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EFFECTS OF SEEDING RATE AND GENOTYPE × SEEDING RATE INTERACTIONS ON PROMISING WHEAT GENEOTYPES AT RUPANDEHI

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ABSTRACT

The study was conducted during winter season of 2022 at National Wheat Research Program of the National Agriculture Research Council at Omsatiya, Rupandehi with the objective to identifying appropriate seeding rate for promising wheat genotypes. The experimental design was split pot with three replications. The main plot comprised of three seeding rates (90,120 and 150 kg/ha) and sub plot consisted of six promising wheat genotypes (NL1330, NL1345, NL1425, NL1450, BL1488, Bandganga (control)). Results revealed that among the tested genotypes, NL 1450 produced the highest grain yield of 4471kg/ha at seeding rate of 150kg/ha which was statistically at par with 120 kg/ha followed by BL1488 at seeding rate of 120 kg/ha. That genotype NL 1450 also had the maximum number of kernels per spike as compared to other genotypes. The genotypes X seeding rate interaction effect on all the yield attributing characters was found statistically non-significant. However, genotype NL1450 being the highest grain yielder should be tested further for confirming its superiority for release.

Keywords: Seeding rate, wheat, genotypes, yield, harvest index,

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important staple cereal crops grown throughout the world providing a significant source of food and nutrition to human as well as to the livestock. Wheat is consumed in most areas of the globe for nutrition of the population. It has been estimated that wheat is contributing to

almost one fourth of the total dietary energy and protein to the diets of developing countries. Obviously, there is a high demand for wheat globally. Demand for surplus wheat production is related to the health and nutritional status of the people. Similarly, in the global context, wheat is grown in the largest area than any other food crops or cereal crops. In 2000, the world production of wheat was 761 million tones, making it the second most produced cereal crop after maize (Haiyan, 2014). Wheat is the third most important cereal crop largely grown in rice-wheat cropping system, and occupies more than 30% of the rice area and 80% of the wheat area in Nepal (NWRP, 2015). As per the Ministry of Agriculture and Livestock Department 716,978 ha. of land is under wheat cultivation with the total production of 2,144,569 Mt (MoALD, 2078/79). The highest production of wheat was done on Madhesh province which is 628,909 Mt. and the least in Gandaki province that is 99,038 Mt. Wheat has been contributing only 5.67% of the national GDP (MoALD, 2079/80).

There is increasing demand of wheat and its products as the population has been increasing. These data indicate the urgency of developing new high yielding wheat genotypes with optimum planting density, sowing time and seeding rates for increasing the total wheat yield in the country. Even two decades back, Gelata *et al*., (2002) had reported that optimum seeding rate is an important production factor for achieving higher grain yield in most of the crop fields. Seeding rate affected plant population, days to flowering, plant height, grain yield, kernel weight, flour yield, flour protein, and mixing time and tolerance of wheat.They therefore suggested that seeding rate should be considered as a factor in obtaining higher grain yields with good end-use quality. This study was conducted with the objective of identifying optimum seeding rate for promising wheat genotypes being tested at the NWRP.

MATERIALS AND METHODS

Description of the study area

The experiment was conducted in the National Wheat Research Program (NWRP), Omsatiya, Rupandehi. The climate is of subtropical type with three distinct seasons, summer, rain and winter. The meteorological data such as temperature, relative humidity and total rainfall during the entire experimental period (December 2022 to April 2023) was recorded from the meteorological station of NWRP, Bhairahawa, 2022-2023.

The mean maximum and minimum temperatures in the research site were 31.12°C in March 2023 and 19.2°C in January 2023. The maximum of 71.1 mm in April and minimum of 0 mm rainfall was recorded in the month of December 2022, January and February of 2023. The relative humidity ranged from 96.2 % in December 2022 to 57.6 % in April 2023.

Selection of plant material

SN	Genotypes	Notation
1.	NL1330	G1
2.	NL1345	G2
3.	NL1423	G3
4.	NL1450	G4
5.	BL1488	G5
6.	Bandganga (Control)	G6 ©

A total of five promising and one released (Control) wheat genotypes available at NWRP were used in the experimental field (Table1).

