

**Original Research Article**

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## **Estimation of Correlation and Path Analysis for Quantitative traits in Chickpea (*Cicer arietinum* L.)**

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A study was carried out in the fields of Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh during 2018-2019. Fifty one genotypes of chickpea were evaluated for means and components of variability, heritability, genetic advance and interrelationships for various parameters, direct and indirect effect of various parameters for seed yield. Characters like days to maturity, followed by number of pods per plant, number of primary branches, number of secondary branches, number of pods per plant, number of seeds per pod, days to 50% flowering etc.. Grain yield had high positive and significant association with days to 50% flowering, plant height, number of primary branches, number of secondary branches, number of pods per plant, number of seeds per plant, biological yield and harvest index. Path coefficient analysis showed maximum direct contribution towards grain yield per plant with biological yield followed by harvest index.

### **Introduction**

Chickpea (*Cicer arietinum* L.) is an integral part of an Indian agriculture since time immemorial, because of only its intrinsic value in terms of higher protein content, carbohydrates, minerals, nitrogen fixing ability and indispensability as alternative crop for crop diversification. Chickpea (*Cicer arietinum* L.) occupies a prime position among the pulses in the country with a maximum hectarage, production and its high nutritive value. It is known to have originated in western Asia. It belongs to genus *Cicer* and

tribe Viciaceae, sub-order Papilionaceae of order Leguminosae (Bentham and Hooker, 1870). Total out of 39 known species are distributed mainly in central and western asia, two are found to be cultivated in india, viz; *Cicer arietinum* ( $2n = 14$ ) which is most widely cultivated and *Cicer soongaricum* ( $2n = 16$ ) cultivated in western temperate and alpine regions (9000-15000 ft.in altitude) of the Himalaya. Southwest Asia and the Mediterranean particularly South -East Turkey and Syria are considered as the primary centre of origin of chickpea Ethiopia is regarded as secondary centre of origin. Chickpea contains

about 17.7 to 38.5 per cent protein and 56.5 per cent carbohydrates besides ash, calcium, phosphorus and iron. Exudation from leaves called "amb" contains oxalic and malic acids which possess medicinal value and used for intestinal disorders, stomach aches, blood purification etc., germinating seeds are prophylactic against scurvy disease. The whole grains are also eaten as raw, boiled or roasted.

Chickpea is one of the most important Rabi pulse crops in Asia. India is largest producer (25%), importer (20%) and consumer (20%) of pulses in the world. In pulses, chickpea accommodates third position in the world.

### Materials and Methods

Fifty one genotypes of chickpea including check were evaluated during Rabi 2018-2019 following RBD with three replications. The research was conducted at the Field Experimentation Centre of Department of Genetics and Plant Breeding, Prayagraj, situated in the "Middle Gangetic Plains" which falls under agro-climatic zone. All the recommended cultural practices were adopted to maintain a healthy crop growth. Data regarding yield and twelve attributing traits viz, days to 50% flowering, plant height (cm), days to maturity, number of primary branches, number of secondary branches, number of seeds per pod, number of pods per plant, number of seeds per plant, seed index (g), days to 50% pod setting, biological yield (g), harvest index (%) and grain yield per plant were recorded for all the chickpea genotypes.

The character association estimated from variance and co variance components as given. While the direct and indirect effects of component traits on grain yield were measured by path analysis.

### Results and Discussion

Correlation analysis (Table 1) revealed that the grain yield per plant showed positive correlation to Days to 50% flowering showed positive significant association with grain yield per plant (0.517\*\*), Days to maturity showed positive significant association with number of secondary branches (0.167\*), days to 50% pod setting (0.381\*\*), Plant height showed positive significant association with number of primary branches (0.164\*), number of secondary branches (0.518\*\*), seed index (0.370\*\*), biological yield (0.390\*\*) and grain yield per plant (0.349\*\*), Number of primary branches showed positive significant association with number of secondary branches (0.484\*\*), number of pods per plant (0.426\*\*), number of seeds per plant (0.255\*\*), days to 50% pod setting (0.201\*\*), biological yield (0.432\*\*), harvest index (0.236\*\*) and grain yield per plant (0.349\*\*).

