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PERFORMANCE OF RICE GENOTYPES IN WESTERN MID HILL OF NEPAL

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ABSTRACT

A field experiment was conducted as on-farm research at Duradanda Lamjung during rainy season 2016 (June to October) to find out the promising genotype to grow in the mid hill of Nepal. The experiment was conducted in Randomized Complete Block Design with 3 replications (farmers as a replication) of 6 genotypes (NR10769-4-2-2, 08FAN10, Khumal 4, NR11105-B-B-27, NR11052-B-B-B-B-66, NR11011-B-B-B-B-29) with a check (Ghaiya). The sterility percent ranged from (15.87-26.35), highest being of 08FAN 10 and lowest of NR 10769. Test weight ranged from (26.03-27.45), highest of Ghaiya and lowest of NR10769. The results revealed that the maximum effective tiller (266 tillers/m^2), number of filled grain per panicle (115 grains) and panicle length (27.17 cm) were observed in Ghaiya while minimum effective tiller (202 tillers/m^2) and filled grain (77 grains) were found in NR11052-B-B-B-B-66. The result shows that local variety Ghaiya had the highest yield (4.34 ton ha^{-1}) which was highly significant followed by the genotype NR11105-B-B-27 (3.42 ton ha^{-1}) and the genotype NR11052-B-B-B-B-66 had the lowest yield (2.50 ton ha^{-1}). Therefore, ghaiya rice was better in Duradanda as compared to other genotypes and need to be encouraged among farmers. Correlation studied shows that harvest index, thousand grain weight, flag leaf width showed positive and significant association with grain yield, while Flag leaf length, flag leaf area, effective grain per panicle, number of effective tillers per m^2, no. of tiller per hill showed positive non significant association to grain yield. So, the improvement in grain yield would be effective and economical, if the selection is based on these component traits.

Keywords: Varietal Screening, Correlation, Yield attributes, Genotypes.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important cereal crops of Nepal. It is the most preferred staple food crop and fulfils more than 50% of the calorie requirement of the Nepalese people. It is cultivated under varied agro-climatic zones from Terai (100-300masl) valleys and foothills (300-1000masl) to the high mountains up to 3050 masl (uppermost elevation of rice cultivation in the world). In the fiscal year 2015/16, the estimated rice cultivated area of Nepal was 1425346 ha with the productivity of 3.35 ton ha^{-1} (CBS, 2016). Rice is an annual grain with a round jointed stem, long leaves from 2 to 6 ft and it is edible. More than 90% of the rice is produced and consumed in Asia, where 60% of the world's population lives. Almost 114 countries of the world grow rice and more than 50 countries produce 0.1 million tons or more (FAO, 2002). Rice is the major food crop in Nepal. It plays a very important role in the national economy. The PVS is an on-farm trial in which a set of new promising lines or newly introduced genotypes are compared with local checks using farmer's crop management practices. It is an on-farm participatory mechanism to introduce and test a range of technological options suited to heterogeneous communities. Among the various problem, improper planting method and varietal selection are the major cause for the decreased rice production that leads to the food insecurity. Not only profitably is affected by the planting method and varietal selection, but this also affects the yield and yield component of crops. Therefore, to increase production, productivity and profitably suitable planting methods and varietal selection is necessary. Use of suitable planting method

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and varietal selection is concerned with the food security and food self-sufficiency of subsistence farmers. This experiment was conducted to identify the promising rice genotypes in western mid hill conditions.

MATERIALS & METHOD

The PVS trial was conducted in the rainfed field in Duradanda, Lamjung which is located at 1000 masl. The selected land was rainfed having no reliable source of irrigation and was the drought prone area. The experiment was conducted during the rainy season 2016. Seven rice genotypes were replicated thrice times in Randomized Block Design (RCBD). Ghaiya is a local check which is the most cultivated variety at that area.

Table 1. List of Genotypes used in research.

