Correlation and path analysis in bunch groundnut (*Arachis hypogaea* L.)

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SUMMARY

Fifty diverse genotypes of bunch groundnut were evaluated during *Kharif* 2009 for genetic parameter *viz*., correlation and path analysis. The magnitudes of genotypic correlation coefficients were higher as compared to the corresponding phenotypic correlation coefficients. The pod yield per plant had highly significant and positive correlations at phenotypic levels with number of mature pods per plant, 100-pod weight, 100-kernel weight, kernel yield per plant, biological yield per plant and harvest index. Path analysis revealed that the kernel yield per plant, biological yield per plant and harvest index had high and positive direct effects on pod yield per plant.

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Key words : Correlation, Path analysis, Groundnut

Groundnut is an important oil seed crop. The knowledge of association among the yield and yield contributing characters would be of great help in constructing a suitable plant type and in planning breeding programme. However, the correlation coefficient does not give any indication about comparative magnitude of contribution made by various component characters. Therefore, genotypic path coefficient analysis was carried out to find the direct and indirect effects of yield components and their correlation with pod yield per plant. Pod yield, a polygenic trait, is influenced by its various components directly as well as indirectly via other traits, which create a complex situation before a breeder for making selection. Therefore, path coefficient analysis could provide a more realistic picture of the interrelationship, as it considers direct as well as indirect effects of the variables by partitioning the correlation coefficient.

MATERIALS AND METHODS

Fifty genotypes of groundnut were sown in a Randomized Block Design with three replications during *Kharif* 2009. Each entry was accommodated in a single row of 3.0 m length with a spacing of 45 cm between rows and 10 cm between plants within the row. The fertilizer in the experimental area was applied at the rate of 25.0 kg N and 50.0 kg P_2O_5 ha^{-1} as it is a recommended dose for *Kharif* cultivation of groundnut in the region. All the recommended package of practices were followed for raising healthy crop. Data were recorded for days to first flower, days to 50% flowering, days to maturity, plant height, primary branches per plant, number of mature pods per plant, number of immature pods per plant, 100-pod weight, 100- kernel weight, shelling out-turn, oil content, protein content, kernel yield per pod, pod yield per plant, biological yield per plant and harvest index. The phenotypic and genotypic correlation coefficients of all the characters were worked-out as per Al-Jibouri *et al*. (1958) and path coefficient analysis was carried-out as per the method suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

Analysis of variance revealed that highly significant differences among the genotypes were observed for all the traits except oil content, which indicating the presence of good amount of genetic variability among the material studied. The genotypic correlations were higher than the phenotypic correlation for most of the character studied that indicating least environmental effects on the expression of the traits (Table 1). In the present study, pod yield per plant was found to be highly significant and positively correlated with number of mature pods per plant,

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Table 1 : Genotypic (r_g) and phenotypic (r_p) correlation coefficients among 16 characters in bunch groundnut

Characters		Day to 1st flower	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches /plant	No. of mature pods/ plant	No. of immature pods/plant	100 pod wt. (g)	100 kernel wt. (g)	Shelling out turn (%)	Oil content (%)	Protein content (%)	Kernel yield/ plant (g)	Biological yield/ plant (g)	Harvest index (%)
Yield/plant (g)	r_g	0.194	0.102	0.025	0.112	0.059	0.863	0.300	0.255	0.273	0.183	0.023	0.200	0.918	0.579	0.738
	r_p	0.159	0.073	0.031	0.085	0.036	0.818**	0.182	0.243**	0.258**	0.079	0.001	0.108	0.880**	0.500**	0.678**
Days to 1st	r_g		0.812	0.742	0.093	0.226	0.227	0.227	0.170	0.267	0.235	0.187	0.038	0.242	0.033	0.170
flower	r_p		0.752**	0.474**	0.044	0.071	0.200*	0.122	0.095	0.254**	0.200*	0.056	0.003	0.211**	0.025	0.124
Days to 50%	r_g			0.931	0.026	0.156	0.189	0.230	0.151	0.250	0.379	0.051	0.124	0.242	0.191	0.225
flowering	r_p			0.663**	0.009	0.038	0.162*	0.096	0.098	0.188*	0.273**	0.004	0.063	0.195*	0.163*	0.190*
Days to maturity	r_g				0.186	0.068	0.136	0.360	0.229	0.299	0.522	0.036	0.180	0.221	0.247	0.148
	r_p				0.111	0.080	0.084	0.082	0.151	0.144	0.259**	0.012	0.079	0.102	0.144	0.044
Plant height (cm)	r_g					0.293	0.260	0.079	0.345	0.200	0.257	0.299	0.560	0.195	0.084	0.102
	r_p					0.164*	0.195*	0.011	0.221**	0.094	0.096	0.158	0.289**	0.125	0.053	0.168*
Primary	r_g						0.162	0.062	0.519	0.651	0.008	0.771	0.516	0.017	0.069	0.184
branches /plant	r_p						0.100	0.024	0.186*	0.274**	0.047	0.130	0.062	0.031	0.011	0.039
No. of mature	r_g							0.313	0.132	0.100	0.497	0.005	0.356	0.939	0.400	0.699
pods/plant	r_p							0.260	0.083	0.071	0.350**	0.027	0.223**	0.874**	0.349**	0.593**
No. of immature	r_g								0.116	0.036	0.174	0.027	0.071	0.261	0.311	0.141
pods/plant	r_p								0.023	0.017	0.123	0.048	0.024	0.175*	0.187*	0.088
100 pod weight	r_g									0.770	0.317	0.346	0.053	0.315	0.032	0.294
(g)	r_p									0.640**	0.132	0.059	0.019	0.255**	0.021	0.249**
100 kernel	r_g										0.266	0.536	0.260	0.306	0.114	0.418
weight (g)	r_p										0.213**	0.134	0.071	0.291**	0.087	0.351**
Shelling out turn	r_g											0.521	0.572	0.544	0.135	0.272
(%)	r_p											0.102	0.196*	0.519**	0.004	0.036
Oil content (%)	r_g												0.838	0.173	0.215	0.236
	r_p												0.397**	0.031	0.165*	0.140
Protein content	r_g													0.399	0.154	0.396
(%)	r_p													0.200*	0.106	0.209*
Kernel	r_g														0.422	0.735
yield/plant (g)	r_p														0.409**	0.592**
Biological yield	r_g															0.104
/plant (g)	r_p															0.267**

