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Performance of Durum Wheat (*Triticum durum*) Genotypes under Variable Sowing Dates in Sub-Tropical Zone of Jammu, Jammu & Kashmir

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ABSTRACT

A field experiment was conducted at research farm of Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu on sandy loam soil of Sub-tropical zone of Jammu division to investigate the effect of sowing dates and genotypes on growth, yield and nitrogen uptake of durum wheat (*Triticum durum*) for two consecutive *rabi* seasons. The treatments comprised of two sowing dates *viz.* D_1-normal sown and D_2-late sown in the main plot, and four genotypes *viz.* PBW-34, PDW-233, WH-896 and PBW-343 in the sub plots were evaluated under split plot design with three replications. Results revealed that variety PBW-343 recorded significant higher number of ear heads, grain and biological yield per m^2 area than that of all other genotypes. Among sowing dates, normal sown wheat crop recorded significant higher grain and biomass yield as compared to late sown wheat. In normal sown wheat (D_1), N uptake in grain was also recorded significantly higher in both the consecutive years whereas, among different genotypes, PBW-343 recorded highest N uptake in grain and straw in second year of cropping.

Introduction

Wheat is the most important cereal crop because it is the staple food of the people of India and thus occupies a central position in forming agricultural policies and dominates all crops in acreage and production. The spectacular increase in the area, production and yield of wheat from merely 12.57 million hectares, 10.40 million tonnes and 837 kg ha^{-1} during 1965-66 to 30.42 million hectares, 92.29 million tonnes and 3034 kg ha^{-1} during 2015-16 (Directorate of Economics and Statistics, 2018) has not only elevated over status from "shortage" to "surplus" in wheat but also opened new avenues for its diversified utilization. Despite of impressive achievements in recent past, concentrated efforts are still needed for achieving sustained growth in wheat production to fulfill nutrient requirements for ever increasing population and for maintaining buffer stock for food security (Tripathi and Mishra, 2017). It has been projected that India will have to produce at least 109 million tonnes of wheat by 2020 AD to feed 1.3 billion population and for meeting the demand under diversified uses, which seems to achieve only through elevating productivity up to 4000 kg ha^{-1} (Nagarajan, 1988). Renewed research and development efforts are needed to exploit potential of major wheat growing areas not only in quantitative terms but also in qualitative terms. The development and identification of high yielding, widely adopted, disease resistance varieties with good quality characteristics is considered the first and foremost to generate production technology for a region to increase productivity of wheat. As wheat is sown in winter, it has its own definite requirements for temperature and light for emergence, growth and flowering (Dabre *et al.,* 1993). Late sowing results in poor tillering and crop grow generally slow because of low temperature. In late planting the wheat genotype should be of short duration that may escape from high temperature at the grain filling stage (Phadnawis and Saini, 1992). Ansary *et al.,* (1989) reported that delay sowing suppressed the yield, caused by reduction in the yield contributing traits like number of tillers, number of grains per spike and grain yield. Rajput and Verma (1994) observed that normal sowing gave higher grain yield than late sowing. Early sowing always produces higher yield than late sowing. Each day delay in sowing from 20th November decreases grain yield @ 39 kg ha^{-1} per day (Singh and Uttam, 1999). According to Shafiq (2004) and Anwar *et al.*, (2015), early sowing of wheat enhances germination per unit area, plant height, spikelets per spike, number of grain per spike and 1000-grain weight over late sowing. Many high yielding genotypes have been evolved and recommended for general cultivation in the past. These genotypes are loosing their yield potential due to changes in various edaphic and environmental conditions. Choice of a suitable genotype for different sowing time further gets prime importance for wheat, being a thermo-sensitive crop. However, there is paucity of information on this aspect in the region. Therefore, keeping this in view, the present investigation was carried out to study the performance of durum wheat (*Triticum durum*) genotypes under different sowing times in Sub-Tropical Zone of Jammu, Jammu & Kashmir.

