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Correlation and path coefficient analysis of yield and its component in chick pea (*Cicer arietinum* L.)

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Abstract
The present experiments were carried out in two consecutive year of Rabi season of 2006-07 and 2007-08 at Agriculture Research Farm of S.D.J.P.G. College, Chandeshwar, Azamgarh (UP) with a view to selection correlation and path coefficient analysis of chickpea. An experiment was connected with sixty variety of cheek pea to Check the correlation and path co-efficient of there lines in different Environment. Results indicated that seed yield/plant was positively Associated with all the component characters except plant height. The correlation coefficient of seed yield were highly significant with Secondary branches/plant and biological yield showed significant Correlation with primary branches/plant pods/plant seed/pod and harvest index. On the basis of pooled data, path coefficient analysis showed that biological yield harvest index, secondary branches and days to flowering were important characters that could be taken into consideration for selection and improvement of seed yield in chickpea.

Keywords: Path coefficient, yield, component, chick pea, *Cicer arietinum* L.

Introduction
Pulse crops are highly valuable grain legumes that are widely used as food, Fodder and feed pulses are important constituent of the Indian diet and supply A major part of the protein requirement. Plus crops, besides being rich in protein and some of the essential amino acids especially lysine (Chatterjee and ASROL, 1975) In India the total food production in 1999-2000 was 209 million tonnes out of which only 13.4 million tonnes was contributed by pulses
The production of cereals increased by 460% since 1950-51 but the production of pulses has remained more or less static. However about 1/3 of total area of pulses in India. A number of pulse crops are grown in Among them chickpea (*Cicer aretinum* L.) commonly known as gram is the most important pulse crop of India .it belong to the most important pulse crop of Inda. It Bengal gram is the most important pulse crop of India. It belong gram is the family leguminosae (previously. a sub family papilionaceae or fasciae or presently fabaceae).Its somatic chromosome number is 2n=16 (Mercy *et al*. 1974). It is used for human consumption as well as for feeding to animal .it is eaten both whole fried or boiled and salted or in the form of the split pulse which is cooked and eaten. Gram is considered to have medicinal properties and it is used for blood purification and gram contains 21.1 per cent protein 61.5 per cent carbohydrate 4.5 per cent fat. It is also rich in calcium, iron and niacin.
Due to its high protein content and several other properties, this pulse has high potentiality of production and productivity. In India, production of pulses including chickpea remain static. Therefore, to fulfill the demand of pulses by continuously growing human population, the production and productivity must be increased, by improving the crop using breeding procedures and by adopting better management practices. A Knowledge of correlation between different character and yield is important for simultaneous improvement of one trait selection the basis of other trait path co efficient analysis (Dewey and lu, 1959) partition the correlation co-efficient into direct and indirect that enables the breeds to choose, most important character on the basis of which selection can be made to improve the crop work on correlation and path analysis in chick pea has been done Earline by several workers (Ram *et al*, 1980, Bahl *et al.*, 1976 Yadav *et al*. 2002 [19], yucel *et al* 2006 [20]. Singh 2007 [14]. there fore, the present experiments have been taken.

Materials and Methods
The experiment was conducted during the winter seasons of 2006-07 and 2007-08 and utilized a Randomized Blocks Design RBD With 3 replication at arid condition in the research area of the department of field crops at the agricultural farm of Sri Durga Ji Post Graduate College,

Chandeshwar, Azamgarh, U.P. Sixty (60) varieties/lines/genotypes of chick pea obtained from the Directorate of Pulses Research I.A.R.I. New Delhi, and the Department of Genetics and Plant Breeding, N.D. University of Agricultural and Technology Kumarganj, Faijabad. The list of the Varieties/lines/genotypes of chick pea. H.o.o 108, Pusa 212,Pusa 256, Pusa 362, Pusa 372, Pusa 1088, B.G. 203, B.G. 209, B.G. 313, B.G. 376,, B.G. 390, B.G. 391, B.G. 1044, B.G. 1053, B.G. 1054, B.G. 1072, B.G. 1073, B.G. 1101, B.G. 1103, B.G. 1105, B.G. 1107, B.G. 1108, B.G. 2019, B.G. 2024, Green 112, KWR 108, DCP 92-23, F.G. 700 Vijay, GPF 2,PG 114,CSG 8962, Avarodhi, PDG 6, PBG 1, MPJG 2000-108, ICC 349, ICC 5221, ICCV 16-2, J.B. 62,J.B. 315,J.G. 315,IPC 94-19,IPC 2000-20,EC 442530, ICRISAT 3070, ICRISAT 3073, ICRISAT 3074, ICRISAT 7806, S.B.D. 377, K 850, Udai, ICCV 88503, B.G. 256, IPCK 96-3, J.G. 74, BGD 72, BGD 1005, EC 539009, ILC 2002. Each of the 60 genotypes were sown in Each line sown in 3 rows of 3 meter length in each replication. Row- to-Row and plant-to-plant distances were 30 cm and 10 cm, plant to plant space .Before sowing nitrogen 20kg/ha phosphorus 60kg/ha and potash 30kg/ha fertilizer was applied. Observations were recorded such as days to 50% Flowing, Days to Maturity ,Number of root nodules per plant, Plant height (cm),Number of primary branches per plant, Number of secondary branches per plant, Number of pods per plant, Number of seeds per pod,100-seed weight (g), Biological yield (g),Harvest index (%),Protein content in seed (%), Seed yield per plant (g).

