The Andhra Agric. J 68 (2): 182-188, 2021

Studies on Character Association and Path Analysis in Groundnut

E Sudhishna, K S S Naik, T Srinivas and D Ramesh
Department of Genetics & Plant Breeding, Agricultural College, Bapatla, A. P.

ABSTRACT

Forty groundnut genotypes obtained from Agricultural Research Station, Kadiri, Andhra Pradesh constituted the experimental material for the present investigation. Character associations among yield, yield component characters and quality traits in addition to path effects of the yield component traits and quality characters for dry pod yield were studied in the present investigation. The results revealed significant and negative association of dry pod yield per plant with number of immature pods per plant and 100 kernel weight. However, significant and positive association was noticed for the trait with plant height, mature pods per plant and fresh pod yield per plant. Further, high and positive direct effects of mature pods per plant and fresh pod yield per plant were observed in the present study, indicating their effectiveness as important selection criteria for dry pod yield improvement in groundnut.

Key words: *Correlation, Groundnut, Path analysis and Yield.*

Groundnut (*Arachis hypogaea* L.) is the world's fourth most important source of edible oil and third most important source of vegetable protein. It is an important commercial crop of rainfed areas and contributes to around 40 per cent of the total oilseeds production. India ranks first in groundnut cultivated area but occupies second place in production. However, the productivity of groundnut in India is low, primarily due to lack of high yielding cultivars. Therefore, there is an urgent need for development of high yielding varieties in groundnut. Pod yield in groundnut, owing to its complex nature of inheritance, is influenced by different yield components and quality traits, which makes direct selection for pod yield ineffective. Therefore, information on the nature and extent of association between the yield component traits and their association with pod yield is an important pre-requisite for planning of effective groundnut crop improvement programmes. Further, information on the direct and indirect effects of these component traits on yield also aids in targeted selections and superior crop improvement. The present investigation was undertaken in this context to study the character associations and path effects of yield components and quality traits on dry pod yield with a view to identify effective selection criteria for higher pod yield in groundnut.

MATERIAL AND METHODS

Experimental material for the present investigation comprised of 40 groundnut genotypes developed at Agricultural Research Station, Kadiri of Acharya N.G. Ranga Agricultural University. These genotypes were sown during *Rabi*, 2020-21 at Agricultural College Farm, Bapatla of Guntur District in Andhra Pradesh state. Each genotype was sown in continuous three row plots of 5m row length at a spacing of 30cm between rows and 10cm between plants within the row in a Randomized Complete Block Design with three replications. The crop was raised under irrigated conditions and all recommended practices were followed to raise a healthy crop. Observations were recorded on yield and quality traits, namely days to 50 per cent flowering, days to maturity, plant height, primary branches per plant, secondary branches per plant, number of mature pods per plant, number of immature pods per plant, sound mature kernel per cent, dry pod yield per plant (g), fresh pod yield per plant (g), 100 kernel weight (g), shelling per cent and oil content (%). All observations were recorded from five randomly selected plants for each genotype in each replication, except for days to 50 per cent flowering and days to maturity which were recorded on plot basis; and 100 kernel weight (g), shelling per cent and oil content (%) which were recorded from a random sample obtained from each plot. The data collected was subjected to standard statistical procedures. Genotypic and phenotypic correlation coefficients (Falconer, 1964) in addition to the direct and indirect effects of different yield attributes (Dewey and Lu, 1959) were estimated and categorized (Lenka and Mishra, 1973).

RESULTS AND DISCUSSION

Correlation measures the magnitude of cause-effect relationship between various plant characters that determines the component characters on which selection can be made for improvement in pod yield (Devi *et al.*, 2017). The nature and magnitude of association among pod yield and its component traits was studied in the present investigation and the results are presented in Table 1.

A perusal of these results revealed phenotypic and genotypic correlations to be of similar direction and significance. However, genotypic correlations recorded a higher magnitude compared to phenotypic correlations, indicating the masking effect of environment. Further, positive and significant association of dry pod yield with plant height (r_p=0.2412** and r_g=0.3865**), mature pods per plant (r_p=0.5679** and r_g=0.7898**) and fresh pod yield (r_p=0.6986** and r_g=(0.9645**) was observed in the present investigation, indicating an increase in pod yield with an increase in these characters. Therefore, priority should be given to these traits while making selections for dry pod yield improvement. The findings are in agreement with the reports of Kyaw *et al.*(2017) for plant height ; Yusuf *et al.* (2017) and Reddy *et al.* (2017) for number of mature pods per plant. However, significant and negative associations were noticed for dry pod yield per plant with number of immature pods per plant (r_p= -0.5580** and r_g= -0.6793**) and 100 kernel weight (r_p= -0.1842* and r_g= -0.2349**) The results are in conformity with the reports of Meta and Monpara (2010) for 100 kernel weight.