Materials and Methods

Field experiments were conducted at Research Farm of Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu to investigate the effect of sowing dates and genotypes on growth, yield and nitrogen uptake of durum wheat (*Triticum durum*) for two consecutive *rabi* seasons. The soil of experimental site was sandy loam with pH 7.3, low in organic carbon (0.36%) and available N (190 kg ha^{-1}), and medium in available P (150 kg ha^{-1}) and available K (162 kg ha^{-1}). The experiment was replicated thrice in split plot design with two sowing times *viz.* normal (14th November) and late (28th November) as main plot treatments and four genotypes *viz.* PBW-34, PDW-233, WH-896 and PBW-343 as sub plot treatments. The crop was sown 20 cm apart with a seed rate of 100 kg ha^{-1}. The crop received a uniform dose of plant nutrients @ 100 kg N, 50 kg P_2O_5 and 25 kg K_2O ha^{-1} through urea, di-ammonium phosphate and muriate of potash, respectively. Half of nitrogen and full dose of phosphorus and potash were applied as basal at the time of sowing. Remaining nitrogen was applied after first irrigation at crown-root initiation stage. Irrigations were applied to crop based on crop demands during both the years.

Results and Discussion

Performance of durum wheat under variable sowing time

Time of sowing significantly influenced the growth characters and yield attributes of wheat

(Table 1). Plant height of normal sown wheat was 4.27 and 9.2 per cent higher in the consecutive *rabi* seasons, respectively. Decrease in plant height in late sowing was due to shorter growing period. Early sown crop may have enjoyed the better environmental conditions especially the temperature and solar radiation which resulted to tallest plants. These results are in line with those reported by Shahzad *et al.,* (2002) and Anwar *et al.,* (2015). Further, it was observed that normal sown crop produced significantly higher number of spikes per square meter and 1000 grain weight in both the consecutive *rabi* seasons. The parameters decreased with delay in sowing. Normal sown crop produced 2.7 and 7.0 per cent more spikes per m^2 than late sown crop during the first and second year, respectively. Less number of grains per spike in late sowing was due to less production of photosynthates due to shorter growing period. These results are in line with those of Shahzad *et al.,* (2002). Moreover, the early sowing resulted in better development of the grains due to longer growing period. These findings are strongly supported by those of Spink *et al.,* (2000) and Anwar *et al.,* (2015) who had also reported decreased 1000-grain weight with delay in sowing.

Grain and straw yields of wheat were significantly affected due to sowing time (Table 2). Delayed sowing reduced the grain yield by 10.4 and 8.9 per cent in the first and second year of experimentation, respectively. Thus, late sowing of wheat caused yield reduction of 25 kg ha^{-1} day^{-1} as compared to normal sowing in both the years. Straw yield of late sown wheat was also significantly lower as compared to its normal sowing. The higher grain and straw yield in normal sown wheat crop may be attributed to better plant growth leading to significantly taller plants and more number of spikes per m^2 and better partitioning of photosynthesis in comparison to delayed sowing. The improvement in yields attributes may be owing to more time available for better use of growth resources and expression of its potential. These findings corroborate that of Shiwani *et al.,* (2003), Gupta *et al.,* (2007) and Anwar *et al.,* (2015). Dry matter accumulation was also significantly higher in normal sown crop than late sown crop (Table 2).

Table.1 Effect of sowing dates and genotypes on growth and yield attributes of durum wheat (*Triticum durum*)

Treatments	Plant height (cm)		No. of spike/m^2		Grains per spike		Test weight	
	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2
Date of sowing								
D_1	87.00	104.58	362.25	371.83	53.91	50.91	41.79	43.46
D_2	83.50	95.75	352.50	345.66	51.75	45.58	40.28	40.65
CD (p=0.05)	3.05	6.03	9.70	24.61	NS	NS	1.35	1.79
Genotypes								
V_1 PBW-34	85.33	100.50	356.66	364.00	52.16	50.16	41.12	43.26
V_2 PDW-233	85.16	97.83	352.56	341.66	50.00	43.66	40.42	40.01
V_3 WH- 896	99.83	53.16	355.00	348.33	53.16	47.83	40.90	41.18
V_4 PBW-343	102.50	56.00	365.33	382.50	56.00	51.33	41.71	43.78
CD (p=0.05)	NS	NS	10.11	23.83	NS	NS	NS	NS

