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PHYSIOLOGICAL VARIABILITY AND PRODUCTION EFFICIENCY IN PROMISING WHEAT GENOTYPES UNDER LATE SOWN CONDITION

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Abstract

The field trialwas conducted to study the physiological variability and production efficiency in promising wheat genotypes under late sown condition, was carried out during rabi 2013-14 a plot with randomized block design with three replication. Among observation were collected different factor as plant height, number of tillers, total dry matter production and NAR. Also yield attributes factors number of ear, number of grain on main shoot, weight of grain per plant and harvest index.

Studies indicate that application of ten promising wheat genotypesNW 1014, HD 2733, K 9465, NW 2036,K 9703,K 424,K 9533,K 9423,HUW 234 and K 9162 they are efficiency along with recommended dose of fertilizer increased the plant growth parameter, dry matter production and its partitioning in different part. The relatively impact of research at different growth stages and after harvesting HUW234 had maximum and HD 2733 minimum production further genotypes in all growing factors.

Key words : Physiological variability, production efficiency,wheat genotypes and late sown condition.

Introduction

Wheat is an important cereal second to rice as the main human food crop. Physiological responses of wheat crop to terminal heat stress have been found to effectively determine genotype resistance or susceptibility. The terminal heat stress was at anthesis and grain filling stages accelerate maturity and significantly reduce grain size, weight and yield. Late sowing threatens the wheat through chilling injury to developing seedlings, accumulation of less solar radiations, incident of high temperature along with limited moisture availability at reproductive development.

Plant metabolites in complex biosynthetic pathways are believed to be affected by terminal heat stress. It showed the changes in cell membrane structure and antioxidants including proline accumulation and chlorophyll contents and thereby plant senescence which leads to shortening of the period of photosynthetic activity.

Wheat is a very adoptable crop and is grown under a wide range of soil and climatic condition. The production of wheat in Uttar Pradesh, one of India's largest producing state had reached high producing state almost 6.38 million hectares till 2014. But, there is a lack of precise information on response of new wheat genotypes to high temperature stress with respect growth and yield determining attributes under changing climatic variations.

Delayed sowing of wheat after paddy and cotton are known to reduce grain yield mainly due to exposure of crop to high temperature during grain development period (Asana and Williams, 1965). Germination and early seedling growth have much effect on ultimate yield of a crop. Soil moisture and temperature play very important role in initiating germination wheat seeds. Each crop species has definite minimal, optimal and maximal temperature for germination. Above and below the optimal temperature, the metabolic activity preceding germination is reduced (Sosebee and Harbel, 1969). A field experiment was conducted in India during the rabi season of 1997-98 and 1998-99 to study the production efficiency of wheat varieties. Wheat varieties DL 803-3 (45.8 q/ha), GW 542 (44.2 q/ha) and HI 83-81 (44 q/ha) were statistically on a par for yield and gave significantly higher yields than the other varieties. Varieties Lok-1, HD 2285, GW 190 and GW 173 were also on a par and had higher yields than GW 170 and HD 1553. The lowest yield was recorded in HD 1553 (control). Lok-1, HD 2285, GW 173 and HI 1077 were early maturing and were fit for late-sown conditions (Rajput, 2001). To study the effect of germination percentage, seedling emergence and tillering on yield of different varieties of wheat significant difference was recorded among dates of sowing from 1st November to 16th January with highest mean grain yield of 6292 kg ha-1 followed by 16th November sowing (6059 kg ha^{-1}). After November, yield of all varieties decreased significantly. Lowest grain yield of 2020 kg ha-1 was recorded on 16th January sown Muhammad *et al*. (2012). Comparative physiological changes in wheat genotypes *viz*., DBW-140, Raj-3765, PBW-574, K-0-307 and HS-240 were evaluated under timely and late sown conditions in rabi season. We observed that heat stress dramatically affects chlorophyll content and leaf area index (LAI) in sensitive genotypes whereas proline and malondialdehyde (MDA) content were higher in tolerant genotypes under late sownconditions (Ansari *et al*., 2013). According to the main objectives of present study were to access, the effect of reduced irrigation on yield attributes, root development, dry matter accumulation and partitioning of wheat (*Triticum aestivum* L.) crop under reduced irrigation in Delhi (India) during winter (*rabi*) weather conditions (Mishra *et al*., 2015). Stated that the late sowing of wheat results in exposure to high temperature during reproductive phase (seed filling). The present paper studies the effects of late sown condition on various morph physiological parameters at different stages of growth (Singh and Dwivedi, 2015).

