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Correlation and Path Coefficient Analysis in Groundnut (*Arachis hypogaea* L.)

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The correlation coefficients among nine yield and yield attributing characters with their path effects towards kernel yield were investigated in F_3 generation for three crosses of groundnut during *Kharif*-2009. From association studies, kernel yield was significant and positively correlated with number of pods per plant, pod yield per plant, shelling percentage and hundred kernel weight for all the crosses. The path analysis indicated that among the nine traits studied, pod yield per plant exerted maximum positive direct effect on kernel yield per plant for all the three crosses. When both direct and indirect positive contributions were considered, number of pods per plant and pod yield per plant influenced kernel yield per plant. Thus, on the basis of correlations and direct and indirect effects, number of pods per plant, pod yield per plant, hundred kernel weight and shelling percentage were proved to be the outstanding characters influencing kernel yield in groundnut and need to be given importance in selection to achieve higher kernel yield.

Key words: Correlation, Path coefficient analysis, Groundnut.

Groundnut is the major oilseed crop of India. It is used as an edible oilseed crop. It contains high oil (45-55 %) and protein (25-30%) content. The nature of association between yield and its components helps in simultaneous selection for many characters associated with yield improvement. Yield is a complex character, which is influenced by a number of inter related traits. The interdependence of these characters will influence kernel yield either directly or indirectly. Path coefficient analysis is used for the separation of direct effects from indirect effects and gives the relationship of the characters. Hence in the present study, such analysis was carried out in the three crosses of F_3 population in groundnut.

Materials and Methods

The field experiment was carried out at Department of Oilseeds, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore during *kharif*, 2009. By using, four groundnut genotypes consisting of three late leaf spot and rust resistant genotypes *viz.,* COG 0437, COG 0438, ICGV 97150 and one susceptible genotype TMV 2, and their F_3 cross combinations *viz*., TMV 2 x COG 0437, TMV 2 x COG 0438 and TMV 2 x ICGV 97150 were used in the present study. All the plants were raised in 1.5 m length of 30 x 20 cm spacing. A total number of nine yield and yield component traits *viz.,* plant height (cm), number of branches / plant, number of pods / plant, shelling percentage (%), hundred kernel weight (g), pod yield/ plant (g), disease scoring for rust and late leaf spot and kernel yield per plant (g) were taken. Nine point disease scale (Subrahmanyam *et al.,* 1995) was used to screen the lines for sources of resistance to rust and LLS. The data were subjected to statistical analysis. Correlation coefficients for kernel yield and yield components were evaluated utilizing the formula suggested by Al-jibouri *et al.*(1958). Further partitioning of correlations into direct and indirect effects by path coefficient analysis was estimated by using the procedure suggested by Dewey and Lu (1959).

Results and Discussion

Genetic association plays a significant role to study the interrelationship and relative contribution of different characters towards crop improvement. Simple correlation coefficient between yield and yield components in three crosses of groundnut are presented in Table 1. In the F_3 cross combinations, kernel yield was significant and positively correlated with number of pods per plant, pod yield per plant, shelling percentage and hundred kernel weight for all the crosses. Similar results were reported by Reddy and Gupta (1992). John *et al.* 2007 reported that pod yield exhibited highly significant positive association with number of mature pods per plant. John *et al.* (2009) indicated that pod and kernel yields showed significant positive association with number of mature pods per plant and hundred kernel weight. The crosses *viz.*, TMV 2 x COG 0437 and TMV 2 x COG 0438 had favourable association of number of branches per plant with kernel yield per plant. The cross TMV 2 x ICGV 97150 had significant association in a positive direction of plant height

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Table 1. Simple correlation coefficient between yield and yield components in three crosses of groundnut

