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Performance of different wheat genotypes under various levels of nitrogen in rainfed condition of terai region of West Bengal

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ABSTRACT

A field experiment was initiated to study the performances of four wheat genotypes under total rainfed condition and also to study the effect of different doses of nitrogen on the growth and yield attributes of these genotypes. The experiment was laid out in split plot design with twelve treatment combinations in three replications. Treatment consisted of three nitrogen levels (40, 60, 80 kg/ ha.) in main plots and four wheat genotypes (HD 3016, C 306, K 8027, HD 2888) in sub plots. Increase in nitrogen levels resulted in higher vegetative growth which in turn delayed the maturity. However, biomass production of different genotypes varied significantly under various nitrogen levels. Genotypes and nitrogen had a significant effect on yield attributing character like earhead m^{-2}, grains $spike^{-1}$ and thousand grain weight. Application of nitrogen brought about significant increase in yield up to 80 kg/ha and the highest yield (20.07 q ha^{-1}) was recorded at 80 kg nitrogen ha^{-1} which was significantly superior to its lower levels (40 and 60 kg nitrogen ha^{-1}). Among the genotypes, HD 3016 was the top yielder (21.37 q ha^{-1}) and the yield increase was statistically significant over the check variety HD 2888. On an average HD 3016 produced 17.80% more yield than the check variety HD 2888. HD 3016 can be considered as a suitable rainfed variety for this region.

Key words: Doses of nitrogen, rainfed, wheat

Wheat is the second most important staple food after rice consumed by nearly 65% of the population in India and is likely to increase further due to changes in food habit. India is one of the most important wheat growing countries and ranks second in terms of area and production only next to China. At present, India produces more than 70 million tonnes of wheat which is around eleven times higher than recorded during 1950-51. The first green revolution which leads the nation to self sufficiency for food is basically attributed to improved varieties, good agronomic practices, improved tools and implements developed by research institutions mainly for irrigated areas. But, the benefits of this revolution did not percolate much to the dry and marginal rural families. Rainfed area in India still accounts for 85.7 m ha which contributes 50% of cereal production in the country. During the period of 1985 to 1995, growth rate of un-irrigated agriculture was higher than the irrigated production systems. Post 1995 years witnessed deceleration of the overall growth in agriculture and was relatively of higher magnitude in the rainfed situations. This was primarily due to over exploitation of ground water resources in the dry land areas, lack of diversification in the high rainfall regions etc. For these reasons, research was initiated to breed wheat varieties for rainfed areas. The strategy used consisted of testing segregating populations and advanced lines under limited moisture regimes either by planting in dry land sites with erratic precipitations, in residual moisture sites or with limited irrigations. Keeping these aspects in mind, the present study was initiated with the objective of testing four advance wheat genotypes under rainfed condition in terai region of West Bengal.

MATERIALS AND METHODS

A field experiment was conducted at University Research Farm, UBKV, Pundibari, Coochbehar, West Bengal during *rabi* seasons to assess the performance of four wheat genotypes under rainfed condition at varying levels of nitrogen application. The experimental soil was sandy loam in texture with pH ranging between 4.9-6.3. The annual rainfall ranges from 2500-3500 mm of which 80% of the rainfall occurs during monsoon months. The experiment was laid out in split plot design with twelve treatment combinations in three replications. Levels of nitrogen were allotted randomly to three main plots; while different wheat genotypes were randomly allotted to four sub plots. The treatment details were as follows:

Levels of nitrogen: (Main plots)	**Genotypes:** (Sub plots)
N_1 - 40 kg/ha	V_1 - HD 3016
N_2 - 60 kg/ha	V_2 - C 306
N_3 -80 kg/ha	V_3 - K 8027
	V_4- HD 2888(Check)

Among these genotypes HD 2888 was considered as check variety for its better and stable performances in this region.

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Table1: Duration, biomass production and yield of different wheat genotypes under different levels of nitrogen application

Variety	Days to maturity				Biomass (q ha^{-1})				Yield (q ha^{-1})			
	40 kg N	60 kg N	80 kg N	Mean	40 kg N	60 kg N	80 kg N	Mean	40 kg N	60 kg N	80 kg N	Mean
HD 3016	126.33	129.00	129.00	127.44	41.16	43.60	47.60	43.92	20.93	21.14	22.04	21.37
C 306	126.67	128.00	129.00	127.89	50.93	54.35	62.00	55.76	17.61	18.04	19.22	18.29
K 8027	131.67	132.67	132.67	133.00	36.03	41.10	47.43	41.52	18.02	20.43	19.32	19.26
HD2888(c)	131.00	132.00	132.67	132.89	37.34	42.25	47.53	42.37	16.36	18.37	19.70	18.14
Mean	128.92	130.41	130.84		41.37	45.33	51.14		18.23	19.49	20.07	
	Nitrogen (N)	**Variety (V)**	**N x V**	**V x N**	**Nitrogen (N)**	**Variety (V)**	**N x V**	**V x N**	**Nitrogen (N)**	**Variety (V)**	**N x V**	**V x N**
SEm(±)	1.05	0.92	1.21	1.29	0.65	1.85	2.85	3.20	0.49	0.55	0.92	0.89
LSD(0.05)	NS	NS	NS	NS	2.58	5.50	8.63	9.53	1.35	1.52	NS	NS

