Effect of seed rate and N application rate in wheat blast resistant genotype BHU 35 under zero till condition

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Article history: Received: 20 Nov., 2020 Revised: 12 Dec., 2020 Accepted: 19 Dec., 2020

Citation: Sarkar P, B Mitra and S Das. 2020. Effect of seed rate and N application rate in wheat blast resistant genotype BHU 35 under zero till condition. *Journal of Cereal Research* 12(3): 338-341. <http://doi.org/10.25174/2582-2675/2020/107399>

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Keywords: Nitrogen, seed rate, wheat, zero tillage

In north eastern plains zone (NEPZ) of India, delay in wheat sowing occurs mainly due to late harvesting of preceding rice crop (ICAR, 2012). In late sown condition, zero tillage technology avoids further delay in wheat sowing (Kumar *et al.*, 2014). In recent years, one of the important challenges in wheat production is wheat blast which appeared in Bangladesh in the 2015-16 causing huge crop loss (Mottaleb *et al.*, 2018). Being neighbouring country, India may face the difficulty due to wheat blast as the disease may spread from Bangladesh through Indo-Bangladesh border. Development of resistant varieties against wheat blast would be the most important strategy. Practically there is no such commercial wheat blast resistant variety till date. A new variety released in Bangladesh, *BARI Gom 33*, which is a CIMMYT line (cross between *Kachu* and *Solala*), had shown resistance against wheat blast as reported from Wheat Research Centre (WRC) in Bangladesh. Mottaleb *et al.* (2019) reported a uniform yield increase in Bangladesh with this variety *BARI Gom 33* over existing genotypes both under timely and delayed sown condition. The same genotype when tested in the name of BHU 35 by Banaras Hindu University (BHU), Varanasi, Uttar Pradesh also indicated superior performance and it was included as testing genotype in the AICRP programme. This genotype may serve as a solution to wheat growers of eastern- India particularly adjoining border areas of West Bengal and Assam. However, inappropriate planting

density and improper nutrition are supposed to be the most crucial agronomic factors responsible for lower grain yield of this genotype. Significant increase in wheat yield with appropriate level of nitrogen (N) application has already been reported by Ali *et al.* (2000). As there was no standardised package of practices of this variety in this part of the country, an attempt has been made to adjust its seed rate and nitrogen management for deriving maximum yield under late sown condition through this blast resistant variety.

A field trial was conducted under zero till condition during *rabi*, 2018-19 at the Instructional farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal located at 26°24'02.2"N latitude, 89°23'21.7"E longitude and 43 m above mean sea level. The experiment was designed in a two factor Randomized Complete Block Design. Three different levels of seed rate (125, 150 and 175 kg/ha) were factor 1, while three different levels of N application rate (120, 150 and 180 kg/ha) were factor 2 and these 9 treatment combinations were randomly allotted in each block, replicated thrice. The area of each experimental plot was 10 m × 4.5 m. Sowing was done on 3rd December, 2018. The seeds were sown in lines 20 cm apart with 9 tyne zero-till-drill. The seed rate was adjusted based on treatment, while the basal fertilizer was applied uniformly irrespective of plots through complex complete fertilizer IFFCO (10-26-26). full P and K along with a portion of N (22.5 kg/ha) were applied as basal-furrow

placement through zero till drill, while rest N (based on treatments) was applied in 2 equal splits during first and second irrigation. Altogether 3 irrigations were given at 20 days interval starting from 20 days after sowing (DAS).

Plant height at harvest varied significantly with varying levels of seed rate and N application rate. Highest plant height at harvest was obtained with seed rate of 125 kg/ha (105.97 cm) and N application rate of 180 kg N/ha (105.97 cm). Perusal of data presented in Table 1 indicated a significant effect of seeding density on tiller density recorded at 75 DAS. Maximum number of tillers/m² at 75 DAS (349) was obtained with the seeding density of 150 kg/ha. Finding of Baloch *et al.* (2010) supported this result. N application rate also influenced tiller density at 75 DAS significantly. Among the N application rates, 150 kg N/ha recorded highest tiller density at 75 DAS (357). This might be due to the supply of sufficient N to the wheat crop. Seed rate and N rate had significant influence on above ground biomass production. Highest above ground biomass was obtained with the seed rate of 150 kg/ha (11806.67 kg/ha). Among the N application rates, 150 kg N/ha produced highest above ground biomass (11775.56 kg/ha) which was statistically *at par* with the above ground biomass obtained under 180 kg/ha N but 18.2% higher than above ground biomass achieved with 120 kg N/ha. Increase in N application rate increases nutrient supplying capacity of soil (Tyagi *et al.*, 2020) which leads to higher above ground biomass production.

