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STUDIES ON CHARACTER ASSOCIATION AND PATH COEFFICIENT ANALYSIS FOR YIELD AND YIELD RELATED TRAITS IN GREENGRAM [*VIGNA RADIATA* (L.) WILCZEK]

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Abstract– Genetic association and path coefficient analysis were studied at phenotypic and genotypic levels in 19 genotypes of greengram for various quantitative characters during *kharif* 2022. The experimental design which was used to conduct the experiment was a randomized block design. Analysis of variance revealed highly significant differences among the genotypes for all the characters under study indicating the presence of adequate variability among the varieties. Estimates of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all characters. High heritability was observed with high genetic advance as mean percentage by 100 seed weight, biological yield and harvest index. Number of clusters per plant, number of pods per plant, number of seeds per pod, 100 seed weight, harvest index and seed protein content showed significant and positive phenotypic correlations in seed yield per plant. Specific seed yield per plant showed significant and positive genotypic correlation with number of clusters per plant, number of pods per plant, number of seeds per pod, 100 seed weight, harvest index and seed protein content. High magnitude of positive direct effect at phenotypic level on grain yield per plant was shown by number of clusters per plant, number of pods per plant, pod length, number of seeds per pod, 100 seed weight, biological yield, harvest index and seed protein. High intensity of positive direct effect at genotypic level on seed yield per plant, number of clusters per plant, harvest index, biological yield, plant height and number of pods per plant was applied by material.

INTRODUCTION

Greengram is one of the most prominant pulses grown in India. It is a rich source of protein, about 25% and very digestible. It is eaten in the form of "dal" (either whole or split, shelled and unshelled). This herb is used in South India as a vegetable or in savory dishes. Greengram is a good source of riboflavin and thiamin. Greengram improvement is largely dependent on selection between multiple parents with limited genetic variation. In self-pollinated species such as Vigna, the main challenge of the breeder is to concentrate superior alleles into one pure line or cultivar. Because of the evolutionary history of plants, it is clear that even the best plants do not have what can be described as economic value. The addition of high beneficiary alleles will greatly increase the genetic worth of the optimal population for breeders. A practical problem in this process is to identify procedures that will provide genetic information about breeding potential and determine the proportion of advantageous alleles present in one or more source populations in one or more languages population. Correlation coefficient analysis measures the correlation between different plant traits and identifies traits that are the basis for selection to improve genetic fertility. Correlation studies in the selection of suitable cultivars will provide reliable information on the nature, size and direction of selection, especially when breeders need to combine high yield potential with desired agronomic traits and grain quality traits. Path coefficient analysis is a standard regression coefficient that measures the direct effect of one variable on another variable. Direct harvesting is not a safe method as it affects the environment. Therefore, it is necessary to identify the characteristics of components that can increase yield.

MATERIALS AND METHODS

The research trial was conducted at the Student Instructor Farm, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, consisting of 19 greengram genotypes with three replications in a randomized block design during *kharif* 2022. Thirteen yield related parameters, namely days to 50% flowering, days to maturity, plant height (cm), number of branches per plant, number of clusters per plant, number of holes per plant, number of seeds per pod, 100 - correlation in phenotype. and genotype level and path coefficient analysis to assess seed weight (g), biological yield (g), yield index (%), seed protein content (%) and seed yield per plant (g) were studied for the estimation of genotypic and phenotypic correlation and direct and indirect effects.

RESULTS AND DISCUSSION

Analysis of variance rectified the significant differences for all the characters studied among the genotypes, stipulating that there is sufficient variability within the species. The estimated phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV) for all characters. High heritability, high genetic advance and weight of 100 seeds as an average percentage, biological yield and yield index were observed.

Correlation Coefficient Analysis

In Table 1 the present study of phenotypic correlation, the most important trait seed yield per plant displayed significant and positive phenotypic correlation with number of clusters per plant, number of pods per plant, number of seeds per pod, 100 seed weight, harvest index and seed protein content and had exhibited significant and negative correlation with days to 50% flowering, days to maturity and plant height.

In Table 2 the present study in genotypic correlation, the most important and dependent trait seed yield per plant had exhibited significant and positive genotypic association with number of clusters per plant, number of pods per plant, number of seeds per pod, 100 seed weight, harvest index and seed protein content and exhibited significant and negative genotypic correlation with days to 50% flowering, days to maturity, plant height and number of branches per plant.

Overall, the genotypic correlation coefficients were higher than phenotypic correlation coefficients revealing that there is strong inherent association between different pairs of characters in greengram genotypes.The present studies were collaborated with the findings of the earlier researchers (Tejaswini *et al.,* 2022 and Goyal *et al.,* 2021)

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Overall, the genotypic correlation coefficients were higher than phenotypic correlation coefficients revealing that there is strong inherent association between different pairs of characters in greengram genotypes. The present studies were collaborated with the findings of the earlier researchers (Tejaswini *et al.,* 2022 and Goyal *et al.,* 2021)

Path coefficient analysis

The direct and indirect effects of different characters on plant seed production at the phenotype and genotype levels are presented in Tables 3 and 4.

