Short Note

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Effect of late sowing on yield and yield attributes of wheat genotypes in Eastern Indo Gangetic Plains (EGIP),

SK DWIVEDI, SANTOSH KUMAR AND VED PRAKASH

ICAR Research Complex for Eastern Region, Patna, Bihar, India

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ABSTRACT

Terminal heat stress is one of the major causes of low productivity in eastern region of India. The aim of present experiment was to evaluate the performance of wheat genotypes for terminal heat stress tolerance on the basis of yield attributes. Ten wheat varieties (HI 1563, HD 2987, Kundan, Raj 4238, GW 273, NW 1012, DBW 14, Halna, HD 2733 and HD 2967) were taken for evaluation. Performances of wheat genotypes were judged on the basis of yield and yield attributes. Study revealed that there were decline in 1000 grain weight and final yield from timely sown to very late sown condition. Although less reduction in yield and yield contributing traits were observed in wheat genotypes HD 2987, NW 1012, Kundan and DBW 14. This finding may be of use to heat stress condition thus will boost wheat production under late sown condition.

Keywords: Terminal heat stress, wheat

Wheat is one of the most staple foods of the humanity (Meena *et al.*, 2013). Its area and productivity is increasing rapidly adopting across the globe, due to its wider adaptability sustainability under divers agro climatic conditions (Kumar *et al.*, 2014). However, considerable portion of the wheat grown in South Asia is considered to be affected by heat stress, of which the majority is present in India (Joshi *et al.*, 2007a). In India terminal heat stress is a major reason of yield decline in wheat due to delayed planting (Joshi *et al.*, 2007a). Selection of suitable crop varieties according to the agroclimatic conditions may play crucial role in realizing the optimum production of any crop commodity (Singh *et al.*, 2008). The most heat-stressed locations of South Asia are the Eastern Gangetic Plains (EGP), central and peninsular India, whereas heat stress is considered moderate in north western parts of the Indio-Gangetic Plains (IGP) (Joshi *et al.*, 2007b). Late planted wheat suffers drastic yield losses which may exceed to 40-50%. Global climate models predict an increase in mean ambient temperature between 1.8 and 5.8 ^{o}C by end of this century (IPCC, 2007). Grain yield was negatively related to the thermal time accumulated above the base temperature of 31^{0}C (Mian *et al.*, 2007). High temperature above 32 ^{0}C has been reported reducing grain yield and grain weight (Wardlaw *et al.*, 2002).

Shrivelled small grains are produced and different yield associated traits such as tillering, grain weight and grains numbers/spike are reduced. Using this factor (3–4 % loss per 1^{0}C above 15–20 ^{0}C), it can be calculated that most commercially sown wheat cultivars in India would lose approximately 50 % of their yield potential when exposed to 32–38 ^{0}C temperature at the crucial grain formation stage. The experiment was conducted at the experimental farm of ICAR Research Complex for Eastern Region, Patna during the year Nov 2013 to April 2014. By the late sowing the varieties was given high temperature stress during grain filling stage in comparison to timely sown condition. Ten wheat varieties (HI 1563, HD 2987, Kundan, Raj 4238, GW 273, NW 1012, DBW 14, Halna, HD 2733 and HD 2967) were taken for evaluation as suggested by breeders. Sowing was done with three replication assigning sowing time as per sowing condition of farmers of Eastern region of India (Timely sown-25 November, Late sown-20 December and very late sown-5 January) in field (plot size= 5.4 m^{2}) having with clay loam soil. Fertilizer were supplied with 120, 60 and 40 kg ha^{-1}of N, P, K,

* Corresponding author email: sharad.dwivedi9736@gmail.com

Table 1: Yield and yield attributes of promising wheat genotypes under different sowing (Timely sown (TS), Late sown (LS) and Very late sown (VLS) condition

