Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

ANSInet
an open access publisher
http://ansinet.com

Asian Journal of Plant Sciences
Volume 1 Number 5: 522-525, 2002

Yield and Yield Components of Various Wheat Cultivars as Affected by Different Sowing Dates

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Abstract: An experiment was conducted to study the yield and yield components of various wheat cultivars as affected by different sowing dates. Statistical analysis of the data revealed that different date of sowing and varieties had a significant effect on days to maturity, 1000 grain weight, grains spike^{-1}, grain yield, biological yield and harvest index. While plant height, days to maturity, grains^{-1}, 1000 grain weight, grain yield and biological yield was significantly affected by interaction between different sowing dates and varieties. Mean value of the data revealed that plant height (106 cm), grains $^{-1}$, 1000 grain weight (75.20 g), grain yield (3611.11 kg ha^{-1}) and biological yield (10370.00 kg ha^{-1}) was maximum in those plots which were sown on November 1st when compared with other sowing dates. Similarly variety tatara-96 recorded maximum plant height, grains^{-1}, 1000 grain weight, grain yield and harvest index when compared with other varieties under study.

Key words: Yield, yield components, sowing dates, wheat varieties

Introduction

Wheat is sown in winter months and it has its own definite requirements for temperature and light for emergence, growth and flowering. So, wheat needs to be sown at such an appropriate date that its temperature requirements are fulfilled. Too early sowing produces weak plants with poor root system. And in too early sowing the temperature is above the optimum. Temperature above the optimum leads to irregular germination and the embryo frequently dies and the endosperm may undergo decomposition due to activities of bacteria or fungi. Late planting results in poor tillering and more chance of winter injury. The late planted wheat grows generally slow because of low temperature. Late planted wheat may suffer from rains during April-May, which impaired grain quality. In late planting the wheat variety should be of short duration that may escape from high temperature at the grain filling stage.

Though Pakistan is a major growing country, yet its yield is too low as compared to other countries. Its production is not up to the mark and required standards to bridge the gap between consumption and production. Besides other reasons, one main reason of low productivity is due to deviation from the recommended sowing time of a genotype for a particular set of environment and thus resulting in failure to achieve its maximum productive capacity. Per unit area production can be increased by adopting proper sowing time, seed rate, judicious application of fertilizers, timely irrigation, proper weed control and proper insect pest and disease management. Early planting produce greater number of spikes m^{-2}, heavier grain and highest grain yield ha^{-1}, while late planting affected these characters adversely. Ishaq and Taha (1974) and Khan and Saleem (1986) reported that wheat sown earlier is more profitable when compared with late sown because of more productive tillers. The late sowing resulted in reduced seed weight and low yield in all the wheat cultivars (Zeb *et al.*, 1987). Ansary *et al.* (1989) reported that delay in sowing suppressed the yield, caused by reduction in the yield contributing traits like, number of tillers, grains spike^{-1}, seed index and grain yield plant^{-1}. The delay in sowing decrease grain yield by 58.2 % and also resulted in lower grain weight and number of grains plant^{-1} (Razzaq *et al.*, 1986). Rajput and Verma (1994) observed that normal sowing gave higher grain yields than late sowing.

Keeping in view the role of proper sowing in wheat producing the study was initiated with aim to find out the proper time of sowing for different wheat varieties under the agro climatic conditions of Peshawar.

Materials and Methods

Field experiment to study the yield and yield components of wheat cultivars as affected by different sowing dates was conducted at Malakandhar Research Farms of NWFP. Agricultural University Peshawar, during 1999-2000. The experiment was laid out in randomized complete block design (RCBD) with split plot arrangements. The following treatments were used during the course of experiment:

Sowing dates:

D_1 = 1st November 1999 D_2 = 16th November 1999
D_3 = 1st December 1999 D_4 = 16th December 1999
D_5 = 1st January 2000 D_6 = 16th January 2000.

Varieties

V_1 = Tatara-96 V_2 = Inqilab-91
V_3 = Bakhtawar-92 V_4 = Dera-98

The data recorded during the experiment were plant height, days to maturity, grains spike^{-1}, thousand grain weight, grain yield, biological yield and harvest index.

Plant height was recorded by measuring height of five representative plants in each treatment at maturity from base to the tip of the spike. Days to maturity were recorded when 90% plants in each treatment were matured. For 1000 grain weight data, were counted from threshed clean lot of each treatment and then weighed with the help of sensitive electronic balance. For calculating number of grains spike^{-1}, five spikes treatment^{-1} were randomly selected in each sub plot and then their grains were counted and divided by 5 to get the average grains spike^{-1}. Grain yield, biological yield and harvest index in each subplot was determined and then converted into kg ha^{-1} according to the following formula:

$$\text{Grain yield (kg ha}^{-1}\text{)} = \frac{\text{Grain yield (kg) subplot}^{-1}}{\text{Area sub plot}^{-1}} \times 1000$$

$$\text{Biological yield (kg ha}^{-1}\text{)} = \frac{\text{Biological yield (kg) subplot}^{-1}}{\text{Area sub plot}^{-1}} \times 1000$$

$$\text{Harvest index (H.I)} = \text{Grain yield/Biological yield}^{-1} \times 100$$

