Madras Agric. J., 93 (1-6) : 26-31 January-June 2006
https://doi.org/10.29321/MAJ.10.100717

Association analysis and scope of selection for yield attributes in chickpea *(Cicer arietinum* (L.))

J.ASLIN JOSHI, S. GANESHRAM AND J.R.KANNAN BAPU

Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore-641003.

Abstract : The present investigation was aimed at estimating the correlation coefficient between seed yield per plant and selected yield components and to evaluate the relative contribution of each component trait to seed yield in using path coefficient analysis. The study was carried out using 100 chickpea germplasm accessions obtained from Department of Pulses, TNAU, Coimbatore and seeds were raised in Randomized Block Design (RBD) with two replications. Seed yield had significant and positive association with all traits namely biological yield, pod yield, days to maturity, plant height, number of secondary branches, hundred seed weight, harvest index, number of primary branches, number of seeds and number of pods except days to 50 per cent flowering which revealed negative and significant correlation. Path coefficient analysis indicated that pod yield, number of secondary branches and harvest index had high positive direct effect on seed yield. Hence, consideration of these traits as significant selection criteria can contribute to the success of chickpea breeding.

Keywords: Chickpea, genotypic correlation, path coefficient

Introduction

Seed yield is a polygenic character and it is the result of many characters that are interdependent. A direct selection for yield is often misleading as the yield is subject to the effect of fluctuating environmental components. The knowledge on the associations among yield characters and with seed yield is essential to establish selection criteria. However correlation coefficients between yield and yield components may not ascertain the characters which really contribute towards yield. Also indirect selection is important when desirable characters have low heritability. Under such situation, path coefficient analysis developed by Wright (1921) serves as an important tool in predicting direct and indirect contribution of these characters.

The objective of this study is to estimate the correlation coefficient between seed yield and its components and to evaluate the relative contribution of each component trait to seed yield in using path coefficient analysis.

Materials and Methods

Seeds of 100 chickpea germplasm accessions obtained from Department of Pulses, TNAU, Coimbatore were used in the study. Seeds were raised in Randomized Block Design (RBD) with two replications during Nov - Jan 2005. Each genotype was sown in a single row in ridges and furrows. Row-to-row and plant- to-plant spacings were maintained at 45 and 10 cm respectively. The recommended agronomic practices were followed during the crop growth period.

Table 1. Genotypic correlation coefficient among the 12 characters in chickpea accessions.

S.No	Characters	Days to Maturity	Plant height (cm)	Number of primary branches/ plant	Number of secondary branches/ plant	Number of pods/ plant	Number of seeds/ plant	Biological yield (g)/ plant	Pod yield (g)/ plant	Harvest index (%)	100 seed weight (g)	Seed yield (g)/ plant
1.	Days to 50% flowering	0.604**	0.182	0.236**	-0.003	-0.062	0.011	-0.078	-0.271**	-0.264**	-0.015	-0.237*
2.	Days to maturity		0.018	0.213*	0.052	-0.295	-0.265**	-0.053	-0.164	-0.155	0.035	-0.153
3.	Plant height (cm)			0.294**	0.092	-0.109	-0.032	0.399**	0.081	-0.379*	0.483**	0.075
4.	Number of primary branches / plant				0.852**	-0.032	-0.084	0.357**	0.084	-0.429**	0.199*	0.079
5.	Number of secondary branches / plant					0.129	0.065	0.357	-0.110	0.537**	0.011	-0.119
6.	Number of pods / plant						0.819**	-0.082	0.034	0.083	0.231*	-0.011
7.	Number of seeds / plant							-.0.221*	-0.098	0.158	-0.230*	-0.115
8.	Biological yield (g)/plant								0.828**	-0.033	0.307**	0.854**
9.	Pod yield (g)/plant									0.416**	0.264**	0.973**
10.	Harvest index (%)										0.096	0.467**
11.	Hundred seed weight (g)											0.278**

* Significance at five per cent level, ** Significance at one per cent level.

Table 2. Phenotypic correlation coefficient among 12 characters in chickpea accessions

S.No	Characters	Days to Maturity	Plant height (cm)	Number of primary branches/ plant	Number of secondary branches/ plant	Number of pods/ plant	Number of seeds/ plant	Biological yield (g)/ plant	Pod yield (g)/ plant	Harvest index (%)	100 seed weight (g)	Seed yield (g)/ plant
1.	Days to 50% flowering	0.616**	0.171	0.129	0.018	-0.062	0.008	-0.064	-0.217*	-0.180	-0.017	-0.197*
2.	Days to maturity		0.019	0.122	-0.027	-0.283**	-0.255	-0.044	-0.129	-0.105	0.030	-0.128
3.	Plant height (cm)			0.228*	0.100	-0.096	-0.032	0.272**	0.075	-0.215*	0.408**	0.067
4.	Number of primary branches / plant				0.327**	-0.013	-0.055	0.188*	0.052	-0.10	0.101	0.063
5.	Number of secondary branches / plant					0.116	0.071	0.210**	-0.064	-0.268**	0.029	-0.079
6.	Number of pods / plant						0.826**	-0.034	0.031	0.036	-0.196*	0.010
7.	Number of seeds / plant							-0.158	-0.087	0.095	-0.193*	-0.084
8.	Biological yield (g)/plant								0.709**	-0.199*	0.255**	0.751**
9.	Pod yield (g)/plant									0.384**	0.237*	0.943**
10.	Harvest index (%)										0.043	0.430**
11.	Hundred seed weight (g)											0.243**

* Significance at five per cent level, ** Significance at one per cent level.