Sowing condition	Ear lengh (cm)			No. of grains/ear			Test weight (1000 GW)			Grain yield (t/ha)		
	TS	LS	VLS	TS	LS	VLS	TS	LS	VLS	TS	LS	VLS
Genotypes												
HI1563	10.00	9.85	7.75	41.0	37.0	31.0	41.3	39.5	36.3	4.2	3.7	2.8
HD2987	9.25	9.15	9.15	46.5	45.0	38.0	40.6	37.9	35.0	4.8	4.7	3.3
KUNDAN	11.8	11.00	9.05	48.5	37.5	33.5	41.9	39.1	36.0	4.1	3.8	3.2
Raj4238	08.65	8.50	8.45	38.0	35.0	31.5	41.4	37.8	33.5	4.0	3.7	3.2
GW 273	11.85	11.00	10.1	49.5	37.5	30.5	43.2	41.5	33.4	3.9	3.8	3.1
NW 1012	09.15	08.90	8.15	50.5	44.5	35.5	43.0	36.1	30.2	4.2	4.0	3.2
DBW 14	10.50	10.05	7.75	50.5	45.5	37.5	41.5	40.7	32.8	2.9	2.6	2.2
HALNA	08.50	8.15	8.05	39.5	43.0	34.5	37.0	38.2	32.5	3.2	3.1	2.8
HD2733	08.95	08.85	7.65	33.5	30.0	27.5	43.7	40.6	34.2	3.4	3.2	2.7
HD 2967	11.65	10.50	8.05	48.5	39.5	29.5	42.8	38.5	33.3	3.7	2.8	2.1
Factors	Treatment (T)	Variety (V)	Interaction (T xV)	Treatment (T)	Variety (V)	Interaction (T xV)	Treatment (T)	Variety (V)	Interaction (T xV)	Treatment (T)	Variety (V)	Interaction (T xV)
CV	4.57			5.72			3.20			2.81		
CD	0.287	0.553	0.905	1.443	2.634	4.563	0.790	1.442	2.498	0.062	0.113	0.196
SEm	0.140	0.256	0.443	0.706	1.288	2.231	0.386	0.7052	1.221	0.030	0.055	0.096

respectively, in the form of urea, single super phosphate and murate of potash at the time of sowing. Urea was applied in two split doses. Irrigation was provided at CRI, maximum tillering and grain filling stage. Weather data of whole crop season were presented in fig 1.

The data was analyzed statistically using factorial CRD (Yield attributes) design and CD at 5% and ANOVA was calculated. The analysis was done using OPSTAT programme available online on CCS Agricultural University, HISAR web site. Yield components were recorded at the time of final harvest; ear length, number of grains per ear, grain yield, 1000-grain weight (g). Ten genotypes of wheat were evaluated on the basis of yield and yield attributes. Data present in table 1 indicates that the length of ear was found longer in timely sown as compared to very late sown condition. Kundan recorded maximum ear length and it was significantly higher than rest of the genotypes. Minimum percent reduction of ear length was observed in HD 2987 followed by Raj 4238, while higher reduction was observed in HD 2967 and HD 2733. On an average delayed sown caused 21% reduction in test weight. Maximum reduction in test weight 30 (%) was recorded in NW 1012 and minimum in HD 2987 (13%). Across the genotypes, 30% yield reduction was observed due to delayed sowing. Among the genotypes HI 1563 registered maximum reduction (33%) while Raj4238 was found less sensitive to delays sowing as it recorded the lowest reduction (20%) in grain yield. HD2987 showed maximium grain yield upto 4.8 t/ha under timely sown, while 3.3 ton/ha under very late sown condition. A similar kind of finding was also reported by Srivastava *et al.* (2012).

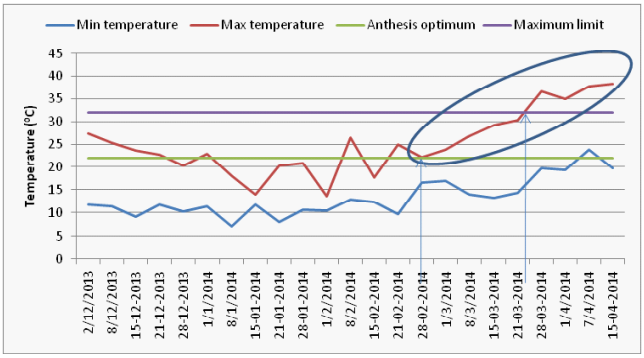

Figure 1: Variation in minimum and maximum temperature (^{0}C) during crop duration of wheat genotypes

The present study suggested that wheat genotypes perform differentially under extreame heat stress environment. Delay sowing of wheat lead to severe

yield reduction. Although genotypes HD 2987, Kundan and Raj 4238 perform better under late sown condition with significant yield advantage as compared to other wheat genotypes.

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