At the phenotypic level, the positive effect on yield per plant is significantly influenced by the number of clusters collected per plant, number of plant fish, pod length, number of pods, weight of 100 seeds, biological yield, yield and seed index. protein composition. At the phenotypic level, the highest magnitude of negative effects on plant grain yield was exertedby days to flowering, days to maturity, plant height, and number of shoots per shoot.

At the genotypic level of path analysis, the positive effect was higher on seed yield per plant, number of clusters per plant, yield index, biological yield, plant height and number of plant shoots. At

Table 1. Estimation of Phenotypic Correlation Coefficient among thirteen characters in Greengram.

TRAITS	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Number of clusters per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	100-seed weight (g)	Biological yield (g)	Harvest index (%)	Seed protein content (%)	Seed Yield per plant (g)
Days to 50% flowering	1	0.5037**	0.245	0.0668	-0.3649**	-0.3888**	0.1036	-0.2091	0.0341	0.0805	0.1575	-0.6014**	-0.422**
Days to maturity		1	-0.039	0.0863	-0.3287*	-0.5860**	0.0989	-0.2783*	-0.093	0.2598	0.0352	-0.5428**	-0.379**
Plant height (cm)			1	0.1199	-0.1692	-0.1081	0.1886	-0.2760*	0.0247	0.2810*	-0.3248*	-0.0741	-0.355**
Number of branches per plant				1	-0.1705	-0.0797	0.4519**	0.062	-0.1185	0.3465**	-0.1214	-0.1097	-0.2023
Number of clusters per plant					1	0.4754**	-0.2329	0.0443	0.3289*	-0.3706**	0.0877	0.3724**	0.4686**
Number of pods per plant						1	-0.1374	0.0859	0.046	-0.3296*	0.0745	0.4858**	0.383**
Pod length (cm)							1	-0.0071	-0.0322	0.3289*	-0.1121	-0.2710*	-0.0549
Number of seeds per pod								1	-0.2042	-0.1574	0.3400**	0.0711	0.483**
100-seed weight (g)									1	0.055	-0.1406	0.1114	0.2731**
Biological yield (g)										1	-0.3186*	-0.467**	-0.1667
Harvest index (%)											1	-0.1642	0.4339**
Seed protein content (%)												1	0.2848**

Table 2. Estimation of Genotypic Correlation Coefficient among thirteen characters in Greengram.

TRAITS	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Number of clusters per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	100-seed weight (g)	Biological yield (g)	Harvest index (%)	Seed protein content (%)	Seed Yield Per Plant (g)
Days to 50% flowering	1	0.7105**	0.268**	0.7028**	-0.5599**	-0.5541**	0.3303**	-0.6188**	0.069	0.0748	0.1747	-0.7024**	-0.5179**
Days to maturity		1	0.064	0.6159**	-0.674**	-0.9135**	0.6078**	-0.5171**	-0.1633	0.3304**	0.0138	-0.7951**	-0.4921**
Plant height (cm)			1	0.1652	-0.561**	-0.3311**	0.6944**	-0.61**	0.0325	0.3812**	-0.3975**	-0.2118	-0.4294**
Number of branches per plant				1	-0.2891**	-0.7334**	0.7442**	-0.3789**	-0.3836**	0.3462**	-0.253	-0.3908**	-0.4706**
Number of clusters per plant					1	0.9005**	-0.3132**	0.3415**	0.4788**	-0.5225**	0.1165	0.6594**	0.7198**
Number of pods per plant						1	-0.3623**	0.6516**	0.0464	-0.4524**	0.1061	0.6056**	0.5665**
Pod length (cm)							1	-0.3593**	0.0237	0.741**	-0.2275	-0.7565**	-0.028
Number of seeds per pod								1	-0.4121**	-0.2989**	0.6872**	0.3129**	0.8692**
100-seed weight (g)									1	0.061	-0.1458	0.1071	0.2737**
Biological yield (g)										1	-0.3226**	-0.541**	-0.1717
Harvest index (%)											1	-0.1971	0.4394**
Seed protein content (%)												1	0.3638**

Table 3. Direct (diagonal) and indirect effects of thirteen characters towards seed yield per plant at phenotypic level in Greengram.

