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Effect of sowing dates and seeding density on yield of wheat (*Triticumm aestivum* L.)

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ABSTRACT: In wheat cropping system, farmers usually use normal wheat seed (100 kg ha-1) even under late planting. The negative effect of late sowing may be compensated by the subsequent increase in seed quantity.A study was undertaken to determine the effects of sowing dates and seeding density on growth and yield of wheat, variety N-85-5 in Iran. The trial was laid out with split plot arrangement having three replications during 2011-12. Three sowing dates i.e. Dec 21, Dec 30 and Jan 29 were in main plots, whereas tow wheat seeding density (350 and 500 plant/m^2) were in sub plots. Results shows that higher number of grain spike, spike weight, 1000-grain weight and biological, grain yield with seed rate of 500 plant/m^2. Similarly, sowing wheat on Dec21 produced the highest number of spike, spike weight, 1000-grain weight and biological, grain yield, which subsequently decreased with successive sowing dates.
Key words*:* Wheat, sowing time, seeding density

INTRODUCTION

Wheat (Triticum aestivum L.) is an important food crop grown during the winter season. Importance of wheat crop may be understood from the fact that it covers about 42% of total cropped area and 32% of total rice (Oryza sativa L.) area in rice-wheat system in South Asia (Iqbal et al., 2002). In wheat uniform stand establishment and early vigor are the principal determinant of crop performance. It occupies 9.042 million hectares of the country with a total production of 23.864 million tones and the national average yield of 2639 kg ha-1 (Anonymous, 2010). Wheat yield is low in Iran on account of many biotic and abiotic factors. Among these, the time of sowing and planting density are of great significance which determine the proper stand establishment of the growing crop through balancing the plant to plant competition and ultimately affect the yield (Nakano and Morita, 2009).

Generally wheat like other cool season crop is seeded early to take maximum period for growth and development toward maturity before the (possible) heat stress. However, mid-season seeding of winter wheat for any locality is usually most favorable, whereas late sown wheat suffers more winter injury, which produces fewer tillers and may ripen in lower grain weight and number of grains per plant. The decline becomes prominent in the cultivars requiring more days for heading under normal planting. Increase in temperature cause shortens of headingperiod (Tashiro & Wardlaw, 1999). Similarly, cultivars matured earlier when planted late, indicating the forced maturity due to high temperature. Kristo et al. (2006) showed that winter wheat grown under more favourable conditions (October sowing with 600 seeds m-2) responded to the treatments more even compared to those grown under unfavourable conditions (November sowing with 300 seeds m-2). Similarly, 15% increase in grain yield was recorded when the seedingrate was increased from 41 to 95 kg ha-1 (Ali, 1982). It has also been noted that the increase of seeding rate at early and optimal sowing time is unfavourable, but the negative effect of late sowing could be compensated by the increase of seed quantity. Hiltbrunner et al. (2007) advocated that a rationale increase of the seeding density with that of sowing time is an effective mean to increase the grain yield.

Therefore this study was planned to examine effect of sowing dates and seeding density on yield of wheat (Triticum aestivum L.).

MATERIALS AND MHETODS

In order to study effect of sowing dates and seeding density on yield wheat (triticum aestivum L.) an experiments was conducted under in agriculture research center, Gorgan, Iran during 20011–2012. The experiment was laid out with split plot arrangement having three replications during 2011-12. Three sowing dates i.e. Dec 21, Dec 30 and Jan 29 were in main plots, whereas tow wheat seeding density (350 and 500 plant/m^2) were in sub plots. At maturity, two outer rows for each plot, 25 cm from each end of the plots, were left as borders and the middle 1 m2 of the two central rows were harvested. Each sample was oven dried at 80 .C and grain yield measured. Then yield components of cultivats were determined. Data were analyzed with Proc GLM procedure, SAS statistical software.

RESULTS

Biological yield

wheat showed difference among the biomass yield of wheat on different sowing time and seed rate differed non-significantly for the bilogical yield (Table 1). The comparison of the mean values for biomass yield for shows that sowing time of Dec21 highest Biological yield (18660 kg/ha) and has the lowest biomass yield (11958 kg/ha) in Jan 29 and the difference was significant (Table 2).