Results and Discussion

Correlation coefficient among different character

Seed yield/plant was positively associated with all the component characters except plant height (Table-1). The correlation coefficients of seed yield were highly significant with secondary branches/plant (rp=0.606) and biological yield (rp=0.946). Seed yield showed significant correlation with primary branches/plant (rp=0.302), pods/plant (rp=0.590), seeds/pod (rp=0.283) and harvest index. Positive and non-significant correlation of protein content was observed with, days to flowering, days to maturity, root nodules, primary branches, secondary branches/plant, pods/plant, 100-seed weight, biological yield and harvest index. Positive and non-significant correlation of harvest index was observed with root nodules, secondary braches/plant, pods/plant, seeds/pod and biological yield. Association of biological yield was positive and significant with days to maturity (rp=0.264) and primary branches (rp=0.365), secondary branches (rp=0.576) and pods/plant (rp=0.558). Correlation of 100-seed weight was negative and significant with pods/plant (rp= -0.359) and seeds/pod (rp= -0.633). Seeds/pod showed positive and significant correlation with secondary branches (rp=0.347) and with pods/plant (rp=0.465), while negative and significant association with plant height (rp= -0.283). Pods/plant showed positive and significant association with primary branches (rp=0.332) and secondary branches (rp=0.655) whereas negative association with plant height (rp= -0.253). Secondary branches had positive correlation with root nodules (rp=0.262) and primary branches (rp=0.394). The number of primary branches showed positive and significant association with days to flowering (rp=0.286). Negative and significant correlation and plant height was observed with days to maturity (rp= -0.255). There was positive and significant correlation of root nodules with days to flowering (rp=0.277) and days to maturity (rp=0.237). Days to maturity and days to flowering (rp=0.313) were positively and significantly correlated with each other.

Strong genotypic correlation was observed between biological yield and seed yield (rg=0.950), between secondary branches and seed yield (rg=0.611) and between pods/plant and seed yield (rg=0.592). Seeds/pod and 100-seed weight showed strong negative association (rg= -0.699). Similar findings made by Singh *et al.* (1985), Mosijidis *et al*. (1986), Singh and Singh (2002) [13]. Shindhu and Prasad (1987) reported that days to maturity, 100-seed weight, pods/plant, seeds/pod and harvest index were positively correlated with seed yield. These findings are similar to the findings of the present experiments. Results similar to the present findings were reported by Govil and Kumar (1989), Malik *et al.* (1988), Shukla *et al.* (1988) and Sindhu *et al.* (1989). Singh *et al.* reported that root volume was highly correlated with root nodules and root weight. Positive and significant association of seed yield with number of primary branches/plant, pods/plant, seeds/plant, 100-seed weight and harvest index was observed in present experiment. These finding were accordance with Tagore and Singh (1990), Raval and Dobariya (2003), Sindhu (1991) [11], Rao *et al.* (1994) [7], Arora (1994) [1] and Tripathi *et al.* (1995) [17]. Babber and Patel (2005) Observed positive and significant correlation between seed yield with biological yield pod weight, pod number and days to maturity. Similar finding were also reported by Renukadevi and Subbalakshmi (2006) [8], yucel *et al*. (2006) [20], meena *et al.* (2006), Singh (2007) [14] and Talebi *et al*. (2007) [16].

Genotypic path coefficient analysis

Genotypic correlation coefficients of seed yield and other 12 characters were partitioned in to direct and indirect effects which are presented in (Table). Path analysis showed that the traits primary branches, secondary branches, seeds/pod, 100-seed weight, biological yield, harvest index and protein content exerted positive direct effects, while days to flowering, days to maturity, root nodules, plant height and pods/plant had negative direct effect on seed yield/ plant. The maximum direct effects was exerted by biological yield (0.922), followed by harvest index (0.307) and 100-seed weight (0.052), seeds/pod (0.035), primary branches (0.019) and protein content (0.013). Negative direct effects of days to flowering, days to maturity, plant height and pods/plant were overcome by positive indirect effects of these characters via other characters resulting into positive genotypic correlation with yield.

