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Research Article

ESTIMATION OF CORRELATION COEFFICIENT ANALYSIS FOR QUANTITATIVE TRAITS IN WHEAT (*Triticum aestivum* L.) UNDER TERMINAL HEAT TOLERANCE

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Abstract: The present was conducted at Crop Research Farm, Nawabganj, C. S. Azad University of Agriculture and Technology, Kanpur, 208 002, U.P. during *Rabi*, 2012-13. The experimental material comprised of 45 F'$_1$s developed by crossing 10 lines *viz*., K-9533, K-9162, K9465, K8962, HUW-234, NW-2036, K-9423, K9351, KRL-210 and K-906 following half diallel fashion design. A total of 100 treatments 10 parents (45 F$_1$s and 45 F's 2) were used for the study of combining ability for eighteen quantitative characters in Wheat. The significant associations were observed in 38 cases out of 45 possible correlations in F$_1$ at phenotypic level and 38 cases at genotypic level, respectively. In F$_2$ the similar results were observed in 29 cases at phenotypic and 28 cases at genotypic level. Most of there were common in both the generations. Similarly, the significant environmental associations in 8 cases of F'$_1$s and 10 cases of F'$_2$s, showed significant at positive or negative levels. Strong associations between grain yield per plant with biological yield per plant and harvest index was strong at phenotypic level in F$_1$ generation were much appreciable whereas at genotypic level. In F$_2$ population, the positive correlation between grain yield per plant with biological yield per plant and harvest index was strong at phenotypic level whereas at genotypic level was visible.

Keywords: *Harvest index, Correlation Coefficients, Genotypic correlation, Phenotypic correlation*

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Introduction

Wheat (*Triticum aestivum* L.) cultivation reaches far back into history. Wheat is a self-pollinated crop of the member of Poaceae family and one of the most important cereal of the world. These are the hexaploid (2n=42), *T. aestivum* L. (bread wheat), the tetraploid (2n=28), *T. durum* Desf and the diploid (2n=14), *T. dicoccum* Schrank and *T. monococcum*. Globally, aestivum wheat is most important species which covers near about 90 per cent of the cultivable area.

Thus, the maximum correlated response in grain yield via, biological yield per plant, harvest index was much appreciable for enhancement of grain yield as the ultimate result. The relative selection efficiency through these traits may directly be useful while might be effective indirect selections for early growth vigour in advance stages for improvement of the productivity [1-5].

Material and Methods

The present investigation was conducted at Crop Research Farm, Nawabganj, C. S. Azad University of Agriculture and Technology, Kanpur, 208 002, U.P. during *Rabi*, 2012-13. Geographically, this place is located between 25°28´ and 26°58´ N latitude, 79°31´ and 80°34´ E longitudes and at an altitude of 125.9 m above from mean sea level. This area falls in sub-tropical climatic zone. The soil type is sandy loam. The annual rainfall is about 1270 mm. The climate of district Kanpur is semi-arid with hot summer and cold winter [6-10].

Experimental materials

The experimental material for present investigation comprised of 45 F'$_1$s developed by crossing 10 lines *viz*., K-9533, K-9162, K9465, K8962, HUW-234, NW-2036, K-9423, K9351, KRL-210 and K-906 following half diallel fashion design. A total of 100 treatments 10 parents (45 F$_1$s and 45 F's 2) were used for the study of combining ability for eighteen quantitative characters in Wheat [11-15].

Producing F$_1$ seed

All possible single crosses ware made during the year *Rabi* 2011-12 to complete a 10x10 diallel set without reciprocals due to absence of extra nuclear inheritance in wheat.

Producing F$_2$ seed (Advancement of generation through off season nursery)

A part of F$_1$ hybrid seed of each cross was selfed in order to get seed for raising in the summer nursery at Lahul and Spiti Valley during summer 2012 to get F$_2$ generation.

