Performance of Different Drought Tolerant Rice Genotypes under Lowland Rainfed Condition in Western Hills of Nepal

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Abstract: ***A field experiment was accomplished to find out the performance of different drought tolerant rice genotypes under lowland rainfed condition at Sundarbazar, Lamjung, Nepal during rainy season 2014. The experiment was carried out in single factor Randomized Complete Block Design with three replications consisting eight droughts tolerant rice genotypes. The analyzed data showed that the genotypes IR-88965-39-1-6-4 (5.3 t ha^{-1}) and IR-87760-15-2-3-4 (5.0 t ha^{-1}) produced significantly higher grain yield than the other tested genotypes. The effective tillers per m^2 were significantly higher in the genotypes IR-88965-39-1-6-4 whereas other yield attributing characters were statistically at par. Thus, the farmers of this region and having similar agro-climatic conditions are advised to grow these genotypes to get higher yield under rainfed and water stressed conditions.***

Keywords: Drought tolerant, Grain yield, Rainfed, Rice

1. Introduction

Rice is the most important crop of Nepal as it ranks first staple crop for acreage (1.48 million ha), production (5.04 million tons) and productivity (3.39 ton ha^{-1}) [1]. It contributes about 20.75% in AGDP and 6.93% in GDP [2]. Regarding to the western hills of Nepal, the recent area, production and productivity of rice is 133716 ha, 435965 tons and 3.26 tons ha^{-1} respectively, while in the Lamjung district, rice cultivated in the area of 16453 ha with the production of 47115 tones and productivity of 2.86 tons ha^{-1} [1]. Most of the areas in western hills including Lamjung districts are rainfed. That implies that the farmers depends on rainfall for the cultivation of rice and they use local cultivars which give lower yield. Further, the erratic nature of the monsoon caused by the climate change decreases the yield of the rice in the western hill of Nepal. Climate change causes the flood and drought condition which delay planting, encourage weed grown and encourage build up insect pest resulting in the yield loss. Besides with the climate change, increasing population, lack of selection of proper varieties, unavailability of quality seed of recommended varieties and improper level of understanding for required features of variety release also play important role in decreasing the productivity of rice under rainfed conditions. Further, in the water stressed condition, drought tolerant rice cultivars could be one of the most important measures to mitigate climate change. Hence, the present study was carried out to explore the performances of drought tolerant rice genotypes under rainfed condition of western mid hills.

2. Materials and Methods

The field experiment was carried out in the Agronomy farm of Lamjung campus (IAAS), Sundarbazar, Lamjung, Nepal from June to November 2014. The cropping history of the experimental field included growing of maize crop in spring season as previous crop before rice. Soil analysis results show that the soil was silt loam, pH 6.03 and low in organic matter (1.80 %). A total of eight drought tolerant genotypes were evaluated together using the Randomized Completely Block Design (RCBD) with single factor (genotypes). The genotypes used in the experiment were IR-87751-20-4-4-2, IR-87754-42-1-4-4, IR-87759-12-2-1-1, IR-87760-15-2-3-4, IR-87761-51-1-1-4, IR-88965-39-1-6-4, IR-64 and Radha-4. The genotype Radha-4, a local check was brought from Sundarbazar, Lamjung, Nepal, whereas other genotypes were brought from IRRI, Philippines. Each treatment was replicated three times and 0.5 m gap was maintained between replication. The dimension of the plot was 3 m in length and 3 m in breadth (9 m^2) where 20 cm x 20 cm RR and PP was maintained. Well decomposed farm yard manure (FYM) was applied as farmer's practice at 6 tons ha^{-1}. The fertilizer was applied at the rate of 60:30:20 kg NPK ha^{-1}. The half dose of nitrogen, whole dose of phosphorous and potash were applied as basal dose at the time of transplanting and remaining half dose of nitrogen was applied as top dressing at the active tillering stage and panicle initation stage. The collected datas were analyzed by using MSTAT-C package and for comparing the mean Duncan's Multiple Range Test (DMRT) was used.

