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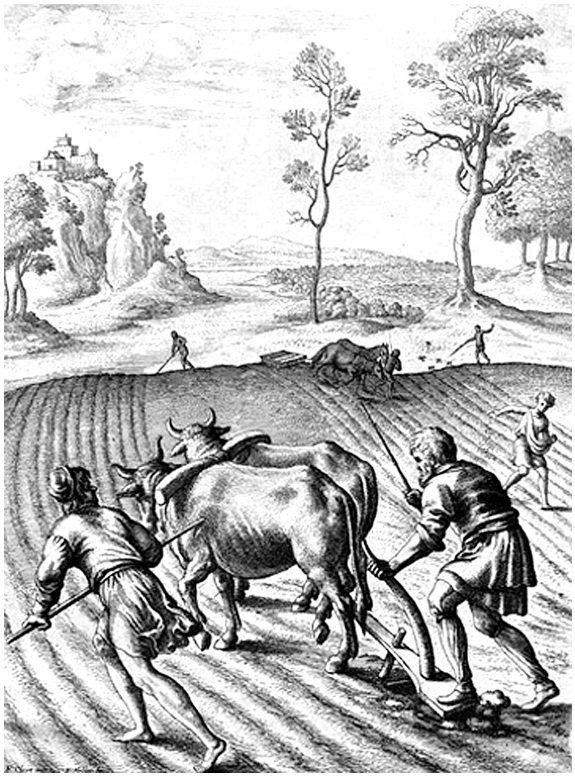

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Effect of Sowing Dates on the Yield and Yield Components of Different Wheat Varieties

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Abstract: To study the effect of sowing dates on the yield and yield components of different wheat varieties an experiment was conducted at Malakandhar Research Farm of NWFP Agriculture University Peshawar during 1999-2000. Statistical analysis of the data revealed that different dates sowing and varieties had a significant effect on emergences m^{-2}, number of productive tillers m^{-2}, number of unproductive tillers m^{-2}, spike length, grain yield and biological yield. While number of unproductive tillers m^{-2}, days to heading and biological yield were significantly affected by interaction between different sowing dates and varieties. Mean value of the data revealed that emergence m^{-2} (179). spike length (11.33 cm). 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 emergence m^{-2}, days to heading, number of productive tillers m^{-2}, spike length and grain yield when compared with other varieties under study.

Key words: Wheat (*Triticum aestivum*), sowing dates, yield components, yield, varieties

INTRODUCTION

The seeding or planting time of various field crops is governed not only by the environmental requirements for the crop but also necessary for avoiding the ravages of diseases and insect pests. Early sown crops mature earlier than those sown later. But they require longer growing period and consequently the differences in harvest date is less that the difference in the planting date. Timely seeding results in highest yield and is most likely to escape injury from drought, heat and diseases which become more prevalent as the season advances. Time of sowing of a specific variety in a particular climatic condition exerts a profound effect on agronomic characters and physiological processes of a variety under consideration. Proper time of sowing helps cultivars to express its growth patterns to its full extent in a diverse setting of environmental dynamic beside genotype environmental interaction as it also helps scientist of particular environment (area) for maximizing the yield. Other environmental factors like temperature, rainfall, humidity, solar radiation and soil types also contribute much towards the variety performance under a given locality. 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 (Paul, 1992). Late planting results in poor tillering and more chances of winter injury (Joshi *et al*., 1992). Wheat like other cool season generally is seeded early in the season to permit maximum growth and development toward maturity before the advent of hot weather, drought and diseases. Wheat sown too early may use soil moisture accumulated in the fall. However medium-season seeding of winter for any locality is usually most favorable whereas wheat sown late suffers more winter injury, produces less tillers and may ripen in lower grain weight and number of grains $plants^{-1}$ (Razzaq *et al*., 1986). Though, Pakistan is a major wheat growing country yet its yield is too low as compared to other developing countries. Its production is not up to the mark and required standards to bridge the gap between consumption and production. Timely irrigation, proper weed control and proper insect pest and disease management can increase production. Early planting produce greater number of spikes m^{-2}, heavier grains and highest grain yield ha^{-1} while late planting affected these characters adversely. Hameed *et al*., (2003) reported that wheat varieties perform better if it is sown in last week of October or 1st week of November. Late sowing either on 1st week of January or 3rd week of January gave minimum production (Shahzad *et al*., 2002). The delay in sowing after first week in November decreased grain yield of wheat (Mahajan *et al*., 1994). 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.