* and ** indicate significant of values at P 0.05 and P 0.01 levels, respectively

Table 2 : Genotypic (r_g) and phenotypic (r_p) path coefficient analysis showing direct and indirect effect of different characters in bunch groundnut

Characters		Day to 1st flower	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches /plant	No. of mature pods/ plant	No. of immature pods/ plant	100 pod weight (g)	100 kernel weight (g)	Shelling Out turn (%)	Oil content (%)	Protein content (%)	Kernel yield /plant (g)	Biological yield/ plant (g)	Harvest index (%)	r_g and r_p with pod yield/ plant
AYS to 1st	r_g	0.012	0.010	0.009	0.001	0.003	0.003	0.003	0.002	0.003	0.003	0.002	0.001	0.003	0.000	0.002	0.194
flower	r_p	0.045	0.034	0.021	0.002	0.003	0.009	0.006	0.004	0.011	0.009	0.003	0.000	0.009	0.001	0.006	0.159
Days to 50%	r_g	0.039	0.048	0.044	0.001	0.007	0.009	0.011	0.007	0.012	0.018	0.002	0.006	0.012	0.009	0.011	0.102
flowering	r_p	0.028	0.037	0.024	0.000	0.001	0.006	0.004	0.004	0.007	0.010	0.000	0.002	0.007	0.006	0.007	0.073
Days to maturity	r_g	0.057	0.072	0.077	0.014	0.005	0.011	0.028	0.018	0.023	0.040	0.003	0.014	0.017	0.019	0.011	0.025
	r_p	0.004	0.006	0.008	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.000	0.001	0.001	0.001	0.000	0.031
Plant height	r_g	0.006	0.002	0.013	0.069	0.020	0.018	0.005	0.024	0.014	0.018	0.021	0.039	0.013	0.006	0.007	0.112
(cm)	r_p	0.001	0.000	0.001	0.010	0.002	0.002	0.000	0.002	0.001	0.001	0.002	0.003	0.001	0.001	0.002	0.085
Primary	r_g	0.008	0.005	0.002	0.010	0.033	0.005	0.002	0.017	0.022	0.000	0.026	0.017	0.001	0.002	0.006	0.059
branches /plant	r_p	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.036
No. of mature	r_g	0.031	0.026	0.018	0.035	0.022	0.135	0.042	0.018	0.014	0.067	0.001	0.048	0.127	0.054	0.094	0.863
pods/plant	r_p	0.006	0.005	0.003	0.006	0.003	0.030	0.008	0.003	0.002	0.011	0.001	0.007	0.026	0.011	0.018	0.818
No. of immature	r_g	0.003	0.003	0.005	0.001	0.001	0.004	0.014	0.002	0.001	0.002	0.000	0.001	0.004	0.004	0.002	0.300
pods/plant	r_p	0.001	0.001	0.001	0.000	0.000	0.003	0.011	0.000	0.000	0.001	0.001	0.000	0.002	0.002	0.001	0.182
100 pod weight	r_g	0.014	0.013	0.019	0.029	0.044	0.011	0.010	0.085	0.065	0.027	0.029	0.005	0.027	0.003	0.025	0.255
(g)	r_p	0.001	0.001	0.001	0.002	0.001	0.001	0.000	0.007	0.005	0.001	0.000	0.000	0.002	0.000	0.002	0.243
100 kernel	r_g	0.020	0.019	0.022	0.015	0.048	0.008	0.003	0.057	0.074	0.020	0.040	0.019	0.023	0.009	0.031	0.273
weight (g)	r_p	0.002	0.002	0.001	0.001	0.002	0.001	0.000	0.006	0.009	0.002	0.001	0.001	0.003	0.001	0.003	0.258
Shelling out	r_g	0.003	0.005	0.007	0.003	0.000	0.007	0.002	0.004	0.004	0.013	0.007	0.007	0.007	0.002	0.004	0.183
turn (%)	r_p	0.058	0.079	0.075	0.028	0.014	0.101	0.036	0.038	0.062	0.289	0.030	0.057	0.150	0.001	0.010	0.079
Oil content (%)	r_g	0.009	0.002	0.002	0.014	0.035	0.000	0.001	0.016	0.025	0.024	0.046	0.038	0.008	0.010	0.011	0.023
	r_p	0.001	0.000	0.000	0.003	0.002	0.000	0.001	0.001	0.002	0.002	0.016	0.006	0.001	0.003	0.002	0.001
Protein content	r_g	0.001	0.003	0.004	0.012	0.011	0.008	0.002	0.001	0.006	0.012	0.018	0.021	0.008	0.003	0.008	0.200
(%)	r_p	0.000	0.001	0.001	0.005	0.001	0.004	0.000	0.000	0.001	0.003	0.007	0.017	0.003	0.002	0.004	0.108
Kernel yield /	r_g	0.103	0.103	0.094	0.083	0.007	0.400	0.111	0.134	0.131	0.232	0.074	0.170	0.426	0.180	0.313	0.918
plant (g)	r_p	0.148	0.136	0.071	0.087	0.022	0.613	0.123	0.179	0.204	0.364	0.022	0.140	0.701	0.287	0.415	0.880
Biological	r_g	0.017	0.098	0.127	0.043	0.035	0.206	0.160	0.017	0.059	0.069	0.111	0.079	0.217	0.514	0.053	0.579
yield/plant (g)	r_p	0.008	0.052	0.046	0.017	0.004	0.111	0.060	0.007	0.028	0.001	0.053	0.034	0.131	0.319	0.085	0.500
Harvest index	r_g	0.100	0.132	0.086	0.060	0.108	0.409	0.083	0.172	0.245	0.159	0.138	0.232	0.431	0.061	0.586	0.738
(%)	r_p	0.047	0.072	0.017	0.064	0.015	0.224	0.033	0.094	0.133	0.014	0.053	0.079	0.224	0.101	0.378	0.678

