Society for Advancement of Wheat and Barley Research
ICAR-Indian Institute of Wheat & Barley Research
Karnal - 132 001, India

Journal of Cereal Research

12(3): 338-341

Homepage: http://epubs.icar.org.in/ejournal/index.php/JWR

Short Communication

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

Biplab Mitra and Triptesh Mondal*

Department of Agronomy, Faculty of Agriculture, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar-736 165, West Bengal

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

Citation: Mitra B and T Mondal. 2020. Effect of seed rate and N application rate in late sown wheat genotype BHU 35 under zero till condition. *Journal of Cereal Research* **12**(3): 338-341. http://doi.org/ 10.25174/2582-2675/2020/107399

****Corresponding author:*** *E-mail: mtriptesh@gmail.com*

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). Wheat blast disease is one of the important challenges in the current era (Mottaleb *et al*., 2018). A new variety BAW 1260 was developed by crossing the wheat varieties Kachu and Solala by Bangladesh Agricultural Research Institute (BARI). This variety showed resistance to wheat blast along with yield increment of 5 to 8% than other cultivars (BARI, 2017). According to Mottaleb *et al.* (2019) a uniform yield increase was recorded in Bangladesh when the grain yield of variety BHU 35 was compared with variety Prodip under both timely and delayed sown situations. The genotype BHU 35 may serve as an alternative to wheat growers in India from the perspective of higher productivity and blast resistance. Inappropriate planting density and improper nutrition are supposed to be the most crucial agronomic factors responsible for low grain yield of wheat. By regulating the seed rate, growth and yield of wheat could be influenced (Ozturk *et al.,* 2006). Significant increase in wheat yield with appropriate level of nitrogen (N) application has already been reported by Ali *et al.* (2000). With this backdrop, an experiment was taken up to standardize the optimum plant density and N application rate of the new wheat genotype BHU 35 under delayed sown situation.

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. Basal application of 25 kg/ha N as recommended by Mondal *et al.* (2018), 60 kg/ha P_2O_5 and 40 kg/ha K_2O was done equally in all the experimental plots and top-dressing of the rest N was done in 50:50 ratio during 1st and 2nd irrigation, respectively as recommended by Kumar *et al.* (2014). An N-P_2O_5-K_2O mixture 12-32-16 (IFFCO) and muriate of potash (MOP) were used for basal application of fertilizers. Urea was used for top-dressing of N. Kumar *et al.* (2014)reported earlier that the recommended seed rate and N application rate for irrigated delayed sown wheat in NEPZ of India were 125 kg/ha and 120 kg N/ha, respectively. 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

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

recorded at 75 DAS. Maximum number of tillers/m^2 at 75 DAS 349 m^2 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 357m^2. 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/m^2, 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/m^2 and spike length differed significantly due to the various N application rates. Maximum number of spikes/m^2 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 120 to 150 kgN/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. Highest number of spikes/m^2 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 treatments 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 grainyield/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/haN 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).

Conclusion

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

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