Materials and Methods

The experiment was conducted in the Crop Physiology research field of C. S. Azad University of Agriculture and Technology, Kanpur, during *Rabi* season 2013-2014. Geographically, Kanpur is situated in the central part of U.P. and subtropical tract of North India between latitude ranging from 25^0 56' to 28^0 58' North and longitude 79^0 31' to 80^0 34' East and is located on an elevation of about 125.9 meters above mean sea level in gangetic plain. The seasonal rainfall of about 816 mm received mostly from IInd Fortnight of June or first Fortnight of July to mid-October with a few showers in winter season.

The experiment was conducted in Randomized Block Design with ten genotypes and three replications. Seeds often promising wheat genotype of comparatively wider adaptability *viz*., NW 1014, HD 2733, K 9465, NW 2036,K 9703,K 424,K 9533,K 9423, HUW 234 and K 9162 were used in this experiment. Pure seeds of these genotypes were obtained from the Economic Botanist (Rabi Cereals) of this University. The experimental field was fertilized with recommended dose of NPK @ 120 Kg N, 60 Kg P_20_5 and 60 KgK_2O. The sowing was done in plot with row to row 22.50cm and depth 5cm below. Randomly three plants were taken out from each wheat genotypes at different growth stages, *viz*. tillering, late jointing, anthesis and harvest stages and the data on different traits were recorded on these plants. Maximum tilleringat 40-45 DAS, when produce stem (formed by sheaths of leaves)Started growing erect and active tiller formation was in progress. Late Jointingat 55-60 DAS when basal 2-3 internodes were well formed in main shoot of the bulk of plant in most of the varieties. Anthesis was recorded at 50% flowering. Milk, when liquid consisting of watery sap coming out when the grain was pressed between the thumb-nails. Harvest the plant had become dry and brittle and the grain was hard and could not normally be crushed between thumb-nail.

The growth factor are plant height, number of tiller, dry matter production and NAR. In yield attributes as number of ear per plant, number of grain on main shoot ear, weight of grain on main shoot, test weight and harvest index.

Results and Discussion

Plant height (cm) and number of tillers/ plant

A perusal of data presented in table 1 that genotype showed a significant differential response in plant height and number of tiller from tillering to maturity. Plant height varied significantly among the genotypes of wheat taken for the different stages. It being maximum in HUW 234(105.38) followed by NW 1014(97.54), whereas the lowest value HD 2733(55.14) was found at harvest stage. The increase in tiller number continued to jointing stage, but in some genotypes tiller production up progressively increased up to anthesis. Maximum tiller production was found in HUW 234 followed by NW 1014 and the minimum was found in K 9703. From the results, it was inferred that tiller production/plant play a key role in augmenting yield potential of the wheat crop. Singh and Alam (1944) observed that tiller production seems to have association with determination of yield potential. Production efficiency ability of the genotype was greatly influenced by the environment factor.

The data presented in table 2 that genotype showed Dry matter production per plant significantly higher overall jointing, anthesis and harvesting stage, respectively. At

Table 1 : Plant height (cm) and number of tillers/ plant at different growth stage of genotypes under late sown condition.

Genotype	Plant height				No. of tiller^{-1}			
	Tillering	Jointing	Anthesis	Harvesting	Tillering	Jointing	Anthesis	Harvesting
NW 1014	6.20	41.16	96.86	97.54	3.00	3.33	3.33	3.33
HD 2733	5.80	21.20	53.50	55.14	1.33	3.33	3.33	3.33
K 9465	6.10	26.56	80.50	86.38	2.33	4.33	4.33	4.33
NW 2036	5.50	33.53	86.83	88.20	2.00	3.66	3.66	3.66
K 9703	5.60	34.06	82.33	83.92	2.00	3.00	3.00	3.00
K 424	6.80	28.56	63.66	64.57	2.66	3.33	3.33	3.33
K 9533	6.70	33.86	84.33	84.64	2.00	3.00	3.00	3.33
K 9423	6.30	28.63	76.33	77.31	2.00	3.00	3.00	3.00
HUW 234	6.10	26.56	104.50	105.38	2.33	5.00	5.00	5.00
K 9162	5.60	30.70	78.66	85.13	2.66	3.33	3.33	3.00
SE (m)±	0.3633	1.3534	2.9116	3.3511	0.1378	0.2008	0.2258	0.2408
CD at 5%	N.S.	4.0218	8.6526	9.9585	0.4083	0.5958	0.6719	0.7150

Table 2 : Total dry matter production/plant and net assimilation rate (mg dry matter/dm^{2}leaf area/day) at harvest stage of genotypes under late sown condition.