A perusal of the results on inter-character associations revealed significant and positive association of days to 50 per cent flowering with days to maturity (r_p= 0.6340** and r_g= 0.8285**), primary branches per plant (r_p= 0.2226* and r_g= 0.6730**), secondary branches per plant (r_p= 0.5023** and r_g= 0.5884**) and 100 kernel weight (r_p= 0.3947** and r_g= 0.5156**); days to maturity with primary branches per plant (r_p= 0.3567** and r_g= 0.7129**), secondary branches per plant (r_p= 0.7316** and r_g= 0.8410**), 100 kernel weight (r_p= 0.3278** and r_g= 0.3855**); primary branches per plant with secondary branches per plant (r_p= 0.2105* and r_g= 0.4502**); secondary branches per plant with 100 kernel weight (r_p= 0.3121** and r_g= 0.3182**); mature pods per plant with fresh pod yield (r_p= 0.5043** and r_g= 0.6636**) and immature pods per plant with100 kernel weight (r_p= 0.3009** and r_g= 0.3623**), in the present investigation, indicating a scope for simultaneous improvement of these traits through selection. The findings are in conformity with the reports of Hampannavar *et al.* (2018) for days to 50 per cent flowering with days to maturity and primary branches per plant; Korat *et al.* (2010) for days to 50 per cent flowering with secondary branches per plant; days to maturity with secondary branches per plant; primary branches per plant with secondary branches per plant; Kyaw *et al.* (2017) for days to 50 per cent flowering with 100 kernel weight; Kumar *et al.* (2014) for days to maturity with 100 kernel weight.

In contrast, significant and negative association of days to 50 per cent flowering with plant height (r_p= -0.2165* and r_g= -0.3403**); days to maturity with plant height (r_p= -0.1824* and r_g= -0.3079**), sound mature kernel per cent (r_p= -0.1924* and r_g= -0.4010**); plant height with secondary branches per plant (r_p= -0.2979** and r_g= -0.3732**), plant height with immature pods per plant (r_p= -0.1985* and r_g= -0.2628**), oil content (r_p= -0.2142* and r_g= -0.2999**); number of secondary branches per plant with sound mature kernel per cent (r_p= -0.1885* and r_g= -0.4421**); mature pods per plant with immature pods per plant (r_p= -0.4443 and r_g= -0.5665**); immature pods per plant with fresh pod yield per plant (r_p= -0.5019** and r_g= -0.6244**) and sound mature kernel per cent with 100 kernel weight (r_p= -0.3345** and r_g= -0.7836**) were observed in the present study, probably due to competition for a common possibility such as nutrient supply, indicating the need for balanced selection while effecting simultaneous improvement for these traits (Reddy *et al.*, 2018). The results are in agreement with the reports of Hampannavar *et al.* (2018) for days to 50 per cent flowering with plant height; days to maturity with plant height; plant height with oil content.

Path coefficient analysis splits the correlation coefficients (Naik *et al.,* 2017). Path co-efficient analysis provides an effective means of finding out the direct and indirect causes of association and presents a critical examination of the specific forces acting to produce a given correlation and also measures the relative importance of each causal factor. The results an path co- efficient analysis for dry pod yield in groundnut are presented in Table 2. The genotypic path co-efficient were observed to be of higher magnitude compared to phenotypic path co-efficient, indicating the masking effect of environment. The results also revealed high residual effect for both phenotypic (0.4613) and genotypic (0.4340) path coefficients, respectively indicating the explanation of about 54 (phenotypic) and 57 (genotypic) per cent of the variability observed for dry pod yield per plant due to the traits studied in the present investigation and therefore, other attributes besides the characters studied are contributing for dry pod yield.