Number of secondary branches showed positive significant association with number of pods per plant (0.365\*\*), number of seeds per plant (0.351\*\*), biological yield (0.640\*\*), harvest index (0.347\*\*) and grain yield per plant (0.643\*\*), Number of pods per plant showed positive significant association with number of seeds per plant (0.738\*\*), biological yield (0.638\*\*), harvest index (0.245\*\*) and grain yield per plant (0.637\*\*), Number of seeds per plant showed positive significant association with number of seeds per pod (0.255\*\*), biological yield (0.570\*\*), harvest index (0.178\*\*) and grain yield per plant (0.560\*\*), Number of seeds per pod showed positive significant association with harvest index (0.231\*\*), Biological yield showed positive significant association with harvest index (0.493\*\*) and grain yield per hill (0.997\*\*). Harvest index showed positive significant association with grain yield per plant (0.559\*\*).

**Table.1** Estimation of genotypic and phenotypic correlation coefficient of 13 yield component traits with seed yield in chickpea during *rabi*, 2018

Sr. no	Character		Days to 50% Flowering	Days to Maturity	Plant height	Primary branches	Secondary branches	No. Pods per plant	No. seed per plant	No. seeds per pod	Seed Index	Days to 50% Pod Setting	Biologica l yield	Harvest Index	Seed yield/plant
1	Days to 50% Flowering	P	1	0.038	-0.119	-0.169*	-0.307**	-0.410**	-0.192*	0.129	-0.087	0.310***	-0.495**	-0.11	0.417**
		G	1	0.113	-0.155	-0.204*	-0.358**	-0.479**	-0.221**	0.15	-0.12	0.119	-0.586**	-0.242**	0.517**
2	Days to Maturity	P		1	0.084	0.047	0.155	-0.162*	-0.128	-0.306**	0.062	0.200*	0.084	0.063	0.091
		G		1	0.12	0.055	0.167*	-0.172*	-0.132	-0.365**	0.074	0.381**	0.092	0.114	0.098
3	Plant height	P			1	0.102	0.346**	-0.096	-0.085	-0.057	0.226**	-0.066	0.209**	0.003	0.197*
		G			1	0.164*	0.518**	-0.167*	-0.113	-0.077	0.370**	0.045	0.390**	-0.169*	0.349**
4	Primary branches	P				1	0.458**	0.403**	0.238**	-0.07	-0.079	0.113	0.401**	0.117	0.403**
		G				1	0.484**	0.426**	0.255**	-0.091	-0.079	0.201*	0.432**	0.236**	0.437**
5	Secondary branches	P					1	0.362**	0.347**	-0.075	0.011	-0.038	0.617**	0.223**	0.622**
		G					1	0.365**	0.351**	-0.087	0.015	-0.034	0.640**	0.347**	0.643**
6	No. Pods per plant	P						1	0.732**	-0.053	-0.239**	-0.119	0.619**	0.175*	0.623**
		G						1	0.738**	-0.061	-0.245**	-0.176*	0.638**	0.245**	0.637**
7	No. seed per plant	P							1	0.237**	-0.435**	-0.124	0.554**	0.13	0.549**
		G							1	0.255**	-0.451**	-0.188*	0.570**	0.178*	0.560**
8	No.seeds per pod	P								1	-0.148	-0.195*	-0.086	0.117	0.087
		G								1	-0.146	-0.345**	-0.101	0.231**	0.103
9	Seed Index	P									1	-0.079	0.082	-0.069	0.071
		G									1	-0.135	0.082	-0.09	0.072
10	Days to 50% Pod Setting	P										1	0.023	0.114	0.033
		G										1	0.06	0.099	0.057
11	Biological yield	P											1	0.256**	0.989**
		G											1	0.493**	0.997**
12	Harvest Index	P												1	0.392**
		G												1	0.559**

**Table.2** Estimation of path coefficient at genotypic level for 13 yield component traits with grain yield per plant in chickpea during *rabi*, 2018