Grain yield

The data showed significant effects ($P<0.05$) of different sowing time, whereas, the seed rate differed non-significantly for the grain yield (Table 1). The highest grain yield was obtained from Dec 21 (6430kg ha-1) while Jan 29 produced the lowest grain yield of 3969.63 kg ha-1 (Table 2). Shahzad et al. (2007) also obtained lower grain yield with delay in sowing due to shorter duration of growth and development. The use of 150 kg seed ha-1 produced higher grain yield of 5103.3 kg ha-1 than other seeding rates used.

number of grain spike

Results showed that the effect of sowing time and seeding density on the number of grains per spike were significan ($P<0.05$) (Table 1). The comparison of the mean values of the number of grain per spike for plant time of Dec21 showed that had the highest (486.08) and the Jan29 had the lowest number of pods per plant (334.96). The comparison of the mean values of the number of grain per spike for seeding density showed that 500 plant/m^2 had the highest (431.28) and the 350 plant/m^2 had the lowest number of pods per plant (401.81) (Table2). Waraich et al. (1981) reported that earlier planting resulted in better spike development due to longer growing period.

Spike weight

The weight of spike plays a vital role in wheat towards the grains spike-1 and finally the yield (Shahzad et al., 2007). As far as the sowing time is concerned, significant observations were recorded for the spike weight. Sowing wheat on Dec21 produced the highest and statistically at par spike weight of 2.44 g (Table 2). Further delay in sowing resulted in shorter spike weight. Seed rate and its interaction with sowing time did not show significant effect on spike weight (Table 1).

1000-grain weight

Among different sowing dates, the maximum 1000-grain weight (43.41g) was recorded on Dec21 (Table 2). The minimum 1000-grain weight (39.31 g) was noted on Jan21 sowing date. Among seeding rates, the maximum 1000-grain weight (45.30 g) was obtained when normal seed rate of 100 kg ha-1 was used. Further increase in seed rate did not show any positive effect on grain weight. This might be due to bulk planting density on account of higher seed rates used that eventually declined the seed weight. The results are in accordance with the findings of Shahzad et al. (2007) who also observed that earlier sowing resulted in betterdevelopment of the grain due to longer growing period.

DISCUSSION

Simple mean comparisons for grain yield of wheat in different date of sowing shows that the highest seed yield gave at Dec21 sowing date the lowest seed yield gave at Jan21 sowing date and difference was significant. The decrease in seed yield was closely associated with lower 1000- seed weight with late sown crops, as was

reported by Darwinkel et al, (1977). The time from sowing to anthesis was longer in the late sown crop, as compared to the earliest sown, presumably due to relatively lower temperatures during anthesis of the late sown crop. Green et al. (1985) stated that crops sown at different dates pass through each developmental stage under different environmental conditions. Thus, the late sown crops in this study passed through cooler temperatures, and were associated with late flowering. Ishag and Mohamed (1995) reported that phasic development stages of wheat are affected by genetic and environmental factors. Sowing date had a great effect on the duration of grain filling.

Table1. Analysis of variance (mean squares) for yield of wheat

s.o.v	df	Biological yield	Grain yield	number of grain spike	spike weight	1000 grain weight
Error a	8	623351.5	52065.13	20658.15	0.103	15.07ns
Sowing data	2	26945 *	355398*	139642*	2.63**	102.36*
Seeding density	1	31794 ns	28084ns	15635.0*	0.0005 ns	0.98 ns
Interaction	2	27811.5 ns	13310.2 ns	633.29 ns	0.82**	0.98 ns
Error b	36	24621.1	7912.5	2436.56	0.13	23.99
CV	-	8.45	16.73	8.9	17.38	7.45

ns = Non-significant * = Significant at 5% level of probability

Table2. mean compare sowing dates and seeding density for yield of wheat

Treatment		Biological yield	Grain yield	number of grain spike	weight spike	1000 grain weight
Sowing data	Dec21	18660 a	6430 a	486.08 a	2.44542 a	43.417 a
	Dec30	15267 ab	5250.21 ab	428.58 ab	2.43125 a	41.8 ab
	Jan29	11958 b	3969.63 b	334.96 b	1.86417 b	39.317 b
density	350 plant/m^2	15085a	501.19a	401.81b	2.24778a	45.3028a
	500 plant/m^2	15505 a	540.69a	431.28a	2.24611a	43.9361a

Means followed by different letter(s) in a row are significant at 5% level of probability

CONCLUSION

In the present research, wheat produced higher number of grain spike, spike weight, 1000-grain weight and the biological grain yield when sown on Dec21 and with seed rate of 500 plant/m^2. Therefore, sowing time Dec21 with500 plant/m^2 is recommended to obtain higher yield of wheat var. N-85-5.

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