The results also revealed high (>0.30) positive direct effects of plant height (P_g= 0.4978), mature pods per plant (P_p= 0.3688 and P_g= 0.5656) and fresh pod yield per plant (P_p= 0.4905 and P_g= 0.5405). The results are in conformity with the findings of Kyaw *et al.* (2017) for plant height and Memon *et al.* (2019) for mature pods per plant. These traits had also exhibited highly significant and strong positive association (r_p= 0.2412** and r_g= 0.3865**), (r_p= 0.5679**and r_g= 0.7898**) (r_p= 0.6986** and r_g= 0.9645**), respectively with dry pod yield per plant. High direct effects of these traits, therefore appear to be the main factor for their strong association with dry pod yield per plant. Hence, these traits should be considered as important selection criteria in all groundnut improvement programmes and direct selection for these traits is recommended for dry pod yield improvement.

In contrast, number of immature pods per plant (P_p= -0.2767 and P_g= -0.3764) had recorded high negative direct effect on dry pod yield, in addition

Table 1. Phenotypic (r_p) and genotypic (r_g) correlation coefficients for yield, yield component traits and quality traits

Characters	r	Days to maturity	Plant height	Primary branches per plant	Secondary branches per plant	Mature pods per plant	Immature pods per plant	Sound mature kernel per cent	Fresh pod yield per plant	Shelling per cent	100 kernel weight	Oil content	Dry pod yield per plant
Days to 50 per cent flowering	r_p	0.6340**	-0.2165*	0.2226*	0.5023**	0.0787	0.0166	-0.1289	0.0374	0.0687	0.3947**	-0.0015	0.0526
	rg	0.8285**	-0.3403**	0.6730**	0.5884**	-0.1245	0.0023	-0.2392**	0.1437	0.0243	0.5156**	0.0251	0.0745
Days to maturity	r_p		-0.1824*	0.3567**	0.7316**	-0.0361	0.0876	-0.1924*	0.0367	-0.075	0.3278**	-0.1086	0.0213
	rg		-0.3079*	0.7129**	0.8410**	-0.0788	0.1616	-0.4010**	0.0499	-0.1147	0.3855**	-0.1476	0.006
Plant height	r_p			0.1301	-0.2979**	0.0935	-0.1985*	-0.0029*	0.2601**	-0.1356	-0.0633	-0.2142*	0.2412**
	r_g			0.1248	-0.3732**	0.1376	-0.2628**	0.0185	0.4878**	-0.2821**	-0.1045	-0.2999**	0.3865**
Primary branches per plant	r_p				0.2105*	0.0662	-0.1290*	-0.0557	0.052	0.0392	0.1213	-0.0798	-0.0254
	r_g				0.4502**	0.0781	-0.1835*	-0.1811*	0.0831	0.1820*	0.2527**	-0.3827**	0.1288
Secondary branches per plant	r_p					-0.0601	0.1941*	-0.1885*	0.0255	-0.0717	0.3121**	-0.025	0.0605
	r_g					-0.0689	0.1975	-0.4421**	0.0092	-0.1489	0.3182**	-0.0243	0.1146
Mature pods per plant	r_p						-0.4443**	0.1359*	0.5043**	0.0941	-0.4797**	-0.1261	0.5679**
	r_g						-0.5665**	0.3813**	0.6636**	0.1822*	-0.5698**	-0.1759	0.7898**
Immature pods per plant	r_p							-0.1432	-0.5019**	0.0341	0.3009**	0.0675	-0.5580**
	r_g							-0.5598**	-0.6244**	-0.033	0.3623**	0.0878	-0.6793**
Sound mature kernel per cent	r_p								-0.0204	0.1677	-0.3345**	-0.0297	0.0493
	r_g								0.2205*	0.5297**	-0.7836**	-0.1322	0.3026**
Fresh pod yield per plant	r_p									-0.0671	0.1022	-0.124	0.6986**
	r_g									-0.3019**	-0.125	-0.1522	0.9645**
Shelling per cent	r_p										0.045	-0.036	-0.0279
	r_g										0.0645	-0.1872*	-0.1862*
100 kernel weight	r_p											0.0109	-0.1842*
	r_g											-0.0191	-0.2349**
Oil content	r_p												-0.1726
	r_g												-0.1118

r_p= Phenotypic correlation; r_g = genotypic correlation; * and ** Significant at 5% and 1% levels, respectively

Table 2. Phenotypic (P_p) and genotypic (P_g) path analysis for dry pod yield in groundnut

