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CORRELATION AND PATH ANALYSIS STUDIES ON F_2 GENERATION OF GROUNDNUT (*ARACHIS HYPOGAEA* L.) FOR YIELD AND ITS ATTRIBUTES

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ABSTRACT

Correlation and path analysis was studied for yield and its contributing traits in F_2 generation derived from two crosses of groundnut (TCGS-888 × ICG-13919 and TPT-4 × ICG-13919). Association analysis of 14 characters in each of two F_2 crosses indicated highly significant positive association of days to 50 per cent flowering, days to maturity, no. of primary branches per plant, no. of secondary branches per plant, no. of mature pods per plant, test weight, shelling per cent, harvest index and kernel yield per plant with pod yield per plant. Selection based on these traits would increase yield ultimately. Path coefficient analysis revealed that no. of mature pods per plant and kernel yield per plant contributed high direct effect towards pod yield per plant in all the five crosses. Therefore, due emphasis should be laid out on these two yield components as selection criterion to select for high pod yield genotypes in both F_2 populations.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) ranks first among the edible oilseed groups. Its seeds are rich source of edible oil (43-55%) and protein (25 to 28%). Correlation coefficient measures the mutual relationship between various characters and determined the component characters on which selection can be relied upon for genetic improvement of yield. Nigam *et al*. (1984) reported that, association among morphological and reproductive traits including pod yield in peanut is of special interest because of the subterranean nature of pod development. Anderson *et al*. (1991) conducted correlation study based on F_2 family means in the F_3 generation in groundnut. John *et al*. (2008) conducted a study on F_2 generation of six groundnut single crosses. Raut *et al*. (2010) studied correlation among eleven yield and yield contributing traits with their path effects towards pod yield were investigated in F_2 generation for six crosses of groundnut. Several correlation analyses for yield and its attributes have also been conducted in sorghum proposed by Singh *et al*. (2013) and in green gram proposed by Kameleshwar *et al*. (2013). A clear picture of contribution of each component is the final expression of character would emerge through the study of correlation and causation of path concept revealing different ways in which component attributes influence the complex traits. In order to achieve the goal of increased production by increasing the yield potential of crop, knowledge of direction and magnitude of association between various traits is essential for plant breeders. Hence keeping aforesaid in view, the present investigation has been planned to assess the magnitude of association of yield components with kernel yield and pod yield and to ascertain the relative contribution of direct and indirect effects of component characters towards kernel yield and pod yield.

MATERIALS AND METHODS

The experimental material comprising of F_2 generation of two crosses *viz*., TCGS-888 × ICG-13919 and TPT-4 × ICG-13919 studied in an unreplicated block along with parents during *Kharif*, 2012-13 at S.V. Agricultural College Farm, Tirupati. Genotypes TCGS-888 and TPT-4 are good performing genotypes based on yield but are susceptible to late leaf spot disease (lines). While, genotype ICG-13919 is a poor performer but have considerable resistance to late leafspot and rust disease (tester). Each F_2 cross was sown with a spacing of 30 × 15 cm in a 3 × 3 m sized plots (Rajesh Kumar, 2013). Data were recorded on 90 plants in each population for days to 50 % flowering, days to maturity, plant height, no. of primary branches per plant, no. of secondary branches per plant, no. of mature pods per plant, test weight, shelling percent, harvest index, kernel yield per plant, no. of leaves affected at 60 DAS, LLS score at 60 DAS, no. of leaves affected at 90 DAS and LLS score at 90 DAS.

Since each F_2 population was raised as unreplicated simple correlation between characters 'X' and 'Y' in F_2 population was computed based on variance and covariance estimates derived from mean values of 'X' and 'Y' of sampled ninety random plants.

$$r(XY) = \frac{\text{cov}(XY)}{\sqrt{\sigma^2(X).\sigma^2(Y)}}$$

where,

r (XY) = Correlation between characters 'X' and 'Y'.

COV (XY) = Covariance between characters 'X' and 'Y'.

σ^2 (X) = Variance of character 'X'.

σ^2 (Y) = Variance of character 'Y'.

The significance of above correlation was tested by using standard 'r' table value (Fisher and Yates, 1963) at n-2 i.e., 90-2 = 88 degree of freedom.

Path coefficient analysis was carried out by using simple correlations in F_2 population to know the direct and indirect effects of the yield components as suggested by Wright (1921) and illustrated by Dewey and Lu (1959).

RESULTS AND DISCUSSION

Correlations between yield attributes and pod yield in TCGS-888 × ICG-13919 (C_1)

In this cross, no. of mature pods per plant showed maximum significant and positive correlation with pod yield per plant (0.953**) followed by kernel yield per plant (0.923**), harvest index (0.536**), no. of secondary branches per plant (0.501**), days to 50 per cent flowering (0.497**), days to maturity (0.437**) and no. of primary branches per plant (0.378**) in the decreasing order of their magnitude indicating that increase in these traits resulted in pod yield potential in the genotypes (Table 1). Improvement in pod yield can be achieved by indirect selection to these characters.

