



## Correlation and Path Analysis in *Desi Chickpea* (*Cicer arietinum* L.)

U Lakshmi Annapurna, S Srimannarayana Murthy, C Panduranga Rao and  
R Srinivasulu

Department of Genetics & Plant Breeding, Agricultural College, Bapatla - 522 101, Andhra Pradesh.

### ABSTRACT

Correlation and path coefficient analysis were studied for eleven different characters in 40 *Desi* chickpea genotypes. Character association studies indicated that number of pods per plant, 100 seed weight (g), harvest index(%) and biological yield per plant (g), were having highly significant correlation with seed yield per plant. Whereas, days to maturity showed negative and significant correlation with seed yield/plant. However, path coefficient analysis revealed that biological yield had highest direct effect on grain yield followed by harvest index.

**Key words :** Correlation, *Desi* Chickpea, Path Analysis

Yield is a complex character governed by interaction of a number of component characters. The success of selection for enhanced yield depends on the degree of genetic variability present in breeding material and unraveling the characters showing correlated response with the grain yield and their degree of the contribution of the various variables to the observed traits and partitioning the correlation coefficients into the components of direct and indirect effects. Hence, an attempt was made to assay the association of yield contributing characters with grain yield and their direct and indirect effects on grain yield.

### MATERIAL AND METHODS

The material for the investigation comprised of 40 *Desi* chickpea genotypes. These genotypes were grown in *rabi* season during 2006-07 in a randomized block design with three replications at Regional Agricultural Research Station, Lam, Guntur. Each entry was planted in a single row of 4 m length with a spacing of 30 cm x 10 cm. The observations were recorded on ten randomly selected competitive plants in each entry and in each replication on 11 component characters, *i.e.*, days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, number of secondary branches per plant, number of pods per plant, 100-seed weight (g), harvest index(%), biological yield per plant (g), protein content (%) and seed yield per plant (g) and mean values were used for statistical analysis. The analysis of variance and correlations were calculated for all the pairs of characters. Path analysis was done following the procedure given by Dewey and Lu (1959).

### RESULTS AND DISCUSSION

The results of analysis of variance for 11 characters studied in *Desi* genotypes indicated that there was significant differences among all the genotypes studied. The genotypic and phenotypic correlations between different pairs of characters are given in Table 1. The values of genotypic coefficients were generally higher than phenotypic coefficients, revealing the influence of environment on phenotypic expressions. The correlation coefficient pattern revealed that grain yield had highly significant positive association with number of pods per plant, 100-seed weight (g), harvest index (%) and biological yield per plant (g). Whereas negative significant correlation with days to maturity. Days to 50% flowering showed significant negative correlation with number of secondary branches per plant and 100-seed weight (g). Days to maturity showed significant negative correlation with plant height (cm), number of pods per plant, 100-seed weight (g) harvest index (%) and biological yield per plant (g). Plant height (cm) showed significant positive correlation with number of secondary branches per plant and harvest index, whereas negative correlation with days to maturity. Number of primary branches per plant showed positive significant correlation with plant height (cm), biological yield per plant (g) and protein content (%). Number of secondary branches per plant showed positive significant correlation with days to 50% flowering and negative correlation with number of primary branches per plant and protein content (%). Number of pods per plant showed significant positive correlation with harvest index(%) and biological yield per plant (g) and negative significant correlation with days to maturity. 100-seed weight showed positive significant correlation with plant

Table 1 : Genotypic and phenotypic correlations between yield and yield components in Desi chickpea (*Cicer arietinum* L.)

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No of primary branches plant <sup>-1</sup>	No of secondary branches plant <sup>-1</sup>	No.of.Pods plant <sup>-1</sup>	100 seed weight (g)	Harvest index (%)	Biological yield plant <sup>-1</sup> (g)	Protein content (%)	Seed yield plant <sup>-1</sup>
Days to 50% flowering	1.000	0.1689	0.069	0.166	-0.265**	-0.015	-0.251**	0.012	-0.083	0.170	-0.063
Days of maturity	0.162	1.0000	-0.1944*	0.0893	0.1238	-0.5970***	-0.254**	-0.352**	-0.386**	0.216*	-0.448**
Plant height (cm)	0.097	-0.230*	1.000	0.209	0.072	0.102	0.254**	-0.138	0.063	-0.167	-0.018
No.of.Primary branches plant <sup>-1</sup>	0.219**	0.105	0.193*	1.000	-0.0002	0.053	0.072	-0.182*	0.214*	0.198*	0.105
No.of.Secondary branches plant <sup>-1</sup>	-0.294**	0.138	-0.013	-0.220*	1.000	-0.020	-0.157	0.016	0.082	-0.192*	0.092
No.of Pods plant <sup>-1</sup>	-0.014	-0.684**	0.059	-0.092	-0.122	1.000	0.169	0.520**	0.590**	-0.086	0.692**
100-seed weight (g)	-0.258**	-0.272**	0.278**	0.058	-0.200*	0.167	1.000	0.224	0.456**	0.029	0.451**
Harvest index (%)	0.035	-0.420**	-0.258**	-0.426**	-0.110	0.550**	0.246**	1.000	0.218*	0.108	0.567**
Biological yield plant <sup>-1</sup> (g)	-0.1306	-0.457**	0.065	0.166	0.025	0.656**	0.499**	0.342**	1.000	-0.072	0.915
Protein content (%)	0.1782	0.243**	-0.225*	0.237**	-0.243**	-0.098	0.026	0.093	-0.087	1.000	-0.025
Seed yield per plant (g)	-0.097	-0.511**	-0.054	-0.0025	0.004	0.7151**	0.473**	0.618**	0.947**	-0.050	1.000