Table 1. Wheat varieties selected for the study, NWRP, 2022/23

Details of treatment and experimental design

Design: Split plot; Main plot: Seeding rate (T1-T3) @ 90,120 and 150 kg/ha); Sub plot: Genotypes (G) (six genotypes); Replication: 3; Total no. of treatments: 18 (3 main plot and 6 sub-plots); Plot size: 4m*2m; Replication-replication distance: 1 m; Plot-plot distance: 0.5 m. Number of plants used for measurement per replication = 20.

Agronomic practices

Seeds the selected genotypes sown in December 1st, 2022.

Tagging, and weeding were done as appropriate.

Irrigation was provided during CRI and flowering stages.

Recommended doges of the chemical fertilizers were applied at the rate of 120:50:50 kg/ha (N: P_2O_5:K_2O, respectively). The fertilizers viz. DAP, MOP and urea were applied @ 108.7g/plot, 83.3g/plot and 87.9g/plot (in 2 equal doses), respectively.

Harvesting was done manually on different dates after the plant attained maturity. From each plot grain of different genotypes were collected and the yield was measured.

Data measurement

The data were collected at the different growth stages and after harvesting as well. Various yield attributing traits such as number of tillers per sqm, spike length, effective tillers, no. of kernels per spike, kernel weight per spike, kernel yield, straw (above ground bio-mass) yield were measured employing standard methods. Likewise, 1000 kernel weight and harvest index (HI) were calculated.

RESULTS AND DISCUSSION

Effect of seeding rate and genotype X seeding rate on:

a. Tillers per sqm

Number of tillers per sqm is an important yield attributing character, and increased with seeding rate (Table 2). It ranged from 195 to 343 per sqm in this experiment. It was found that genotype NL1450 (G4) had the statistically significant maximum number of tillers per sqm (343) with seeding rate @ 90 kg/ha as (Table 2). Genotype 2 had the highest numbers of tillers at seeding rate 120 kg/ha as well and Bandganga (Control) had the least. The number of tillers increased in all genotypes with the increase in seeding rate from 90 to 120 kg/ha. It should however be noted that the number of tillers per sqm was statistically higher in G4 only as compared to Control (G6). Genotype X seeding rate interaction was not found statistically significant. This result agreed to Gelata et al., (2002), and Iqtidar et al., (2010).

Table 2. Effect of seeding rate and genotype on tillers per sqm

	Genotypes					
Treatments	G1	G2	G3	G4	G5	G6©
T1: 90 kg/ha	230	245	195	229	242	202
T2: 120 kg/ha	274	314	252	270	254	229
T3: 150 kg/ha	313	309	313	343*	296	290
LSD=46.6						
CV%=10.8						

b. Number of kernels per spike

The number of kernels per spike and kernel weight contribute to yield depending on agro-ecological conditions as well as genotype. From the statistical data, it was evident that the seeding rate X genotype interaction was found non-significant with the number of kernels per spike. At seeding rate of 90 kg/ha, genotype NL1330 (G1) had the highest number of kernels per panicle while genotype

NL1345 and NL1425 had the least. Similarly, NL1450 (G4) had the highest number (49) of kernels per spike at seeding rate 120 kg/ha and 150kg/ha (Table 3). These differences were statistically significant as compared to G6 (control).

Table 3. Effect of seeding rate and genotype on number of kernels per spike

	Genotypes					
Treatments	G1	G2	G3	G4	G5	G6©
90kg/ha	49*	42	42	46	44	40
120kg/ha	44	41	46	49*	43	39
150kg/ha	43*	40	39	49*	38	34
LSD=7.9						
CV%=10.5						

c. 1000 kernels weight

Already released variety Bandganga had the highest kernel weight as compared to all the other promising genotypes (Table 4). These differences were statistically significant. Although statistically insignificant the seeding rate X genotype interaction was found indirectly proportional.