* and ** indicates significant of values at P 0.05 and P 0.01 levels, respectively. Residual Effects: R 0.0040 (Genotypic path r_g), R 0.0113 (Phenotypic path r_p)

number of immature pods per plant, 100-pod weight, 100 kernel weight, kernel yield per plant, biological yield per plant and harvest index at phenotypic levels. Similar results were obtained by Sharma and Gupta (2008) for number of mature pods per plant and harvest index, John *et al*. (2009) for number of mature pods per plant and 100-kernel weight, John *et al*. (2008) for kernel yield per plant, John *et al*. (2005) for biological yield per plant. The pod yield per plant was positively correlated at both phenotypic and genotypic levels with primary branches per plant (John *et al*., 2008 and Savaliya *et al*., 2008), number of immature pods per plant (Parameshappa *et al*., 2008) and shelling out-turn (Mane *et al*., 2008 and Parameshappa *et al*., 2008). Pod yield per plant exhibited negative correlation with days to first flower, days to 50% flowering, plant height and protein content at both phenotypic and genotypic levels. The negative association between these traits has been reported by Awatade *et al*., (2010) for plant height and John *et al*. (2005) for days to first flower and days to 50% flowering. The present results on correlation coefficients thus, revealed that the days to 50% flowering, primary branches per plant, number of mature pods per plant, 100-pod weight, 100-kernel weight, kernel yield per plant, biological yield per plant and harvest index were the most important attributes and may contribute considerably towards higher pod yield. The interrelationship among yield components would help in increasing the yield levels and therefore, more emphasis should be given to these components while selecting better types in groundnut.

The path coefficient analysis indicated that the kernel yield per plant, biological yield per plant and harvest index exhibited high and positive direct effects on pod yield per plant (Table 2). Thus, these characters turned-out to be the major components of pod yield. Plant height and 100-kernel weight exhibited moderate and positive direct effects towards pod yield. The highest positive direct effect on pod yield per plant also conformed by John *et al*. (2007), Sharma and Gupta (2008) and Sharma and Dashora (2009). The maximum and positive direct effects of kernel yield per plant, biological yield per plant and harvest index have also been reported by Bera and Das (2000) and Awatade *et al*. (2010). It was apparent from the path analysis that maximum direct effects as well as appreciable indirect influences were exerted by plant height, 100-kernel weight, kernel yield per plant, biological yield per plant and harvest index towards pod yield. These characters also exhibited positive association with pod yield per plant except plant height and hence, they may be considered as the most important yield contributing characters and due emphasis should be placed on these components while breeding for high yielding types in groundnut.

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