International Journal of Food, Agriculture and Veterinary Sciences ISSN: 2277-209X (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jfav.htm
2015 Vol. 5 (2) May-August, pp. 82-85/Singh
Research Article

RESPONSE OF WHEAT GENOTYPES TO NITROGEN UNDER RAINFED CONDITIONS

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ABSTRACT
A field experiment was conducted to assess the performance of various genotypes of rainfed wheat under different levels of nitrogen. The treatments comprising of three levels of nitrogen at 40, 60 and 80 kg ha^{-1} and eight genotypes i.e. DBW 74, PBW 660, WH 1097, WH 1098, C 306(c), PBW 175(c), WH 1080(c) and PBW 644 (I) were tested in split plot design with three replications. Number of effective tillers, grains per year, test weight, grain and straw yield increased with increase in rate of nitrogen application. The N_{80} resulted in 21.9 and 7.9 per cent increase in grain yield as compared to N_{40} and N_{60} nitrogen levels, respectively. Among the various wheat varieties, the maximum grain yield of wheat (43.3 q/ha) was reported in WH 1098 which was on par with PBW 660 (42.4 q/ha), PBW 644 (42.3 q/ha) and WH 1097 (41.2 q/ha) and significantly superior over DBW 74 (40.4 q/ha), C 306 (37.8 q/ha), PBW 175 (36.8 q/ha) and WH 1080 (37.6 q/ha). Genotype performance varied with different application rates and N_{60} was found to be most suitable for DBW 74, PBW 660, WH 1097, WH 1098, and PBW 644 (I) whereas C 306 (c), PBW 175 (c), WH 1080 (c) responded up to N_{80}. The maximum straw yield of 85.9 q/ha was obtained under C 306 variety which was significantly higher than all other cultivars. The straw yield of WH 1098 (62.9 q/ha) and PBW 644 (60.5 q/ha) remained statistically on par with each other. Interactive impact of nitrogen and genotypes was significant on test weight, grain yield and straw yield.

Keywords: *Nitrogen, Wheat, Genotypes, Yield, Rainfed*

INTRODUCTION
In India, rainfed area constitutes almost 55 per cent of the total net sown area and it is the home of about two-third of livestock and 40 per cent of human population (NRAA, 2012) Wheat is one of the most important food crop grown in India under rainfed conditions and it is a challenging task to achieve the potential yield. Among the various factors which contribute towards productivity, the nitrogen management and selection of suitable genotype
is quite important. As the release of new genotypes is a continuous process and also, the behavior of different genotypes varies under various rate of nitrogen application, therefore, there is a need to generate valuable information on these aspects. Keeping these points under consideration, the present study was planned to assess the performance of various genotypes of rainfed wheat to different levels of nitrogen.

MATERIAL AND METHODS
A field experiment was conducted during *rabi* season, 2011-12 at Regional Research Station, Gurdaspur, Punjab to assess the performance of various genotypes of rainfed wheat under different levels of nitrogen. The pH of the soil was 7.8 and it was medium in organic carbon, available nitrogen, phosphorus and potassium with silty clay loam texture. The treatments comprising of three levels of nitrogen at 40, 60 and 80 kg ha^{-1} and eight genotypes i.e. DBW 74, PBW 660, WH 1097, WH 1098, C 306 (c), PBW 175(c), WH 1080(c) and PBW 644 (I) were tested in split plot design with three replications. The 'c' in parentheses stands for check variety and 'I' refers to identified variety. The levels of N at 40, 60 and 80 kg ha^{-1} were designated as N_{40}, N_{60} and N_{80}, respectively. The wheat varieties under test were sown on October 29, 2011 with row to row spacing of 20 cm and the crop was harvested in the last week of April. Full dose of N (as per treatment), 30 kg P_2O_5 and 20 kg K_2O ha^{-1} was applied as basal application at the time of sowing. A pre-sowing irrigation was given for sowing purpose only but later on, throughout the

season, no irrigation was given so as to maintain the rainfed conditions. During the crop growing season, a total of 178 mm rainfall was received.

RESULTS AND DISCUSSION

Effect of nitrogen on different genotypes and interactive impact of nitrogen and genotypes on yield and yield attributes of wheat under rainfed condition has been present in the Table 1 and 2.