Table 3. Path analysis depicting direct and indirect effects of 12 characters on seed yield of chickpea.

S.No	Characters	Days 50% flowering	Days to Maturity	Plant height (cm)	Number of primary branches/ plant	Number of secondary branches/ plant	Number of pods/ plant	Number of seeds/ plant	Biological yield (g)/ plant	Pod yield (g)/ plant	Harvest index (%)	100 seed weight (g)	Seed yield(g)/ plant
1.	Days to 50% flowering	**0.113**	0.003	0.020	-0.053	-0.001	0.003	-0.001	0.003	-0.269	-0.055	0.000	-0.237
2.	Days to maturity	0.068	**0.004**	0.002	-0.048	-0.016	0.015	0.016	0.002	-0162	-0.032	-0.001	-0.0153
3.	Plant height (cm)	0.021	0.000	**0.110**	-0.066	0.028	0.005	0.002	-0.013	0.081	-0.079	-0.014	0.075
4.	Number of primary branches / plant	0.027	0.001	0.032	**-0.225**	0.261	0.002	0.005	-0.011	0.084	-0.090	-0.006	0.079
5.	Number of secondary branches / plant	0.000	0.000	0.010	0.192	**0.306**	-0.006	-0.004	-0.011	-0.109	-0.112	0.000	-0.120
6.	Number of pods / plant	-0.007	-0.001	-0.012	0.007	0.039	**-0.049**	-0.048	0.003	0.034	0.017	0.007	-0.011
7.	Number of seeds / plant	0.001	-0.001	-0.004	0.019	0.020	-0.041	**-0.059**	0.007	-0.097	0.033	0.007	-0.115
8.	Biological yield (g)/plant	-0.009	0.000	-0.044	-0.081	0.109	0.004	0.013	**-0.032**	0.820	-0.007	-0.009	0.854
9.	Pod yield (g)/plant	-0.031	-0.001	0.009	-0.019	-0.034	-0.002	0.006	-0.027	**0.991**	0.087	-0.007	0.973
10.	Harvest index (%)	-0.030	-0.001	-0.042	0.097	-0.164	-0.004	-0.009	0.001	0.412	**0.209**	-0.003	0.466
11.	Hundred seed weight (g)	-0.002	0.000	0.053	-0.045	0.003	0.011	0.014	-0.010	0.261	0.020	**-0.028**	0.278

Seed yield = Genotypic correlation coefficient with seed yield   Residual effect = 0.201

Direct effects are enbolded.

Observations were recorded from five plants chosen randomly from the middle of the row. Days to 50 per cent flowering, plant height, number of primary branches per plant, numbers of secondary branches per plant, days to maturity, number of pods per plant, number of seeds per plant, pod yield, 100 seed weight, seed yield, biological yield were recorded and harvest index was computed

Correlation coefficients *i.e.* phenotypic and genotypic were calculated using variance and covariance components (Webber and Murthy, 1952). Path coefficient analysis was done for different characters to find out direct and indirect effects using the correlation coefficient as suggested by Wright (1921) and Dewey and Lu (1959). In path analysis, seed yield per plant was the dependent variable and other traits were considered independent variables. All these calculations were done using a statistical program (INDOSTAT)

Results and Discussion

The inter correlation among the 12 traits estimated through correlation coefficients both for genotypic and phenotypic levels are presented

in Table 1 and 2. Seed yield had significant and positive association with biological yield (0.854 and 0.750) and pod yield (0.973 and 0.943) both at genotypic and phenotypic level. Similarly all the traits except days to 50 per cent flowering had positive and significant correlation with seed yield indicating a strong association of these characters. These can be given importance during selection to improve the yield potential of the crop. Similar finding was reported by Jeena *et al.* (2005).

The data on days to 50 per cent flowering (-0.237) revealed negative and significant correlation. This was in accordance with the findings of Singh *et al.* (2001) and Yadav and Sharma (1998). Positive and significant correlation was observed at both levels for days to maturity (0.604 and 0.616). Number of primary branches (0.236) was positively correlated with days to 50 percent flowering at genotypic level. This was in accordance with Yadav and Sharma (1998).