\*Significant at 5% level

\*\*\* Significant at 1% level

Above diagonal values are phenotypic correlation values  
Below diagonal values are genotypic correlation values

height (cm), harvest index (%) and biological yield per plant (g) and negative correlation with days to 50% flowering and days to maturity. Harvest index showed significant positive correlation with number of pods per plant, 100-seed weight (g) and negative significant correlation with days to maturity and number of primary branches per plant. Biological yield per plant showed significant positive correlation with number of primary branches per plant, number of pods per plant, 100-seed weight (g) and harvest index (%) and significant negative correlation with days to maturity. Protein content showed positive significant association with days to maturity and primary branches per plant. The results are in accordance with the findings of Singh *et al.* (1990), and Jeena and Arora (2001).

Path analysis furnishes a means of measuring the direct and indirect effect of a variable on the end product. The days to 50% flowering had a positive direct effect on seed yield per plant. However its positive direct effect was through primary branches per plant, pods per plant and 100 seed weight. But the direct positive effect was nullified by the indirect negative effects through biological yield per plant and protein content, resulting in negative and non-significant correlation with seed yield per plant (Table 2 and 3). Similar results were reported by Raut *et al.* (2004). Days to maturity showed positive direct effect on seed yield per plant. It had positive indirect effect through days to 50% flowering, plant height, primary branches per plant, secondary branches per plant, pods per plant and 100-seed weight. Its positive indirect effect was nullified by negative indirect effect through harvest index, biological yield per plant and protein content resulting in negative and significant correlation with seed yield per plant. Similar results were reported by Brar *et al.* (2004). Plant height had a negative direct effect on yield and its correlation with yield is also negative and non significant. However, the magnitude of negative indirect effect was through harvest index and 100 seed weight. The traits which contributed positively and indirectly are selected for yield improvement. Similar results were reported by Yadav *et al.* (2002).

Table 2 . Estimates of direct and indirect effects (phenotypic) of components on yield in *Desi* chickpea (*Cicer arietinum* L.)

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No of primary branches plant <sup>-1</sup>	No.of secondary branches plant <sup>-1</sup>	No.of.Pods plant <sup>-1</sup>	100 seed weight (g)	Harvest index (%)	Biological yield plant <sup>-1</sup> (g)	Protein content (%)
Days to 50% flowering	<b>0.0028</b>	0.0005	0.0002	0.0005	-0.0007	0.0000	-0.0007	0.0000	-0.0002	0.0005
Days of maturity	0.0014	<b>0.0082</b>	-0.0016	0.007	0.0010	-0.0049	-0.0021	-0.0029	-0.031	0.0018
Plant height (cm)	-0.0009	0.0028	<b>-0.0144</b>	-0.003	-0.001	-0.0015	-0.0035	0.0020	-0.0009	0.0024
No.of.Primary branches plant <sup>-1</sup>	0.0004	0.0002	0.0005	<b>0.0023</b>	0.0000	0.0001	0.0002	-0.0004	0.0005	0.0004
No.of.Secondary branches plant <sup>-1</sup>	-0.0034	0.0016	0.0009	0.0000	<b>0.0130</b>	-0.0003	-0.0021	0.0002	0.0011	-0.0025
No.of Pods plant <sup>-1</sup>	0.0000	0.0018	-0.0003	0.0002	0.0001	<b>-0.003</b>	-0.0005	-0.0016	-0.0018	0.0003
100-seed weight (g)	0.0038	0.0039	-0.0038	-0.0011	0.0024	-0.0028	<b>-0.0154</b>	-0.00354	-0.0070	-0.0005
Harvest index (%)	0.0048	-0.1398	-0.0548	-0.0722	0.0063	0.2065	0.0895	<b>0.3966</b>	0.0839	0.042
Biological yield plant <sup>-1</sup> (g)	-0.070	-0.325	-0.053	0.180	0.069	0.497	0.385	0.178	<b>0.8428</b>	-0.060
Protein content (%)	-0.0017	-0.0021	0.0017	-0.002	0.0019	0.0009	-0.0003	-0.0011	0.0007	<b>-0.01</b>
Seed yield per plant (g)	-0.063	-0.448***	-0.0018	0.1053	0.092	0.692**	0.450**	0.567**	0.915**	-0.025