Sr. No.	Name of Genotypes
1	08F AN10
2	Khumal 4(Standard chk)
3	NR10769-4-2-2
4	NR11105-B-B-27
5	NR11052-B-B-B-B-66
6	NR11011-B-B-B-B-29
7	Local (Ghaiya) local chk

The gross plot size was 3m x 2m = 6 m^2. Sowing was done at the well prepared field of the farmer on 12th June 2016. The rice seedling is allowed to grow up to 25 days and transplanting was done in the well puddled field. The organic manure (FYM) was applied as farmers' practices @6 tons ha^{-1} plus fertilizer @ 60:30:20 kg NPK ha^{-1}. The half dose of N plus a full dose of P and K was applied as basal dose and remaining half dose of N used as topdressing at tillering and panicle initiation stage. The parameters that were observed were a phenological character, growth character and yield and yield attributing characters and data were collected. And All the collected data of quality and quantity parameters were analyzed by analysis of variance through MS-EXCEL, Statistical Package R and SPSS version 20.

RESULTS AND DISCUSSION

Heading and maturity days: Statistically highly significant differences was found in both the heading days and maturity days. The early heading days and maturity days was found in Ghaiya (69 and 98 respectively) and late heading days and maturity days was found in 08FAN 10 (76 and 107 respectively).

Panicle length (cm): Panicle length shows a significant difference among the tested genotypes. The longest panicle length observed was for Ghaiya (27.17 cm) followed by NR11105-B-B-27 (26.21 cm) which was followed by NR11011-B-B-B-B-29 (25.31 cm) and were statistically at par. The shortest panicle length was observed for 08FAN10 (20.50 cm) followed by NR11052-B-B-B-B-66 (21.19 cm).

Plant height (cm): Statistically highly significant difference found on plant height in different genotypes. Among different genotype longest plant observed was for NR10769 (152.8 cm) followed by NR11105-B-B-27 followed by (151.1 cm) which is followed by NR11011-B-B-B-B-29 (149.2 cm) which were statistically similar. The lowest plant height observed was for 08FAN 10 (86.1cm).

Effective tillers per m^2: Statistically highly significant differences found on effective tillers among the tested genotypes. High effective tiller was observed in Ghaiya (265.7 cm) followed by genotype NR11105-B-B-27 (258) which was followed by the genotype NR11011-B-B-B-B-29 (253) and these genotypes NR1105-B-B-27 and NR11011-B-B-B-B-29 were statistically similar. The lowest number of effective tillers was observed in NR11052-B-B-B-B-66 (202) followed by NR 10769 (206) and were statistically similar.

Non-effective tillers per m^2: Statistically highly significant differences found on non-effective tillers among the tested genotypes. The highest number of non effective tillers was observed in genotype NR11052-B-B-B-B-66 (53) followed by the genotype 08FAN10 (48) and they were statistically at par. The lowest number of non effective tiller was observed in NR11105-B-B-27 (38) which was followed by Khumal 4(39) followed by Ghaiya (41) shown in Table 2.

Filled grains per panicle: Statistically highly significant difference was found on filled grain among the tested genotypes. The highest number of filled grain was observed in Ghaiya (115) followed by the genotype NR11105-B-B-27 (106) and were statistically at par. The lowest number of filled grain was observed in the genotype NR11052-B-B-B-B-66 (77) which was followed by the genotype 08FAN10 (82) shown in Table 2.

Unfilled grains per panicle: Statistically non significant differences were found in unfilled grain. The highest number of unfilled grains was observed in NR11105-B-B-27 (16) followed by the genotype Khumal 4 (16) and the lowest number of unfilled grains was observed in Ghaiya and 08FAN10 which was 12.

Table 2. Phenological and growth characters of Rice genotypes tested in the experiment at Duradanda, Lamjung during 2016.

Treatments	Genotypes	50% HD	MD	PH (cm)	PL (cm)	ET/m^2	NET/m^2	UFG/P	FG/P
1	NR 10769	70^{d}	98^{c}	152.8^{a}	23.61^{bc}	206^{e}	44.00^{bc}	13	90^{cd}
2	08FAN 10	76^{a}	107^{a}	86.1^{c}	20.50^{d}	221.0^{d}	48.00^{ab}	12	82d^{e}
3	Khumal 4	73^{bc}	103^{b}	135.9^{a}	24.41^{ab}	242.0^{c}	39^{cd}	16	100^{bc}
4	NR11105-B-B-27	75^{ab}	106^{a}	151.1^{a}	26.21^{ab}	258^{b}	38^{d}	16	106^{ab}
5	NR11052-B-B-B-B-66	71^{cd}	100^{c}	132.9^{ab}	21.19^{cd}	202^{e}	53^{a}	13	77^{e}
6	NR11011-B-B-B-B-29	73^{bc}	103^{b}	149.2^{a}	25.31^{ab}	253^{bc}	44^{bc}	16	95^{bc}
7	Local (Ghaiya)	69^{d}	98^{c}	113.8^{b}	27.17^{a}	266^{a}	41^{cd}	12	115^{a}
	F value (5%)	**	**	**	*	**	**	NS	**
	L.S.D.	2.03	2.57	19.73	2.75	6.96	5.15	4.34	11.72
	CV%	1.4	1.4	5	2.3	0.3	0.7	16.7	4.2
	Grand mean	72.43	102.38	131.7	24.06	235.52	43.81	14.10	95