Characters	Crosses	Plant height (cm)	Number of branches / plant	Number of pods / plant	Shelling %	100 kernel weight (g)	Pod yield / plant(g)	Kernel yield/plant (g)	Rust score
No. of branches / plant									
	TMV 2 X COG 0437	0.24**							
	TMV 2 X COG 0438	-0.05							
	TMV 2 X ICGV 97150	-0.06							
No.of pods / plant									
	TMV 2 X COG 0437	0.26**	0.34**						
	TMV 2 X COG 0438	0.01	0.44**						
	TMV 2 X ICGV 97150	0.26**	0.11						
Shelling %									
	TMV 2 X COG 0437	-0.25**	-0.16*	0.09					
	TMV 2 X COG 0438	-0.23**	0.07	0.22**					
	TMV 2 X ICGV 97150	0.00	-0.17*	0.19*					
100 kernel weight (g)									
	TMV 2 X COG 0437	-0.11	-0.15	-0.16*	0.43**				
	TMV 2 X COG 0438	0.10	0.01	-0.07	0.27**				
	TMV 2 X ICGV 97150	0.17*	0.06	0.06	0.45**				
Pod yield/plant (g)									
	TMV 2 X COG 0437	0.25**	0.28**	0.85**	0.07	0.23**			
	TMV 2 X COG 0438	0.19*	0.42**	0.80**	0.10	0.40**			
	TMV 2 X ICGV 97150	0.33**	0.13	0.90**	0.14	0.30**			
Kernel yield/plant (g)									
	TMV 2 X COG 0437	0.17	0.20**	0.80**	0.37**	0.38**	0.94**		
	TMV 2 X COG 0438	0.11	0.39**	0.79**	0.40**	0.44**	0.94**		
	TMV 2 X ICGV 97150	0.28**	0.05	0.82**	0.49**	0.45**	0.91**		
Rust score									
	TMV 2 X COG 0437	0.07	-0.10	-0.18*	-0.04	0.05	-0.14	-0.13	
	TMV 2 X COG 0438	-0.03	0.04	0.09	0.09	-0.20*	-0.06	-0.02	
	TMV 2 X ICGV 97150	0.02	-0.19*	-0.05	0.21**	0.09	-0.02	0.03	
LLS score	TMV 2 X COG 0437	-0.22**	-0.03	-0.15	0.17	0.18	-0.11	-0.03	0.49**
	TMV 2 X COG 0438	0.12	0.10	0.16*	0.01	0.02	0.15	0.14	0.50**
	TMV 2 X ICGV 97150	0.03	-0.18*	-0.04	0.27**	0.12	0.00	0.08	0.91**

*, ** Significant at 5 and 1% levels respectively.

with kernel yield per plant. Similar result was reported by John *et al.* (2009).

It is therefore, logical to conclude that for improving the kernel yield per plant in groundnut, selection has to be exercised on number of branches, number of pods, pod yield per plant, hundred kernel weight and shelling percentage. Among the three crosses, the crosses *viz.*, TMV 2 x COG 0437 and TMV 2 x COG 0438 had non significant association with foliar diseases (rust and late leaf spot) and shelling percentage. Hence, selection of resistant genotypes with high shelling percentage is possible in these crosses. However, in the cross TMV 2 x ICGV 97150, shelling percentage had significant and positive association with rust and late leaf spot severity scores. Such type of different association in the crosses may be due to pedigree of the donor parents utilized. In the present case, COG 0437 and COG 0438 are second generation materials which had parents of locally adopted cultivars whereas the parents of ICGV 97150 involved more of introduced lines. The rust and LLS severity scores also had significant and positive association between each other. Hence, selection on resistance for one disease may have selection for other disease also. However, positive correlation between foliar diseases and shelling percentage will lead to poor shelling in resistant types. This type of undesirable association causes major impediment in breeding for disease resistant programme.In this situation, marker assisted selection for foliar disease resistance and high shelling may help to select rare recombinants with desirable characteristics.

The estimates of correlation coefficients revealed only the relationship between yield and yield components, but do not show the direct and indirect effects of different traits on the yield. This is because the attributes, which are in association do not exist by themselves, but are linked to other components. The path coefficient analysis suggested by Dewey and Lu (1959) specifies the effective measures of the direct and indirect causes of association and depicts the relative importance of each factor involved in contributing to the final product yield. In order to get the developmental relations, the cause and effect relationship between yield *per se* and yield component traits were investigated through path coefficient analysis. The correlation coefficients were further partitioned into direct and indirect effects for each of the nine characters by path analysis and are presented in Table 2.The residual factor was low for all the three crosses which suggested that the variables selected in the present study were sufficient to explain the kernel yield per plant.

The analysis indicated that among the nine traits studied, pod yield per plant exerted maximum positive direct effect on kernel yield per plant for all

Table 2. Direct and indirect effects of different characters towards kernel yield at genotypic level in groundnut

