RESEARCH PAPER

Character association and path analysis in F_8 recombinant inbred line population of the cross NRCG 12568 x NRCG 12326 in groundnut (*Arachis hypogea* L.)

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The present study was undertaken to study the correlation and path association for ten growth and physiological traits related to water use efficiency in groundnut during *Kharif* 2010. The base material comprised of 196 F_8 recombinant inbred line population developed by crossing NRCG 12568 and NRCG 12326through single seed descent method. Genotype NRCG 12568 and NRCG 12326 are diverse for trait Carbon Isotopic Discrimination. The studies on Phenotypic and genotypic correlation coefficients revealed that pod yield per plant had strong positive correlation with pods per plant, kernel yield per plant, sound mature kernel percentage indicating that improvement in these characters will lead to improvement in yield. Whereas significant negative association was observed for pod yield per plant with days to fifty per cent flowering and shelling percentage. Among these characters kernel yield per plant recorded maximum direct effect on pod yield per plant whereas all other characters recorded low direct effects. Sound mature kernel percentage, pods per plant and SLA recorded maximum indirect effect on pod yield plant through kernel yield per plant. The results of the study revealed that the character kernel yield per plant and specific leaf area could be given emphasis for selection of genotypes with high yield coupled with high water use efficiency.

Key words **:** Correlation, Path analysis, Carbon isotopic discrimination, Water use efficiency, Direct and indirect effects

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INTRODUCTION

Groundnut (*Arachish ypogaea* L.) is one of the important oilseed crop of the world which is native to Brazil in South America. Over two third of groundnut area in India is grown under rain fed conditions where frequent dry spells is a major constraint for productivity. Limited water availability especially during flowering and peg penetration stage leads to low productivity. To harness complete genetic potential of yield of groundnut, Water use efficiency is one such trait which increases yield under drought situation but direct measurement of WUE under field condition with large number of population is a difficult task; hence surrogate traits like specific leaf area (SLA), SPAD chlorophyll meter reading (SCMR) and carbon isotopic discrimination ($D^{13}C$) could be used. $D^{13}C$ and SLA are inversely related to WUE and yield. SCMR and $d^{18}O$ are positively related to yield and WUE (Farquhar *et al*., 1989; Wright *et al.*, 1994; Nageshwararao *et al*., 2001).

Efficiency of selection in any breeding programme mainly depends on the knowledge of association of characters. Hence, knowing association of water use efficiency related traits with yield trait is important in breeding for drought tolerance. The phenotypic correlation indicated the extent of the observed relationship between the two characters, while the genotypic correlation provides information about linkages for the genes controlling the characters. The path co-efficient analysis, which is a standardized partial regression analysis, separates the correlation into direct and indirect effects. In the present study an attempt was made to investigate the correlation and path co-efficient analysis in F_8 recombinant inbred line population of the cross NRCG 12568 X NRCG 12326 in groundnut.

RESEARCH METHODOLOGY

The present experimental material consisted of 194 F_8 RIL population developed through single seed descent method using parental lines NRCG12568 and NRCG12326 which are diverse for trait carbon isotopic discrimination and specific leaf area. These were grown in a simple lattice design with two replications with spacing of 45 cm x 30 cm during *Kharif* 2009 in UAS, GKVK, Bengaluru. Observations were recorded on five randomly chosen plants per replication in each line. Ten characters *viz.,* days to 50 per cent flowering, plant height, number of branches per plant, number of pods per plant, kernel yield per plant, shelling percentage, sound mature kernel percentage, specific leaf area, SPAD chlorophyll meter reading and pod yield per plant were recorded. The correlation co-efficient were calculated as per Al-Jibouri *et al.* (1958). Path analysis was worked out by following the method of Dewey and Lu (1959).

RESEARCH FINDINGS AND ANALYSIS

In the present study phenotypic and genotypic correlation values between traits were calculated by regressing phenotypic values of one trait on those of other.The result pertaining to this has been presented in Table 1. Pod yield per plant showed positive association both at phenotypic and genotypic level with pods per plant (0.576, 0.625), kernel yield per plant (0.861, 0.934), sound mature kernel percentage (0.632, 0.714). Whereas days to 50 per cent flowering (-0.40, -0.56), shelling percentage (-0.268, -0.505) and specific leaf area (-0.487, -0.615) were negatively correlated with pod yield per plant both at phenotypic and genotypic level.