It was observed that the yield attributing characters, number of spikes/m², spike length, number of filled grains/spike and 1000-grain weight were not significantly influenced by different seed rates. Among these characters, number of spikes/m² and spike length differed significantly due to the various N application rates. Maximum number of spikes/m² was recorded with 150 kg N/ha. Longest spike (11.75 cm) was observed under 180 kg N/ha treatment, which was statistically similar with the spike length recorded under 150 kg N/ha treatment (11.53 cm). In case of 1000-grain weight, significant interaction effect of different seed rate and N application rate treatments was observed.

Grain yield was significantly affected by the seed rate. Highest grain yield of 4742.22 kg/ha was recorded under the seed rate of 150 kg/ha. It was found that the grain

yield recorded under the seed rate of 150 kg/ha was 15.4% higher over the grain yield recorded under the seed rate of 125 kg/ha. Significant difference in grain yield was also recorded due to various N rates. Application of 150 kg/ha N resulted in maximum grain yield (4708.89 kg/ha). There was 15.0% yield enhancement with enhancing N application rate from 125 to 150 kg N/ha. Finding of Mitra *et al.* (2014) corroborated this result. Grain yield decreased with increasing the rate of N application from 150 to 180 kg N/ha, though both the grain yields were statistically *at par*. Mondal *et al.* (2018) achieved higher yield in wheat with 140 kg N/ha under sub-Himalayan plains of West Bengal. Highest number of spikes/m² under 150 kg/ha N treatment was mainly responsible for obtaining highest grain yield under the same treatment. Seed rate and N application rate treatments influenced the straw yield significantly. Highest straw yield was recorded under 180 kg N/ha treatment (7116.67 kg/ha) which was statistically *at par* with the straw yield obtained under 150 kg N/ha treatment (7072.22 kg/ha). Harvest index did not vary significantly due to various planting densities. Various application rates of N had significant impact on harvest index. Harvest index was found to be highest with 120 kg/ha N application (0.41). Harvest index decreased gradually with increasing the application rate of N from 120 to 180 kg N/ha.

Different seed rate treatments significantly influenced partial factor productivity of N (PFP_N). Highest PFP_N was recorded under 125 kg/ha seed rate treatment (34.25 kg grain yield/kg N applied) followed by 150 kg/ha seed rate treatment (31.61 kg grain yield/kg N applied). PFP_N decreased with increasing seed rate from 125 to 175 kg/ha. This might be due to the application of same amount of N under all the three seed rates. Similarly, different N application rate treatments significantly influenced PFP_N. Highest PFP_N was observed with 150 kg/ha N application (32.09 kg grain yield/kg N applied). Maximum proportionate increase of grain yield with the application of 150 kg N/ha was responsible for this increment. Significant impact of seed rate and N application rate on PFP_N was previously reported by Yang *et al.* (2019).

Table 1: Growth and yield attributing characters of wheat as influenced by different seed rates and application rates of nitrogen (2018-19)

Treatments	Growth attributes			Yield attributes			
	Plant height at harvest (cm)	No. of tillers/m ² at 75 DAS	Above ground biomass (kg/ha)	No. of spikes/m ²	Spike length (cm)	No. of filled grains/spike	1000-grain weight (g)
Seed rate (kg/ha)							
125	105.97	311	10441.11	252	11.34	44	39.73
150	102.45	349	11806.67	286	11.61	44	40.33
175	101.00	340	11021.11	267	11.45	43	39.99
CD (P=0.05)	1.74	29.20	376.04	NS	NS	NS	NS
Nitrogen rate (kg/ha)							
120	100.43	317	9964.44	246	11.12	42	39.78
150	103.02	357	11775.56	289	11.53	45	40.10
180	105.97	326	11528.89	270	11.75	44	40.17
CD (P=0.05)	1.74	29.20	376.04	31.35	0.38	NS	NS
Seed rate×Nitrogen rate							
CD (P=0.05)	NS	NS	NS	NS	NS	NS	0.87

Table 2: Grain yield, straw yield and harvest index of wheat and PFP_N as influenced by different seed rates and application rates of nitrogen (2018-19)

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index	PFP _N (kg grain yield/kg N applied)
Seed rate (kg/ha)				
125	4110.00	6332.22	0.39	34.25
150	4742.22	7068.89	0.40	31.61
175	4367.78	6657.78	0.40	24.27
CD (P=0.05)	352.09	426.38	NS	2.53
Nitrogen rate (kg/ha)				
120	4095.56	5870.00	0.41	27.94
150	4708.89	7072.22	0.40	32.09
180	4415.56	7116.67	0.38	30.09
CD (P=0.05)	352.09	426.38	0.01	2.53
Seed rate×Nitrogen rate				
CD (P=0.05)	NS	NS	NS	NS

Conclusion

From the present study, it can be concluded that the seed rate for achieving highest tiller density, above ground biomass and grain yield in wheat blast resistant genotype BHU 35 could be 150 kg/ha. Maximum grain yield *vis-à-vis* partial factor productivity of N could also be achieved with the N application rate @ 150 kg/ha under zero till condition.

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