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Research Article

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Evaluation of Wheat Genotypes (*Triticum aestivum* L.) at Grain Filling Stage for Heat Tolerance

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ABSTRACT

A field experiment was conducted with six wheat genotypes K-8962, PBW-373, RAJ-3765, K-9006, LOK-54, HD-2733 at Student Instructional farm of NDUAT Kumarganj, Faizabad - 224229. Wheat genotypes were exposed for heat by delayed sowing of 60 days from normal date of sowing so that grain filling stage of wheat could experience sever heat stress. Wheat genotype K-8962, RAJ-3765 and LOK-54 had high stability in yield components traits by sowing less reduction in plant height, tiller number, spike length, grains per spike, test weight and grain yield over other genotypes. These genotypes can be used as donor for transferring heat tolerance traits in high yielding heat susceptible genotypes by physio-molecular breeding approaches for development high yielding heat tolerance wheat genotypes.

Key word: *Heat stress, wheat, Genotypes, Grain filling, Tolerance*

INTRODUCTION

Wheat is a winter season crop grown in tropics and sub tropics of the world. Wheat (*Triticum aestivum* L.) is one of the important crops of India as well as in the many parts of the world. It belongs to the family Poaceae (Gramineae). Globally wheat is the leading source of vegetable protein in human food. It has most staple food of about two billion people of world. Most of the people of India have it in form of chapatti in their daily diet and in several other forms in other country. Wheat grain contains average 71.18 % carbohydrate, up to 1.5% fat, and 12.6 % protein[6].

The influence of high temperatures on growth and development of wheat and other crops is well documented. Heat stress is an important constraints to wheat productivity affecting growth stage specially anthesis and grain filling. High temperatures damage photosynthetic membranes and cause chlorophyll loss decrease leaf photosynthetic rate, increase embryo abortion lower grain number, and decrease grain filling duration and rates thus, resulting in lower grain yield. At the molecular level, high temperatures adversely affect cell metabolism and cause changes in the pattern of protein synthesis and gene expression[1].

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Terminal heat stress is a common abiotic factor for reducing yield of wheat crop in north western part of India. It reduces grain grow period, grain setting, no. of grain per spike. High temperature also reduces filling period and resultantly grain become thin shriveled with low test weight[2].

High temperature reduce the photosynthesis and enhance photo respiration. Photosynthetic enzymes of C3 plants are highly susceptible to temperature above 30^0C. Therefore, there is a dire need to develop genotypes that are either tolerant to terminal heat stress or that mature early without yield losses and thus scape the stress. Terminal heat stress is a common abiotic factor for reducing yield in certain area of India. Thus development of terminal heat tolerance is current demand of wheat growing farmers of north of north-eastern part of India[7].

MATERIALS AND METHODS

An experiment was conducted with six wheat genotypes K-8962, PBW-373, RAJ-3765, K-9006, LOK-54 and HD-2733 to evaluate yield and yield components under reproductive heat stress conditions. Heat treatment was given by delayed sowing 60 days from normal date of sowing so that wheat genotypes could experience sever heat stress at reproductive stage. General agronomic practices were followed as per recommendation for wheat crop. Data related to yield and yield components were recorded control vs treatment. Plant was recorded from ground surface to base of spike of five plants average out to one as per plant. Tillers of five plants counted separately and average out as a tiller per plant. Spike length and number of grains per spike of five main spike were recorded and average out as per spike. Weight of thousand wheat grain at 12% moisture were recorded as test weight per plant. Total grain weight of five randomly selected plant were recorded separated and average out to one as grain yield per plant.

RESULT AND DISCUSSION

Wheat genotypes showed genetic variability in plant (fig.-1). High percent reduction in plant height was received in K-8962 (30%) and PBW-373 (28%) while low in K-9006 (12.5%) and LOK-54 (13.6 %).Heat stress reduces the growth and development of wheat genotypes by forced maturity and reduced cell division and cell elongation process[4].

