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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 hypogaea* 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 12326 through 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 per 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

**How to cite this paper** : Nandini, C. and Savithramma, D.L. (2012). Character association and path analysis in  $F_8$  recombinant inbred line population of the cross NRCG 12568 x NRCG 12326 in groundnut (*Arachis hypogaea* L.). *Asian J. Bio. Sci.*, 7 (1) : 55 - 58.

## INTRODUCTION

Groundnut (*Arachis hypogaea* 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<sub>8</sub> 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 coefficient 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 <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>	X <sub>9</sub>	X <sub>10</sub>
X <sub>1</sub>	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 <sub>2</sub>	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 <sub>3</sub>	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 <sub>4</sub>	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 <sub>5</sub>	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 <sub>6</sub>	P						1.000	-0.181*	0.088	0.121	-0.268**
	G						1.000	-0.374**	0.290**	-0.169*	-0.505**
X <sub>7</sub>	P							1.000	-0.437**	-0.145**	0.632**
	G							1.000	-0.529**	-0.29**	0.714**
X <sub>8</sub>	P								1.000	0.082	-0.487**
	G								1.000	0.066	-0.615**
X <sub>9</sub>	P									1.000	-0.023
	G									1.000	-0.098
X <sub>10</sub>	P										1.000
	G										1.000

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

X<sub>1</sub>- Days to 50 per cent flowering

X<sub>2</sub>- Plant height (cm)

X<sub>3</sub>- Number of branches per plant

X<sub>4</sub>- Pods per plant

X<sub>5</sub>- Kernel yield per plant (g)

X<sub>6</sub>- Shelling percentage

X<sub>7</sub>- Sound mature kernel percentage

X<sub>8</sub>- Specific leaf area (cm<sup>2</sup>/g)

X<sub>9</sub>- SPAD chlorophyll meter reading

X<sub>10</sub>- 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<sub>2</sub>RIL population of the cross NRCG12568 x NRCG12326 in groundnut**

Characters	X <sub>1</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>	r
Days to 50% flowering(X <sub>1</sub> )	-0.143	0.010	-0.543	-0.086	0.193	0.006	-0.564**
Pods per plant(X <sub>4</sub> )	0.056	-0.025	0.598	0.144	-0.141	-0.006	0.625**
Kernel yield per plant(g)(X <sub>5</sub> )	0.079	-0.015	0.979	0.081	-0.183	-0.008	0.934**
Shelling percentage(X <sub>6</sub> )	-0.037	0.011	-0.235	-0.338	0.091	0.004	-0.505**
Sound mature kernel percentage(X <sub>7</sub> )	0.114	-0.015	0.738	0.127	-0.243	-0.007	0.714**
Specific leaf area(cm <sup>2</sup> /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

X<sub>1</sub>- Days to 50% flowering

X<sub>6</sub> -Shelling percentage

Figures in bold represent direct effect

X<sub>4</sub>- Pods per plant

X<sub>7</sub>- Sound mature kernel percentage

X<sub>5</sub>- Kernel yield per plant (g)

X<sub>10</sub>- 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.

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- Received : 17.12.2011; Revised : 22.01.2012; Accepted : 21.02.2012**