Phenotypic path coefficient analysis

Phenotypic path analysis (Table-3) showed that 4 traits had negative direct effects on seed yield, they were days to flowering, root nodules, plant height and pods/plant. Highest positive direct effects on seed yield/plant was exerted by biological yield (0.920), harvest index (0.303),100-seed weight (0.044), seeds/pod (0.025), Protein content (0.015), primary branches (0.012) and secondary branches (0.010). indirect effect of primary branches via biological yield was positive that caused significant positive correlation with yield (rp=0.302). Similarly indirect effect of secondary branches via biological yield also increased the value of correlation coefficient with seed yield. Pods/plant had negative direct effect but its indirect effect via biological yield (0.513) caused increased negative of correlation coefficient to become significant (rp=0.590). similarly indirect effects of seeds/pod and protein content via biological yield was also positive

resulting in positive and significant correlation with seed yield. On the basis of pooled data, path coefficient analysis showed that biological yield, harvest index, secondary branches and days to flowering were important characters that could be taken into consideration for selection and improvement of seed yield in chickpea. Toker and Cagirgan (2003), Arora *et al*. (2003) [2], Raval and Dobariya (2003), Chaudhary *et al*. (1992), Singh *et al*. (1997) [12] also reported that biological yield and harvest index were the most important characters contributing highest positive direct effects on seed yield. Singh (2007) [14] reported the high positive direct effect of biological yield and pods/plant an seed yield.

Path coefficient analysis was studied by several workers. Singh *et al.* (2002) [13], Shukla (1988), Khorgade *et al.* (1995) Sandhu and Mangat (1995) [9] Singh and Singh (2002) [13], Singh *et al.* (2001) noted highest direct effect of biological yield on grain yield, followed by number of pods/plant and harvest index. Similar result were also observed in by a number of workers. Narayan and Reddy (2002) [6], Rao and Kumar (2003), Jahansouz *et al.* (2004) and Talebi *et al.* (2007) [16] also reported similar results.

Table 1: Estimates of correlation coefficient among different characters in chickpea grown environments (E I)

Sr. No.	Characters	Days to 50% flowering	Days to maturity	Root nodules/plant	Plant height	Primary branches	Secondary branches	Pods/ Plant	Seeds/ Pod	100-Seed weight	Biological Yield	Harvest Index	Protein content	Seed Yield/plant
1	Days to 50% flowering	rp	0.313*	0.277*	-0.169	0.286*	0.098	0.044	0.027	0.114	0.106	-0.117	0.117	0.068
		rg	0.437	0.287	-0.178	0.332	0.100	0.045	0.034	0.114	0.108	-0.127	0.129	0.069
2	Days to maturity		rp	0.237	-0.255*	0.236	0.085	0.190	0.191	-0.007	0.264*	-0.162	0.152	0.202
			rg	0.373	-0.317	0.414	0.151	0.284	0.293	-0.013	0.400	-0.198	0.218	0.321
3	Root nodules/plant			rp	0.033	0.147	0.262*	0.119	0.162	-0.011	0.244	0.010	0.159	0.223
				rg	0.040	0.160	0.279	0.228	0.191	-0.007	0.254	0.026	0.166	0.237
4	Plant height				rp	-0.091	-0.125	-0.253	-0.283*	0.219	-0.046	-0.147	-0.006	-0.099
					rg	-0.154	-0.140	-0.271	-0.333	0.221	-0.059	-0.180	-0.008	-0.120
5	Primary branches/plant					rp	0.394**	0.332**	0.100	0.016	0.365**	-0.168	0.090	0.302*
						rg	0.413	0.351	0.057	0.015	0.380	-0.176	0.105	0.316
6	Secondary branches/plant						rp	0.655**	0.347**	-0.143	0.576**	0.204	0.078	0.606**
							rg	0.662	0.361	-0.150	0.579	0.222	0.080	0.611
7	Pods/plant							rp	0.465**	-0.359**	0.558**	0.237	0.053	0.590**
								rg	0.506	-0.366	0.560	0.250	0.052	0.592
8	Seeds/pod								rp	-0.633**	0.230	0.231	-0.095	0.283*
									rg	-0.699	0.247	0.259	-0.101	0.303
9	100-seed weight									rp	0.106	-0.182	0.229	0.069
										rg	0.105	-0.201	0.231	0.066
10	Biological yield										rp	0.027	0.118	0.946**
											rg	0.037	0.120	0.950
11	Harvest index											rp	0.049	0.328*
												rg	0.054	0.338
12	Protein content												rp	0.145
													rg	0.148

Notes: rp = Phenotypic correlation coefficient, rg = Genotypic correlation coefficient, ** = Significant of 0.01 P Level, * = Significant of 0.05 P level

Table 2: Genotypic path coefficient analysis considering seed yield as dependent trait and other 12 characters as independent traits in chickpea in the, sowing.

