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Correlation and path coefficient analysis for yield and it's components traits in chickpea (*Cicer arietinum* L.)

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Abstract
The present investigation entitled "Correlation and Path Coefficient analysis for yield and its components traits in Chickpea (*Cicer arietinum* L.)" was conducted to evaluate correlation, and path coefficient analysis in 22 chickpea (*Cicer arietinum* L.) genotypes, including two check varieties, during the *Rabi* 2024 season at Hirapuri Farm, Department of Genetics and Plant Breeding, Deen Dayal Upadhyay Gorakhpur University, Uttar Pradesh, India. The genotypes were evaluated using a randomized block design (RBD) with three replications. Data were recorded on eleven Agro-morphological traits: days to 50% flowering, days to maturity, plant height, primary branches per plant, secondary branches per plant, pods per plant, seeds per pod, seed yield per plant, biological yield, 100-seed weight, and harvest index. Correlation analysis revealed that phenotypic correlations were generally higher than genotypic correlations, suggesting a significant environmental influence. Seed yield per plant showed a positive and significant phenotypic correlation with biological yield, 100-seed weight, and harvest index, while genotypic correlations were positive and highly significant only with harvest index. Path coefficient analysis indicated that at the phenotypic level, days to 50% flowering, secondary branches, pods per plant, biological yield, and harvest index had a positive direct effect on seed yield. In contrast, at the genotypic level, days to maturity, plant height, secondary branches per plant, pods per plant, 100-seed weight, and harvest index showed a positive direct effect. Traits such as days to 50% flowering, primary branches per plant, seeds per pod, and biological yield exerted a negative direct effect at the genotypic level. The study concludes that these traits can serve as effective selection criteria for improving chickpea yield.

Keywords: Chickpea, genotypic correlation, path coefficient analysis, seed yield

Introduction
Chickpea (*Cicer arietinum* L.) is a self-pollinating diploid legume (2n = 16) with a genome size of approximately 738 Mbp, belonging to the Fabaceae family (Sofi *et al.* 2020) [12]. It is an important pulse crop cultivated since ancient times for its high nutritional value, containing 18-29% protein, 52-70% carbohydrates, 4-10% fat, 50-60% starch, along with dietary fiber, vitamins, calcium, phosphorus, and iron (Sofi *et al.* 2020; Vandemark *et al.* 2018) [20, 13]. Chickpeas are used in multiple forms including whole grains, splits (dal), flour (besan), salads, curries (chole), falafel, and hummus, and also serve as green fodder and dry straw for animals (Gaur *et al.*, 2015) [5]. Based on seed characteristics, chickpeas are classified into Desi, which have small, angular, rough-textured seeds with pink flowers and anthocyanin pigmentation, and Kabuli, which are large, smooth, beige-seeded types with white flowers and no anthocyanin (Singh, 2013) [10]. In India, chickpea is primarily a rabi (winter) crop, sown from October to November and harvested from February to March, mainly in states like Maharashtra, Madhya Pradesh, and Rajasthan, with limited kharif cultivation under irrigation in regions such as Andhra Pradesh and Karnataka (Gaur *et al.* 2015) [5]. India is the world's largest chickpea producer, expected to contribute approximately 11.337 million metric tonnes to the projected 2025 global production of 17.1 million tonnes, although its productivity per hectare is lower than countries like Ethiopia and the USA (AgPulse Analytica, 2025; ANGRAU, 2025; IGC, 2025) [1, 3, 6]. Correlation and path coefficient analyses are essential tools in plant breeding to identify the direct and indirect effects of various traits on seed yield, facilitating effective selection and genetic enhancement of desirable plant types (Banik *et al.* 2017) [4].