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MATERIALS AND METHODS

A field experiment to study the effect of sowing dates on the yield and yield components of different wheat varieties was conducted at Malakandhar Research Farms of NWFP Agriculture University Peshawar 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 arrangements having three replications. Four varieties of wheat were planted on different dates. The schematic presentation is as follows:

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 = January 2000

Varieties:

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

The data recorded during the experiment were emergence m^{-2}, days to heading, number of productive tillers m^{-2}, number of unproductive tillers m^{-2}, spike length, grain yield and biological yield. Emergence m^{-2} in subplots was recorded randomly at three different spots with the help of meter rod.

RESULTS AND DISCUSSION

Emergence m^{-2}: Statistical analysis of the data showed that there were significant ($p \leq 0.05$) differences in emergence m^{-2} due to different planting dates. While the effect of cultivars and interaction between cultivars and sowing dates was not significant (Table 1). Emergence m^{-2} decreased as planting was delayed from 1st November to 16th January. Mean values of planting dates revealed that maximum emergence m^{-2} of 179.29 was recorded when sowing was done on 1st November. While minimum emergence m^{-2} was noted when crop was planted on 16th of January. This could be due to favorable climatic conditions prevailing during November compared to other sowing dates. In case of varieties, it was revealed that Tatara-96 produced the maximum number of 131.06 seedlings m^{-2} followed by inqilab-91.

Days to heading: Statistical analysis of the data showed that days to heading was significantly ($p \leq 0.005$) affected by different cultivars and sowing dates. Data revealed that days to heading decreased as planting were delayed from 1st November to 16th January. It can be inferred from the mean values of the data that maximum days to heading (197.08) were recorded in those plots which were planted on 16th November followed by those plots sown on 1st November while days to heading (72.33) were minimum when sowing was done on 16th January (Table 2). When the effect of different cultivars was taken into an account, Inqilab-91 took maximum days to heading (93.94) followed by Tatara-96 (93.72) the difference in number of days to heading may be due to difference in their genetic makeup and also due to their differential response to different sowing season (Nayeem and Delve, 1992).

Productive tillers m^{-2}: Data regarding number of productive tillers m^{-2} were significantly ($p \leq 0.05$) affected by different cultivars and sowing dates while interaction between cultivars and sowing dates was non significant (Table 3). Mean values of the data indicated that highest number of 292.67 productive tillers m^{-2} were produced when sowing was done on 1st November which was at par with the 16th November' sowing (282.00) while lowest number of 31.25 productive tillers m^{-2} were produced when planting was done on January 16th. In case of varieties, Tatara-96 produced maximum number of 117.72 productive tillers m^{-2} followed by Inqilab-91. Ansary *et al.* (1989) reported that delay in sowing suppressed the yield caused by reduction in the yield contributing traits; number of productive tillers, grains spile^{-1} and grain yield plant^{-1}.

Unproductive tillers m^{-2}: Analysis of the data showed that number of unproductive tillers m^{-2} was significantly ($p \leq 0.05$) affected by different wheat cultivars. Mean values of the data presented in Table 4 indicated that number of unproductive tillers m^{-2} increased as sowing was delayed from 1st November to 16th January. Highest number of unproductive tiller m^{-2} (6.76) was observed when sowing was done on 1st January. In case of varieties, maximum number of unproductive tillers m^{-2} was observed in plots sown with Dera-98 (3.17) while Inqilab-91 recorded minimum number of unproductive tiller m^{-2} when compared with other varieties under study. In case of interaction between dates of sowing and cultivars revealed that highest number of 7.67 unproductive tillers m^{-2} was produced by Dera-98 when sown on 16th January.

Spike length: Analysis of the data presented in Table 5 indicated that spike length was significantly ($p \leq 0.05$) affected by different wheat cultivars and sowing dates, while their interaction was found non significant. Spike

Table 1: Effect of different wheat cultivars and date of sowing on emergence m^{-2}

Sowing dates	Cultivars				
	Tatara-96	Inqilab-91	Bakhtawar-92	Dera-98	Mean
1st November	190.50	183.33	175.00	168.33	179.29a
16th November	185.83	177.50	175.00	165.00	175.83a
1st December	127.50	120.83	119.17	109.17	119.17b
16th December	120.00	134.17	115.00	106.67	118.96b
1st January	112.50	105.83	107.50	105.50	107.71c
16th January	50.00	51.67	41.65	49.17	48.13d
Mean	131.06a	128.89a	122.22b	117.22c	

Mean followed by different letter (s) are significantly different from one another at $p<0.05$