Significant positive correlation of no. of secondary branches per plant, no. of primary branches per plant and no. of mature pods per plant with pod yield per plant was reported earlier by Shreya *et al.*(2015), while days to 50 per cent flowering with pod yield by Mathews *et al.* (2001) and corroborates the results of the present study.

Similarly, significant positive correlation between no. of mature pods per plant and pod yield per plant was reported earlier by Venkateswarlu *et al.* (2007), Sobha *et al.* (2012). Sah *et al.* (2000) and Awatade *et al.*(2010) reported positive correlation between kernel weight per plant and pod yield while, Venkateswarlu *et al.* (2007), Sharma and Gupta (2008) and Korat *et al.* (2010) revealed positive correlation between harvest index and pod yield per plant which is in conformity with the findings of the present study.

Direct and indirect effects of highly correlated component traits towards pod yield per plant

No. of mature pods per plant showed positive and high (0.554) direct effect as well as high significant positive correlation with pod yield per plant indicating that indirect selection based on

Table 1: Correlation of pod yield with other 15 characters in both crosses

Sl. No.	Characters	C_1	C_2
1.	Days to 50 % flowering	0.497**	0.279**
2.	Days to maturity	0.437**	0.307**
3.	Plant height	0.184	-0.037
4.	No. of primary branches per plant	0.378**	0.280**
5.	No. of secondary branches per plant	0.501**	0.282**
6.	No. of mature pods per plant	0.953**	0.970**
7.	Test weight	0.132	0.655**
8.	Shelling percent	-0.196	0.482**
9.	Harvest index	0.536**	0.522**
10.	Kernel yield per plant	0.923**	0.950**
11.	No. of Leaves affected at 60 DAS	-0.173	0.093
12.	LLS Score at 60 DAS	-0.078	0.034
13.	No. of Leaves affected at 90 DAS	-0.169	0.076
14.	LLS Score at 90 DAS	-0.002	-0.118

C_1: Correlation coefficient among TCGS-888 × ICG-13919; C_2: Correlation coefficient among TPT-4 x ICG-13919; * and **: significant at 5% and 1%, respectively

Table 2: Direct and indirect effects of highly correlated component traits towards pod yield per plant in F_2 generation of the cross TCGS-888 x ICG-13919

Traits	Days to50 % flowering	Days to maturity	No. of primary branches per plant	No. of secondary branches per plant	No of mature podsper plant	Harvest index	Kernel yield per plant	Correlation with podyield per plant
Days to 50 % flowering	-0.063	-0.003	0.083	0.023	0.246	0.045	0.167	0.497**
Days to maturity	-0.049	-0.004	0.056	0.014	0.207	0.064	0.151	0.437**
No. of primary branchesperplant	-0.045	-0.002	0.117	0.028	0.189	-0.019	0.110	0.378**
No. of secondary branchesperplant	-0.030	-0.001	0.067	0.049	0.276	-0.007	0.147	0.501**
No. of mature podsperplant	-0.028	-0.002	0.040	0.024	0.554	0.067	0.297	0.953**
Harvest index	-0.020	-0.002	-0.016	-0.002	0.260	0.142	0.174	0.536**
Kernel yield per Plant	-0.031	-0.002	0.038	0.021	0.485	0.073	0.340	0.923**

ResiduaL effect = 0.6861; Bold: Direct effects; Non-bold: Indirect effects; *,** significant at 5% and 1% level, respectively; LLS Score at 90 DAS 0.113; *,** significant at 5% and 1% level, respectively

Table 3: Direct and indirect effects of highly correlated component traits towards pod yield per plant in F_2 generation of the cross TPT-4 x ICG-13919

Traits	Days to 50 % flowering	Days to maturity	Primary branches perplant	Secondary branches per plant	Mature pods per plant	Test weight	Shelling percent	Harvest index	Kernel yield per plant	Correlation with pod Yield per plant
Days to 50 % flowering	-0.003	-0.091	0.149	-0.001	0.045	a	0.032	-0.011	0.158	0.279**
Days to maturity	-0.003	-0.098	0.143	-0.001	0.055	a	0.031	-0.009	0.189	0.307**
No. of primary branches per plant	-0.003	-0.092	0.152	-0.001	0.045	a	0.028	-0.010	0.162	0.280**
No. of secondary branches per plant	-0.002	-0.058	0.086	-0.002	0.047	a	-0.020	-0.013	0.243	0.282**
No. of mature pods per plant	-0.001	-0.023	0.029	a	0.232	a	-0.122	0.033	0.821	0.970**
Test weight	a	0.002	-0.007	a	0.150	a	-0.181	0.022	0.668	0.655**
Shelling %	a	0.011	-0.016	a	0.106	a	-0.267	0.010	0.637	0.482**
Harvest index	0.001	0.015	-0.026	a	0.130	a	-0.046	0.059	0.389	0.522**
Kernel yield per Plant	-0.001	-0.021	0.027	-0.001	0.213	a	-0.190	0.026	0.896	0.950**

