Original Research Article

Study of correlation and path coefficients to emphasize grain yield and its components in bread wheat

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Abstract

The research was conducted to study traits association with direct and indirect effect and its cumulative effect in 40 bread wheat genotypes at SardarVallabhbhai Patel University of Agriculture and Technology, Meerut, (U.P.). The research was laid out in Randomized Block Design with 3 replications during Rabi 2019. Genotypic correlation coefficient observed higher comparison to all respective phenotypic correlation coefficient. Path coefficient analysis were observed positive and direct effect on grain yield per plant exerted by days of 50% flowering, number of productive tillers per plants, total number of spikelets per spikes, 1000 seeds weight, biological yield per plant and harvest index. Cumulative effect correlation and path on grain yield per plant exerted by biological yield per plant, harvest index, days of 50% flowering and total number of spikelets per spikes indicated that improvement in wheat can be achieved by selecting these characters.

Key words: Correlation, Path coefficient, Selection parameter, Grain Yield,.

Introduction

"Wheat is the world's most superior crop in respective of other cereal crops and is cultivated on about 217 million hectares with a production of 731 million tonnes of grain with 3424 kg/ha productivity (2020-21). It is considered as the second most important cereal staple food crop nearly 35% of world's population depends on this crop and provides 20% food calories. China is top most producing country in the world followed by the India" (Kumar et al. 2019). "India's wheat production has touched the landmark figure of 108.75 million tonnes (3rd AE, 2021) from 31.76 million hectares (13.43% of global area) registering an all-time highest crop productivity of 3424 kg/ha". (Annual report 2020-21, IIWBR, Karnal).

In India wheat cultivation spread on both north and south India on plan and hills region respectively.

On the basis of its adaptability for structured study and research India has been divided into six different wheat growing zones namely Northern Hill Zone (NHZ), North Western Plains Zone (NWPZ), North Eastern Plains Zone (NEPZ), Central Zone (CZ), Peninsular Zone (PZ), and Southern Hill Zone (SHZ). The zone wise total percentage of Acreages of wheat crop is 2.9%, 40.1%, 33.2%, 18.1%, 5.4% and 0.4% respectively. Wheat production is affected by several environmental factors responsible for yield losses over world including India. This demand can be met by developing high yielding varieties with better resistance to biotic and abiotic stress.

The studies of character associations provide us with a better understanding of character`s responsible for grain yield. Path coefficient analysis helps to differentiate the characters influence directly and indirectly to increase grain yield (Dixet&Dubey, 1984). The character 1000 – kernel weight and the number of spikes per square meter produce remarkable improvement in grain yield has been reported by (Korkut et al.,2001). Dwivedi et al.(2002) found that total biomass, followed by tillers per plant and grain weight per ear exerted the highest direct effect on grain yield.

Generally,yield of wheat depends on many characteristics like productive tillers, number of grains, 1000 grain weight etc. and heritability and stability of these characteristics are necessary to improve the yield of crop. Thus, it is important to know its association and a way to influence yield to harness its maximum potential for grain yield.

“Knowledge of selection parameters is a prime pre-requisite for any breeding program aimed at developing new varieties with high yield potential and yield stability”. [18]

“Breeding program does not getting proper flow due to lack of information of character association and trait regarding grain yield.This factor need an extensive research, as this includes the major influence by its direct or indirect relationship on grain yield. The present study aims to vanquish all these constraints and help breeders by providing the information about selection parameter present in wheat

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for yield and its contributing traits so researcher can utilize this for wheat improvement". [18]

Material and methods

The present experiment was carried out during Rabi 2019-2020 at Technology Park of SardarVallabhbhai Patel University of Agriculture & Technology, Meerut-250110 (U.P.) using 40 indigenous genotypes of Wheat (*Triticum aestivum* L.) given in Table no:1. The experiment was laid out in Randomized Block Design (RBD). Observations were recorded on yield and yield attributing characters. All the observations were taken from each plot, on randomly five selected plants from each genotype. The study was based on the following characters. 1.Days of 50% flowering, 2.Days to maturity, 3. Plant height (cm), 4. Number of productive tillers/plant, 5. Spike length (cm), 6. Total number of spikelet's/spike, 7.Number of grains/ spike, 8. Biological yield / plant (g), 9.Grain yield / plant (g), 10. Harvest index (%), 11. 1000 grain weight (g), 12. Gluten content (%).

