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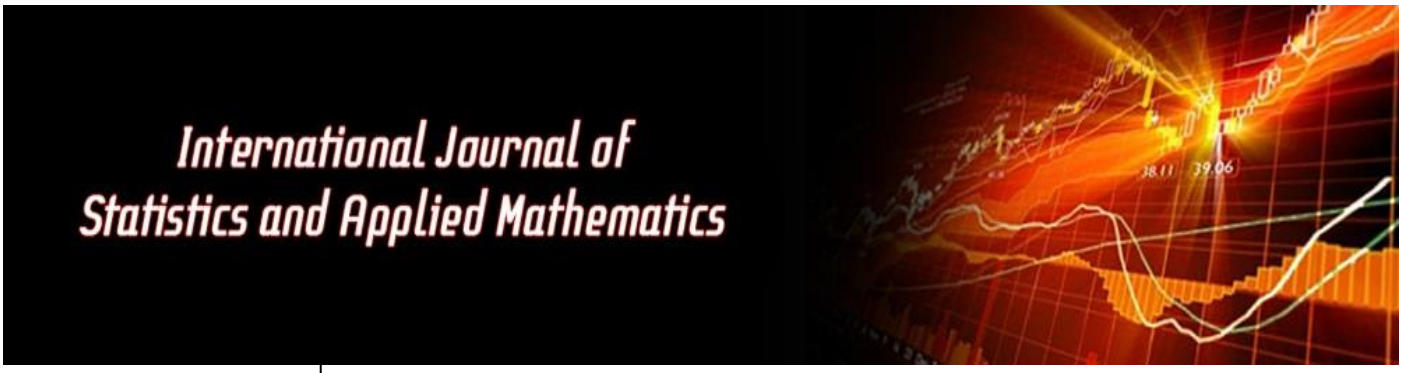

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Character association studies in wheat (*Triticum aestivum* L.) under high fertility conditions

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Abstract
The present investigation "Character association studies in Wheat (*Triticum aestivum* L.) under high fertility conditions" was carried out at BTC College of Agriculture and Research Station, Bilaspur (C.G.) during *Rabi* season of 2022-23. The study was conducted on 36 wheat genotypes and fertilizer doses 180:90:60 NPK kg/ha + Growth regulatore mix-(Chlormequat chloride (Lihocin) @ 0.2% + tebuconazole (Folicur, 430 SC) @ 0.1%) + 15 t. FYM to evaluate their quantitative traits and determine the association between seed yield and contributing characters. Various agro-morphological traits including days to heading, days to maturity, plant height (cm), number of tillers per plant, seed length, seed width, length of spike (cm) spikelets per spike, seeds per spike, test weight, biological yield per plant and seed yield per plant were recorded. In general values of genotypic correlation coefficient were higher than respective phenotypic levels. Only two characters *viz*., harvest index and biological yield per plant showed positive with seed yield per plant at both genotypic and phenotypic level. Test weight also had significant positive association with seed yield per plant at genotypic level. So the positive selection for test weight and biological yield can increase the seed yield under high fertility conditions. Spikelets per spike, seeds per spike and seed width showed significant negative correlation with seed yield per plant at genotypic level. Correlations of these characters are non-significant at phenotypic level. The significant negative association are unstable at two levels, needs to confirm the findings with another studies. Inter-correlation among yield attributing traits revels that days to 50% heading is significantly negatively associated with tillers per plant, indicating to isolate a early heading genotypes with high number of tillers per plant. Days to maturity and spike length did not showed any significant association with other yield attributing traits indicated that days to maturity is effected by the environmental factors. Plant heigh and tillers per plant are significantly negative correlated with seed width, suggesting the combination of high tillering and dwarf plant type with good seed width can be isolated. Number of seeds per spike will be increased with number of spikelets per spike. The negative association of spikelets per spike, seed width and seeds per spike with seed length, biological and grain yield per plant are unstable at two levels of correlation studies, needs to confirm in future studies under high fertility conditions. Correlation among seed characters *viz*., test weight, seed length and seed width are significant positive, indicated positive selection for any seed character improve all the seed characters. Increased biological yield per plant reduced the harvest index.

Keywords: Genotypic correlation coefficient, character association, wheat (*Triticum aestivum* L.)

Introduction
India achieves the highest wheat production of 112.74 million tons in the year 2022-23 with productivity of 35.43 q/ha. The highest wheat production of the country is attributed by higher average coverage by farmers with high yielding varieties. Resource management practices also contributed significantly to words the land mark achievement of wheat production in country. Crop improvement along with resource management technology played significant role for the per unit higher production. Varieties with high yield potential, climate resilient, biofortified and biotic-abiotic resistance contributed to higher production.
Globally, wheat have been under cultivation in 224.05 million hectares with the annual production reaching an all-time highest output of 793.37 million tons (Anonymous, 2022) [2]. Wheat was cultivated in 31.82 million hectares with highest production 112.74 million tones with national average productivity of 35.43 q/ha. Uttar Pradesh accounted for the highest share of crop output estimated at 34.91 million tons (31%).