Field lay out

The experimental materials consisted of 100 treatments (45 F$_1$'s + 45 F$_2$'s + 10 parents) were sown in Randomized Block Design with three replications in late sown (LS) condition.

Correlation Coefficients

The following formulae were used for calculating the genotypic and phenotypic coefficient of correlations in both the experiments as suggested by Al-Jibouriet al. (1958):

Genotypic correlation [rxy (g)]=Cov.xy(g) / [Vx(g).Vy(g)]$^{0.5}$

where,

Cov.xy (p) = genotypic covariance between characters x and y, and this was obtained as follows:

Cov.xy (p) = [Cov.xy (g) - Cov.xy (e) + Error MSP

Cov.xy (g) = Treatment of MSP-Error/r

Vx (g) and Vy(g) = genotypic variances for the characters x and y, respectively

r = number of replications

Phenotypic correlation [rxy(p)]=[Cov.xy(p)]/[Vx(p).Vy(p)]$^{0.5}$

Table-2a Estimate of genotypic and phenotypic correlation coefficients for 18 attributes in F_1 generation of wheat (Triticum aestivum L.)

Characters		DA	SLW	LN	Fv/Fm	CTD	CI	FLA	DPM	PH	SL	SL/S	SD	PT/P	G/S	TW	GY/P	BY/P	HI
	G	1	0.196	-0.024	-0.012	-0.081	-0.046	-0.129	0.6	-0.033	-0.11	-0.227	-0.035	0.059	-0.149	-0.089	0.049	-0.245	0.197
DA	P	1	0.194*	-0.025	-0.01	-0.075	-0.044**	-0.127**	0.542**	-0.03	-0.109	-0.217**	-0.029	0.044	-0.141	-0.085	0.043	-0.236**	0.187*
	G		1	-0.473	0.298	0.388	0.365	0.411	0.044	0.007	0.213	0.358	0.009	0.221	0.452	0.507	0.689	-0.132	0.704
SLW	P		1	-0.464**	0.288**	0.379**	0.357**	0.392**	0.042	0.01	0.200**	0.352**	0.017	0.191	0.445**	0.497**	0.672**	-0.128	0.684**
LN	G			1	-0.293	-0.286	-0.474	-0.505	0.158	-0.114	-0.087	-0.158	-0.008	0.048	-0.482	-0.226	-0.632	-0.085	-0.526
	P			1	-0.289**	-0.282**	-0.471**	-0.493**	0.147	-0.113	-0.086	-0.157	-0.008	0.041	-0.477**	-0.225**	-0.627**	-0.085	-0.519**
Fv/Fm	G				1	0.325	0.286	0.223	-0.22	-0.081	-0.018	0.006	-0.019	0.082	0.305	0.224	0.334	-0.075	0.373
	P				1	0.311**	0.278**	0.205**	-0.201**	-0.08	-0.022	0.006	-0.014	0.075	0.294**	0.219**	0.328**	-0.073	0.364**
CTD	G					1	0.562	0.446	0.037	0.061	0.061	0.022	-0.099	0.099	0.333	0.423	0.616	0.301	0.335
	P					1	0.556**	0.436**	0.038	0.06	0.059	0.022	-0.094	0.095	0.327**	0.420**	0.607**	0.292**	0.331**
	G						1	0.555	0.028	0.109	0.134	0.13	-0.088	0.125	0.633	0.485	0.721	0.204	0.502
CI	P						1	0.544**	0.025	0.11	0.133	0.129	-0.088	0.12	0.629**	0.484**	0.717**	0.203**	0.496**
	G							1	-0.043	0.057	0.259	0.255	-0.126	0.125	0.603	0.494	0.624	0.307	0.355
FLA	P							1	-0.037	0.054	0.253**	0.251**	-0.121	0.115	0.588**	0.485**	0.611**	0.299**	0.346**
	G								1	0.178	-0.018	-0.282	-0.157	0.125	-0.039	0.005	-0.022	-0.032	-0.02
DPM	P								1	0.165	-0.012	-0.264**	-0.151*	0.117	-0.039	0.004	-0.02	-0.029	-0.017
	G									1	0.278	0.213	-0.117	-0.054	0.123	-0.013	0.009	0.245	-0.147
PH	P									1	0.272**	0.215**	-0.11	-0.048	0.122	-0.012	0.008	0.242**	-0.145
	G										1	0.234	-0.771	-0.098	0.261	0.001	0.113	0.12	0.014
SL	P										1	0.231**	-0.774**	-0.078	0.255**	0	0.114	0.119	0.015
	G											1	0.426	0.009	0.332	0.226	0.21	0.052	0.167
SL/S	P											1	0.423**	0.008	0.327**	0.224**	0.206**	0.053	0.165
	G												1	0.079	-0.055	0.096	-0.015	-0.124	0.084
SD	P												1	0.06	-0.053	0.096	-0.018	-0.122	0.081
	G													1	0.042	0.258	0.301	0.056	0.23
PT/P	P													1	0.037	0.241**	0.278**	0.052	0.206**
	G														1	0.458	0.605	0.187	0.413
G/S	P														1	0.455**	0.599**	0.183	0.407**
	G															1	0.629	0.151	0.451
TW	P															1	0.625**	0.148	0.447**
	G																1	0.218	0.743
GY/P	P																1	0.215**	0.741**
	G																	1	-0.485
BY/P	P																	1	-0.485**
	G																		1
HI	P																		1