** significant at (P<0.01), * significant at (p<0.05), NS= non significant, LSD= least significant difference, CV= coefficient of variation, HD= heading days, MD= maturity days, PH= plant height, PL= panicle length, ET/m^2= effective tiller/m^2, NET/m2= non effective tiller / m^2, UFG/P= unfilled grain per panicle FG/P=filled grain per panicle

Sterility (%): A statistically non significant difference was found on sterility percentage among the tested genotypes. Sterility percentage was observed highest in 08FAN 10(26.35) followed by the genotype NR11052-B-B-B-B-66 (25.72). The lowest sterility percentage was observed in NR 10769.

Harvest index (%): Harvest index was found non significant among the tested genotypes. Highest was for Ghaiya (39.7) and the lowest was for NR11052-B-B-B-B-66 (30.82).

Test weight (g): Statistically non significant differences were found on test weight among the tested genotype. Highest test weight was observed in Ghaiya (27.45) and lowest for NR10769 (26.03).

Grain yield (ton ha^{-1}): The statistically highly significant difference was observed on grain yield. Grain yield was highest for the local variety Ghaiya (4.343 ton ha^{-1}) which was highly significant among all tested genotypes and was followed by genotype NR11105-B-B-27 (3.420 ton ha^{-1}) followed by NR11011-B-B-B-B-29 (3.240 ton ha^{-1}) and were statistically at par. The lowest grain yield was observed in NR11052-B-B-B-B-66 (2.507 ton ha^{-1}) followed by NR10769 (2.897 ton ha^{-1}).

Straw yield (ton ha^{-1}): Statistically, a significant difference was observed on straw yield. The straw yield was highest for the local variety Ghaiya (6.77 ton ha^{-1}) which was followed by genotype 08FAN 10 (6.32 ton ha^{-1}) followed by NR10769 (6.01 ton ha^{-1}) and were statistically at par. The lowest straw yield was observed in NR11052-B-B-B-B-29 (5.377 ton /ha^{-1}) followed by Khumal 4 (5.45 ton ha^{-1}) and were statistically at par.

Table 3. Yield Attributing characters of rice genotypes tested in the experiment at Duradanda, Lamjung during 2016.

Treatments	Genotypes	S%	HI (%)	TW(g)	SY (ton ha^{-1})	GY (ton ha^{-1})
1	NR 10769	21.77	32.53	26.03	6.00^{abc}	2.89cd
2	08FAN 10	24.62	32.83	27.17	6.31^{ab}	3.08bc
3	Khumal 4	21.58	36.89	26.43	5.45^{bc}	3.18bc
4	NR11105-B-B-27	21.31	36.86	27.12	5.86^{bc}	3.42b
5	NR11052-B-B-B-B-66	27.47	30.82	26.79	5.64^{bc}	2.50e
6	NR11011-B-B-B-B-29	21.27	37.71	27.34	5.37^{c}	3.24bc
7	Local (Ghaiya)	15.10	39.7	27.45	6.77^{a}	4.343a
	F value (5%)	NS	NS	NS	*	**
	L.S.D.	18.9	0.035	1.277	0.83	0.38
	CV%	6.91	1.9	0.3	2.2	0.7
	Grand mean	21.87	35.24	26.91	5.92	3.239

**significant at (P<0.01), * significant at (p<0.05), NS= non significant, LSD= least significant difference, CV= coefficient of variation, S%= sterility percentage, HI= harvest index, TW= thousand grain weight, SY= straw yield (ton ha^{-1}) GY= grain yield (ton ha^{-1}).

