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ANALYSIS FOR YIELD AND YIELD COMPONENTS OF WHEAT GENOTYPES UNDER IRRIGATED CONDITIONS IN MID-WESTERN TERAI OF NEPAL

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Abstract:-

*With the objective of identifying high yielding wheat varieties for irrigated condition of midwestern region of Nepal, Coordinated Varietal Trials (CVT) of wheat were planted under irrigated conditions at Regional Agriculture Research Station (RARS) Khajura in winter season of 2011/12 and 2012/13. Trials were planted in Randomized Complete Block Design (RCBD) and recommended cultivation practices were followed. Various phenological, morphological and yield attributing traits were recorded. Obtained data of both years were analyzed by using MSTATC software program. Correlation and path analysis for yield was conducted by using SPSS and MS-Excel. Combined analysis over year indicated highly significant differences among the genotypes in terms of days to heading, days to maturity, thousand kernels weight, grain yield and straw yield. The difference was significant for plant height but non-significant in terms of grains per spike. Among the tested entries included in the experiment, NL 1135 had late heading and maturity. In contrast, genotype BL 3978 was earliest. Genotype Gautam was obtained to be tallest and Thousand kernels weight was obtained highest in genotype BL3978. Grain yield was obtained significantly high over the years in NL1094 followed by NL 1135. Maximum straw yield was obtained in genotype NL 1094 followed by NL1135. Correlation coefficient computation showed that days to maturity had highest positive correlation (0.684**) with days to heading. Path analysis for yield revealed that thousand kernels weight had the highest positive value (0.732681) as compared to direct effect of other traits.*

Keywords: - *Varietal improvement, irrigated, yield attributes, genotypes*

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the most important cereal crop of the world, being the foremost staple food of mankind contributing significant calories protein to world's diet. Wheat ranks first both in the acreage and production of the world (UNDP and FAO, 2002). It ranks third important cereal crop (after rice and maize) in Nepal with production, productivity and area of 1882220 metric ton, 2477 kg/ha and 759843 hectare, respectively in 2012/13 (MoAD, 2014). Wheat contributes 7.14% of AGDP of the country (MoAC, 2011). To provide food for rapidly growing population, Nepal needs to increase the production of wheat by 0.6 mt per hectare by the end of 2020 (Gami et al., 2001). The major reasons for low productivity of wheat are lack of knowledge of new improved varieties, delay in sowing, decline of soil organic carbon, imbalanced use of nutrition, low nutrient use efficiencies, weed problem, labor scarcity, high cost of inputs and other local problems. The use of high yielding improved cultivar, along with improved cultivation practices can significantly raise the wheat productivity.

Irrigation is one of the most important factors for plant production and distribution (Bartles and Villabo, 2002). Favourable soil moisture regime created by proper irrigation scheduling (Pal et al., 1996) takes care of deleterious effect of high temperature during reproductive stage along with increasing water use efficiency. High temperature during flowering causes pollen sterility which can be prevented by proper irrigation scheduling. The increase in supply of irrigation in supply of irrigation provided adequate moisture in soil, which played an important role in nutrient uptake (Dutta and Mandal, 2006).

The correlation of yield attributing and quantitative traits with grain yield described the inter-relationship among them. It merely indicates the intensity of association. Assuming yield is a contribution of several characters which are correlated among themselves and to the yield. Path coefficient analysis was developed by Wright (1921) and Dewey and Lu (1959). Unlike the correlation coefficient which measures the extent of relationship, path coefficient measures the magnitude of direct and indirect contribution of a component character to a complex character. More than 75% of wheat growing area in the terai belt is irrigated. Thus, varietal improvement work for irrigated condition is of great importance. In this light, current research was conducted with aim to develop and identify superior wheat varieties for irrigated condition of mid-western terai region of Nepal.

Materials and methods

CVT of wheat were planted under irrigated conditions at RARS Khajura, with coordination from National Wheat Research Program (NWRP), Bhairahawa in winter season of 2011/12 and 2012/13. The precise location of experimental site was $28^0$06'N, $81^0$37'E and at an altitude of 181 meters above sea level. The soil was sandy to silty loam with pH 7.2-7.5 and poor in organic carbon and available N but medium in available P_2O_5 and K_2O. A set of twenty genotypes obtained from NWRP is planted as CVT. Trials were planted in RCBD. The planting geometry was continuous sowing in row with row spacing of 25 cm and recommended cultivation practices were adopted. Among cultivated genotypes, ten superior genotypes and checks repeated in two years' trial were used for combined analysis. These genotypes include NL 1093, NL 1097, NL 1094, BL 3978, NL 1143, NL 1135, Bhrikuti, Gautam, RR 21 and NL 1140. Various phenological, morphological and yield attributing traits such as days to heading, days to maturity, plant height (cm), grains per spike, thousand kernels weight (gm), grain yield (kg/ha) and straw yield (kg/ha) were recorded. Different software and computer programs; MSTAT and MS-Excel were applied in detail data analysis. Correlation computation and path analysis for yield was also carried out by using SPSS and MS-Excel.