\*Significant at 5% level

\*\* Significant at 1% level

Residual effect : 0.117

Number of primary branches per plant had positive and direct effect on seed yield per plant. It had positive indirect effect through biological yield per plant, days to 50% flowering and days to maturity. Its positive indirect effect was nullified by negative indirect effect through remaining characters resulting in positive non significant correlation with seed yield per plant. Similar results were reported by Hari Satya Narayana and Sree Rami Reddy (2002). Number of secondary branches per plant had direct and positive effect on seed yield per plant. It had negative indirect effect through plant height and days to 50% flowering. This effect was nullified by the remaining characters resulting in positive and non significant correlation with seed yield per plant. Similar results were reported by Ozdemir (1996). Number of pods per plant had negative and direct effect on seed yield per plant. It had positive indirect effect through biological yield per plant, harvest index and protein content, nullified the negative indirect effect through remaining characters, resulting in positive and significant correlation with seed yield per plant. Similar results were reported by Manjare *et al.* (1997).

100-seed weight had negative direct effect on seed yield per plant. It had positive indirect effect through biological yield per plant and harvest index. The negative indirect effect was nullified by the positive indirect effect, resulting in positive and significant correlation with seed yield per plant. Hence, selection can be practiced on these traits for yield improvement. Similar results were reported by Sandhu *et al.* (1991). Harvest index had positive direct effect on yield per plant. It had positive indirect effect through biological yield per plant resulting in positive and significant correlation with seed yield per plant. Seed yield can be improved by selecting this trait. Similar results were reported by Singh *et al.* (1990).

Biological yield per plant had positive direct effect on yield per plant. It had positive indirect effect through harvest index, secondary branches per plant and protein content and this trait showed significant and positive correlation with seed

Table 3. Estimates of direct and indirect effects (genotypic) of components on yield in Desi chickpea (*Cicer arietinum* L.)

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No of primary branches plant <sup>-1</sup>	No of secondary branches plant <sup>-1</sup>	No.of.Pods plant <sup>-1</sup>	100 seed weight (g)	Harvest index (%)	Biological yield plant <sup>-1</sup> (g)	Protein content (%)
Days to 50% flowering	<b>-0.0027</b>	-0.0004	-0.0003	-0.0006	0.0008	0.000	0.0007	-0.0001	0.0004	-0.0005
Days of maturity	-0.0018	<b>-0.0113</b>	0.0026	-0.0012	-0.0016	0.0077	0.0031	0.0047	0.0051	-0.0027
Plant height (cm)	-0.0011	0.0026	<b>-0.013</b>	0.0022	0.0001	-0.0007	-0.0031	0.0029	-0.0007	0.0026
No.of.Primary branches plant <sup>-1</sup>	0.0024	0.0011	0.0021	<b>0.0109</b>	0.0024	-0.001	0.0006	-0.0046	0.0018	0.0026
No.of.Secondary branches plant <sup>-1</sup>	-0.0018	0.0009	-0.0001	-0.0014	<b>0.0062</b>	-0.0008	-0.0012	-0.0007	0.0002	-0.0015
No.of.Pods plant <sup>-1</sup>	0.0008	0.0383	-0.0033	0.0052	0.0069	<b>-0.0559</b>	-0.0093	-0.030	-0.036	0.0055
100-seed weight (g)	0.0108	0.0114	-0.0118	-0.0024	0.0084	-0.0070	<b>-0.0418</b>	-0.0103	-0.0209	-0.0011
Harvest index (%)	0.0129	-0.1509	-0.092	-0.1533	0.0396	0.1976	0.0884	<b>0.3592</b>	0.1231	0.0334
Biological yield plant <sup>-1</sup> (g)	-0.114	-0.3998	0.0575	0.1456	0.0225	0.5738	0.4367	0.2996	<b>0.8744</b>	-0.0762
Protein content (%)	-0.0023	-0.0031	0.0029	-0.003	0.0031	-0.0013	-0.0003	-0.0012	0.0011	<b>-0.0128</b>
Seed yield per plant (g)	-0.097	-0.5112**	-0.054	-0.002	0.004	0.715**	0.473**	0.618**	0.947**	-0.0508

\*Significant at 5% level

\*\* Significant at 1% level

Residual effect: 0.039

Bold and diagonal values are direct effects

yield per plant. Hence direct selection for this trait will improve seed yields. Similar results were reported by Neter Pal Singh *et al.* (2001). Protein content had negative direct effect on seed yield per plant. It had positive indirect effect through days to 50% flowering, days to maturity, plant height, primary branches per plant, pods per plant and harvest index and negative indirect effect through secondary branches per plant and 100-seed weight. This trait showed negative and non-significant correlation with seed yield per plant. Similar results were reported by Sontakey *et al.* (1991).

From this study it could be inferred that biological yield per plant and harvest index considered as reliable characters for improving grain yield during the chickpea yield improvement programme.

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