Table 2: Yield attributes of different wheat genotypes with different nitrogen levels

Treatments	Earhead m^{-2}		No. of grains $spike^{-1}$		Test weight (g)	
Nitrogen						
40 kg N	238.67		18.92		40.51	
60 kg N	247.75		19.58		41.18	
80 kg N	257.25		19.75		41.41	
SEm(±)	3.32		0.48		0.33	
LSD(0.05)	9.19		NS		NS	
Variety						
HD 3016	254.78		22.31		37.59	
C 306	244.11		17.83		41.99	
K 8027	249.22		16.38		43.41	
HD 2888 (c)	243.44		18.65		41.14	
SEm(±)	3.88		0.55		0.36	
LSD(0.05)	10.59		1.52		1.09	
Interaction	**N x V**	**V x N**	**N x V**	**V x N**	**N x V**	**V x N**
SEm(±)	6.70	6.68	0.96	0.95	0.59	0.58
LSD(0.05)	NS	NS	NS	NS	NS	NS

P_2O_5 and K was applied @ 30 kg and 20 kg per hectare uniformly in all the treatments. The crop was sown on November 15, 2010. The growth and yield parameters were taken accordingly.

RESULTS AND DISCUSSION

The present study exhibited that duration of different genotypes did not differ significantly with respect to varying levels of nitrogen application. Among four different genotypes, K 8027 was having the maximum duration (131.67 days), while rest of the varieties were having the duration ranging between 126.33-131 days (Table 1). With the increase in nitrogen levels from 40 kg to 80 kg nitrogen ha^{-1} there was very little increase in the duration of the varieties. Increase in nitrogen levels resulted in higher vegetative growth which in turn delayed the maturity. Similar type of result was obtained by earlier workers like Das and Guha (1998), Negi and Gulshan (2000), Patra *et al.* (2007). However, biomass production of different genotypes varied significantly under various nitrogen levels. The increase in biomass production was recorded to be 23.61% at 80 kg nitrogen ha^{-1} as compared to 40 kg nitrogen ha^{-1}. Among the genotypes, C 306 showed significantly higher biomass production due to its huge vegetative growth. The interaction between nitrogen and genotypes was found significant with regard to biomass production, while days to maturity were found non-significant. These results were in conformity with the findings of Singh and Singh (1995).

Genotypes and nitrogen had a significant effect on primary yield attributing character, *i.e.* number of earhead m^{-2} whereas their interaction effects were non-significant. HD 3016 produced maximum number of earhead (254.78 m^{-2}) closely followed by K 8037 (249.22 m^{-2}). Application of nitrogen brought about significant increase in number of earhead $m^{-2}$and the highest number of earhead (257.25 m^{-2}) was recorded at 80 kg nitrogen ha^{-1} (Table 2). It was also reveled that the genotypes varied significantly with respect to number of grains $spike^{-1}$. HD 3016 recorded significantly higher number of grains $spike^{-1}$ (22.31), though the other two genotypes, C 306 and K 8027, were statistically *at par* with the check variety HD 2888. Increasing nitrogen levels had no significant effect towards increase in number of grains $spike^{-1}$. The interaction effect between genotypes and nitrogen levels were statistically non-significant in increasing number of grains $spike^{-1}$. Similarly, nitrogen had no significant effect towards improvement of test weight though the genotypes varied significantly in their test weight. The boldest grain was recorded in K 8027.

Application of nitrogen brought about significant increase in yield up to 80 kg ha^{-1} and an average yield of 20.07 q ha^{-1} was observed at 80 kg N ha^{-1} which was significantly superior to its lower levels (Table 1). This result was in conformity with the findings of earlier workers *viz.* Mandal and Chettri (2008), Singh (1997), Shirpurkar *et al.* (2006). Among the genotypes, HD 3016 was the top yielder with an average yield of 21.37 q ha^{-1} and the yield increase was statistically significant over the check variety HD 2888. On an average HD 3016 produced 17.80% more yield than the check variety. This was due to its higher number of earhead m^{-2} as well as higher number of grains $spike^{-1}$. However, the interaction effects between genotypes and nitrogen were found to be non-significant for yield.

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