Residual effect = 0.8018; Bold: Direct effects; Non-bold: Indirect effects;*,** significant at 5% and 1% level, respectively;a = negligible effect

this trait will result in increase in the pod yield potential (Table 2). It showed moderate positive indirect effect via kernel yield per plant (0.297). Positive direct effect of no. of mature pods per plant on pod yield was reported earlier by Venkataravana *et al.* (2000).

The direct effect of kernel yield per plant on pod yield per plant was positive and high (0.340). It exerted positive and high indirect effect via no. of mature pods per plant (0.485) while, it showed negligible positive indirect effect via harvest index (0.073), no. of primary branches per plant (0.038) and no. of secondary branches per plant (0.021). Positive direct effect of kernel yield per plant was reported earlier by Ravikumar *et al.* (2012).

Harvest index showed positive and low direct effect (0.142) on pod yield per plant. It showed moderate and positive indirect effect via no. of mature pods per plant while, it showed negligible positive indirect effects via no. of mature pods per plant (0.259) and kernel yield per plant (0.174). The findings of positive direct effect of harvest index on pod yield were in conformity with the earlier reports of Verma *et al.* (2001) and Ravikumar *et al.* (2012).

Number of primary branches per plant showed positive and low direct effect (0.117) on pod yield per plant. It showed low and positive indirect effect via no. of mature pods per plant (0.189) and kernel yield per plant (0.110) while, it showed negligible positive indirect effects via no. of secondary branches per plant (0.028).

From the foregoing results, it is to conclude that no. of mature pods per plant, kernel yield per plant and harvest index are the major yield components associated with pod yield and are the major contributors to pod yield in the F_2 generation of cross TCGS-888 × ICG-13919. Also, kernel yield per plant and no. of mature pods per plant contributed high direct effects indicating that indirect selection of these traits would result in increase in pod yield. Hence, due emphasis should be laid out on these yield components as selection criterion to select the high pod yield genotypes in this F_2 population.

Correlations between yield attributes and pod yield in TPT-4 × ICG-13919 (C_2)

In this F_2 generation, no. of mature pods per plant recorded significant positive correlation with pod yield per plant (0.970**) followed by kernel yield per plant (0.950**), test weight (0.655**), harvest index (0.522**), shelling per cent (0.482**), days to maturity (0.307**), no. of secondary branches per plant (0.282**), no. of primary branches per plant (0.280**) and days to 50 per cent flowering (0.279**) in the decreasing order of magnitude (Table 1) indicating that genetic improvement in pod yield can be achieved by indirect selection through these component characters.

The reports of positive significant association of test weight with pod yield were contradicted with the results recorded by Jogloy *et al.* (2005) and Sobha *et al.* (2012). Positive association of yield with plant height was reported by Singh *et al.* (2013). Significant positive association of shelling percent with pod yield per plant observed in the present study was in concordance with the findings of Kotzamanidis *et al.* (2006).

Direct and indirect effects of highly correlated component traits towards pod yield per plant:

Among all the traits, kernel yield per plant exerted the maximum positive direct effect (0.896) on pod yield per plant (Table 3). It showed moderate and positive indirect effects via no. of mature pods per plant (0.213). No. of mature pods per plant contributed positive and moderate (0.232) direct effect on pod yield per plant. It exerted high and positive indirect effects via kernel yield per plant (0.821). Positive direct effect of no. of mature pods per plant on pod yield was reported earlier by Parameshwarappa *et al.* (2008) and Ravikumar *et al.* (2012) and corroborates the findings of the present study.

Number of Primary branches per plant expressed positive and low direct effect (0.151) on pod yield per plant. It showed low and negative indirect effects via kernel yield per plant (0.162). The present finding of positive direct effect of no. of primary branches per plant on pod yield is in conformity with the earlier reports of Lal *et al.* (2003), Sumathi and Muralidharan (2007) and Raut *et al.* (2010).

From the foregoing results, it is to conclude that no. of mature pods per plant, kernel yield per plant, test weight, harvest index, shelling per cent, days to maturity, no. of secondary branches per plant, no. of primary branches per plant, days to 50 per cent flowering, days to maturity and days to 50 per cent flowering are the yield components associated with pod yield in the F_2 generation of cross TPT-4 × ICG-13919. Further, kernel yield per plant, no. of mature pods per plant and no. of primary branches per plant exerted high positive direct effect on pod yield. Hence, due emphasis should be laid out on these three yield components as selection criterion to select for high pod yield genotypes in this F_2 population.

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