Results and Discussion

Yield attributing traits

Highly significant differences among the genotypes were observed in terms of days to heading and days to maturity (table 1). On combine analysis of the tested entries included in experiment, NL 1135 had late heading (96 days) and maturity (123 days) followed by NL 1097 with heading and maturity days of 94 and 122 respectively. In contrast, genotype BL 3978 was earliest in terms of heading (83 days) followed by NL 1140 (85 days) and RR 21 (86 days respectively. Similarly, genotype BL 3978 matured earliest (116 days) followed by RR 21 (117 days).

Combined analysis over year indicated significant differences for plant height but non-significant in terms of grains per spike. Genotype Gautam was recorded to be tallest (96 cm) followed by NL 1093 (95 cm) and RR 21 (94 cm) respectively. In contrast, Genotype NL 1094 was found to be most dwarf (83 cm) followed by NL 1135 (83 cm). Number of grains per spike was found highest in genotype NL 1093.

The difference was also highly significant among the genotypes in terms of thousand kernels weight. Thousand kernels weight was obtained highest (43.15 gm) in genotype BL3978 followed by Gautam (39.51 gm) and RR 21 (35.36 gm) whereas lowest in genotype NL 1140 (30.96 gm) followed by NL 1143 (31.54 gm).

Details of the combine analysis result regarding different yield attributes; days to heading, days to maturity, plant height, number of grains per spike and thousand kernel weight is presented in
Table 1.

Table 1: Combine analysis of yield attributes of irrigated wheat trial

Genotypes	Days to heading	Days to maturity	Plant Height	No. of Grains per Spike	Thousand Kernel wt
NL 1093	91.75 ABC	119.3 CD	94.56 A	43.5	33.36 CD
NL 1094	91.25 BCD	118.5 DE	83.00 C	37.45	32.97 CD
NL 1097	93.75 AB	121.5 AB	90.56 AB	36.55	33.24 CD
BL 3978	83.00 F	115.8 F	93.38 A	37.4	43.15 A
NL 1135	95.50 A	122.5 A	83.25 C	36.1	34.18 CD
NL 1140	85.00 EF	117.8 DE	85.56 BC	38.45	30.96 D
NL 1143	88.00 CDE	119.3 CD	85.69 BC	35.95	31.54 D
Gautam	87.50 DE	120.8 BC	95.88 A	37.9	39.51 B
Bhrikuti	87.00 E	119.3 CD	85.25 BC	41.8	32.41 CD
RR 21	86.25 EF	117.3 EF	93.88 A	40.65	35.36 C
GM	88.9	119.175	89.1	38.575	34.669
CV	2.79%	0.93%	4.03%	12.48%	6.28%
LSD	3.666	1.645	5.308	-	3.223
F-test	**	**	*	NS	**

Grain and straw yield

Highly significant differences among the genotypes were observed on combined analysis of traits; grain yield (kg/ha) and straw yield (kg/ha). Grain yield was obtained highest over the years in NL 1094 (2880 kg/ha) followed by NL 1135 (2708 kg/ha), and Bhrikuti (2663 kg/ha) respectively. Variety NL 1094 is reported to have better yield performance in preliminary experiments of NWRP in RARS Nepalgunj as well as other location. Lowest grain yield (1823 kg/ha) was obtained for genotype RR21 followed by NL 1097 (2161 kg/ha). Similarly, maximum straw yield was also obtained in genotype NL 1094 (3024 kg/ha) followed by NL1135 (2924 kg/ha) and Bhrikuti (2869 kg/ha). In contrast, minimum straw yield (2240 kg/ha) was obtained for genotype RR21 followed by NL 1097. Detail of result regarding yield traits is presented in Tab. 2 and Fig 1.