3. Result and Discussion

3.1 Grain yield

Effect of different drought tolerant rice genotypes on grain yield was significant (Table 1). The maximum grain yield was obtained on the genotypes IR- 8865-39-1-6-4 (5.3 t ha^{-1}), followed by genotype IR-87760-15-2-3-4 (5.0 t ha^{-1}) whereas the minimum grain yield was obtained on the genotype IR-87759-12-2-1-1 (3.4 t ha^{-1}) and genotype IR-64 (3.4 t ha^{-1}). The maximum grain yield on genotypes IR-8865-39-1-6-4 and IR-87760-15-2-3-4 may be due to higher number of effective tiller m^{-2} [3],[4], less grain sterility percentage and higher thousand grains weight and better adaptation of these genotypes to soil moisture stress during critical vegetative and reproductive stages. These result are in line with the findings of earlier experiments [5], [6], which concludes the higher grain yields in the drought tolerant rice genotypes as compared to the farmers' preferred genotype.

3.2 Yield attributing characters

3.2.1 Effective tiller per m^2

The effective tiller m^{-2} was found statistically significant among the tested genotypes (Table 1). Among the tested genotypes IR-88965-39-1-6-4 showed the highest effective tiller m^{-2} (326.00) whereas comparative lower (293.00) effective tiller m^{-2} was given by genotypes IR-87759-12-2-1-1. And remaining tested genotypes had the effective tiller m^{-2} statistically at par and had the highest effective tillers m^{-2} as compared to the farmers preferred variety Radha-4. This result was in the line with the findings of earlier experiment [7], where the higher effective tillers per m^2 in the drought tolerant rice genotypes than the farmers preferred genotypes were observed.

3.2.2 Filled grains per panicle

Total grains per panicle were found statistically non-significant among the tested genotypes (Table 1). Among the tested genotypes IR- 87751-20-4-4-2 (193) had the highest number of grains per panicle followed by the genotypes IR- 88965-39-1-6-4 (192) whereas IR-64 had the lowest number of grains per panicle (154). The remaining tested genotypes had the number of grains per panicle higher than the farmers preferred variety Radha-4 and were statistically at par. This result was in the line with the findings of earlier experiment [7], where the higher filled grains per panicle were observed in the drought tolerant rice genotypes than the farmers preferred genotypes.

3.2.3 Thousand grains weight (gm)

The analyzed data showed that test weight was found non-significant among the different drought tolerant rice genotypes (Table 1). Almost similar thousand grains weight was recorded in all genotypes possibly due to their genetic nature.

Table 1: Grain yield and yield attributing characters of tested genotypes in the experiment at Sundarbazar, Lamjung, Nepal during 2014

Treatments	Yield and Yield attributing characters			
	Grain Yield ($t\ ha^{-1}$)	Effective tillers m^{-2}	Filled grains $panicle^{-1}$	Thousand grains weight (g)
IR-87751-20-4-4-2	4.0^{dc}	297.0^{b}	193	25.8
IR-87754-42-1-4-4	4.9^{b}	306.0^{b}	185	25.4
IR-87759-12-2-1-1	3.4^{f}	293.0^{b}	185	25.2
IR-87760-15-2-3-4	5.0^{ab}	311.0^{ab}	186	27.8
IR-87761-51-1-1-4	3.6^{cf}	298.0^{b}	178	25.4
IR-88965-39-1-6-4	5.3^{a}	326.0^{a}	192	29.6
IR-64	3.4^{cd}	300.0^{b}	154	24.4
Radha-4	4.6^{bc}	295.0^{b}	169	28.5
SEm (±)	0.14	2.79	3.79	0.58
LSD	0.39	19.52	ns	ns
CV (%)	5.2	3.68	8.38	10.25
Grand Mean	4.4	304	180	26.5

NS= Non Significant; Treatment mean followed by common letter (S) within column are nor significantly different among each other based on DMRT at 5% level of significance

4. Conclusions

The genotype IR-88965-39-1-6-4 and IR-87760-15-2-3-4 were stable high yielding and best performing genotypes under rainfed lowland condition and remaining tested genotypes shows the satisfactory yield. So, the farmers of this region and having similar agro-climatic conditions are advised to grow these genotypes to get higher yield under rainfed and water stressed conditions.

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