Traits	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Number of clusters per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	100-seed weight (g)	Biological yield (g)	Harvest index (%)	Seed protein content (%)
Days to 50% flowering	-0.1789	-0.0901	-0.0438	-0.012	0.0653	0.0696	-0.0185	0.0374	-0.0061	-0.0144	-0.0282	0.1076
Days to maturity	-0.0031	-0.0062	0.0002	-0.0005	0.002	0.0036	-0.0006	0.0017	0.0006	-0.0016	-0.0002	0.0033
Plant height (cm)	-0.0251	0.004	-0.1025	-0.0123	0.0173	0.0111	-0.0193	0.0283	-0.0025	-0.0288	0.0333	0.0076
Number of branches per plant	-0.0149	-0.0192	-0.0267	-0.2229	0.038	0.0178	-0.1007	-0.0138	0.0264	-0.0772	0.0271	0.0245
Number of clusters per plant	-0.078	-0.0703	-0.0362	-0.0365	0.2139	0.1017	-0.0498	0.0095	0.0703	-0.0793	0.0188	0.0796
Number of pods per plant	-0.0492	-0.0742	-0.0137	-0.0101	0.0602	0.1266	-0.0174	0.0109	0.0058	-0.0417	0.0094	0.0615
Pod length (cm)	0.0176	0.0168	0.032	0.0767	-0.0395	-0.0233	0.1698	-0.0012	-0.0055	0.0558	-0.019	-0.046
Number of seeds per pod	-0.0732	-0.0974	-0.0966	0.0217	0.0155	0.0301	-0.0025	0.3499	-0.0715	-0.0551	0.1189	0.0249
100-seed weight (g)	0.0095	-0.0259	0.0069	-0.033	0.0917	0.0128	-0.009	-0.057	0.2788	0.0153	-0.0392	0.0311
Biological yield (g)	0.0237	0.0764	0.0826	0.1019	-0.109	-0.0969	0.0967	-0.0463	0.0162	0.294	-0.0937	-0.1375
Harvest index (%)	0.0692	0.0155	-0.1428	-0.0534	0.0386	0.0327	-0.0493	0.1495	-0.0618	-0.1401	0.4396	-0.0722
Seed protein content (%)	-0.1205	-0.1088	-0.0148	-0.022	0.0746	0.0974	-0.0543	0.0142	0.0223	-0.0937	-0.0329	0.2004
Correlation with Seed yield per plant	-0.4229**	-0.3794**	-0.355**	-0.2023	0.4686**	0.383**	-0.0549	0.483**	0.2731**	-0.1667	0.4339**	0.2848**

R SQUARE = 0.7428 RESIDUAL EFFECT = 0.5071

Table 4. Direct (diagonal) and indirect effects of thirteen characters towards seed yield per plant at genotypic level in Greengram.

Traits	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Number of clusters per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	100-seed weight (g)	Biological yield (g)	Harvest index (%)	Seed protein content (%)
Days to 50% flowering	-10.1077	-7.1819	-2.7091	-7.1032	5.6592	5.6002	-3.3381	6.2546	-0.6969	-0.7562	-1.7656	7.0999
Days to maturity	-3.5725	-5.028	-0.3216	-3.0968	3.3889	4.5931	-3.056	2.6	0.821	-1.6612	-0.0694	3.9978
Plant height (cm)	0.6886	0.1643	2.5691	0.4245	-1.4412	-0.8505	1.784	-1.5672	0.0836	0.9793	-1.0211	-0.5442
Number of branches per plant	-3.3182	-2.9082	-0.7802	-4.7217	5.6145	3.463	-5.4025	1.7892	1.8111	-4.9396	1.1945	5.6224
Number of clusters per plant	-6.1223	-7.3702	-6.1342	-13.0025	10.935	9.8473	-3.4249	3.7339	5.236	-5.714	1.2737	7.2107
Number of pods per plant	-0.477	-0.7864	-0.285	-0.6314	0.7752	0.8609	-0.3119	0.561	0.0399	-0.3895	0.0914	0.5213
Pod length (cm)	-3.6143	-6.6518	-7.5998	-12.5219	3.4277	3.965	-10.944	3.9319	-0.2589	-8.1098	2.4893	8.2788
Number of seeds per pod	11.7344	9.8061	11.5678	7.1857	-6.4753	-12.357	6.8131	-18.9633	7.8144	5.6687	-13.0321	-5.9328
100-seed weight (g)	-0.8171	1.935	-0.3856	4.5454	-5.6743	-0.5493	-0.2804	4.8833	-11.850	-0.7224	1.7283	-1.2695
Biological yield (g)	0.6168	2.7238	3.1424	8.6244	-4.3078	-3.7296	6.1089	-2.4643	0.5025	8.2439	-2.6595	-4.4602
Harvest index (%)	1.4969	0.1183	-3.406	-2.1678	0.9981	0.9096	-1.9491	5.889	-1.2498	-2.7645	8.5692	-1.6891
Seed protein content (%)	12.9747	14.6868	3.9129	21.9948	-12.1802	-11.1861	13.9729	-5.7789	-1.9788	9.9936	3.6408	-18.4713
Correlation with Seed yield per plant	-0.5179**	-0.4921**	-0.429**	-0.4706**	0.7198**	0.5665**	-0.028	0.8692**	0.2737**	-0.1717	0.4394**	0.3638**

R SQUARE = 0.6051 RESIDUAL EFFECT = 0.7577

the phenotypic level, the magnitude of the higher negative direct effect on grain yield per plant is influenced by the number of plant shoots, seed protein content, weight of 100 seeds, pod length, days to 50% flowering, days to maturity and the number of plant branches. The current study is supported by the findings of previous researchers (Muralidhara *et al*., 2015 and Ahmad *et al*., 2019).

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