Genotype	Total dry matter production/plant			Net Assimilation Rate (mg dry matter/dm^2 leaf area /day)		
	Jointing	Anthesis	Harvesting	Tillering to jointing	Tillering to anthesis	Tillering to harvesting
NW 1014	9.29	19.66	22.57	1.36	0.79	0.20
HD 2733	4.34	14.45	17.31	1.02	0.59	0.11
K 9465	7.96	15.43	18.77	1.37	0.60	0.19
NW 2036	7.99	18.92	21.78	1.23	0.68	0.11
K 9703	5.34	15.99	19.41	0.92	0.79	0.19
K 424	6.90	16.35	19.53	1.19	0.67	0.17
K 9533	7.85	17.82	20.56	1.31	0.66	0.14
K 9423	5.34	16.67	19.83	0.83	0.77	0.15
HUW 234	9.52	19.89	22.92	1.46	0.89	0.32
K 9162	6.99	18.72	21.33	1.30	0.69	0.11
SE (m)±	0.4223	0.7780	0.8818	0.0894	0.0365	0.0316
CD at 5%	1.2553	2.3121	2.6205	0.2647	0.1138	0.0940

the time of harvesting HUW234 higher dry matter produced followed by NW1014 and very low dry matter production is HD2733 from the reviewed of result that both HUW234 and NW1014 were given best response and statically significant @5% levels.

Net assimilation rate has been better growth between maximum tillering to jointing stage but HD 2733 exihibit low NAR between jointing to anthesis stage. Amoung all rest genotype had reasonable good NAR throughout their lifecycle. The lowest value for these traits was obtained in K9162.

Yield and yield attribute

In table 3 the parameter of number of ear per plant showed significant result under late sowing condition over that of normal sowing. In anthesis and harvesting stage genotype HUW234 are higher number of ear/plant and lower number of ear/plant genotype HD2733. The genotype HUW 234 was significantly superior regarding to other genotypes.

The showed data on the table 4 its describe the number of grain on main shoot ear was measured as the base of the ear to the tip of terminal spikelet and also counted the number of spikelet on main shoot ear, after which it was threshed to determining the grain number and grain weight on the main shoot. The maximum number of grain main shoot ear was recorded of genotype HUW 234 and the minimum number of grain HD 2733.

Table 3 : Number of ear/plant at different stage.

Genotype	Growth stage	
	Anthesis	Harvesting
NW 1014	3.66	9.00
HD 2733	2.33	6.00
K 9465	2.33	6.00
NW 2036	3.66	8.00
K 9703	2.33	4.33
K 424	2.33	5.33
K 9533	2.66	6.66
K 9423	2.66	6.00
HUW 234	4.66	9.33
K 9162	3.33	8.00
SE (m) ±	0.1080	0.4694
CD at 5%	0.3214	1.3953

Table 4 :

Genotype	At harvest	
	Number of grain on main shoot ear	Weight of grain on main shoot ear
NW 1014	52.66	1.76
HD 2733	37.00	0.86
K 9465	45.00	1.62
NW 2036	49.66	1.75
K 9703	43.00	1.24
K 424	39.33	1.26
K 9533	47.33	1.67
K 9423	38.33	1.62
HUW 234	53.00	2.39
K 9162	49.00	1.71
SE (m) ±	1.4285	0.0876
CD at 5%	4.2450	0.2605

Table 5 :

Genotype	At harvest	
	Test weight	Harvest Index
NW 1014	38.57	33.75
HD 2733	34.58	33.33
K 9465	35.99	35.59
NW 2036	37.74	34.45
K 9703	36.34	37.60
K 424	29.43	34.07
K 9533	36.66	36.56
K 9423	36.55	33.55
HUW 234	41.22	37.90
K 9162	37.52	36.44
SE (m) ±	0.7624	0.5069
CD at 5%	2.2659	1.5062

The weight of grain on main shoot ear was measured as the weight of the ear to terminal spikelet and also weight of the grain on main shoot ear after it was threshed to determining the grain weight on the main shoot . The highest weight of grain was found in genotypes HUW234 and lowest grain weight of HD2733at time of harvesting.

Data presented in table 5 the size of the grains as judged by their test weight of wheat. It varied considerably due to the genotype. The highest value was found in HUW 234 (41.22 g) and the lowest value of test wt. (34.58 g) HD 2733 at harvest stage. Remaining genotypes occupied between 34.58 to 41.22 (g) of test weight**.** The genotype HUW 234 was found statically superior among all other genotype. It is very important as the role of photosynthetic buildup is the proportion of portioning photosynthates between the organ of economic yield and other accessory plant part. This depend on the efficiently which the sight of their production to the organs of economic yield in wheat. Among index of this as provided by the value of harvest index. Which was significantly highestis HUW234 and lowest HD2733, respectively.

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