In general genotypic correlation was higher than phenotypic correlation in all the characters studied indicating that strong association between characters. Phenotypic and genotypic correlation coefficients revealed that pod yield per plant had strong positive correlation with pods per plant, kernel yield per plant and sound mature kernel percentage indicating that improvement in these characters will lead to improvement in yield. These results are in agreement with the results of Nagda *et al.*(2001), Kalmeshwar *et al.* (2006), John *et al.* (2007), Mane *et al.* (2008), Sudhir *et al.* (2008) in groundnut. Association of pod yield, kernel yield and pods per plant suggests that individual plant selection can be practiced for plants with higher number of pods which ultimately leads to improvement in both pod and kernel yield in the later generations.

Significant negative association of pod yield per plant with days to fifty per cent flowering and shelling percentage

Table 1: Genotypic and phenotypic correlation coefficient for yield and physiological traits related to water use efficiency in 194 RIL of the cross NRCG12568 x NRCG 12326 of groundnut

Characters		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	P	1.000	-0.062	0.021	-0.272**	-0.321**	0.161*	-0.615**	0.320**	0.069	-0.402**
	G	1.000	-0.130	-0.015	-0.389**	-0.554**	0.255**	-0.796**	0.432**	0.087	-0.564**
X_2	P		1.000	0.032	0.127	-0.011	0.021	0.020	0.001	-0.071	-0.042
	G		1.000	-0.025	0.163*	-0.027	-0.005	0.025	-0.024	-0.134	-0.037
X_3	P			1.000	0.024	-0.033	-0.069	-0.007	-0.020	0.047	0.009
	G			1.000	0.001	-0.052	-0.186**	-0.003	-0.050	0.237**	0.001
X_4	P				1.000	0.516**	-0.192**	0.476**	-0.382**	-0.103	0.576**
	G				1.000	0.611**	-0.425**	0.582**	-0.486**	-0.242**	0.625**
X_5	P					1.000	0.179**	0.592**	-0.451**	0.011	0.861**
	G					1.000	0.240**	0.753**	-0.621**	-0.327**	0.934**
X_6	P						1.000	-0.181*	0.088	0.121	-0.268**
	G						1.000	-0.374**	0.290**	-0.169*	-0.505**
X_7	P							1.000	-0.437**	-0.145**	0.632**
	G							1.000	-0.529**	-0.29**	0.714**
X_8	P								1.000	0.082	-0.487**
	G								1.000	0.066	-0.615**
X_9	P									1.000	-0.023
	G									1.000	-0.098
X_{10}	P										1.000
	G										1.000

* and ** indicate significance of values at P=0.05 and 0.01, respectively

X_1- Days to 50 per cent flowering X_2- Plant height (cm) X_3- Number of branches per plant X_4- Pods per plant
X_5- Kernel yield per plant (g) X_6 –Shelling percentage X_7- Sound mature kernel percentage X_8- Specific leaf area(cm^2/g)
X_9-SPAD chlorophyll meter reading X_{10}- Pod yield per plant (g).

Table 2 : Genotypic path co-efficient analysis showing direct and indirect effects of different characters on pod yield in 194 F_8RIL population of the cross NRCG12568 x NRCG12326 in groundnut

Characters	X_1	X_4	X_5	X_6	X_7	X_8	r
Days to 50% flowering(X_1)	-0.143	0.010	-0.543	-0.086	0.193	0.006	-0.564**
Pods per plant(X_4)	0.056	-0.025	0.598	0.144	-0.141	-0.006	0.625**
Kernel yield per plant(g)(X_5)	0.079	-0.015	0.979	0.081	-0.183	-0.008	0.934**
Shelling percentage(X_6)	-0.037	0.011	-0.235	-0.338	0.091	0.004	-0.505**
Sound mature kernel percentage(X_7)	0.114	-0.015	0.738	0.127	-0.243	-0.007	0.714**
Specific leaf area(cm^2/g)	-0.062	0.012	-0.608	-0.098	0.128	0.013	-0.615**

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Residual effect=0.17 Figures in bold represent direct effect

X_1- Days to50% flowering X_4- Pods per plant X_5- Kernel yield per plant (g)

X_6 –Shelling percentage X_7- Sound mature kernel percentage X_{10}- Pod yield per plant (g)

was observed in the present investigation.This suggests that selection for higher yield results in reduced shelling percentage and early maturing this indicates photosynthates are more utilized for the pod development rather than to vegetative growth. Hence, early maturing ones coupled with higher yielding could be selected by individual plant selection. Similar results were observed by Alam *et al.* (1985), Abraham (1990) and Praveen Kumar (2006) in groundnut.