The increase use of higher rates of macronutrient fertilizers like nitrogen, phosphorus and potassium on wheat crops over the years has led to changes in soil micronutrient levels and dynamics. Long-term field experiments have shown decreases in the availability and uptake of important micro elements in wheat, such as zinc, manganese, copper and boron, due to the accelerated uptake of major nutrients disrupting micronutrient cycling. The 'dilution effect' causes a decrease in micronutrient concentrations in plant tissues even when overall yields are increasing with higher fertilizer use.

Study of yield contributing components in respect of their genetic mechanism is very important for improvement in grain yield. Information regarding interrelationships between quantitatively inherited plant traits and their direct and indirect effects on seed yield is of great importance for success in selections in changed fertilizer and growth regulators application. The analysis of correlation coefficient is the one among numerous methods that can be used for this purpose but it cannot provide reasons of association. Path coefficient analysis is simply a standardized partial regression coefficient and as such measures the direct and indirect effect for one variable upon another and permits the separation of the correlation coefficient into components of direct and indirect effect under higher doses of fertilizer application. Using path coefficient analysis, it is easy to determine which yield component is influencing the yield substantially. Having this information, selection can then be based on that criterion thus making possible great progress through selection. Path coefficient analysis has been used by plant breeders to assist in identifying traits that are useful as selection criteria to improve crop yield.

Keeping in view the present study "Character association studies in Wheat (*Triticum aestivum* L.) under high fertility conditions" were caried out during the *rabi* season 2022-23 at instructional cum research Farm, Barrister Thakur Chhedilal College of Agriculture and Research Station, Sarkanda, Bilaspur (C.G.) with thirty-six wheat genotypes evaluated under high fertilizer application and twice use of growth retardants during crop growth stages

Materials and Methods

The present investigation was undertaken with 36 Wheat genotypes including four checks (DBW187, DBW303, DBW327, DBW332). The experiment laid out in Simple Lattice (6x6) with two replications in *Rabi* 2022-23 at Instructional Farm of Barrister Thakur Chhedilal College of Agriculture and Research Station, Bilaspur (Chhattisgarh). Wheat genotypes were evaluated in experiment plot area 41m X 15.4 m as per technical programme of work. Approximately 9.5 qt FYM added to experimental area @ 15 ton FYM per ha. Nitrogen 90 @ kg /ha phosphorus @ 90 kg/ha and potash @ 60 kg/ha were applied as basal by fertilizer urea, SSP and MOP 20 respectively. Nitrogen @ 45 kg/ha applied at first irrigation ie 20DAS by Urea and remains nitogen @ 45 kg/ha was applied after second irrigation ie 40 DAS. The experiment was conducted in an simple lattice (6x6) using two replications for each treatment. Each genotype was sown in plot size of 6 m X 1.2 m plot size with gross plot size of 7.20 m^2 in each replication. Thirty-six genotypes were grouped in six blocks and one meter gap was provided between two blocks. One meter gap is also given between two replications. Row- to-row and plant-to-plant distances were 20 cm and 10 cm, respectively. Tank mixed growth regulatore (Chlormequat chloride (Lihocin) @ 0.2% + tebuconazole (Folicur, 430 SC) @ 0.1%) was sprayed at node stage of crop which reached around 30 DAS. Second spray of same mixture is done at around 55 DAS. All the recommended cultural practices were adopted to raise a good stand for wheat cultivation.

Traits observed: 7 Observation recorded. Visible and measurable observations were recorded in thirty wheat genotypes. Visible observations like days to 50% heading and days to maturity are recorded on plot basis. Five randomly selected plants from each replication were observed to record other characters *viz*., plant height (cm), number of tillers per plant, number of spikelets per spike, length of spike (cm), number of seeds per spike, seed yield per plant (g), biological yield per plant (g). Test weight was recorded by choosing 1000 seed randomly and weighed in gm, however to record seed length (mm), seed width (mm) 20 seeds from each genotypes were taken and measured by vernier calliper. Harvest index (%) are calculated as per standard formula. Average of data from the sampled plant in term of different attributes were used for statistical analysis.

Statistical analysis: The 36 genotypes was estimated by method for knowing the correlation between two quantitative traits. Association attempts to determine the degree of relation between traits. It is represented by different characters with the help of the formula suggested by Miller *et al*. (1958).