S. N	Characters	1	2	3	4	5	6	7	8	9	10	11	12	Genotypic correlation with yield (rg)
1	Days to 50% flowering	-0.004	-0.001	-0.004	0.002	0.006	0.000	0.000	0.001	0.006	0.100	-0.039	0.002	0.069
2	Days to maturity	-0.002	-0.001	-0.005	0.003	0.008	0.001	-0.003	0.010	-0.001	0.368	-0.061	0.003	0.321
3	Root nodules/plant	-0.001	-0.001	-0.014	0.000	0.003	0.001	-0.002	0.007	0.000	0.234	0.008	0.002	0.237
4	Plant height	0.001	0.000	-0.001	-0.010	-0.003	-0.001	0.003	-0.012	0.011	-0.055	-0.055	0.000	-0.120
5	Primary branches	-0.001	-0.001	-0.002	0.001	0.019	0.002	-0.003	0.002	0.001	0.350	-0.054	0.001	0.316
6	Secondary branches	0.000	0.000	-0.004	0.001	0.008	0.005	-0.006	0.013	-0008	0.533	0.068	0.001	0.611
7	Pods/plant	0.000	0.000	-0.003	0.003	0.007	0.003	-0.009	0.018	-0.019	0.516	0.077	0.001	0.592
8	Seeds/pod	0.000	0.000	-0.003	0.003	0.001	0.002	-0.005	0.035	-0.036	0.228	0.079	-0.001	0.303
9	100-Seed Weight	0.000	0.000	0.000	-0.002	0.000	-0.001	0.003	-0.025	0.052	0.097	-0.062	0.003	0.066
10	Biological Yield	0.000	-0.001	-0.004	0.001	0.007	0.003	-0.005	0.009	0.005	0.922	0.011	0.002	0.950
11	Harvest Index	0.001	0.000	0.000	0.002	-0.003	0.001	-0.002	0.009	-0.010	0.034	0.307	0.001	0.338
12	Protein Content	-0.001	0.000	-0.002	0.000	0.002	0.000	0.000	-0.004	0.012	0.111	0.017	0.013	0.148
	Residual=0.0045													

Notes: Under lined values are direct effects

Table 3: Phenotypic path coefficient analysis considering seed yield as dependent trait and other 12 characters as independent traits in chickpea in the, sowing

S. N	Characters	1	2	3	4	5	6	7	8	9	10	11	12	Phenotypic correlation with yield (rp)
1	Days to 50% flowering	-0.005	0.000	-0.004	0.002	0.003	0.001	0.000	0.001	0.005	0.098	-0.036	0.002	0.068
2	Days to maturity	-0.001	0.000	-0.003	0.004	0.003	0.001	-0.001	0.005	0.000	0.242	-0.049	0.002	0.202
3	Root nodules/plant	-0.001	0.000	-0.013	0.000	0.002	0.003	-0.001	0.004	0.000	0.224	0.003	0.002	0.223
4	Plant height	0.001	0.000	0.000	-0.014	-0.001	-0.001	0.001	-0.007	0.010	-0.042	-0.044	0.000	-0.099
5	Primary branches	-0.001	0.000	-0.002	0.001	0.012	0.004	-0.001	0.003	0.001	0.336	-0.051	0.001	0.302
6	Secondary branches	0.000	0.000	-0.003	0.002	0.005	0.010	-0.002	0.009	-0.006	0.530	0.062	0.001	0.606
7	Pods/plant	0.000	0.000	-0.003	0.004	0.004	0.007	-0.003	0.012	-0.016	0.513	0.072	0.001	0.590
8	Seeds/pod	0.000	0.000	-0.002	0.004	0.001	0.004	-0.001	0.025	-0.028	0.211	0.070	-0.001	0.283
9	100-Seed Weight	-0.001	0.000	0.000	-0.003	0.000	-0.001	0.001	-0.016	0.044	0.097	-0.055	0.003	0.069
10	Biological Yield	-0.001	0.000	-0.003	0.001	0.004	0.006	-0.002	0.006	0.005	0.920	0.008	0.002	0.946
11	Harvest Index	0.001	0.000	0.000	0.002	-0.002	0.002	-0.001	0.006	-0.008	0.025	0.303	0.001	0.328
12	Protein Content	-0.001	0.000	-0.002	0.000	0.001	0.001	0.000	-0.002	0.010	0.108	0.015	0.015	0.145
	RESIDUAL=0.0123													

Note: Under lined values are direct effects

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