Materials and Methods

The present investigation was conducted with 20 chickpea genotypes with two check varieties, raised in randomized block design with three replications during the season of *rabi* 2024 at the experiment farm, Heera puri farm, Department of Genetics and Plant Breeding, Institute of Agriculture and Natural Sciences, Deen Dayal Upadhyay Gorakhpur University, U.P. India. A comprehensive evaluation of 22 chickpea genotypes (BDG 1059, BDG1060, BGM 556, BGM 559, BGM 571, HIR 70, HC 3, HB 07-163, HC 1, IC 424254, ICC 5789, ICC 5335, IPC 2005-23, IPC 2005-29, IPC 2005-79, IPC 99-34, PG 063, RKG 135, RVSSG 2, RVSSG 4(check), RVSSG 5(check) revealed significant genetic variability across all traits studied such as Days to 50% flowering, Days to maturity, Plant height (cm), Primary branches per plants, Secondary branches per plants, Pods per plants, Seeds per pods, Seed yield per plants (g), Biological yield (g), 100 seed weight (g), Harvest index (%). Observations were recorded by selecting randomly five competitive plants from each plot on eleven characters were analyzed first by randomized block design to test the significance of differences among the genotypes. Trait association studies were conducted using correlation and path analysis to quantify the interrelationships between different traits and to investigate the direct and indirect effects of different traits on yield and quality components respectively.

Results and Discussion

Chickpea germplasm data analysis was done to evaluate correlation coefficient, path coefficient analysis and their direct and indirect effects of various characters on seed yield in chickpea, and Further discussion are mentioned below:

Correlation coefficient analysis

The correlation studies showed that for almost all the characters phenotypic correlation were higher than genotypic correlation it means, the environment is playing a significant role in the expression of the trait, potentially masking the underlying genetic relationships. However, in some cases phenotypic correlation were obtained lower than genotypic correlation indicates, environmental influences playing a smaller role in masking or modifying the expression of that correlation. Results showed that phenotypic coefficient of correlation of seed yield per plant was found positive and highly significant with biological yield per plant, 100 seed weight, and harvest index, whereas, for genotypic coefficient of correlation was found negative and non-significant with biological seed yield and 100 seed weight while positive and highly significant with harvest index. These findings were also found by Singh *et al.* (2014) [7], Pravalika *et al.* (2024) [9].

Path coefficient analysis

Path coefficient analysis allows separation of the direct effect and their indirect effect through other attributes by partitioning the correlations (Wright, 1921) [14]. Phenotypic Path coefficient analysis revealed that the positive and direct effect on seed yield per plant has been exerted by days to 50% flowering, number of secondary branches, pods per plant, biological yield, and harvest index, while negative and direct effect on seed yield per plant by days to maturity, plant height, number of primary branches, seed per pod, 100 seed weight. The high indirect effects on seed yield per plant by biological yield via days to maturity, days to 50% flowering, secondary branches per plant and plant height; harvest index via days to maturity, and days to 50% flowering. These findings work in conformity with Yadav *et al.* (2020) [2], and Tadesse *et al.* (2020) [8]. And genotypic path coefficient analysis showed that the positive and direct effect on seed yield per plant has been exerted by Days to maturity, plant height, secondary branches per plant, pods per plant, 100 seed weight, and harvest index, while negative and direct effect by days to 50% flowering, primary branches per plant, seeds per pods, biological yield per plant. The high indirect effect on seed yield per plant by days to maturity via days to 50% flowering and days to maturity via secondary branches per plant. These findings were similar to result obtained by Kumar *et al.* (2014) [7], Yadav *et al.* (2020) [2].

Table 1: Estimates of phenotypic and genotypic correlation coefficients between eleven characters in chickpea genotypes.