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

Statistical analysis of the data showed (Table 1) that there were significant ($P \leq 0.05$) differences in plant height due to different

planting dates. While cultivars and interaction between cultivars and sowing dates was not significant. It can be seen from the data (Table 1) that plant height decreased as planting was delayed from 1st November to 16th January. Mean values of the planting dates revealed that maximum plant height (95.50 cm) was attained in plots sown on 1st November, while minimum plant height of 72.00 cm was attained when crop was planted on 16th January. In case of varieties, it was revealed that tatara-96 produced the maximum plant height of 94.16 cm followed by inqilab-91 (91.20 cm), cultivars dera-98 had the lowest plant height of 75.00 cm. Ashiq *et al*. (1995) reported that the difference in plant height might be due to difference in their genetic makeup. In case of interaction between dates of sowing and cultivars revealed that taller plants (106.00 cm) was attained by tatara-96 when sown on 1st November, followed by those plots sown on 16th November and 1st December with cultivars tatara-96.

Statistical analysis of the data (Table 2) showed that days to maturity was significantly ($P \leq 0.05$) affected by different cultivars, sowing dates and their interaction. Days to maturity decreased as planting were delayed from 1st November to 16th January. Maximum days to maturity (169.58) were recorded in those plots, which were planted on 16th November. While minimum days to maturity (109.33) were taken when crop was planted on 16th of January. In case of varieties, tatara-96 or bakhtawar-92 took significantly higher number of days to maturity i.e., 172.67 when planted on 1st November followed by dera-98 and inqilab-91 with 169.33 of 165.67 days to maturity (Table 2). In case of interaction between dates of sowing and cultivars revealed that more days to maturity were taken by cultivars tatara-96 when sown on 1st November. Analysis of the data (Table 3) revealed that grains spike^{-1} was significantly ($P \leq 0.05$) affected by different cultivars, sowing dates and their interaction between cultivars and sowing dates. Mean values of the data indicated that grains spike^{-1} decreased from 1st November to 16th January. Mean values (Table 3) of the planting dates showed that maximum grains spike^{-1} (51.00) were recorded in plots sown on 1st November while minimum grains spike^{-1} of 34.00 was observed when sowing was done on 16th January. In case of varieties, tatara-96 attained maximum grains spike^{-1} (45.80 grains spike^{-1}). In case of interaction between dates of sowing and cultivars revealed that more grains spike^{-1} (54.00) was produced by tatara-96 when sown on 1st November (Table 3). Similar results were also reported by Khan and Saleem (1986).

When the effect of varieties on thousand grains weight was taken into an account, it was revealed that tatara-96 gave significantly higher thousand grain weight of 36.65 g followed by inqilab-91 with thousand grain weight of 35.03 g. Similarly dera-98 produced lighter grains. Similar results are also reported by Mahajan (1994). Thousand grain weight was found to be decreased proportionally as the planting was delayed. In case of planting dates, maximum thousand grain weight (46.63 g) was produced when sowing was done on 1st November while 16th January sowing resulted in minimum thousand grain weight. In case of interaction between dates of sowing and cultivars revealed that heavier seed (52.20 g 1000 grains^{-1}) was produced by tatara-96 when sown on 1st November (Table 4).

Table 1: Effect of different wheat cultivars and date of sowing on plant height (cm)

	Cultivars				
Sowing dates	Tatara-96	Inqilab-91	Bakhtawar-92	Dera-98	Mean
1st November	106.00a	101.00b	95.00c	84.00ef	96.50a
16th November	105.00a	100.00b	96.00c	80.00g	95.25a
1st December	104.00a	101.00b	94.00c	82.00fg	95.25a
16th December	090.00d	090.00d	85.00e	71.00j	84.25b
1st January	085.00e	080.00g	81.00g	68.00k	78.50c
16th January	075.00h	076.00hi	72.00ij	65.00j	72.00d
Mean	094.16a	091.20b	87.16c	75.00d	

Table 2: Effect of different wheat cultivars and date of sowing on days to maturity

	Cultivars				
Sowing dates	Tatara-96	Inqilab-91	Bakhtawar-92	Dera-9	Mean
81st November	172.67a	165.67cd	172.67a	167.33bc	169.58a
16th November	166.33bcd	164.67d	168.33b	164.33de	162.92b
1st December	159.67f	158.00f	163.33e	158.67f	159.67c
16th December	149.33l	145.33j	152.00h	155.00g	150.42d
1st January	124.67k	119.33l	126.33k	124.33k	123.67e
16th January	108.33n	105.33o	112.67m	111.00m	109.33f
Mean	146.83b	143.06c	149.06a	146.78b	

Table 3: Effect of different wheat cultivars and date of sowing on grains spike^{-1}