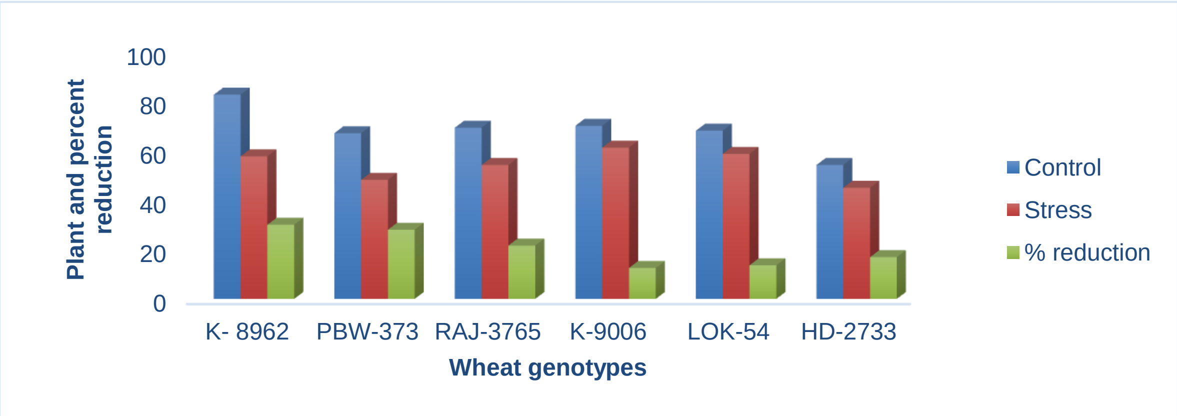

Fig. 1: Effect of heat stress on plant height (cm) of wheat genotypes

Tiller number varies genotypes to genotypes under control and stress condition (fig.2). High tiller number was recorded in LOK-54, PBW-343 and K-9006 under control condition. High reduction in tiller number was recorded in PBW-373 (51.2%), HD-2733 (38.4%) and K-9006 (35.3%) over other genotypes. Heat stress disturbs the normal physic development of wheat genotypes. Tiller initiation reduced under heat stress due to suppress growth of wheat plant. Some time number of tiller remains as same as control but its growth reduces or become bushy[8].

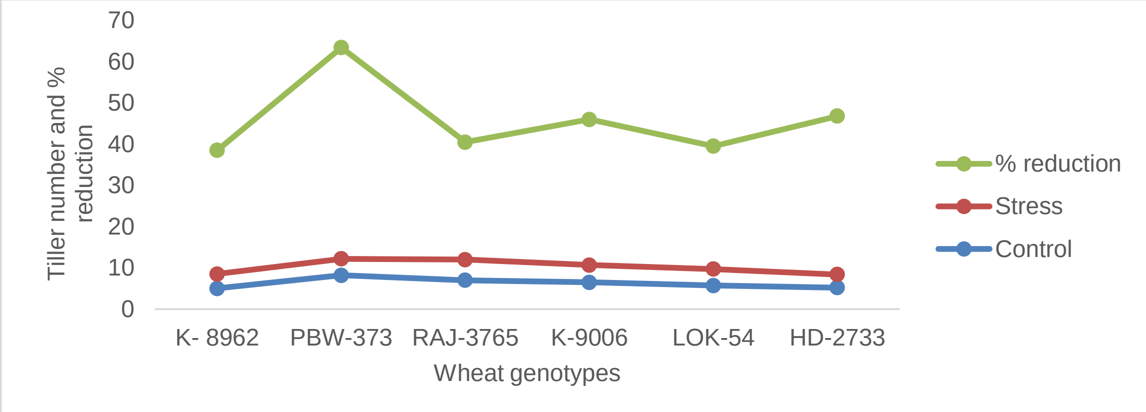

Fig. 2: Effect of heat stress on tiller numbers of wheat genotypes

Heat stress reduces the spike length irrespective of wheat genotypes (fig.3). High reduction in spike length was noted in PBW-373 (39.3%), K-9006 (31.8) and HD-2733 (29.9%). While less reduction was recorded in RAJ-3765 (11.1%) and LOK-54 (22.3%) under heat stress condition. Heat stress during reproductive phase suppress the spike growth induces force development of reproduction phase. Spike length influence by reduces cell division and cell elongation process[9].