Traits		Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches per plant	Secondary branches per plant	Pods per plant	Seed per pods	Seed yield per plant (g)	Biological yield per plant (g)	100 seed weight (g)	Harvest index (%)
Days to 50% flowering	P		0.9294 **	-0.37 **	-0.0475	0.5733 **	0.773 **	-0.1452	0.7516 **	0.1898	0.854 **	0.6361 **
	G		-0.477	-0.371	-0.9545	-0.2997	-0.7373 **	-0.8242	-0.6506 **	-0.0671	-0.4619	-0.7903 **
Days to maturity	P			-0.4253 **	-0.0406	0.4297 **	0.2674 **	-0.1257	0.2387	0.1531	0.8392 **	0.2243
	G			-0.6768	-0.5569	-0.3737	-0.3253	-0.7963	-0.4339	-0.1468	-0.404	-0.5967
Plant height (cm)	P				0.0373	0.6721 **	0.9447 **	0.2121	-0.0243	0.633 **	0.9185 **	-0.0471
	G				-0.3403	-0.3648	-0.208	-0.6113 **	-0.4905 *	-0.3263	-0.4711	-0.7898 **
Primary branches per plant	P					0.603 **	0.7032 **	0.9436 **	0.3813 **	0.952 **	0.956 **	0.2889 *
	G					-0.5358 *	-0.3191	-0.7458 **	-0.6306 **	-0.692 **	-0.6437 **	-0.7405 **
Secondary branches per plant	P						0.4254 **	-0.0682	0.9707 **	0.8555 **	0.716 **	0.7732 **
	G						0.0329	-0.7624 **	-0.3878	-0.7554 **	-0.9722	-0.6047 **
Pods per plant	P							0.0519	0.995 **	0.4376 **	0.3606 **	0.7412 **
	G							0.003	0.5153 *	0.1003	-0.5179 *	0.2591
Seeds per plant	P								0.194	-0.0641	0.9518 **	0.6333 **
	G								-0.0936	-0.8286 **	-0.4916 *	-0.1672
Seed yield per plant (g)	P									0.1395 **	0.8177 **	0.809 **
	G									-0.1404	-0.0165	0.7514 **
Biological yield per plant (g)	P										0.9382 **	0.6789 **
	G										-0.8386 **	-0.6104 **
100 seed weight (g)	P											-0.2272
	G											0.0355

Table 2: Direct and indirect effect of 10 characters on seed yield per plant in chickpea (*Cicer arietinum* L.)

Traits		Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches per plant	Secondary branches per plant	Pods per plant	Seeds per pod	Biological yield per plant (g)	100 Seeds per plant (g)	Harvest index (%)	Seed yield per plant (g)
Days to 50% flowering	P	0.8104	-2.2437	-0.0663	-0.0833	-0.1047	0.2199	-0.0878	1.8878	-0.0421	1.4614	1.7516
	G	-1.232	1.9358	-0.5606	0.0791	0.2151	-0.3153	0.3104	-0.2301	-0.2255	-0.6274	-0.6506
Days to maturity	P	1.3628	-3.9794	-0.1214	-0.152	-0.1884	0.4052	-0.154	3.3303	-0.0713	2.5445	2.9763
	G	-2.6904	3.8544	-1.0219	0.144	0.409	-0.5667	0.6459	-0.4616	-0.4789	-1.2677	-1.4339
Plant height (cm)	P	0.3385	-1.0201	-0.0495	-0.0499	-0.0612	0.1172	-0.045	1.1023	-0.0135	0.3077	0.6265
	G	-0.6637	0.8705	0.0606	0.0138	0.0341	-0.089	0.104	-0.0363	-0.1575	-0.627	-0.4905
Primary branches per plants	P	0.2927	-0.8791	-0.0343	-0.0608	-0.0494	0.0872	-0.0343	0.8173	-0.0162	0.258	0.3811
	G	-0.6431	0.842	-0.0946	-0.0113	0.0501	-0.1365	0.1269	-0.077	-0.0993	-0.5879	-0.6306
Secondary branches per plant	P	0.4244	-1.2572	-0.0486	-0.057	-0.0806	0.1768	-0.0559	1.1955	-0.0173	0.6907	0.9708
	G	-0.7567	1.0354	-0.1014	0.0217	0.019	0.0141	0.1297	-0.0841	-0.1855	-0.4801	-0.3879
Pods per plant	P	0.1645	-0.4991	-0.0172	-0.0186	-0.0326	0.1667	-0.0273	0.6018	-0.0053	0.662	0.995
	G	-0.2426	0.3137	-0.0578	0.0129	-0.0031	0.3556	-0.0005	0.0112	-0.0799	0.2057	0.5153
Seeds per pods	P	0.2242	-0.6472	-0.0225	-0.025	-0.0352	0.093	-0.062	0.5759	-0.014	0.5656	0.6529
	G	-0.6002	0.8988	-0.1699	0.0302	0.0713	0.0013	-0.0241	-0.0922	-0.0759	-0.1328	-0.0936
Biological yield per plant (g)	P	0.4184	-1.2152	-0.0479	-0.0516	-0.0654	0.1783	-0.05	1.3876	-0.0212	0.6064	1.1395
	G	-0.6801	0.9817	-0.0907	0.028	0.0707	0.0429	0.141	-0.0198	-0.1294	-0.4847	-0.1404
100 seed weight (g)	P	0.2648	-0.7392	-0.0167	-0.029	-0.0268	0.0447	-0.0346	0.6021	-0.0294	0.7816	0.8176
	G	-0.481	0.7348	-0.2838	0.0261	0.1124	-0.2215	0.0837	-0.0934	0.0779	0.0282	-0.0165
Harvest index (%)	P	0.1518	-0.4352	-0.0063	-0.0076	-0.0177	0.0919	-0.023	0.2842	-0.0129	1.1837	1.209
	G	-0.26	0.378	-0.2195	0.03	0.0566	0.1108	0.0285	-0.068	0.0055	0.6896	0.7514