	Cultivars				
Sowing dates	Tatara-96	Inqilab-91	Bakhtawar-92	Dera-9	Mean
81st November	54.00a	52.00b	48.00de	47.00ef	51.00a
16th November	51.00bc	52.00b	48.00de	46.00ef	49.25ab
1st December	49.00cd	53.00ab	46.00ef	45.00f	48.25b
16th December	48.00de	46.00ef	42.00g	35.00jk	42.25c
1st January	38.00hi	39.00h	37.00hij	32.00lm	36.50d
16th January	35.00jk	33.00kl	35.00ij	31.00m	34.00e
Mean	45.80a	45.80a	42.80b	09.33c	

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

Table 4: Effect of different wheat cultivars and date of sowing on thousand grain weight (g)

	Cultivars				
Sowing dates	Tatara-96	Inqilab-91	Bakhtawar-92	Dera-98	Mean
1st November	57.20a	45.27b	45.03bc	39.03d	46.63a
16th November	39.03d	40.90cd	41.17bcd	40.53d	40.40b
1st December	38.33d	37.57d	39.83d	30.90efg	36.66c
16th December	30.97efg	32.13ef	32.92e	30.93efg	31.73d
1st January	28.33fgh	31.07efg	27.20ghi	27.87gh	28.62e
16th January	26.03hij	23.23ijk	22.33jk	21.50k	23.27f
Mean	36.65a	35.03ab	34.74b	31.79c	

Table 5: Effect of different wheat cultivars and date of sowing on grain yield (kg ha^{-1})

	Cultivars				
Sowing dates	Tatara-96	Inqilab-91	Bakhtawar-92	Dera-98	Mean
1st November	3611.14	3333.36	3000.02	2805.57	3188.00a
16th November	3500.02	3277.80	2916.69	2861.13	3139.00a
1st December	3000.02	2777.80	2972.25	2003.35	2708.00b
16th December	2500.02	2083.35	1888.90	1555.57	2007.00c
1st January	2001.01	1666.66	1500.01	1444.45	1653.00d
16th January	1389.01	1166.60	1111.12	1055.46	918.01e
Mean	2666.70a	2384.09b	2231.00c	1954.25d	

Table 6: Effect of different wheat cultivars and date of sowing on biological yield (kg ha^{-1})

	Cultivars				
Sowing dates	Tatara-96	Inqilab-91	Bakhtawar-92	Dera-98	Mean
1st November	10370.00	9260.00	10185.00	9630.00	9861.00a
16th November	9259.00	8889.00	9260.00	7778.00	8798.00ab
1st December	9129.00	8333.00	7407.00	7407.00	8074.00bc
16th December	8518.00	7500.00	7407.00	7037.00	7612.00c
1st January	8019.00	6796.00	7404.00	7037.00	7315.00cd
16th January	2360.00	2135.00	2000.00	2000.00	2124.00d
Mean	7943.00a	7152.00bc	7278.00ab	6815.00c	

Table 7: Effect of different wheat cultivars and date of sowing on harvest index (%)

	Cultivars				
Sowing dates	Tatara-96	Inqilab-91	Bakhtawar-92	Dera-98	Mean
1st November	34.82	36.00	29.46	29.13	32.33ab
16th November	37.80	36.87	31.50	36.78	35.68a
1st December	32.86	33.33	40.13	27.05	33.54b
16th December	29.35	27.78	25.50	22.11	26.37c
1st January	24.94	24.52	20.25	20.53	22.60cd
16th January	58.86	54.64	55.56	52.77	54.46d
Mean	36.44ab	35.53a	33.73b	31.40b	

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

Analysis of the data (Table 5) revealed that different wheat cultivars and sowing dates had a significant ($P \leq 0.05$) effect on grain yield, while their interaction was non significant. It can be inferred from the mean value of the data that highest grain yield (3188.00 kg ha^{-1}) was produced when sowing was done on 1st November, while January 16th sowing recorded minimum grain yield (918.01 kg ha^{-1}). Similarly, in case of varieties, tatara-96 produced maximum grain yield (2666.70 kg ha^{-1}), while dera-98 produced minimum grain yield (1954.25 kg ha^{-1}). Similar results are also reported by Jain *et al.* (1992) and Kumar *et al.* (1994).

The mean values of the data revealed that biological yield decreased as sowing delayed from 1st November to 16th January (Table 6). Perusal of the mean for planting dates indicated that the highest biological yield of 9861.00 kg ha^{-1} was produced when sowing was done on 1st November, while the lowest biological yield of 2124.00 kg $ha^{-1}$was recorded when sowing was done on 16th January. In case of cultivars, tatara-96 produced the highest biological yield, while minimum was produced by dera-98. These results agree with those reported by Rajput and Verma (1994).

Harvest index was significantly ($P \leq 0.05$) affected by different varieties and sowing dates while their interaction was non significant (Table 7). Maximum harvest index was observed in those plots, which were sown on November 16th, while minimum was noted in 1st January sowing. In case of varieties, tatara-96 recorded maximum harvest index when compared with other varieties under study. This results agree with Sharma and Smith (1987).

These results leads to the conclusion that wheat cultivar tatara-96 perform better if it is sown on 1st week of November or 3rd week of November. Late sowing either on 1st week of January or 3rd week of January gave minimum production.

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