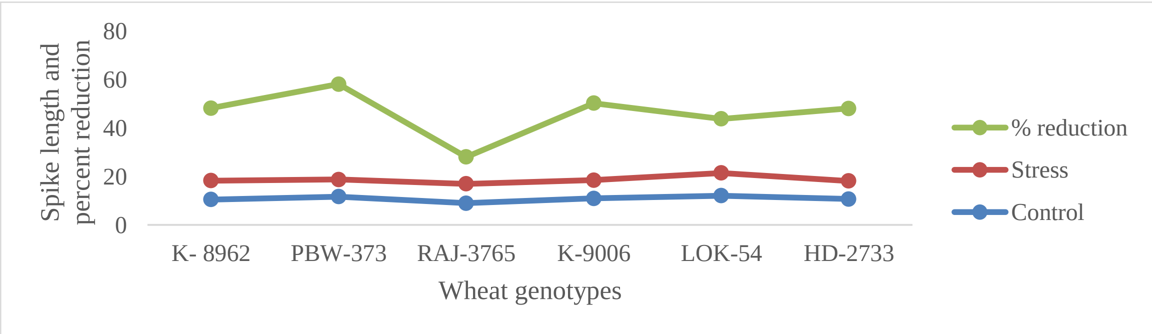

Fig. 3: Effect of heat stress on main spike length of wheat genotypes

Heat stress at reproductive stage reduced the number of grains per spike (Fig.4). High reduction was recorded in PBW-373 (64.2%) and HD-2733 (49.2%) while low in LOK-54 and K-8962 in stress condition. Number of grain per spike reduce due to short length of spike and less grain filling per spike due to heat stress[3].

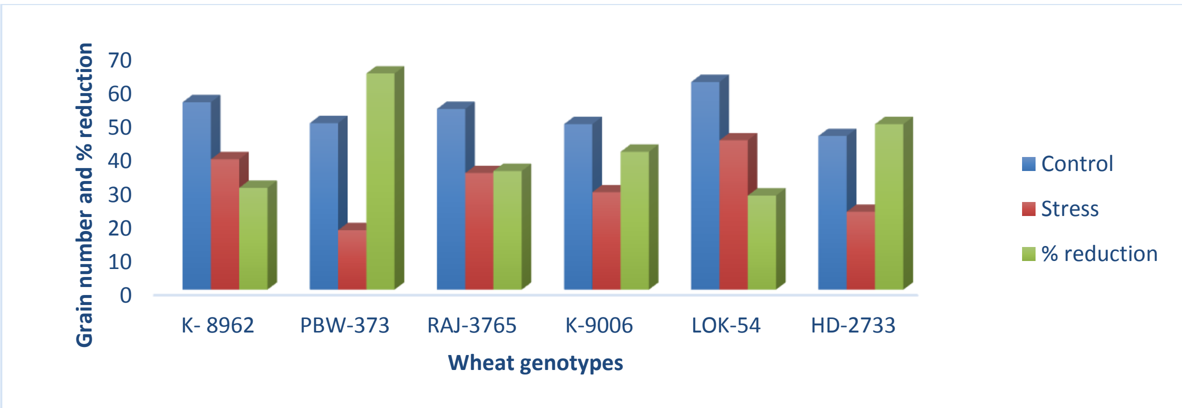

Fig. 4: Effect of heat stress on number of grains per main spike of wheat genotypes

The wheat genotypes had variability in test weight under control and stress condition (fig.-5). High test weight was recorded in K-8962 (47), LOK-54 (43.5) and K-9006 (43) under control condition. Heat stress reduces the grain filling duration of starch synthase actively. In this condition wheat grain become shriveled and less in size and resultantly test weight reduces[4].