"The correlations at genotypic, phenotypic and environmental levels were estimated from the analysis of variance and covariance" as suggested by **Searle (1961).**The analysis of path-coefficient was conducted following the procedure as suggested by **Wright (1921)** and further elaborated by **Dewey and Lu (1959).** The yield contributing characters were considered in path coefficient analysis to estimate their direct and indirect effect on seed yield.

Result and Discussion

Correlation Coefficient

In present study, correlation coefficients at both genotypic and phenotypic level relation to grain yield and its component characters have been worked out. Study revealed that higher genotypic correlation coefficient compared to its

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respective phenotypic correlation coefficient. The genotypic and phenotypic correlation are presented in table 1 and 2 respectively.

The present research revealed that both genotypic and phenotypic correlation the trait like number of productive tillers per plants, biological yield per plant, number of grains per spikes, plant height, spike length, total number of spikelets per spikes, harvest index, and 1000 seeds weight, Days of 50% flowering, days to maturity have positive association with grain yield. So research should be focused to improve these characters in order to improve grain yield. These results are in confirmation with **Lone *et al.*, (2017), Baranwal*et al.*, (2012), Desheva (2016), Ozukum*et al.*, (2019), Rajaneesh*et al.*, (2019), Anu*et al.*, (2020), Singh *et al.*, (2021), Kumar et al., (2019), Yadav et al., (2020).** The trait Gluten content was recorded the nonsignificant negative correlation with grain yield per plant.

Genotypic Path Coefficient Analysis

The direct and indirect effects of various characters towards grain yield per plant at genotypic level are presented in Table 3. At genotypic level highest positive direct effect towards grain yield was observed by biological yield (0.883) followed by harvest index (0.818), days of 50% flowering (0.317), total number of spikelets per spikes (0.131), 1000 seeds weight (0.090), number of productive

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tillers per plants (0.046), while negative direct effect was exerted by days to maturity (-0.329) , number of grain per spikes (-0.297), plant height (-0.059), spike length (-0.051) and gluten content (-0.020). The direct effects of remaining characters on grain yield per plant were of low magnitude. The results are in agreement with **Singh et al., (2010), Abderrahmane et al., (2013), Kumar et al., (2019), Kumari et al., (2020).**

Phenotypic Path Coefficient analysis

The direct and indirect effect of various characters towards grain yield per plant at genotypic level is presented in Table 4. At phenotypic level highest positive direct effect towards grain yield was observed by biological yield per plant (0.732) followed by harvest index (0.621), days to maturity (0.130), spike length (0.068), number of grain per spikes (0.067), gluten content (0.057), number of productive tillers per plants (0.019). While, negative direct effect was exerted by days to 50% flowering (-0.067), 1000 seeds weight (-0.030) and plant height (-0.011). The direct effects of remaining characters on grain yield per plant were of low magnitude. The results are in agreement with **Singh et al., (2010), Kumar et al., (2019), Kumari et al., (2020).**

Conclusion

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Considerable variability existed in the genotypes for all the characters studied. The genotype HD-2664 (87.67) with high mean values in desirable direction showed early in flowering, the earliest maturity was shown by HD-3076 (120.00) and HD-2864 (84.00 cm.) is the short statured variety. High number of productive tillers per plants HD-3086 (6.70), the spike length is more in WB-1 (11.25), total number of spikelets per spikes is more in PBW-62-50 (20.93), highest number of grains per spikes is were present in PBW-62-50 (58.00), the highest 1000 seed weight is for HD-3086 (42.33), the highest gluten content is present in HD-2664 (10.90). The highest value of biological yield per plant was estimated in NW-306 (40.14), HD-3086 (45.60) recorded high value of harvest index and the maximum grain yield is from WB-1 (14.87). Direct effects as well as positive and significant association of grain yield per plant with biological yield per plant, harvest index, days of 50% flowering and total number of spikelets per spikes indicated that improvement in wheat can be achieved by selecting these characters.