Table-2b Estimate of genotypic and phenotypic correlation coefficients for 18 attributes in F_2 generation of wheat (Triticum aestivum L.)

Characters		DA	SLW	LN	Fv/Fm	CTD	CI	FLA	DPM	PH	SL	SL/S	SD	PT/P	G/S	TW	GY/P	BY/P	HI
	G	1	0.297	-0.046	0.055	-0.08	0.093	0.005	0.596	0.046	0.074	0.118	0.001	0.151	-0.046	-0.016	0.126	-0.165	0.171
DA	P	1	0.291**	-0.044	0.055	-0.08	0.093	0.003	0.568**	0.047	0.074	0.119	0.004	0.147*	-0.041	-0.011	0.125	-0.156	0.167
	G		1	-0.416	0.432	0.395	0.436	0.365	0.151	0.1	0.414	0.5	-0.116	0.522	0.525	0.529	0.683	-0.039	0.721
SLW	P		1	-0.411**	0.428**	0.388**	0.431**	0.357**	0.147	0.101	0.405**	0.484**	-0.112	0.503**	0.517**	0.517**	0.671**	-0.036	0.707**
LN	G			1	-0.212	-0.335	-0.416	-0.492	0.07	-0.142	-0.122	-0.145	0.042	-0.09	-0.493	-0.243	-0.582	-0.125	-0.571
	P			1	-0.212**	-0.332**	-0.413**	-0.482**	0.068	-0.142	-0.121	-0.139	0.042	-0.088	-0.487**	-0.239**	-0.578**	-0.122	-0.566**
Fv/Fm	G				1	0.461	0.468	0.418	-0.108	0.035	0.117	0.304	0.02	0.493	0.422	0.356	0.516	0.093	0.51
	P				1	0.458**	0.467**	0.413**	-0.105	0.037	0.116	0.296**	0.02	0.484**	0.417**	0.352**	0.513**	0.092	0.505**
CTD	G					1	0.621	0.536	0.078	0.171	0.164	0.182	-0.114	0.327	0.491	0.522	0.644	0.384	0.512
	P					1	0.618**	0.530**	0.076	0.171*	0.161*	0.180*	-0.109	0.328**	0.482**	0.515**	0.639**	0.375**	0.508*8
	G						1	0.489	0.096	0.126	0.178	0.217	-0.113	0.372	0.619	0.479	0.7	0.14	0.671
CI	P						1	0.481**	0.092	0.125	0.177*	0.212*	-0.109	0.367**	0.612**	0.475**	0.694**	0.139	0.663**
	G							1	0.019	0.195	0.218	0.307	-0.078	0.382	0.619	0.504	0.678	0.393	0.558
FLA	P							1	0.019	0.193*	0.214	0.304**	-0.066	0.377**	0.599**	0.492**	0.667**	0.381**	0.546**
	G								1	0.066	-0.123	-0.063	0.098	0.091	0.022	0.063	0.063	-0.118	0.09
DPM	P								1	0.063	-0.118	-0.068	0.096	0.089	0.021	0.056	0.061	-0.097	0.08
	G									1	0.314	0.22	-0.182	0.101	0.231	0.036	0.177	0.254	0.09
PH	P									1	0.312*	0.214**	-0.180*	0.101	0.227**	0.034	0.176	0.249**	0.088
	G										1	0.318	-0.797	0.155	0.257	0.127	0.298	0.061	0.281
SL	P										1	0.307**	-0.789**	0.153	0.251**	0.125	0.292**	0.066	0.272**
	G											1	0.305	0.43	0.37	0.341	0.429	-0.019	0.453
SL/S	P											1	0.302**	0.425**	0.364**	0.337**	0.421**	-0.017	0.444**
	G												1	0.071	-0.064	0.025	-0.089	-0.151	-0.027
SD	P												1	0.071	-0.062	0.027	-0.084	-0.148	-0.022
	G													1	0.345	0.467	0.675	0.218	0.601
PT/P	P													1	0.337**	0.458**	0.663**	0.211**	0.588**
	G														1	0.554	0.684	0.2	0.644
G/S	P														1	0.549**	0.674**	0.200**	0.631**
	G															1	0.664	0.207	0.603
TW	P															1	0.655**	0.207**	0.593**
	G																1	0.301	0.915
GY/P	P																1	0.297**	0.910**
	G																	1	-0.103
BY/P	P																	1	-0.11
	G																		1
HI	P																		1

