50	10.25	17.25	11.67
	120	6.75	10.00	17.25	11.33
	140	7.25	10.75	17.25	11.75
	160	8.25	10.75	17.75	12.25
			D x F		F
	0	7.17	10.00	17.08	11.42bc
	120	6.58	10.00	16.92	11.17c
	140	7.25	10.25	17.08	11.53b
	160	8.00	10.33	17.33	11.89a
		D x S	S		
75		6.94	9.88	16.69	11.17b
100		7.38	10.13	17.25	11.58a
125		7.44	10.44	17.38	11.75a
	Mean (D)	7.25c	10.15b	17.10a	

LSD value for sowing dates = 0.2316 LSD value for seed rate = 0.2454 LSD value for fertilizer value = 0.2833
Mean followed by different letters are significantly different from one another at $P \leq 0.05$

Table 2: Emergence m^{-2} of wheat variety Fakher- Sarhad as affected by sowing dates (D), seed rates (S) and fertilizer levels (F)

		Sowing dates			
		25th October	10th November	25th November	Means
Seed rate kg ha^{-1}	Fert. Levels kg N ha^{-1}		D x S x F		S x F
75	0	123.80	118.80	117.50	119.90f
	120	130.80	132.80	123.50	129.00ef
	140	128.80	133.00	127.00	129.60ef
	160	135.80	141.80	132.50	136.70cd
100	0	126.50	125.30	124.50	125.40fg
	120	132.50	133.00	133.00	132.90de
	140	153.30	145.80	147.50	148.80b
	160	154.00	146.80	146.50	149.10b
125	0	134.30	131.00	130.50	131.90def
	120	164.30	156.50	169.00	163.30a
	140	142.80	139.00	139.80	140.50c
	160	153.00	161.50	158.30	157.60a
			D x F		F
	0	128.10	125.00	124.20	125.80c
	120	142.60	140.80	141.80	141.70b
	140	141.60	139.30	138.10	139.60b
	160	147.60	150.00	145.80	147.80a
			D x S		S
75		129.70	131.60	125.10	128.80ab
100		141.60	137.70	137.90	139.10ab
125		148.60	147.00	149.40	148.30a
	Mean (D)	140.00	138.80	137.50	

LSD value for fertilizer levels = 3.989 LSD value for seed rate = 12.21 LSD value at 5 % S x F = 6.910
Mean followed by different letters are significantly different from one another at $P \leq 0.05$

(1986), Zeb *et al.* (1987), who have concluded that early sown crop are damaged by low temperature (Anand and Singh, 1958). In case seed rates, plots sown with higher seed rate (125 kg ha^{-1}) had maximum tillering potential compared with lower seeding density. These results are supported by Khokar *et al.* (1985), who found highest tillering at higher seed rates. Mean values of the data indicated in Table 3 also suggested that control plots (0 kg N ha^{-1}) produced less tillers m^{-2} when compared with other treatments. Tillers were increased with increase in N levels. These observations are confirmed by Shah (1984) and Sultan *et al.* (1991).

Data regarding days to heading is shown in Table 4. Mean values of the data indicated that significant

Table 3: Tillers m^{-2} of wheat variety Fakhre- Sarhad as affected by sowing dates (D), seed rates (S) and fertilizer levels (F)

		Sowing dates			
		25th October	10th November	25th November	Means
Seed rate kg ha^{-1}	Fert. Levels kg N ha^{-1}		D x S x F		S x F
75	0	415.80k-m	386.50k-m	330.80m	377.70
	120	581.30f-j	537.50j	613.00c-j	577.30
	140	585.30e-j	574.50f-j	526.30j	562.00
	160	646.00b-g	632.50b-h	544.30h-j	607.60
100	0	407.00k-m	241.00kl	333.00lm	387.00
	120	698.00a-c	655.30b-f	548.00h-j	633.80
	140	625.30c-I	716.30ab	558.30g-j	633.30
	160	671.80a-b	615.30c-j	646.80b-g	644.60
125	0	422.80k	428.00k	358.00k-m	402.90
	120	607.50d-j	624.80c-I	603.80d-j	612.90
	140	749.80a	676.80a-d	569.50f-j	665.30
	160	658.80b-f	671.30f-j	627.80b-h	619.30
			D x F		F
	0	415.20	411.80	340.60	389.30b
	120	628.90	605.82	588.30	607.70a
	140	653.40	655.80	551.30	620.20a
	160	658.80	606.30	606.30	623.80a
			D x S		S
75		557.10	532.80	503.60	531.10b
100		600.50	601.90	521.50	574.60a
125		609.70	575.20	539.80	574.90a
	Mean (D)	589.10a	570.00a	522.00b	