No	Character	Days to 50% Flowering	Days to Maturity	Plant height	Primary branches	Secondary branches	No.Pods per plant	No. seed per plant	No. seeds per pod	Seed Index	Days to 50% Pod Setting	Biological yield	Harvest Index	Seed yield/plant
1.	<b>Days to 50% Flowering</b>	<b>0.0134</b>	0.0004	-0.0008	-0.0020	0.0018	-0.0014	-0.0036	-0.0028	-0.0008	-0.0016	0.5396	-0.0253	0.51693
2.	<b>Days to Maturity</b>	-0.0015	<b>0.0036</b>	0.0006	0.0005	-0.0008	-0.0005	-0.0022	0.0067	0.0005	-0.0050	0.0846	0.0119	0.09847
3.	<b>Plant height (cm)</b>	0.0021	0.0004	<b>0.0051</b>	0.0016	-0.0026	-0.0005	-0.0019	0.0014	0.0026	-0.0006	0.3590	-0.0176	0.349
4.	<b>Primary branches</b>	0.0027	0.0002	0.0008	<b>0.0098</b>	-0.0024	0.0012	0.0042	0.0017	-0.0005	-0.0026	0.3978	0.0246	0.43747
5.	<b>Secondary branches</b>	0.0048	0.0006	0.0027	0.0048	<b>-0.0050</b>	0.0011	0.0058	0.0016	0.0001	0.0004	0.5898	0.0362	0.64271
6.	<b>No. Pods per plant</b>	0.0064	-0.0006	-0.0009	0.0042	-0.0018	<b>0.0029</b>	0.0121	0.0011	-0.0017	0.0023	0.5873	0.0256	0.63697
7.	<b>No. seed per plant</b>	0.0030	-0.0005	-0.0006	0.0025	-0.0018	0.0022	<b>0.0164</b>	-0.0047	-0.0031	0.0025	0.5250	0.0186	0.55954
8.	<b>No. seeds per pod</b>	-0.0020	-0.0013	-0.0004	-0.0009	0.0004	-0.0002	0.0042	<b>-0.0183</b>	-0.0010	0.0045	0.0934	0.0241	0.10258
9.	<b>Seed Index</b>	0.0016	0.0003	0.0019	-0.0008	-0.0001	-0.0007	-0.0074	0.0027	<b>0.0069</b>	0.0018	0.0755	-0.0094	0.07225
10.	<b>Days to 50% Pod Setting</b>	-0.0016	0.0014	0.0002	0.0020	0.0002	-0.0005	-0.0031	0.0063	-0.0009	<b>-0.0131</b>	0.0555	0.0103	0.0567
11.	<b>Biological yield</b>	0.0079	0.0003	0.0020	0.0043	-0.0032	0.0019	0.0094	0.0019	0.0006	-0.0008	<b>0.9211</b>	0.0515	0.99658
12.	<b>Harvest Index</b>	0.0033	0.0004	-0.0009	0.0023	-0.0018	0.0007	0.0029	-0.0042	-0.0006	-0.0013	0.4539	<b>0.1044</b>	0.55919

**Table.3** Estimation of path coefficient at phenotypic level for 13 yield component traits with grain yield per plant in chickpea during *rabi*, 2018