Table 1: Effect of nitrogen levels on yield attributes and physiological maturity of wheat genotypes

Treatments	No. of effective tillers m^{-1}	No. of grains ear^{-1}	Physiological maturity (days)
Nitrogen (kg ha^{-1})			
40	290.7	42.5	165.8
60	312.9	44.6	165.6
80	326.4	46.4	166.3
CD at 5%	14.82	1.86	NS
Wheat genotypes			
DBW 74	276.8	48.5	165.9
PBW 660	284.9	47.1	166.9
WH 1097	327.9	45.7	167.1
WH 1098	293.8	45.2	167.0
C 306(c)	355.0	43.6	170.7
PBW 175(c)	358.7	36.4	164.8
WH 1080(c)	294.5	41.0	164.3
PBW 644(I)	288.6	48.5	160.4
CD at 5%	16.74	1.98	0.85
Interaction	NS	NS	NS

**(c)= check variety*

Table 2: Interactive impact of N levels (kg ha^{-1}) and genotypes on the 1000 grain weight, grain and straw yield of wheat

	Test weight (g)				Grain yield (qha^{-1})				Straw yield (qha^{-1})			
Varieties	**N_{40}**	**N_{60}**	**N_{80}**	**Mean**	**N_{40}**	**N_{60}**	**N_{80}**	**Mean**	**N_{40}**	**N_{60}**	**N_{80}**	**Mean**
DBW 74	40.05	40.15	40.63	40.27	39.7	40.0	41.5	40.4	65.2	68.1	71.4	68.2
PBW 660	40.47	42.84	42.73	42.02	38.1	43.2	45.7	42.4	61.8	73.3	79.0	71.4
WH 1097	32.80	34.20	35.57	34.19	33.8	44.4	45.4	41.2	49.6	72.0	79.8	67.2
WH 1098	36.58	38.49	38.62	37.90	39.4	44.4	45.9	43.3	55.0	64.5	69.0	62.9
C 306(c)	38.35	42.43	41.95	40.91	33.9	38.0	41.5	37.8	68.9	90.3	98.6	85.9
PBW 175(c)	35.15	35.51	35.75	35.47	30.7	36.8	42.9	36.8	60.2	85.2	102.5	82.6
WH 1080(c)	37.29	37.34	39.31	37.98	32.8	36.5	43.4	37.6	44.9	50.6	64.9	53.5
PBW 644(I)	42.26	42.77	43.13	42.72	39.5	42.2	45.1	42.3	55.2	59.8	66.5	60.5
Mean	37.87	39.22	39.71		36.0	40.7	43.9		57.6	70.5	79.0	
CD at 5%												
N levels	0.980				2.23				3.27			
Varieties	0.753				1.70				3.16			
Interaction	1.304				2.95				5.47			

The present study exhibited that number of effective tillers were affected significantly by varying rate of nitrogen application as maximum tillers were recorded in N_{80} which was statistically on par with N_{60}, however N_{40} recorded significantly lower number of effective tillers (Table 1). Among genotypes, maximum number of effective tillers were recorded under PBW 175 (c) which was on par with C 306 (c)

and significantly higher over other genotypes. WH 1080(c), WH 1098, PBW 644(I), PBW 660, DBW 74 were on par among themselves but significantly lower than WH 1097. Interactive effect of rate of nitrogen application and different genotypes was not significant.

As the application of N increased from N_{40} to N_{80}, the number of grains per year also increased but significant enhancement was recorded only upto N_{60}. Among genotypes, both PBW 644 (I) and DBW 74 recorded highest grains per year (48.5 grains ear^{-1}) which was on par with PBW 175(c) and significantly higher over remaining genotypes (Table 1).

Nitrogen application did not affect the days taken to reach physiological maturity by crop, however, it differed significantly among genotypes. Maximum days to reach physiological maturity (170.7) were taken by C 306 (c) which were significantly higher than all other genotypes. Days taken by WH 1097 (167.1), WH 1098 (167.0) and PBW 660 (166.9) were statistically on par but significantly higher than DBW 74 (165.9). Minimum days were taken by PBW 644 (160.4) genotype which were significantly lower as compared to all other genotypes (Table 1).