Correlation between Yield and yield component traits: The correlation coefficient estimates, the degree, and direction of the association between a pair of characters and proved to be useful for simultaneous improvement of the correlated traits through selection (Panigrahi *et al.*, 2018). Harvest index recorded highest correlation (r=0.64**) with grain yield followed by thousand kernel weight (r=0.61**), flag leaf width (0.48*). Similar results were reported by earlier workers on different characters viz., for the association of grain yield with thousand grain weight (Abarshahr et al., 2011; Kandel et al., 2017), harvest index (Dubey *et al.*, 2018). Non-effective tiller per m^2 (r=-.46*), exhibited a negative significant association with grain yield. Plant height (r=-0.21), no. of grain per panicle (-0.08), no. of non effective grain per panicle (-0.02), maturity days(r=-0.16) and heading days (r=-0.14) sterility percentage (r=-0.19). While positive non significant association with grain yield was exhibited by Flag leaf length (0.07), flag leaf area=(r=0.07), panicle length (r=0.05) effective grain per panicle (0.06) number of effective tillers per m^2 (r=0.39), no. of tiller per hill(r=.07). The finding of non-significant negative correlation of grain yield is similar to the finding of other scientists for sterility% (Anis *et al.*, 2017; Karim *et al.*, 2014).

Table 4. Correlation between yield and yield component traits of rice genotypes tested in the experiment at Duradanda, Lamjung during 2016.

	PH	PL	FLL	FLW	FLA	NG/P	NEG/P	EG/P	S	NT/H	MD	DH	NET	ET	HI	TW	GY
PH	1	0.70**	0.85**	0.27	0.80**	0.39	0.12	0.43*	-0.16	-0.31	-0.29	-0.31	-0.24	-0.19	-0.45*	-0.22	-0.21
PL		1	0.78**	0.28	0.71**	0.44*	0.32	0.45*	0.12	-0.01	0.15	0.07	-0.34	0.26	-0.11	0.02	0.05
FLL			1	0.357	0.882**	0.323	0.141	0.352	-0.087	-0.35	-0.154	-0.197	-.513*	-0.022	-0.244	0.064	0.07
FLW				1	0.670**	0.323	0.249	0.326	0.079	-.514*	-0.318	-0.3	-.732**	-0.051	0.245	0.157	0.48*
FLA					1	0.40	0.26	0.42	0.02	-.54*	-0.15	-0.17	-0.64**	-0.16	-0.17	-0.0	0.07
NG/P						1	0.854**	0.99**	0.44*	-0.41	0.08	0.05	-0.44*	-0.15	-0.11	0.01	-0.008
NEG/P							1	0.786**	0.846**	-0.36	0.36	0.33	-0.44*	-0.09	0.16	0.02	-0.20
EG/P								1	0.34	-0.40	0.01	-0.01	-0.42	-0.16	-0.16	0.00	0.06
S									1	-0.19	0.52*	0.51*	-0.30	0.005	0.38	0.03	-0.19
NT/H										1	0.23	0.18	0.613**	.763**	-0.03	0.27	0.007
MD											1	0.97**	-0.01	0.314	0.19	0.08	-0.16
DH												1	-0.03	0.25	0.18	0.08	-0.14
NET													1	-0.04	-0.34	-0.33	-0.46*
ET														1	0.23	.61**	0.39
HI															1	0.26	0.64**
TW																1	0.61**
GY																	1

** Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed), PH= Plant height, PL= Panicle length, NEG/P=No. of non effective grain per panicle, EG/P= No. effective grain per panicle, S= Sterility percentage, NT/H= No. of tiller per hill, MD= Maturity days DH= Days to heading, NET= No. of non effective tiller/m^2, ET=No. of effective tiller/m^2, FLL= Flag leaf length, FLW= Flag leaf width, FLA=Flag leaf area, HI= Harvest index, TW= Thousand grain weight, GY= Grain yield(ton ha^{-1}).