Table.2 Effect of sowing dates and genotypes on yield (q ha^{-1}) of durum wheat (*Triticum durum*)

Treatments	Grain yield (q ha^{-1})		Dry matter yield (q ha^{-1})	
	Y_1	Y_2	Y_1	Y_2
Date of sowing				
D_1	33.64	39.80	116.16	107.66
D_2	30.12	36.26	105.83	96.50
CD (p=0.05)	2.22	2.51	9.41	10.08
Genotypes				
V_1 PBW-34	32.60	39.41	110.83	106.50
V_2 PDW-233	30.25	31.60	106.33	93.16
V_3 WH- 896	31.35	34.73	106.66	99.16
V_4 PBW-343	33.33	46.40	120.16	109.50
CD (p=0.05)	1.04	3.70	9.82	9.27

Table.3 Effect of sowing dates and genotypes on nitrogen uptake (kg ha^{-1}) by durum wheat (*Triticum durum*)

Treatments	Grain		Straw	
	Y_1	Y_2	Y_1	Y_2
Date of sowing				
D_1	52.2	60.57	46.73	45.50
D_2	43.60	54.94	44.62	40.94
CD (p=0.05)	4.18	3.01	NS	NS
Genotypes				
V_1 PBW-34	50.10	59.81	44.18	44.92
V_2 PDW-233	46.88	52.57	43.60	38.58
V_3 WH- 896	46.52	47.20	46.50	41.43
V_4 PBW-343	48.10	71.46	48.48	47.45
CD (p=0.05)	NS	5.93	NS	4.95

The reduction in dry matter production with delay in sowing time may be due to reduction in duration of tillering phase with delayed sowing resulting in lesser dry matter production in both the years. This is in accordance to the finding of Sardana *et al.*, (2002), Shiwani *et al.*, (2003) and Anwar *et al.*, (2015). Nitrogen uptake in grain of wheat was recorded significantly higher in normal shown crop (Table 3) in both the years, whereas N uptake in straw was found to be non-significant. Similar results were also obtained by Iqbal *et al.*, (2012).

Performance of durum wheat genotypes

Perusal of data presented in Table 1 revealed that genotypes of wheat did not differ in plant height and other growth characters like number of grains per spike and 1000 grain weight. However, the genotype PBW-343 produced significantly higher grain yield (33.33 and 46.40 kg ha^{-1} during the first and second year of experimentation, respectively) and straw yield than all other genotypes but remained at par with PBW-34 genotype. Since wheat yield formation is a complex process and governed by complimentary interaction between source (photosynthesis and availability of assimilates) and sink component (storage organs). Thus, as a consequence of marked important in both these regulative process as evinced from higher accumulation of biomass and number of spikes per m^2 under variety PBW-343 led to significant increase in production of grain and straw yields. Genotypes PDW-233 recorded lowest grain yield (30.25 and 31.60 q ha^{-1}) in the consecutive *rabi* seasons, respectively.

Similar results were reported by Kulkarni *et al.,* (2003) and Gupta *et al.,* (2007). The data presented in Table 3 on nitrogen uptake revealed that N uptake was non-significant in wheat grain and straw under various genotypes in first year whereas it was found to be significantly higher in PBW-343 in comparison to other genotypes in second year. These results are in close conformity with the results obtained by Iqbal *et al.*, (2012)

In conclusion, on the basis of experimental findings, the farmers of Sub-Tropical Zone of Jammu, Jammu & Kashmir may be advised to raise PBW-343 durum wheat (*Triticum durum*) genotypes under normal sowing date i.e. 14th November for getting optimum production.

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