where,

Cov.xy(p) = phenotypic covariance between the characters x and y, and this was obtained as follows:

Cov.xy (p) = Cov.xy (g) + Cov.xy(e)

Vx (p) and Vy (p) = phenotypic variance for the characters x and y, respectively

Test of significance of correlation coefficients

The significance of phenotypic correlation coefficient was tested against 'r' values from 'r' table of Fisher and Yates (1938) for (n-2) degree of freedom, where 'n' is the number of treatments.

Result and discussion

The parents, in the present investigation were selected on the basis of nature of gene action in a group of widely phenotypic differences among all the eighteen characters. The general analysis of variance of the experiment also revealed an appreciable and significant variability among parents and progenies (F_1 and F_2) in respect to eighteen characters (1.... 18) under study. Reflection towards parents chosen were genetically divergent and thus, amenable for detailed bio techniques for the estimation of various genetic parameters through the method suggested by Galton, (1989). Estimates of possible correlation coefficients at phenotypic, genotypic and environmental levels were computed for all the eighteen characters in F_1 and F_2 generations with grain yield and the characters among themselves.

Table-2c Estimates of environmental association between 18 attributes in F_1 generation of wheat

Characters	DA	SLW	LN	Fv/Fm	CTD	CI	FLA	DPM	PH	SL	SL/S	SD	PT/P	G/S	TW	GY/P	BY/P	HI
DA	1	0.173	-0.062	0.02	0.057	-0.018	-0.114	0	0.058	-0.107	-0.045	0.064	-0.069	0.008	-0.009	-0.137	-0.099	0.002
SLW		1	-0.04	0.023	0.03	-0.049	-0.141	0.009	0.194*	-0.171	0.125	0.226**	-0.126	0.158*	-0.057	-0.134	0	-0.058
LN			1	-0.164*	0.068	0.002	0.15	-0.059	0.018	-0.04	-0.117	0.008	-0.082	0.064	0.093	0.021	-0.071	0.126
Fv/Fm				1	-0.135	-0.082	-0.240**	0.031	-0.056	-0.101	-0.005	0.084	0.013	-0.127	-0.058	0.099	0	0.072
CTD					1	0.034	0.065	0.081	0.008	-0.042	0.02	0.072	0.097	-0.088	0.173	-0.019	-0.160*	0.144
CI						1	-0.044	-0.085	0.265	0.135	0.021	-0.138	0.194*	0.132	0.073	0.126	0.129	-0.052
FLA							1	0.055	-0.086	0.075	0.11	0.002	0.021	-0.102	-0.008	0.009	0.032	-0.006