LSD value for sowing dates = 27.35 LSD value for seed rate = 25.87 LSD value for fertilizer level = 29.87
LSD value at 5% D x S x F = 89.62 Mean followed by different letters are significantly different from one another at $P \leq 0.05$

Table 4: Days to heading of wheat variety Fakhre- Sarhad as affected by sowing dates (D), seed rates (S) and fertilizer levels (F)

		Sowing dates			
		25th October	10th November	25th November	Means
Seed rate kg ha^{-1}	Fert. Levels kg N ha^{-1}		D x S x F		S x F
75	0	126.80	119.80	117.50	121.30
	120	127.50	119.80	117.80	121.70
	140	127.50	119.80	118.00	121.80
	160	127.80	121.50	118.80	122.70
100	0	126.80	119.80	117.30	121.30
	120	128.00	120.30	117.80	122.00
	140	128.00	119.80	117.80	121.80
	160	128.50	121.80	118.80	123.00
125	0	126.80	119.50	116.50	120.90
	120	128.30	120.00	118.30	122.20
	140	128.30	120.30	118.00	122.20
	160	128.50	121.30	119.30	123.10
			D x F		F
	0	126.80b	119.70d	117.10g	121.20c
	120	127.90a	120.00d	120.00d	121.90b
	140	127.90a	119.90d	119.90d	121.90b
	160	128.30a	121.50c	121.50c	122.90a
			D x S		S
75		127.40	121.20	118.00	121.90
100		127.80	120.40	117.90	122.00
125		128.00	120.30	118.00	122.10
	Mean (D)	127.70a	120.30b	118.00c	

LSD value for sowing dates = 1.007 LSD value for seed rate = 0.3074 LSD value at 5% D x F = 0.5324
Mean followed by different letters are significantly different from one another at $P \leq 0.05$

($P \leq 0.05$) differences were found in days to heading in crop sown on different dates using various N levels while the effect of different seed rates were non significant. It is clear from the mean values of the data that early sown (25th October) crop took more days to heading than the late sown crop. Plots sown in October had vigorous vegetative growth, which resulted in delayed heading. Waraich *et al.* (1982) and Nerson *et al.* (1979) reported that October sown crop took maximum days to heading. Days to heading increased with increase in N levels upto 160 kg ha^{-1}. It might be due to the maximum uptake of nutrients at the time of tillering, which had prolonged the vegetative growth of the crop and thus led to maximum days to heading at highest N level. Delay of days to

Table 5: Days to maturity of wheat variety Fakhre- Sarhad as affected by owing dates (D), seed rates (S) and fertilizer levels (F)

		Sowing dates			
		25th October	10th November	25th November	Means
Seed rate kg ha^{-1}	Fert. Levels kg N ha^{-1}		D x S x F		S x F
75	0	176.80	166.80	155.50	166.30
	120	179.30	170.30	158.00	169.20
	140	179.30	170.50	158.00	169.30
	160	179.50	171.50	159.00	166.30
100	0	176.82	166.80	155.30	169.20
	120	179.80	170.30	158.00	169.30
	140	179.80	170.00	157.80	196.20
	160	180.00	171.80	158.80	170.20
125	0	176.80	166.50	154.30	165.80
	120	180.00	170.30	158.30	169.50
	140	180.00	170.80	158.30	169.80
	160	180.50	171.30	159.00	170.30
			D x F		F
	0	176.70	166.70	155.00	166.10c
	120	179.70	170.20	158.10	169.30b
	140	179.70	170.40	158.10	169.40b
	160	180.00	171.50	158.90	170.10a
			D x S		S
75		178.70	169.80	157.60	168.70
100		179.00	169.70	157.40	168.70
125		179.30	169.70	157.50	168.80
	Mean (D)	179.00a	169.70b	157.50c	

LSD value for sowing dates = 1.270 LSD value for fertilizer levels = 0.4425

Mean followed by different letters are significantly different from one another at $P \leq 0.05$

Table 6: Plant height (cm) of wheat variety Fakhre- Sarhad as affected by sowing dates (D), seed rates (S) and fertilizer levels (F)