At genotypic level, days to maturity exhibited highly positive association with number of primary branches (0.294 and 0.228), biological yield (0.399 and 0.272) and hundred seed weight (0.483 and 0.408) at both levels. Negative correlation with plant height was observed for harvest index (-0.379 and -0.215) both at genotypic and phenotypic levels.

Positive and highly significant correlation was exhibited by number of secondary branches (0.852 and 0.327) and biological yield (0.357 and 0.188) with number of primary branches. Hundred seed weight had positive correlation with number of primary branches.

Biological yield per plant (0.210) showed positive and significant correlation with number of secondary branches. Harvest index (-0.537 and -0.268) showed negative and significant association with number of secondary branches at both levels. This was in accordance with Tagore and Singh (1990).

At both levels, hundred seed weight (-0.230 and -0.193) showed negative and significant correlation with number of seeds. Biological yield per plant (-0.022) showed negative and significant correlation at genotypic level. Traits namely pod yield (0.828 and 0.709), seed yield (0.854 and 0.751) and hundred seed weight (0.307 and 0.255) exhibited positive and significant correlation both at genotypic and phenotypic levels.

Positive associations of harvest index (0.416 and 0384) and hundred seed weight (0.264 and 0.237) with pod yield were recorded at both levels. The data on harvest index (0.096 and 0.043) revealed positive correlation with hundred seed weight at both levels. The genotypic correlation coefficients of seed yield per plant with other traits were divided into direct and indirect effects and presented in Table 3.

The highest positive direct effect was recorded by pod yield (0.991) followed by number of secondary branches (0.306) and harvest index (0.209). Among traits showing negative direct effects, number of primary branches (-0.225) exhibited highest value followed by number of seeds (-0.059) and number of pods (-0.049). Positive direct effect on seed yield was revealed by number of secondary branches, harvest index, days to 50 per cent flowering, days to maturity and plant height indicating their relationship and selection based on these traits will be highly desirable. Similar results were obtained by Jeena *et al.* (2005) and Jeena and Arora (2002).

Hundred seed weight also had negative direct effect on seed yield and this was in accordance with Ozdemir (1996). But these negative direct effects were compensated by positive indirect effects. The total variation in seed yield accounted by pod yield (0.973) and biological yield (0.854). This exhibited that pod yield and biological yield are the major direct contributors to seed yield. The effectiveness of selection for high yield could be enhanced by including harvest index as a selection criterion along with biological yield. Singh *et al.,* (1990) reported that the residual effect (53.9 %) obtained in their study indicated that there were factors other than the traits they had included in their study which affected the seed yield and also suggested that efforts should be made to explore them. Since earlier workers had not included biological yield and harvest index in their studies, they found that other characters influencing the yield components.

In this present study, harvest index though it is a derived index was also included and the residual effect (0.201) was low indicating the adequacy of the characters chosen. Positive indirect effect of biological yield and harvest index *via* pod yield, number of primary branches *via* number of secondary branches was found to be high among indirect effects and indirect selection through pod yield and biological yield will lead to yield improvement.

In this study, the direct effects of pod yield, number of secondary branches and harvest index were high and positive. Similarly genotypic correlation coefficients were high and positive for pod yield and biological yield. Hence consideration of these traits can contribute to the success of chickpea breeding programme. Also hundred seed weight had significant and positive correlation with plant height. Tall plants with more vegetative growth may result in increased hundred seed weight by adversely affecting the reproductive growth by limiting number of pods per plant. Hence, seed yield can be improved by increasing the pod yield and biological yield.

References

Dewey, D. R. and Lu, K. H. (1959). A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J.*, **51**: 515-518.

Jeena, A.S. and Arora, P.P. (2002). Path analysis in relation to selection in chickpea. *Agric. Sci. Digest*, **22(2):** 132-133.

Jeena. A.S., Arora, P.P. and Ojha, O.P. (2005). Variability and correlation studies for yield and its components in chickpea. *Legume Res.*, **28(2):** 146-148.

Ozdemir, S. (1996). Path coefficient analysis for yield and its components in chickpea. ICPN, **3:** 19-21.

Singh, K.B., Bejiga, G. and Malhotra, R.S. (1990). Association of some characters of seed yield in chickpea collections. *Euphytica*, **49:** 83-88.

Tagore, K.R. and Singh, I.S. (1990). Character association and path analysis under two levels of management in chickpea. *Crop Improv.*, **17 (1):** 41-44.

Webber, C.R. and Murthy, B.R. (1952). Heritable and non-heritable relationship and variability of oil content and agronomic characters in the F_2 segregation of soybean cross. *Agron. J.*, **44:** 202-209.

Wright, S. (1921). Correlation and causation. *J. Agric. Res.*, **20:** 257-287.

Yadav, N.P. and Sharma, C.M. (1998). Correlation studies in late - sown chickpea. *J. Res.* (BAU), **10 (2):** 5-7.