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

Sowing dates	Cultivars				
	Tatara-96	Inqilab-91	Bakhtawar-92	Dera-98	Mean
1st November	107.33	100.33	106.33	105.33	107.08a
16th November	102.23	94.00	100.67	100.33	101.58b
1st December	97.33	98.00	95.67	65.33	96.58b
16th December	92.33	92.67	90.67	90.00	91.42d
1st January	87.00	88.00	85.33	85.00	86.33c
16th January	76.00	52.67	70.33	70.33	72.33f
Mean	93.72a	93.94a	91.50b	91.00b	

Mean followed by different letter (s) are significantly different from one another at $p<0.05$

Table 3: Effect of different wheat cultivars and date of sowing on number of productive tillers m^{-2}

Sowing dates	Cultivars				
	Tatara-96	Inqilab-91	Bakhtawar-92	Dera-98	Mean
1st November	306.00	278.00	293.33	293.33	297.67a
16th November	275.33	280.67	282.00	290.00	282.00ab
1st December	278.67	284.33	272.00	272.67	276.92bc
16th December	280.67	258.67	261.33	262.33	265.72c
1st January	190.67	190.00	185.00	170.33	182.50b
16th January	35.00	35.00	30.00	25.00	31.25c
Mean	227.72	221.00	220.00	215.55	

Mean followed by different letter (s) are significantly different from one another at $p<0.05$

Table 4: Effect of different wheat cultivars and date of sowing on number of unproductive tillers m^{-2}

Sowing dates	Cultivars				
	Tatara-96	Inqilab-91	Bakhtawar-92	Dera-98	Mean
1st November	0.0f	0.0f	0.0f	0.00f	0.00c
16th November	0.0f	0.0f	0.00f	0.00f	0.00c
1st December	0.0f	0.00f	0.00f	0.00f	0.00c
16th December	5.00d	0.0f	5.00d	6.00cd	4.00b
1st January	5.33cd	2.33c	6.00cd	5.33cd	4.75b
16th January	6.33bc	5.67cd	7.33ab	5.67a	6.75a
Mean	2.78a	1.33b	3.06a	3.17a	

Mean followed by different letter (s) are significantly different from one another at $p<0.05$

Table 5: Effect of different wheat cultivars and date of sowing on spike length

Sowing dates	Cultivars				
	Tatara-96	Inqilab-91	Bakhtawar-92	Dera-98	Mean
1st November	11.33	9.67	10.00	9.00	10.00a
16th November	10.33	10.33	8.00	9.67	9.58ab
1st December	9.67	9.67	8.00	8.33	8.92b
16th December	10.67	8.33	9.33	7.67	9.00b
1st January	9.67	9.67	8.33	8.33	9.00b
16th January	7.33	7.33	6.00	6.65	6.83c
Mean	9.83a	9.17b	8.28c	8.28c	

Mean followed by different letter (s) are significantly different from one another at $p<0.05$

Table 6: 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	300.02	2777.80	2972.25	2003.35	2708.00b
16th December	2500.02	2083.35	1888.92	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	198.01c
Mean	2666.70a	2384.09b	2231.00c	1954.25d	

Mean followed by different letter (s) are significantly different from one another at p<0.05

Table 7: 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	7287.00ab	5815.00c	

Mean followed by different letter (s) are significantly different from one another at p<0.05

Table 8: 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	54.60	55.56	52.77	54.46d
Mean	36.44ab	35.53a	33.73b	31.40b	

Mean followed by different letter (s) are significantly different from one another at p<0.05

length decreased as planting was delayed from 1st November to 16th January. Mean values of the data revealed that maximum spike length of 10 cm was recorded in plots which were sown on 16th January. Among the varieties, Tatara-96 attained maximum spike length of 9.83 cm followed by Inqilab-91(9.17 cm). Similar results were also reported by Piech and Atankowski (1989).

Grain yield: Table 6 revealed that different wheat cultivars and sowing dates had a significant ($p \leq 0.005$) 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}). Among 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).

Biological yield: The mean values of the data revealed that biological yield decreased as swing delayed from 1st November to 16th January (Table 7). 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. Tatara-96 produced the highest biological yield among all varieties, while, minimum biological yield was produced by Dera-98. These results agree with those reported by Rajput and Verma (1994).

Harvest index: Harvest index was significantly ($p \leq 0.05$) affected by different varieties and sowing dates while their interaction was non significant (Table 8). 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. These results are in agreement with those of Sharma and Smith (1987).

CONCLUSIONS

These results lead to the conclusion that wheat cultivar Tatara-96 performs 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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