Table 4. Effect of seeding rate and genotypes on 1000 kernels weight (g)

	Genotypes					
Treatments	G1	G2	G3	G4	G5	G6©
90kg/ha	39.00	38.16	34.00	38.59	41.83	49.57
120kg/ha	39.37	36.15	36.97	35.11	40.93	47.89
150kg/ha	38.77	36.63	34.99	33.44	40.45	48.49
LSD=4.32 CV%=7						

d. Adjusted grain yield (AGY)

Statistically, it was found that the seeding rate and seeding rate X genotype interaction was found significant with the adjusted grain yield at 0.05 level of significance. It is evident from Table 5 that genotype NL1450 (G4) had the statistically significant and the highest adjusted grain yield at seeding rate 120 kg/ha and 150 kg/ha as compared to G6 (Control) and other promising genotypes.

When a graphical representation of the comparison was done (Figure 1), it was found that there was 9.4% increment in the yield of NL1450 followed by BL1488 with 6.0% yield increment.

Table 5. Effect of seeding rate and genotype on adjusted grain yield (Kg)

Treatments	Genotypes					
	G1	G2	G3	G4	G5	G6 ©
90kg/ha	3936	3366	3961	4029	3826	3914
120kg/ha	3924	3655	3754	4291*	4125	3819
150kg/ha	3842	3541	3845	4471*	4445*	3959
F-test				*	*	*
LSD=363.5						
CV%=4.9						

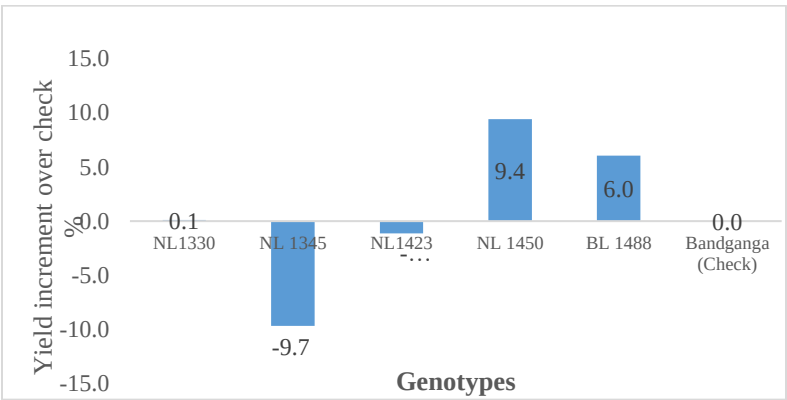

Figure 1. Graph showing the yield increment over control variety

Straw yield

Straw is an important output of wheat. It is used for bedding of livestock and then for compost making. Genotype NL1330 (G1) was found to have the statistically significant and the highest straw yield at all three seeding rates (90kg/ha, 120kg/ha and 150kg/ha). Also, all the seeding rates and genotypes had more or less similar amount of the straw yield which were higher than in control genotype (Table 6).

Table 6. Effect of seeding rate and genotype on straw yield (kg)

Treatments	Genotypes					
	G1	G2	G3	G4	G5	G6©
90kg/ha	4444*	3720	3771	3963	3826	3507
120kg/ha	4431*	3952	3653	4359*	4106	3593
150kg/ha	4606*	3717	3799	4283*	4549*	3517
LSD=585.8						
CV%=8.6						

e. Harvest Index (HI)

From the Table 7, all the seeding rates had comparatively similar harvesting index as per each genotype. Hence, there was no any benefit of using higher seeding rate. The cotrol genotype had the highest HI as compared to all promising genotypes. The difference was statistically significant. It was due to lower straw yield of the control genotype as compared to all promising genotypes.

Table 7. Effect of seeding rate and genotype on harvest index (%)

	Genotypes					
Treatments	G1	G2	G3	G4	G5	G6©
90kg/ha	47	48	52	50	50	53*
120kg/ha	47	48	51	50	50	52*
150kg/ha	46	49	51	51	49	53*
LSD= 0.028						
CV%= 3.3						

CONCLUSION

From the research experiment, genotype NL1450 was found to be the high yielding genotype with the yield of 4471 kg/ha at the seeding rate of 150kg/ha and had the highest kernels per Spike (49). All the growth and yield parameters of wheat was non-significantly influenced by the genotype X seeding rate interaction. However, grain yield was increased with the increased seeding rate.

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