DPM								1	-0.067	0.08	0.002	-0.09	0.066	-0.078	-0.04	0.019	0.003	0.041
PH									1	-0.021	0.371**	0.198	0.034	0.05	0.127	-0.047	0.041	-0.011
SL										1	0.116	-0.857**	0.145	-0.029	-0.116	0.186*	0.083	0.045
SL/S											1	0.362**	-0.004	-0.001	0.131	-0.019	0.095	0.067
SD												1	-0.156	0.024	0.164*	-0.182*	-0.062	-0.014
PT/P													1	-0.032	0.221**	0.063	0.01	-0.069
G/S														1	0.049	-0.009	-0.065	-0.07
TW															1	-0.028	-0.096	0.04
GY/P																1	-0.023	0.629**
BY/P																	1	-0.513**
HI																		1

Table-2d Estimates of environmental association between 18 attributes in F_2 generation of wheat

Characters	DA	SLW	LN	Fv/Fm	CTD	CI	FLA	DPM	PH	SL	SL/S	SD	PT/P	G/S	TW	GY/P	BY/P	HI
DA	1	-0.017	0.153	0.146	-0.013	0.170*	-0.084	-0.055	0.141	0.087	0.163	0.121	-0.055	0.222*8	0.305**	0.05	0.203	-0.073
SLW		1	-0.088	0.279**	-0.01	0.164*	0.113	0.077	0.157	0.051	0.026	0.018	-0.174	0.126	-0.022	0.047	0.042	0.04
LN			1	-0.06	0.095	0.146	0.107	0.04	-0.013	-0.054	0.270**	0.076	0.042	0.204**	0.255*8	0.025	0.199	-0.036
Fv/Fm				1	0.045	0.225**	0.240**	-0.085	0.283**	0.065	-0.058	0.037	-0.125	-0.059	-0.035	0.057	-0.006	0.066
CTD					1	0.337**	0.350**	0.038	0.233	0.055	0.119	0.194	0.412**	-0.113	0.053	0.240**	-0.048	0.175*
CI						1	0.146	-0.01	0.085	0.143	0.058	0.103	0.137	0.131	0.193	0.129	0.144	0.048
FLA							1	0.023	0.126	0.082	0.237	0.307**	0.220**	-0.193	0.017	0.248**	0.017	0.051
DPM								1	-0.021	-0.033	-0.163	0.068	0.048	0.003	-0.134	0.021	0.332**	-0.189*
PH									1	0.237**	-0.02	-0.093	0.071	-0.089	-0.091	0.04	-0.002	-0.079
SL										1	0.003	-0.524**	0.055	0.002	0.046	-0.03	0.230**	-0.153
SL/S											1	0.215**	0.292**	0.162	0.235	0.163*	0.04	0.151
SD												1	0.093	0.016	0.128	0.181	-0.037	0.178
PT/P													1	-0.004	0.065	0.087	-0.028	0.022
G/S														1	0.282**	-0.05	0.211	-0.09
TW															1	0.069	0.182	0.039
GY/P																1	0.101	0.581**
BY/P																	1	-0.431**
HI																		1

The correlations between the pairs of characters and their relationships are presented in [Table-2a, 2b, 2c and 2d].