Similarly, days to heading were in concordant with Augustina *et al.* (2013). A similar finding has been reported by others for positive non significant results of grain yield with flag leaf area (Rahman *et al.*, 2012), the number of effective tillers (Shrestha *et al.*, 2018) and number of tillers per hill (Jayasudha and Deepak, 2010). In addition, Silitonga (1989) also observed a significant positive association between the number of filled grains and grain yield of hybrid rice and suggested its significance in selecting high yielding hybrid rice Pant height exhibited a negative and significant association with grain yield ha^{-1}. Any increase in plant height could result in a decrease in grain yield ha-1 that could be related to tallness in rice reduces the grain yield due to high accumulation of photosynthates on the elongation of vegetative parts rather than reproductive parts. Therefore, the selection is devised on semi dwarf genotypes would result in increased grain yield. Satheesh and Saravanan (2012), Augustina *et al.* (2013) and Kalyan *et al.* (2017) found a negative association of plant height with grain yield which is in accordance with our finding. On the contrary, Seyoum *et al.* (2012) detected a significant and positive association of plant height and non-significant association of days to 50% heading with grain yield.

CONCLUSION

From the analysis of data, we conclude that local variety Ghaiya had the highest yield (4.34 ton ha^{-1}) which was highly significant from all studied genotypes. Genotype NR11105-B-B-27 (3.42 ton ha^{-1}), NR11011-B-29(3.24 ton ha^{-1}), 08FAN 10(3.08 ton ha^{-1}) and NR 10769(2.89 ton ha^{-1}) which is statistically at par with Khumal -4(3.18 ton ha^{-1}) which is standard check. So, we conclude that studied genotypes are not suited in Mid hill condition of Nepal.

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REFERENCES

Anis, G., H. El-Mowafi, A. El-Sabagh and C. Barutçular. 2017. Hybrid Vigor Expression for Some Important Agronomic Traits in Rice Using Diallel Method. Journal of Experimental Agriculture International, 14: 1-6.

Augustina, U. A., O. P. Iwunor and O. R. Ijeoma. 2013. Heritability and character correlation among some rice genotypes for yield and yield components. Journal of Plant Breeding and Genetics, 1: 73-84.

CBS. 2016. Central Bureau of Statistics, National Planning Commission Secretariat. Government of Nepal, Kathmandu, Nepal.

Dubey, V., D. K. Singh, A. Rampreet and A. Chh. 2018. Correlation and path coefficient analysis of yield components in rice under drought condition. International Journal of Current Microbiology and Applied Sciences, 7: 4116-4122.

FAO. 2002. Food and Agriculture Organization. United Nations, New York, United States.

Jayasudha, S. and S. Deepak. 2010. Genetic parameters of variability, correlation and path-coefficient for grain yield and physiological traits in rice (*Oryza sativa* L.) under shallow lowland situation. Electronic Journal of Plant Breeding, 1: 1332-1338.

Kalyan, B., K. V. R. Krishna and L. V. S. Rao. 2017. Correlation Coefficient Analysis for Yield and its Components in Rice (*Oryza sativa* L.) Genotypes. International Journal of Current Microbiology and Applied Sciences, 6: 2425-2430.

Karim, D., M. N. A. Siddique, U. Sarkar, Z. Hasnat and J. Sultana. 2014. Phenotypic and genotypic correlation co-efficient of quantitative characters and character association of aromatic rice. Journal of Bioscience and Agriculture Research, 1: 34-46.

Panigrahi, A. K., M. Bharathi and N. Kumaravadive. 2018. Genetic variability and character association studies in advanced backcross generation of rice (*Oryza sativa* L.). Journal of Pharmacognosy and Phytochemistry, 7: 2397-2400.

Rahman, M. M., M. A. Syed, M. Adil, H. Ahmad and M. M. Rashid. 2012. Genetic variability, correlation and path coefficient analysis of some physiological traits of transplanted Aman rice (*Oryza sativa* L.). Middle East Journal of Scientific Research, 11: 563-566.

Satheesh, K. P. and K. Saravanan. 2012. Genetic variability, correlation and path analysis in rice (Oryza Sativa L.). International Journal of Current Research, 12: 082-085.

Seyoum, M., S. Alamerew and K. Bantte. 2012. Genetic variability, heritability, correlation coefficient and path analysis for yield and yield related traits in upland rice (Oryza sativa L.). Journal of Plant Sciences, 7: 13-22.

Shrestha, N., A. Poudel, S. Sharma, A. Parajuli, S. Budhathoki and K. Shrestha. 2018. Correlation Coefficient and Path Analysis of Advance Rice Genotypes in Central Mid-hills of Nepal. International Journal of Research in Agricultural Sciences 5: 150-154.

Silitonga, T. S. 1989. Analisis koefisien lintasan dari komponen hasil galur-galur padi hibrida. Penelitian Pertanian, 9: 68-70.