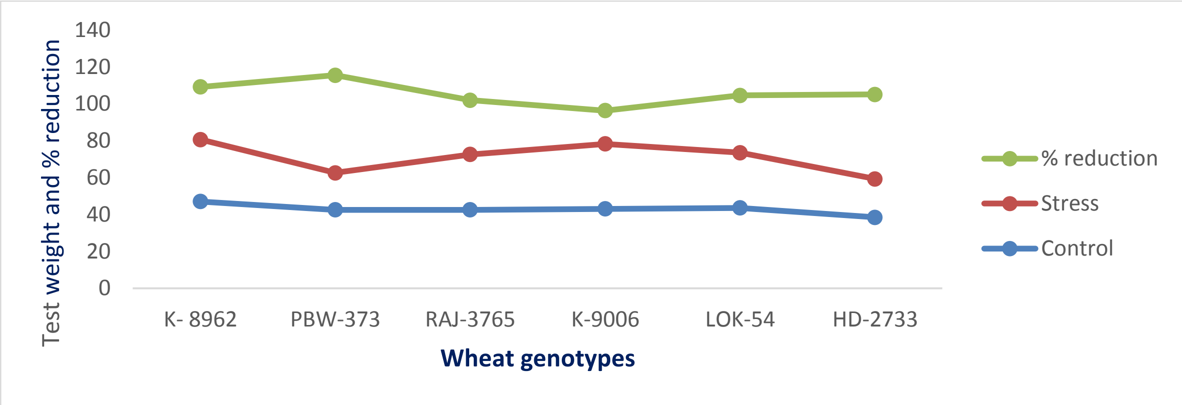

Fig. 5: Effect of heat stress on test weight (g.) of wheat genotypes

The wheat genotypes showed genetic variability in yield per plant (fig.6). Heat stress significantly reduced the grain yield per plant can compared to control. High reduction in yield was reduction in PBW-343 (60.3%), HD-2733 (68.1%) while low LOK-54 (28.3%) and RAJ-3765 (31.1%) under heat stress. Grain yield is outcome of yield component like spike length, number of grains per spike and biomass of plant. Heat stress reduces yield due to reduce activity of photosynthetic enzymes and starch synthase activity during grain filling stage[5].

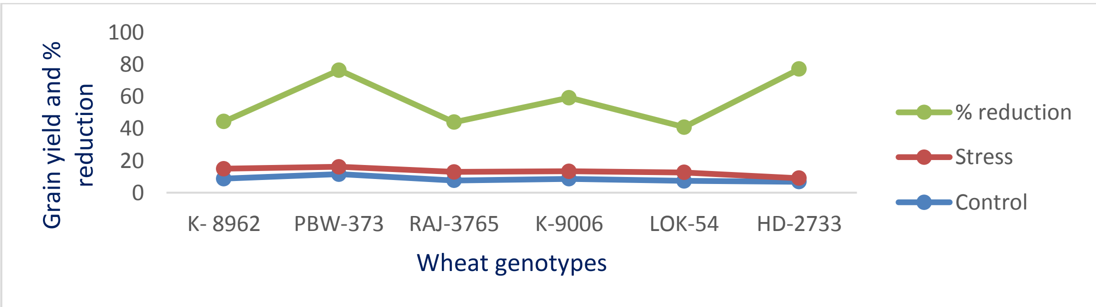

Fig. 6: Effect of heat stress on grain yield (g.) of wheat genotypes

CONCLUSION

Heat stress reduces the yield and yield components irrespective of wheat genotypes**.** The genotypes K8962, Raj3765, and Lok 54 has less percent reduction in reproductive stage of heat stress under late sown condition**.** So these genotypes can be used as donor for developing high yielding wheat genotypes**.**

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