Characters	Crosses	Plant height (cm)	No.of branches / plant	No. of pods / plant	Shelling %	100 kernel weight (g)	Pod yield/ plant (g)	Rust score	LLS score	Kernel yield/ plant (g)
Plant height (cm)										
	TMV 2 X COG 437	0.0263	-0.0010	0.0162	-0.0713	-0.0073	0.2136	-0.0001	-0.0030	0.1734
	TMV 2 X COG 0438	0.0087	0.0007	0.0001	-0.0687	0.0008	0.1684	-0.0004	-0.0007	0.1090
	TMV 2 X ICGV 97150	-0.0059	0.0001	-0.0149	0.0033	0.0043	0.2961	-0.0008	0.0003	0.2824
No.of branches/plant										
	TMV 2 X COG 0437	0.0062	-0.0041	0.0209	-0.0466	-0.0105	0.2362	0.0001	-0.0004	0.2019
	TMV 2 X COG 0438	-0.0005	-0.0132	0.0065	0.0212	0.0001	0.3752	0.0005	-0.0006	0.3892
	TMV 2 X ICGV 97150	0.0003	-0.0022	-0.0062	-0.0624	0.0016	0.1136	0.0071	-0.0015	0.0504
No.of pods/plant										
	TMV 2 X COG 0437	0.0068	-0.0014	0.0622	0.0245	-0.0111	0.7179	0.0002	-0.0021	0.7972
	TMV 2 X COG 0438	0.0001	-0.0058	0.0148	0.0668	-0.0005	0.7179	0.0011	-0.0009	0.7936
	TMV 2 X ICGV 97150	-0.0016	-0.0002	-0.0567	0.0702	0.0016	0.8086	0.0018	-0.0003	0.8233
Shelling %										
	TMV 2 X COG 0437	-0.0066	0.0007	0.0054	0.2839	0.0296	0.0590	0.0001	0.0024	0.3744
	TMV 2 X COG 0438	-0.0020	-0.0009	0.0032	0.3048	0.0020	0.0911	0.0011	-0.0001	0.3993
	TMV 2 X ICGV 97150	-0.0001	0.0004	-0.0110	0.3627	0.0113	0.1299	-0.0079	0.0022	0.4875
100 kernel weight (g)										
	TMV 2 X COG 0437	-0.0028	0.0006	-0.0100	0.1226	0.0686	0.1965	-0.0001	0.0024	0.3778
	TMV 2 X COG 0438	0.0009	-0.0001	-0.0010	0.0814	0.0074	0.3586	-0.0025	-0.0001	0.4446
	TMV 2 X ICGV 97150	-0.0010	-0.0001	-0.0035	0.1630	0.0252	0.2713	-0.0033	0.0010	0.4526
Pod yield/plant (g)										
	TMV 2 X COG 0437	0.0067	-0.0011	0.0528	0.0198	0.0160	0.8452	0.0002	-0.0015	0.9380
	TMV 2 X COG 0438	0.0016	-0.0055	0.0118	0.0308	0.0029	0.9012	-0.0007	-0.0009	0.9413
	TMV 2 X ICGV 97150	-0.0019	-0.0003	-0.0510	0.0524	0.0076	0.8990	0.0008	0.0000	0.9066
Rust score										
	TMV 2 X COG 0437	0.0018	0.0004	-0.0111	-0.0126	0.0033	-0.1179	-0.0013	0.0066	-0.1308
	TMV 2 X COG 0438	-0.0002	-0.0005	0.0014	0.0263	-0.0015	-0.0515	0.0125	-0.0029	-0.0165
	TMV 2 X ICGV 97150	-0.0001	0.0004	0.0027	0.0775	0.0023	-0.0187	-0.0372	0.0074	0.0343
LLS score										
	TMV 2 X COG 0437	-0.0057	0.0001	-0.0096	0.0492	0.0120	-0.0938	-0.0006	0.0136	-0.0348
	TMV 2 X COG 0438	0.0011	-0.0013	0.0023	0.0037	0.0001	0.1331	0.0062	-0.0058	0.1394
	TMV 2 X ICGV 97150	-0.0002	0.0004	0.0021	0.0972	0.0031	0.0009	-0.0338	0.0081	0.0779

Residual effects: 0.15(TMV 2 x COG 0437); 0.14(TMV 2 x COG 0437); 0.21(TMV 2 x COG 0437)

the three crosses. Sumathi and Muralidharan (2007) and Raut *et al.* (2010) reported the similar results. The direct effect of shelling percentage and hundred kernel weight showed positive direct effect on kernel yield per plant for all the three crosses. The traits *viz.*, plant height (for the cross TMV 2 x ICGV 97150), number of branches per plant (all the three crosses), number of pods per plant (for the cross TMV 2 x ICGV 97150), rust score (for the crosses TMV 2 x COG 0437 and TMV 2 x ICGV 97150) and LLS score (for the cross TMV 2 x COG 0438) indicated negative direct effect on kernel yield per plant. The traits *viz*., plant height, number of branches per plant, number of pods per plant, shelling percentage and hundred kernel weight had positive indirect effects on kernel yield per plant through pod yield per plant and also direct contribution with kernel yield per plant for all the three crosses. Among the above traits, the trait, number of pods per plant had the highest positive indirect effect. When both direct and indirect positive contributions were considered, number of pods per plant and pod yield per plant were proved to be the outstanding traits which influenced kernel yield per plant in groundnut.

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