Results and Discussion

Correlation coefficient analysis at genotypic and phenotypic level of the study were presented in Table 1. These correlations were obtained by application of 150% fertilizer of recommended doses (120:60:40 NPK kg/ha) with 15 ton FYM and two spray of growth regulators at first node and flag leaf stage. Findings will be discussed considering the fertilizer application its response to character association in wheat.

In general values of genotypic correlation coefficient were higher than respective phenotypic levels. Only two characters *viz*., harvest index and biological yield per plant showed positive with seed yield per plant at both genotypic and phenotypic level. Test weight also had significant positive association with seed yield per plant at genotypic level. So the positive selection for test weight and biological yield can increase the seed yield under high fertility conditions. Spikelets per spike, seeds per spike and seed width showed significant negative correlation with seed yield per plant at genotypic level. Correlations of these characters are non-significant at phenotypic level. The significant negative association are unstable at two levels, needs to confirm the findings with another studies.

Inter-correlation among yield attributing traits revels that days to 50% heading is significantly negatively associated with tillers per plant, indicating to isolate a early heading genotypes with high number of tillers per plant. Days to maturity and spike length did not showed any significant association with other yield attributing traits indicated that days to maturity is effected by the environmental factors. Plant height and tillers per plant are significantly negative correlated with seed width, suggesting the combination of high tillering and dwarf plant type with good seed width can be isolated. Number of grains per spike will be increased with number of spikelets per spike. The negative association of spikelets per spike, seed width and seeds per spike with seed length, biological and grain yield per plant are unstable at two levels of correlation studies, needs to confirm in future studies under high fertility conditions. Correlation among seed

characters *viz*., test weight, seed length and seed width are significant positive, indicated positive selection for any seed character improve all the seed characters. Increased biological yield per plant reduced the harvest index

Table 1: Genotypic (lower diagonal) and phenotypic (upper diagonal) correlation between yield and attributing characters in wheat

Characters	Days of heading	Days of maturity	Plant height (cm)	Number of tillers per plant	Number of Spikelets per spike	Length of spike (an)	Number of seeds per spike	Test Wright (g)	Seed length (mm)	Seed width (mm)	Biological yield per plant (g)	Harvest index (%)	Seed yield per plant (g)
Days of heading	1.00	0.094	-0.046	-0.294'	0.162	-0.192	0.005	-0.052	0.039	-0.000	0.182	-0.060	0.160
Days of maturity	0.101	1.00	0.178	0.030	0.170	0.125	-0.027	-0.114	-0.170	-0.073	0.010	-0.044	-0.008
Plant height(cm)	-0.031	0.199	1.00	0.231	0.023	-0.109	0.002	-0.058	-0.062	-0.223	-0.036	0.066	0.001
Number of tillers per plant	-0.322*	0.044	0.262*	1.00	-0.098	0.314**	0.188	0.008	0.079	-0.259*	0.028	0.086	0.080
Number of Spikelets per spike	0.194	0.220	0.047	-0.128	1.00	-0.107	0.628-	-0.061	-0.203	0.048	0.036	-0.076	0.002
Length of spike (cm)	-0.218	0.206	-0.135	0.381*	-0.12	LH	-0.064	-0.174	0.104	0.057	-0.130	0.066	-0.088
Number of seeds per spike	-0.030	-0.023	0.026	0.248'	0.776*	-0.094	1.00	-0.066	-0.226	-0.034	-0.083	0.058	-0.056
Test weight (g)	-0.044	-0.133	-0.073	0.051	-0.053	-0.189	-0.136	1.00	0.417**	0.323*	0.169	-0.049	0.125
Seed length (mm)	0.023	-0.190	-0.076	0.089	-0.278'	0.109	-0.368"	0.467**	110	0.461-	-0.109	0.139	-0.016
Seed width (mm)	0.027	-0.088	-0.277*	-0.274*	0.025	0.028	-0.005	0.369**	0.616**	1.00	-0.175	-0.068	-0.201
Biological yield per plant (g)	0.203	0.076	-0.013	0.045	-0.366**	-0.104	-0.353-	0.271*	-0.216	-0.268·	1.00	-0.297·	0.819**
Harvest index (%)	-0.058	-0.182	0.085	0.122	0.055	0.182	0.012	-0.074	0.289'	-0.231	4322·*	1.00	0.301*
Seed yield per plant (g)	0.198	-0.013	0.034	0.119	-0.341**	0.013	-0.36**	0.238*	-0.028	-0.39**	0.826**	0.267*	1.00

Conclusion

The genotypic and phenotypic correlation study revealed that seed yield per plant (g) had high positive association with biological yield per plant (g), seed width (mm), harvest index (%) and Test weight (g). The association studied indicated that seed yield of wheat genotypes can be improved by selecting genotypes having higher performances for the above characters.

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