The magnitude of genotypic correlations was greater than phenotypic ones in both the generations for characters associated to one another except in few cases. The significant of the genotypic correlations could not be tested as no suitable statistical test is available. According to Nasr et al. (1973), their magnitude in relation to their phenotypic correlation values among the traits form a sound basis for their practical implications. Hence, the significance of correlations among the traits based on phenotypic correlation values are explained here.

At phenotypic levels [Table-2a] significant and positive associations were observed for days to anthesis with specific leaf weight, days to physiological maturity and harvest index, while with chlorophyll intensity, flag leaf area and number of spikelets per spikeit showed significant and negative correlation; specific leaf weight with chlorophyll florescences, canopy temperature depression, chlorophyll intensity, flag leaf area, spike length, number of Spikelets per spike, number of grains per spike, 1000-grain weight, grain yield per plant and harvest index, while with leaf angle only showed significant and negative correlation; leaf angle with 1000-grain weight, grain yield per plant and harvest index, while chlorophyll florescences, canopy temperature depression, chlorophyll intensity, flag leaf area and , number of grains per spike showed significant and negative correlation; chlorophyll florescences with canopy temperature depression, chlorophyll intensity, flag leaf area, number of grains per spike, 1000-grain weight and grain yield per plant, while days to physiological maturity and harvest index showed significant and negative correlation; canopy temperature depression with chlorophyll intensity, flag leaf area, number of grains per spike, 1000-grain weight, grain yield per plant, biological yield per plant and harvest index showed significant and positive correlation ; chlorophyll intensity with flag leaf area, number of grains per spike , 1000-grain weight, grain yield per plant, biological yield per plant and harvest index showed significant and positive correlation;flag leaf area with spike length, number of spikelets per spike, number of grains per spike , 1000-grain weight, grain yield per plant, biological yield per plant and harvest index showed significant and positive correlation; days to physiological maturity with number of Spikelets per spike and number of grains per spike were significant and negative correlation observed; plant height with spike length, number of spikelets per spike biological yield per plant, while only harvest index showed significant and negative correlation; spike length with number of spikelets per spike, spike density and number of grains per spike showed significant and positive correlation; number of spikelets per spike with, spike density, number of grains per spike , 1000-grain weight and grain yield per plant were significant and positive correlation observed; number of productive tillers with 1000-grain weight, grain yield per plant and harvest index; number of grains per spike with 1000-grain weight, grain yield per plant and harvest index showed significant and positive correlation; 1000-grain weight with grain yield per plant and harvest index showed significant and positive correlation; grain yield per plant with biological yield per plant and harvest index showed significant and positive correlation; biological yield per plant, while significant and negative correlation with harvest index in F_1 generation.

In F_2 generation at phenotypic levels [Table-2b] significant and positive associations were observed for days to anthesis with specific leaf weight, days to physiological maturity and number of productive tillers per plant; specific leaf weight with leaf angle, chlorophyll florescences, canopy temperature depression, chlorophyll intensity, flag leaf area, spike length, number of spikelets per spike, number of productive tillers per plant, number of grains per spike , 1000-grain weight, grain yield per plant and harvest index showed significant and positive correlation; leaf angle while with chlorophyll florescences, canopy temperature depression, chlorophyll intensity, flag leaf area, number of grains per spike , 1000-grain weight, grain yield per plant and harvest index were significant and negative correlation observed; chlorophyll florescences with canopy temperature depression, chlorophyll intensity, flag leaf area, number of spikelets per spike, number of productive tillers per plant, number of grains per spike , 1000-grain weight, grain yield per plant and harvest index were significant and positive correlation observed; canopy temperature depression with chlorophyll intensity, flag leaf area, plant height, spike length, number of spikelets per spike, number of productive tillers per plant, number of grains per spike, 1000-grain weight, grain yield per plant, biological yield per plant and harvest index were significant and positive correlation observed; chlorophyll intensity with flag leaf area, spike length, number of spikelets per spike, number of productive tillers per plant, number of grains per spike, 1000-grain weight, grain yield per plant and harvest index were significant and positive correlation observed; flag leaf area with height, spike length, number of spikelets per spike, number of productive tillers per plant,