Table 2: Combine Analysis of yield traits

Genotypes	Grain Yield (kg/ha)	Straw Yield (kg/ha)
NL 1093	2281 EF	2476 CD
NL 1094	2880 A	3024 A
NL 1097	2161 F	2451 D
BL 3978	2664 BC	2822 AB
NL 1135	2708 AB	2924 AB
NL 1140	2482 CD	2700 BC
NL 1143	2358 DE	2715 B
Gautam	2626 BC	2815 AB
Bhrikuti	2663 BC	2869 AB
RR 21	1823 G	2240 D
GM	2464.581	2703.65
CV	4.87%	5.68%
LSD	177.5	227.3
F-test	**	**

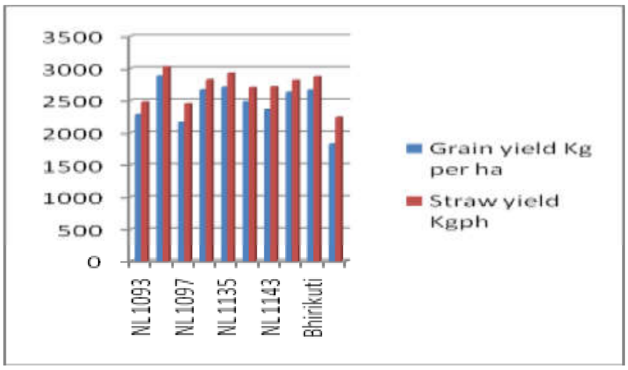

Fig 1: Graph Showing yield trait

Correlation analysis

For rational improvement of yield and its components, the understanding of correlation is very useful. Correlation measures the degree and direction of association between two or more variables. Correlation analysis was conducted among yield and yield attributes of irrigated wheat trials over two years. Based on correlation coefficient, days to maturity had highest positive correlation (0.684) with days to heading. Similarly, significant negative correlation of thousand kernels weight was obtained with days to heading (-0.458), days to maturity (-0.407) but positive correlation with plant height (0.518). Grain yield has positive correlation with days to maturity (0.130) and thousand kernel weight (0.286) whereas negative corelation with plant height (-0.247). The strong negative correlation was obtained between days to heading and thousand kernel weight (-0.458**) followed by that between days to maturity and thousand kernel weight (-0.407*). The detail correlation coefficients among recorded traits are shown in Table 3.

Table 3: Correlation analysis of yield attributing and yield traits

	Days to heading	Days to maturity	Plant height	No. of grains per spike	Thousand kernelswt	Grain yield	Straw yield
Days to heading	1						
Days to maturity	0.684**	1					
Plant height	-0.229	-0.179	1				
No. of grains per spike	-0.379*	-0.231	0.285	1			
Thousand kernel wt	-0.458**	-0.407**	0.518**	0.180	1		
Grain yield	0.083	0.130	-0.247	-0.093	0.286	1	
Straw yield	0.381*	0.256	-0.004	-0.129	-0.238	-0.064	1

** Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Path analysis for grain yield

Path coefficient measures the magnitude of direct and indirect contribution of a component character to a complex character. Grain yield is the major economic trait in wheat that depends on several component traits, which are mutually related. The direct and indirect effects of various yield components on grain yield kg/ha have been analyzed by path analysis. Path coefficient analysis for grain yield provides a more reliable assessment of the relationship between grain yield and its component characters as it permits separation of correlation into the direct as well as indirect effects. Considering the direct effects on grain yield; thousand kernel weight had the highest positive value (0.732681) followed by that of days to maturity (0.240554) as compared to direct effect of other traits. Plant height had least value (-0.56364) based on direct effect in path analysis. The detail of direct and indirect effects determined through path analysis is presented in Table 4.

Table 3: Path analysis for grain yield in irrigated wheat trial

	Days to heading	Days to maturity	Plant height	Grains per spike	Thousand kernels wt	Straw yield
via Days to heading	0.142873	0.097725	-0.03272	-0.05415	-0.06544	0.054435
via Days to maturity	0.164539	0.240554	-0.04306	-0.05557	-0.09791	0.061582
via Plant height	0.129074	0.100892	-0.56364	-0.16064	-0.29197	0.002255
via Grains per spike	-0.01713	-0.01044	0.012884	0.045207	0.008137	-0.00583
via Thousand ernelswt	-0.33557	-0.2982	0.379529	0.131883	0.732681	-0.17438
via Straw yield	-0.00079	-0.00053	0.00000825	0.000266	0.000491	-0.00206
Total	**0.083**	**0.13**	**-0.247**	**-0.093**	**0.286**	**-0.064**

Conclusion

Varietal evaluation and yield analysis of some improved wheat genotypes under irrigated condition was conducted through this study. Grain yield was obtained highly significant over the years in NL1094 followed by NL 1135. This research paper presents possibility of extension of new promising wheat genotypes in farmers' field of the region because of their high yield and ecological suitability. Considering the food security issues of resource poor farmers as well as possibility of extension of new irrigation facilities in mid-western terai region of Nepal; similar researches need to be focused in days to come.

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