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Conclusion
The correlation studies suggested that the environment has a significant influence on the expression of the traits with phenotypic coefficient of correlation, generally genotypic correlation indicates that environmental influences playing a smaller role in masking or modifying the expression of that correlation. According to the correlation studies, selecting genotypes with superior performance for the above-mentioned attributes can increase seed yield production. The phenotypic path coefficient shows positive and direct effect on seed yield per plant has been exerted by DFF, NSB, PPP, BY, and HI, while negative and direct effect on seed yield per plant by another DTM, PH, NPB, SPP, HSW, while genotypic path coefficient shows positive and direct effect on seed yield per plant by DTM, PH, NSB, PPP, HSW, and HI, while negative and direct effect by DFF, NPB, SPP, BY.

References
1. AgPulse Analytica. India's Chickpea Production Outlook 2025 [Internet]. 2025 [cited 2025 Jul 31]. Available from: https://hectar.blog
2. Ajay Kumar Yadav, Chaubey SK, Pyare R, Kumar A, Dwivedi DP. Correlation and path coefficient analysis of yield and its component in chickpea (*Cicer arietinum* L.). J Pharmacogn Phytochem. 2020;9(Special Issue 5):67-70.
3. ANGRAU. Chickpea Productivity Report: Comparative Study Among Major Producing Nations. 2025.
4. Banik P, Basu M, Biswas M. Correlation and path coefficient analysis in chickpea for yield and its attributes. Legume Res. 2017;40(5):875-879.
5. Gaur PM, Jukanti AK, Varshney RK. Impact of genomic technologies on chickpea breeding strategies. Agronomy. 2015;5(3):356-370.
6. International Grains Council (IGC). Grains Market Report: Chickpea Forecast 2024-25. 2025.
7. Kumar J, Singh D, Yadav RS. Correlation and path coefficient analysis for seed yield and its components in chickpea (*Cicer arietinum* L.) genotypes. Legume Res. 2014;37(6):591-595.
8. Tadesse M, *et al.* Correlation and path coefficient analysis for various quantitative traits in desi chickpea genotypes under rainfed conditions. J Agric Sci. 2020;[cited 2025 Jul 31]; Available from: [insert URL if available].
9. Pravalika Y, Aggarwal N, Kumar R, Tutlani A, Parveen S, Rathore M. Genotypic variability, correlation and path coefficient analysis for elite genotypes of chickpea (*Cicer arietinum* L.). Int J Bioresour Stress Manag. 2024;15(4):1-10.
10. Singh A. Chickpea genetic resources: types and classifications. Int J Agric Sci. 2013;5(1):124-129.
11. Singh TP, Raiger HL, Kumari J. Evaluation of chickpea genotypes for variability in seed protein content and yield components under restricted soil moisture condition. Indian J Plant Physiol. 2014;19:273-280.
12. Sofi PA, Wani SA, Wani SH. Nutritional and health benefits of chickpea. J Food Legumes. 2020;33(2):83-91.
13. Vandemark GJ, Miklas PN, Coyne CJ. Chickpea: breeding and genetics. Plant Breed Rev. 2018;42:419-444.
14. Wright S. Correlation and causation. Part I: Method of path coefficients. J Agric Res. 1921;20(7):557-585.