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Table .1. Genotypic correlations

Characters	Days of 50% flowering	days to maturity	Plant heigth cm.	No. of productive tillers /plants	Spike Length cm.	Total no. of spikelets/ spikes	No. of Grains / spikes	1000 Seeds weight	Gluten content %	Biological yield / plant gm.	Harvest index %	Grain yield / plant gm.
Days of 50% flowering	1.000	0.833**	0.178	0.266**	0.243**	0.297**	0.197*	-0.031	-0.315**	0.203*	0.060	0.244**
days to maturity			0.186*	0.213*	0.120	0.152	-0.093	0.061	-0.483**	0.139	0.112	0.205*
Plant heigth cm.				0.643**	0.581**	0.612**	0.456**	0.363**	-0.101	0.543**	0.351**	0.682**
No. of productive tillers /plants					0.609**	0.554**	0.650**	0.362**	0.050	0.552**	0.558**	0.846**
Spike Length cm.						0.740**	0.653**	0.476**	0.030	0.498**	0.386**	0.681**
Total no. of spikelets/ spikes							0.731**	0.453**	-0.124	0.381**	0.424**	0.637**
No. of Grains / spikes								0.466**	-0.017	0.367**	0.582**	0.703**
1000 Seeds weight									0.080	0.219*	0.423**	0.489**
Gluten content %										0.090	-0.212*	-0.053
Biological yield / plant gm.											-0.130	0.722**
Harvest index %												0.595**
Grain yield / plant gm.												1.000

*, ** significant at 5% and 1% level, respectively

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Table 2. Phenotypic correlations

Characters	Days of 50% flowering	days to maturity	Plant heigth cm.	No. of productive tillers /plants	Spike Length cm.	Total no. of spikelets/ spikes	No. of Grains / spikes	1000 Seeds weight	Gluten content %	Biological yield / plant gm.	Harvest index %	Grain yield / plant gm.
Days of 50% flowering	1.000	0.617**	0.180*	0.194*	0.189*	0.278**	0.141	-0.028	-0.288**	0.189*	0.069	0.206*
days to maturity			0.124	0.221*	0.086	0.130	-0.055	0.024	-0.440**	0.119	0.090	0.212*
Plant heigth cm.				0.558**	0.538**	0.528**	0.350**	0.351**	-0.106	0.521**	0.319**	0.633**
No. of productive tillers /plants					0.497**	0.514**	0.567**	0.316**	0.054	0.518**	0.545**	0.818**
Spike Length cm.						0.547**	0.533**	0.400**	0.012	0.463**	0.310**	0.633**
Total no. of spikelets/ spikes							0.532**	0.374**	-0.105	0.336**	0.408**	0.570**
No. of Grains / spikes								0.296**	-0.014	0.336**	0.474**	0.631**
1000 Seeds weight									0.066	0.205*	0.402**	0.432**
Gluten content %										0.082	-0.207*	-0.050
Biological yield / plant gm.											-0.137	0.711**
Harvest index %												0.569**
Grain yield / plant gm.												1.000

*, ** significant at 5% and 1% level, respectively

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Table.3. Genotypic path with grain yield per plant (g)