number of grains per spike, 1000-grain weight, grain yield per plant, biological yield per plant and harvest index showed significant and negative correlation; plant height with spike length, number of spikelets per spike, grain yield per plant and biological yield per plant showed significant and negative correlation, while only spike density showed significant and negative correlation; spike length with number of spikelets per spike, number of grains per plant, grain yield per plant and harvest index showed significant and negative correlation, while only spike density showed significant and negative correlation; number of spikelets per spike with, spike density, number of productive tillers per plant, number of grains per spike, 1000-grain weight, grain yield per plant and harvest index showed significant and negative correlation; number of productive tillers with number of grains per spike, 1000-grain weight, grain yield per plant, biological yield per plant and harvest index showed significant and negative correlation; number of grains per spike 1000-grain weight, grain yield per plant, biological yield per plant and harvest index showed significant and negative correlation; 1000-grain weight with grain yield per plant, biological yield per plant and harvest index showed significant and negative correlation; grain yield per plant with biological yield per plant and harvest index showed significant and negative correlation.

The magnitude of genotypic correlations was greater than environmental ones in both the generations for the characters associated to one another except in few cases [Table-2c and 2d]. In F_1 generation 16 cases and 30 cases in F_2 generation were found significant at environmental level. Among these positive and significant associations were observed with for days to specific leaf weight with plant height, spike density, number of grains per spike; leaf angle while with chlorophyll florescences were significant and negative correlation observed; chlorophyll florescences while with flag leaf area were significant and negative correlation observed; chlorophyll intensity with number of productive tillers showed significant and negative correlation; plant height with number of spikelets per spike showed significant and negative correlation; number of productive tillers with spike density showed significant and negative correlation; spike density with 1000-grain weight showed significant and negative correlation, while with grain yield per plant significant and negative correlation observed; number of productive tillers with 1000-grain weight showed significant and negative correlation; grain yield per plant with harvest index and biological yield per plant showed significant and negative correlation, while with harvest index significant and negative correlation observed.

Conclusion

In F_2 generation significant and positive associations was observed at environmental level for days to anthesis with chlorophyll intensity and 1000-grain weight; days to specific leaf weight with chlorophyll florescences and chlorophyll intensity were significant and positive correlation observed; leaf angle with number of spikelets per spike, number of grains per spike and 1000-grain weight were significant and positive correlation observed; flag leaf area with spike density, number of productive tillers per plant and grain yield per plant were significant and positive correlation observed; days to physiological maturity with biological yield per plant and harvest index were significant and positive correlation observed; spike length with biological yield per plant showed significant and negative correlation, while with spike density were significant and negative correlation observed; number of grain per spike with spike density showed significant and negative correlation; grain yield per plant with harvest index showed significant and negative correlation, while with biological yield per plant were significant and negative correlation observed.

Application of research: Research shows the positive correlation between grain yield per plant with biological yield per plant and harvest index was strong at phenotypic level whereas at genotypic level was visible

Research Category: Genotypic and Phenotypic Analysis

Abbreviations: DA-days to anthesis; SLW-specific leaf weight; LN-leaf angle; Fv/Fm-chlorophyll florescences; CTD-canopy temperature depression; CI-chlorophyll intensity; FLA-flag leaf area; DPM-days to physiological maturity; PH-plant height; SL-spike length; SL/S-number of spikelets per spike; SD-spike density; PT/P-number of productive tillers per plant; G/S-number of grains per spike; TW-1000-grain weight; GY/P-grain yield per plant; BY/P-biological yield per plant and HI-harvest index

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Study area / Sample Collection: Crop Research Farm, Nawabganj

Cultivar / Variety / Breed name: Wheat (*Triticum aestivum* L.)

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