		Sowing dates			
		25th October	10th November	25th November	Means
Seed rate kg ha^{-1}	Fert. Levels kg N ha^{-1}		D x S x F		S x F
75	0	119.90d	114.00f-I	94.00s	109.30f
	120	121.70b-d	113.80g-I	103.80o-q	113.10cd
	140	120.70cd	111.80ij	101.70g	111.40e
	160	122.80bc	108.00lm	105.40mo	112.10e
100	0	116.90e	108.90kl	95.60rs	107.10g
	120	127.30a	110.60jk	104.30op	114.10a-c
	140	123.50b	114.40f-h	106.10m-o	114.70ab
	160	123.10bc	116.30ef	105.30no	114.90a
125	0	113.10g-I	105.50no	102.30r	105.40h
	120	122.10b-d	115.50eg	102.30pq	113.30b-d
	140	127.60a	108.70kl	106.90lm	114.40a-c
	160	121.70b-d	113.00h-j	107.20l-n	114.00a-c
			D x F		F
	0	116.60b	109.50e	95.70h	107.30b
	120	123.71a	113.30c	103.50g	113.50a
	140	123.90a	111.60d	104.90fg	113.50a
	160	122.50a	112.40cd	106.00f	113.60a
			D x S		S
75		121.30b	111.90cd	101.20f	111.50b
100		122.70a	112.60c	102.80e	112.70a
125		121.10b	110.70d	103.50e	111.80d
	Mean (D)	121.70 a	111.70b	102.50c	

LSD value for sowing dates = 0.7712 LSD value for seed rate = 0.7211 LSD value for fertilizer levels = 0.8327

LSD value at 5 % D x S = 1.249 LSD value at 5 % S x F = 1.442 LSD value at 5 % D x S x F = 2.498

Mean followed by different letters are significantly different from one another at $P \leq 0.05$

heading by the application of high level of N was also reported by Herald *et al*. (1963).

Data presented in Table 5 indicated that different planting dates and N levels had a significant ($P \leq 0.05$) effect on days to maturity while seed rates and all interactions had a non significant effect. It can be inferred from the mean values of the data that maximum and minimum days to maturity were taken by crop sown on 25th October. These variation days to maturity might be due to change in temperature. Ashraf *et al*. (1968) concluded that longer period to maturity was taken by early sown crop. Maturity of the crop was delayed when N levels was increased.

Table 7: 1000 grain weight (g) of wheat variety Fakhre- Sarhad as affected by sowing dates (D), seed rates (S) and fertilizer levels (F)

Seed rate kg ha^{-1}	Fert. Levels kg N ha^{-1}	Sowing dates 25th October	 10th November D x S x F	 25th November	Means S x F
75	0	33.20	33.40	30.50	32.70
	120	35.50	35.50	33.10	34.70
	140	35.30	35.10	31.00	33.80
	160	35.10	34.20	30.40	33.20
100	0	32.90	33.90	31.80	32.90
	120	35.00	35.20	32.30	34.10
	140	35.50	34.00	30.60	33.40
	160	35.20	34.20	30.40	33.30
125	0	34.30	3180	32.30	32.80
	120	35.10	35.10	32.60	34.20
	140	33.80	35.20	32.10	33.70
	160	35.00	33.20	32.50	33.60
			D x F		F
	0	33.80	33.00	31.60	32.80b
	120	35.20	35.20	32.70	34.30a
	140	34.90	34.80	31.20	33.60ab
	160	35.10	33.90	31.10	33.40b
			D x S		S
75		35.00	34.50	31.30	33.60
100		34.60	34.30	31.30	33.40
125		34.60	33.80	32.40	33.60
	Mean (D)	37.70a	34.20a	31.60b	

LSD value for sowing dates = 0.9653 LSD value for fertilizer levels = 0.8860

Mean followed by different letters are significantly different from one another at $P \leq 0.05$

Table 8: Grain yield (kg ha^{-1}) of wheat variety Fakhre- Sarhad as affected by sowing dates (D), seed rates (S) and fertilizer levels (F)