Characters	Days of 50% flowering	days to maturity	Plant heigth cm.	No. of productive tillers /plants	Spike Length cm.	Total no. of spikelets/ spikes	No. of Grains / spikes	1000 Seeds weight	Gluten content %	Biological yield / plant gm.	Harvest index %	R with Grain yield / plant gm.
Days of 50% flowering	**0.317**	-0.274	-0.010	0.012	-0.012	0.039	-0.058	-0.003	0.006	0.179	0.049	0.244**
days to maturity	0.264	**-0.329**	-0.011	0.010	-0.006	0.020	0.028	0.006	0.010	0.122	0.092	0.205*
Plant heigth cm.	0.057	-0.061	**-0.059**	0.030	-0.030	0.080	-0.136	0.033	0.002	0.479	0.287	0.682**
No. of productive tillers /plants	0.084	-0.070	-0.038	**0.046**	-0.031	0.073	-0.193	0.033	-0.001	0.487	0.456	0.846**
Spike Length cm.	0.077	-0.039	-0.034	0.028	**-0.051**	0.097	-0.194	0.043	-0.001	0.440	0.316	0.681**
Total no. of spikelets/ spikes	0.094	-0.050	-0.036	0.026	-0.038	**0.131**	-0.217	0.041	0.003	0.337	0.347	0.637**
No. of Grains / spikes	0.062	0.031	-0.027	0.030	-0.033	0.096	**-0.297**	0.042	0.000	0.324	0.476	0.703**
1000 Seeds weight	-0.010	-0.020	-0.021	0.017	-0.024	0.060	-0.139	**0.090**	-0.002	0.193	0.346	0.489**
Gluten content %	-0.100	0.159	0.006	0.002	-0.002	-0.016	0.005	0.007	**-0.020**	0.079	-0.174	-0.053
Biological yield / plant gm.	0.064	-0.046	-0.032	0.025	-0.025	0.050	-0.109	0.020	-0.002	**0.883**	-0.107	0.722**
Harvest index %	0.019	-0.037	-0.021	0.026	-0.020	0.056	-0.173	0.038	0.004	-0.115	**0.818**	0.595**

Residual effect = 0.0186

*, ** significant at 5% and 1 % level, respectively

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Table. 4. Phenotypic path with Grain yield per plant (g)

Characters	Days of 50% flowering	days to maturity	Plant heigth cm.	No. of productive tillers /plants	Spike Length cm.	Total no. of spikelets/ spikes	No. of Grains / spikes	1000 Seeds weight	Gluten content %	Biological yield / plant gm.	Harvest index %	R with Grain yield / plant gm.
Days of 50% flowering	**-0.067**	0.080	-0.002	0.004	0.013	0.004	0.009	0.001	-0.017	0.138	0.043	0.206*
days to maturity	-0.041	**0.130**	-0.001	0.004	0.006	0.002	-0.004	-0.001	-0.025	0.087	0.056	0.212*
Plant heigth cm.	-0.012	0.016	**-0.011**	0.010	0.037	0.007	0.023	-0.011	-0.006	0.381	0.198	0.633**
No. of productive tillers /plants	-0.013	0.029	-0.006	**0.019**	0.034	0.007	0.038	-0.010	0.003	0.379	0.338	0.818**
Spike Length cm.	-0.013	0.011	-0.006	0.009	**0.068**	0.007	0.036	-0.012	0.001	0.339	0.193	0.633**
Total no. of spikelets/ spikes	-0.019	0.017	-0.006	0.010	0.037	**0.013**	0.036	-0.011	-0.006	0.246	0.253	0.570**
No. of Grains / spikes	-0.009	-0.007	-0.004	0.011	0.036	0.007	**0.067**	-0.009	-0.001	0.246	0.295	0.631**
1000 Seeds weight	0.002	0.003	-0.004	0.006	0.027	0.005	0.020	**-0.030**	0.004	0.150	0.250	0.432**
Gluten content %	0.019	-0.057	0.001	0.001	0.001	-0.001	-0.001	-0.002	**0.057**	0.060	-0.128	-0.050
Biological yield / plant gm.	-0.013	0.015	-0.006	0.010	0.031	0.004	0.022	-0.006	0.005	**0.732**	-0.085	0.711**
Harvest index %	-0.005	0.012	-0.003	0.010	0.021	0.005	0.032	-0.012	-0.012	-0.100	**0.621**	0.569**

Residual effect = 0.0274

*, ** significant at 5% and 1% level, respectively

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