Path co-efficient analysis for pod yield per plant was carried out at genotypic level by subjecting highly significantly correlated characters like days to 50 per cent flowering, pods per plant, kernel yield per plant, shelling percentage and sound mature kernel percentage. The result pertaining to this has been presented in Table 2.Kernel yield per plant had the highest positive direct effect (0.979) on pod yield per plant whereas SLA had the lowest positive direct effect (0.013) on pod yield per plant. All other characters *viz*., days to 50 per cent flowering, pods per plant, shelling percentage, sound mature kernel percentage had the negative direct effect on pod yield per plant.Maximum positive direct effect on pod yield per plant through kernel yield per plant hence, selection for kernel yield would contribute greatly towards enhancing pod yield per plant. This results are in accordance with the reports of Abraham (1990), Venkataravana *et al.*(2004), Gomes and Lopes (2005), Kalmeshwar *et al.* (2006) and Praveen Kumar (2006) in groundnut.

Even through number of pods per plant, days to 50 per cent flowering, shelling percentage, sound mature kernel percentage, shelling percentage and SLA had a very low negative direct effect on pod yield per plant but their significant correlation with pod yield per plant was mainly due to high indirect effect via other characters. This suggests that importance should be given to these traits while selecting for high yielding genotypes in groundnut. Similar results were observed by Gomes and Lopes (2005) and Praveen Kumar (2006). SLA exhibited maximum indirect effect through kernel yield per plant for pod yield per plant, similar results were reported by Praveen Kumar (2006).Thus the present study indicated that high positive direct effect through kernel yield per plant and indirect effect through pods per plant, shelling percentage, sound mature kernel percentage and SLA. Hence, priority should be given to these characters while selecting genotypes for high yield and water use efficiency.

LITERATURE CITED

Abraham, M.J. (1990). Correlation, path and discriminant function analysis in groundnut grown on P deficient acidic soil. *Crop Improv*.,**17** (1): 34 –37.

Alam, M.S., Begum, D. and Khair, A.B. (1985). Study of genetic parameters and character inter- relationship in groundnut in groundnut. *Bangladesh J. Agric. Res.*, **10**: 111-117.

Al-Jibouri, H.A., Meller, P.A. and Robinson, H.F. (1958). Genolypic and environmental variances in upland cotton cross of interspecific orgin. *Agron. J.*, 50 : 633-635.

Dewey, D.R. and Lu, K.H. (1959). Correlation and path analysis of component of created wheat grass seed production. *Agron. J.*, **51** : 513-518.

Farquhar, G.D., Ehleringer, J.R. and Hubick, K.T. (1989). Carbon istope discrimination and photosynthesis.*Ann. Rev. Plant Physiolol.,* **40** : 503-507.

Gomes, R.L. and Lopes, A. (2005). Correlation and path analysis in Peanut.*Crop Breed. Appl. Biotech*., **5**(1): 105-110.

John, K., Vasanthi, R.P. and Venkateswarlu, O. (2007). Variability and correlation studies for pod yield and its attributes in F_2 generation of six Virginia x Spanish crosses of groundnut (*Arachis hypogaea* L.).*Leg Res*., **30**(4): 292-296.

Kalmeshwar, G.P., Kenchangoudar,P.V., Parmshwarappa, K.G. and Salimath, P.M. (2006). A study of correlation and path analysis in groundnut. *Karnataka J. Agric. Sci.,***19**: 272-277.

Mane, P.S., Lad, D.B. and Jagtap, P.K. (2008). Correlation and path coefficient analysis in summer bunch groundnut.*J. Maharastra Agric. Univ*., **33**(2) : 174-176.

Nagda, A.K., Dashora, A. and Jain, D.K. (2001). Character association in parents and hybrids of groundnut (*Arachis hypogaea* L.). *Crop Res.,***22**(3) : 463-468.

Nageshwar, Rao, R.C., Talwar, H.S. and Wright, G.C. (2001). Rapid assessment of specific leaf area and leaf nitrogen in peanut using chlorophyll meter. *J. Agron. Crop Sci.,***186** : 175-182.

Praveen Kumar, P. (2006). Genetics of water use efficiency (WUE), yield and its related traits in groundnut (*Arachis hypogaea* L.). M.Sc.(Ag.) Thesis, University of Agricultural Sciences, BANGLORE, KARNATAKA (India).

Sudhir, K.J. and Venkataravanaand Rao, Guraraj (2008). Evaluation of new germplasm and advanced breeding lines of groundnut (*Arachi shypogaea* L.) under late *Kharif* situation. *Legume Res*., **31** (4) : 254-258.

Venkataramana, P. (2001). Variability and correlation studies in groundnut. *Crop Res.,* **21** (1) : 81-83.

Wright, G.C., Nageshwara, Rao, R.C. and Farquhar, G.D. (1994). Water use efficiency and carbon isotope discrimination in peanut under water deficit conditions. *Crop Sci.,* **34** : 92 – 97.

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