Seed rate kg ha^{-1}	Fert. Levels kg N ha^{-1}	Sowing dates 25th October	 10th November D x S x F	 25th November	Means S x F
75	0	5546.00	5313.00	4427.00	5095.00
	120	8583.00	6167.00	5750.00	6833.00
	140	8042.00	6375.00	5208.00	6542.00
	160	8667.00	6583.00	5333.00	6861.00
100	0	4979.00	5052.00	4531.00	4854.00
	120	8542.00	6709.00	5417.00	6889.00
	140	7875.00	7292.00	5625.00	6931.00
	160	7667.00	6583.00	5250.00	6500.00
125	0	4760.00	4583.00	3958.00	4434.00
	120	7459.00	7425.00	5959.00	6947.00
	140	8584.00	6750.00	5708.00	7014.00
	160	7625.00	7000.00	6292.00	6972.00
			D x F		F
	0	5095.00cd	4983.00d	4306.00e	4794.00b
	120	8195.00a	6767.00b	5709.00c	6890.00a
	140	8167.00a	6806.00b	5514.00cd	6829.00a
	160	7986.00a	6722.00b	5625.00cd	6778.00a
			D x S		S
75		7709.00	6109.00	5180.00	6333.00
100		7266.00	6409.00	5206.00	6293.00
125		7107.00	6440.00	5479.00	6342.00
	Mean (D)	7361.00a	6319.00ab	5288.00b	

Mean followed by different letters are significantly different from one another at $P \leq 0.05$

Plots treated with 160 kg ha^{-1} took maximum days to maturity. Similar results are also reported by Khan (1985). Analysis of the data presented in Table 6 showed that plant height was significantly ($P \leq 0.05$) affected by all factors under study and their interactions. October 25th sown crop produced taller plants when compared with the other planting dates. The possible reason could be that long duration was available for maximum vegetative growth when planting was carried out earlier. Decrease in plant height with delay in sowing time was also reported by Razzaq *et al.* (1986). When the effect of different seed rates was taken into account, it was observed that plots seeded with 100 kg ha^{-1} recorded maximum plant height when compared with other seed rates. This increase in plant height at seeding density of 100 kg ha^{-1} could be due to better competition be very individual tiller for solar radiation, which might have helped in the increase of their length. When compared with control increase in plant height was observed with respect to increase in N levels. These findings are conformed by Ahmad *et al.* (1994) and Woodward (1966).

Data regarding 1000-grain weight is shown in Table 7. Analysis of the data indicated that different sowing dates and N levels showed a significant ($P \leq 0.05$) effect on 1000-grain weight. While different seed rates and all interactions did not show any significant effect. Plots sown earlier (25th October) produced heavier grains than late sown crop. Similar results are also reported by Mahajan (1994). Thousand grain weights were found to be decreased proportionally as the planting was delayed. Early sown crop suitable and longer environmental conditions for vegetative growth, which had resulted in the synthesis and translocation of maximum photosynthesis to the grains and thus had heavier grains. Razzaq *et al.* (1986), Zeb *et al.* (1987) and Ansary *et al.* (1989) reported that early sowing is better compared to late sowing for production of maximum grain weight and grain yield. Mean values of the data shown in Table 7 also revealed that highest grain weight was recorded from those plots, which had lower nitrogen level. These results agree with those reported by Memon *et al.* (1989), Kandera (1980) and Shah (1984), who concluded that though N helped in increasing tillers, height and dry weight of plants but produce heavier grains due to late maturity.

Yield is an important criterion in evaluating the adoptability of a crop to an environmental variation. Mean values of the data indicated that grain yield was significant ($P \leq 0.05$) affected by different sowing dates and fertilizer levels (Table 8). Analysis of the data revealed that early sowing dates favored the maximum partitioning of photosynthesis when compared to the late sowing and gave maximum grain yield. Furthermore, there was sufficient time available for the plant growth and development at early sowing. Similar results have also been reported by Razzaq *et al.* (1986), Zeb *et al.* (1987) and Iftikhar *et al.* (1992), they concluded that grain yield decreased progressively with delay in sowing time. It can be seen from the mean values of the data that the response of grain yield to seed rates was non significant, which was also confirmed by Auto and Kendal (1985) and Paul (1992) reported that seed rates did not affect the grain yield of wheat. All N levels increased grain yield when compared to control plots. The highest grain yield of wheat crop with maximum level of N could be attributed to availability of plant nutrients in abundant amount resulting in more tillers, longer spikes and more grains $spike^{-1}$, which ultimately led to maximum grain yield. These results are confirmed by Rathi and Singh (1973) and Ahmad *et al.* (1994), who concluded that grain yield increased with increase in fertilizer rates.

These results lead to the conclusion that wheat Cv. Fakher-Sarhad performs better if it is sown either in last week of October of November. The seed rate effect was non significant but it should not be used less than 100 kg ha^{-1}. In case of fertilizer treatments, control plots had poor yield and 160 kg N ha^{-1} seems to be an optimum level due to more tillers and grains $spike^{-1}$.

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