The data presented in Table 2 clearly indicated that with the increase in rate of N application from N_{40} to N_{80}, an increasing trend in test weight was observed. However, the test weight increased significant only upto N_{60} and further increment due to N_{80} was marginal. In line with these findings, increasing rate of N application also enhanced the test weight in wheat (Gouis *et al.*, 2000; Guarda *et al.*, 2004). The performance of genotypes also differed significantly and PBW 644 (I) recorded maximum test weight of 42.72g which was significantly higher over all the check varieties i.e. C 306(c), PBW 175(c), WH 1080(c) and other varieties like WH 1097, WH 1098 but it was on par with PBW 660.

The interactive impact of nitrogen and genotypes was significant on test of wheat sown under rainfed situation. The data presented in the Table 2 revealed that maximum test weight of 43.13 g was recorded in PBW 644(I) at N_{80} which was on par with both PBW 660 and C 306(c) at N_{60} and N_{80} and PBW 644(I) with N_{40} and N_{60}. Interaction in nitrogen and genotypes on test weight of wheat was also observed by Kaur *et al.,* (2011). The grain yield of wheat increased significantly with successive increase in nitrogen levels and response was significant up to N_{80}. The N_{80} resulted in 21.9 and 7.9 per cent increase in grain yield as compared to N_{40} and N_{60} nitrogen levels, respectively (Table 2). Among the various wheat varieties, the maximum grain yield of wheat (43.3 q/ha) was reported in WH 1098 which was on par with PBW 660 (42.4 q/ha), PBW 644 (42.3 q/ha) and WH 1097 (41.2 q/ha) and significantly superior over DBW 74 (40.4 q/ha), C 306 (37.8 q/ha), PBW 175 (36.8 q/ha) and WH 1080 (37.6 q/ha). Results were in close conformity with the findings Das and Mitra (2011), Mandal and Chettri (2008) and Shirpukar *et al.,* (2006). The interaction effect (Table 2) revealed that the highest grain yield of wheat was obtained under WH 1098 cultivar at N_{80} nitrogen dose (45.9 q/ha) which was statistically similar to wheat varieties PBW 660 (45.7 q/ha) and WH 1097 (45.4 q/ha), PBW 644 (45.1 q/ha) and WH 1080 (43.4 q/ha) at N_{80} and PBW 660 (43.2 q/ha), WH 1097 (44.4 q/ha) and WH 1098 (44.4 q/ha) at N_{60} but significantly superior to all other treatment combinations. Genotype performance varied with different application rates and N_{60} was found to be most suitable for DBW 74, PBW 660, WH 1097, WH 1098, and PBW 644 (I) whereas C 306 (c), PBW 175 (c), WH 1080 (c) responded up to N_{80}. The straw yield of wheat followed the same trend as exhibited by grain yield (Table 2) and it increased significantly with successive increment in N levels. The maximum straw yield of 85.9 q/ha was obtained under C 306(c) variety which was significantly higher than all other cultivars. The straw yield of WH 1098 (62.9 q/ha) an PBW 644 (60.5 q/ha) remained statistically on par with each other. The treatment combination of PBW 175 with N_{80} nitrogen level resulted in maximum straw yield which was statistically on par with C 306(c) but significantly higher than all other varieties at N_{80} nitrogen level.

The role of nitrogen application to plant has been well documented by the scientists, as it enhance the crop growth, likewise in our study also, it increased the effective tillers, grains per year and test weight with higher application of nitrogen which ultimately improved the grain yield.

Conclusion

Growth of crop is enhanced by higher application of nitrogen, but interactive effects indicate that best suited dose must be decided on the basis of genotype. WH 1098 variety produced maximum grain yield of

43.3 q/ha which was superior to DBW 74 (40.4 q/ha), WH 1097 (41.2 q/ha), C 306 (37.8 q/ha), PBW 175 (36.8 q/ha) and WH 1080 (37.6 q/ha). Genotype performance varied with different application rates and N_{60} was found to be most suitable for DBW 74, PBW 660, WH 1097, WH 1098, and PBW 644 (I) whereas C 306 (c), PBW 175 (c), WH 1080 (c) responded up to N_{80}.

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