No	Character	Days to 50% Flowering	Days to Maturity	Plant height	Primary branches	Secondary branches	No. Pods per plant	No. seed per plant	No. seeds per pod	Seed Index	Days to 50% Pod Setting	Biological yield	Harvest Index	Seed yield/plant
1.	<b>Days to 50% Flowering</b>	<b>-0.0166</b>	0.0002	0.0002	-0.0007	-0.0006	-0.0039	-0.0021	-0.0009	-0.0009	0.0002	0.4586	-0.0167	0.41686
2.	<b>Days to Maturity</b>	-0.0006	<b>0.0040</b>	-0.0001	0.0002	0.0003	-0.0016	-0.0014	0.0021	0.0006	0.0001	0.0775	0.0095	0.0906
3.	<b>Plant height</b>	0.0020	0.0003	<b>-0.0013</b>	0.0004	0.0006	-0.0009	-0.0009	0.0004	0.0023	0.0000	0.1934	0.0005	0.19663
4.	<b>Primary branches</b>	0.0028	0.0002	-0.0001	<b>0.0040</b>	0.0008	0.0039	0.0026	0.0005	-0.0008	0.0001	0.3716	0.0177	0.40315
5.	<b>Secondary branches</b>	0.0051	0.0006	-0.0005	0.0018	<b>0.0018</b>	0.0035	0.0037	0.0005	0.0001	0.0000	0.5712	0.0337	0.62158
6.	<b>No. Pods per plant</b>	0.0068	-0.0006	0.0001	0.0016	0.0007	<b>0.0096</b>	0.0079	0.0004	-0.0024	-0.0001	0.5729	0.0264	0.6232
7.	<b>No. seed per plant</b>	0.0032	-0.0005	0.0001	0.0010	0.0006	0.0070	<b>0.0107</b>	-0.0016	-0.0043	-0.0001	0.5129	0.0197	0.54872
8.	<b>No. seeds per pod</b>	-0.0022	-0.0012	0.0001	-0.0003	-0.0001	-0.0005	0.0025	<b>-0.0069</b>	-0.0015	-0.0001	0.0792	0.0177	0.0868
9.	<b>Seed Index</b>	0.0015	0.0002	-0.0003	-0.0003	0.0000	-0.0023	-0.0047	0.0010	<b>0.0099</b>	0.0000	0.0763	-0.0104	0.07099
10.	<b>Days to 50% Pod Setting</b>	-0.0051	0.0008	0.0001	0.0005	-0.0001	-0.0011	-0.0013	0.0013	-0.0008	<b>0.0005</b>	0.0209	0.0172	0.03276
11.	<b>Biological yield</b>	0.0082	0.0003	-0.0003	0.0016	0.0011	0.0060	0.0060	0.0006	0.0008	0.0000	<b>0.9257</b>	0.0386	0.98856
12.	<b>Harvest Index</b>	0.0018	0.0003	0.0000	0.0005	0.0004	0.0017	0.0014	-0.0008	-0.0007	0.0001	0.2370	<b>0.1507</b>	0.39231

The phenotypic correlation with Days to 50% flowering showed positive significant association with grain yield per plant (0.417\*\*), Days to maturity showed positive significant association with days to 50% pod setting (0.200\*\*), Plant height showed positive significant association with number of secondary branches (0.346\*\*), seed index (0.226\*\*), biological yield (0.209\*\*) and grain yield per plant (0.197\*\*), Number of number of panicles per hill showed positive significant association with number of secondary branches (0.458\*\*), number of pods per plant (0.403\*\*), number of seeds per plant (0.238\*\*), biological yield (0.401\*\*) and grain yield per plant (0.403\*\*), Number of secondary branches showed positive significant association with number of pods per plant (0.362\*\*), number of seeds per plant (0.347\*\*), biological yield (0.617\*\*), harvest index (0.223\*\*) and grain yield per plant (0.622\*\*), Number of pods per plant showed positive significant association with number of seeds per plant (0.732\*\*), biological yield (0.619\*\*), harvest index (0.175\*\*) and grain yield per plant (0.623\*\*), Number of seeds per plant showed positive significant association with number of seeds per pod (0.237\*\*), biological yield (0.554\*\*) and grain yield per plant (0.549\*\*), Biological yield showed positive significant association with harvest index (0.256\*\*) and grain yield per plant (0.989\*\*), Harvest index showed positive significant association with grain yield per plant (0.392\*\*). These traits seem to be major yield factors, hence selection of these characters will be effective for improvement on seed yield. These findings are in accordance with (Table 1).

Path coefficient analysis is the most widely used biometrical technique in plant breeding. The information obtained from this technique, also helps in making selection based on component characters of yield. It helps in understanding the cause of association

between two variables. Traits viz., The path analysis at genotypic level indicated that days to 50% flowering (0.0134), days to maturity (0.0036), plant height (0.0051), number of primary branches (0.0098), number of pods per plant (0.0029), number of seeds per plant (0.0164), seed index (0.0069), biological yield (0.921) and harvest index (0.1044) showed positive direct effect on grain yield per plant.

The path analysis at phenotypic level indicated that days to maturity (0.0040), number of primary branches (0.0040), number of secondary branches (0.0018), number of pods per plant (0.0096), number of seeds per plant (0.0107), seed index (0.0099) days to 50% pod setting (0.0005), biological index (0.9257) and harvest index (0.1507) showed positive direct effect on grain yield per plant (Table 2 and 3).

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