Character	p	Days to 50 per cent flowering	Days to maturity	Plant height	Primary branches per plant	Secondary branches per plant	Mature pods per plant	Immature pods per plant	Sound mature kernel per cent	Fresh pod yield per plant	Shelling per cent	100 kernel weight	Oil content	Dry pod yield per plant
Days to 50 P flowering	Pp	0.0646	-0.0642	-0.0283	-0.0334	0.1116	-0.0212	-0.0046	-0.0018	0.0146	0.0003	0.015	0.0001	0.0526
	Pg	0.0616	0.4172	-0.2375	-0.4655	0.4437	-0.0704	-0.0009	0.0607	-0.0014	0.0035	-0.1325	-0.004	0.0745
Days to maturity	Pp	0.0409	-0.1013	-0.0238	-0.0535	0.1625	-0.0097	-0.0242	-0.0027	0.0143	-0.0003	0.0124	0.0066	0.0213
	Pg	0.8795	-0.7035	-0.2149	-0.4931	0.6342	-0.0446	-0.0608	0.1017	-0.0005	-0.0166	-0.0991	0.0236	0.006
Plant height	Pp	-0.014	0.0185	0.2407	-0.0195	-0.0662	0.0151	0.0549	0	0.0015	-0.0005	-0.0024	0.013	0.2412**
	Pg	-0.3613	0.0166	0.4978	-0.0863	0.1186	0.0778	0.0989	-0.0047	-0.0048	-0.0409	0.0269	0.0479	0.3865**
Primary branches per plant	Pp	0.0144	-0.0361	0.017	-0.15	0.0468	0.0178	0.0357	-0.0008	0.0203	0.0001	0.0046	0.0049	-0.0254
	Pg	0.7145	-0.5015	0.0871	-0.7916	0.3395	0.1442	0.0691	0.0459	-0.0008	0.0264	-0.0649	0.0611	0.1288
Secondary branches per plant	Pp	0.0324	-0.0741	-0.0389	-0.0316	0.2222	-0.0162	-0.0537	-0.0027	0.0099	-0.0003	0.0119	0.0015	0.0605
	Pg	0.5246	-0.5917	-0.2604	-0.3114	0.8542	-0.0389	-0.0743	0.1121	-0.0001	-0.0216	-0.0818	0.0039	0.1146
Mature pods per plant	Pp	-0.0051	0.0037	0.0122	-0.0099	-0.0133	0.3688	0.0229	0.0019	0.1969	0.0003	-0.0182	0.0077	0.5679**
	Pg	-0.1322	0.0554	0.096	-0.054	-0.0519	0.5656	0.2132	-0.0967	-0.0065	0.0264	0.1464	0.0281	0.7898**
Immature pods per plant	Pp	0.0011	-0.0089	-0.0259	0.0194	0.0431	-0.1195	-0.2767	-0.002	-0.196	0.0001	0.0114	-0.0041	-0.5580**
	Pg	0.0025	-0.1137	-0.1137	0.1269	0.1489	-0.3204	-0.3764	0.142	0.0061	-0.0744	-0.0931	-0.014	-0.6793**
Sound mature kernel percent	Pp	-0.0083	0.0195	-0.0004	0.0083	-0.0419	0.0365	0.0396	0.0141	-0.008	0.0006	-0.0127	0.0018	0.0493
	Pg	-0.254	0.2821	0.0129	0.1252	-0.3334	0.2156	0.2107	-0.2536	-0.0021	0.0767	0.2013	0.0211	0.3026**
Fresh pod yield per plant	Pp	0.0024	-0.0037	0.034	-0.0078	0.0057	0.1356	0.0389	-0.0003	0.4905	-0.0002	-0.0039	0.0075	0.6986**
	Pg	0.1525	-0.0351	0.047	-0.0575	0.0069	0.2254	0.128	-0.0559	0.5405	-0.0437	0.0321	0.0243	0.9645**
Shelling percent	Pp	0.0044	0.0076	-0.0177	-0.0059	-0.0159	0.0253	-0.0094	0.0024	-0.0262	0.0037	0.0017	0.0022	-0.0279
	Pg	0.0258	0.0807	-0.1969	-0.1259	-0.1123	0.1031	0.0124	-0.1343	0.0029	0.1449	-0.0166	0.0299	-0.1862*
100 kernel weight	Pp	0.0255	-0.0332	-0.0083	-0.0182	0.0693	-0.129	-0.0832	-0.0047	-0.0399	0.0002	0.038	-0.0007	-0.1842*
	Pg	0.5473	-0.2712	-0.0729	-0.1748	0.24	-0.3223	-0.1363	0.1987	0.0012	0.0093	-0.257	0.003	-0.2349**
Oil content(%)	Pp	-0.0001	0.011	-0.028	0.012	-0.0056	-0.0339	-0.0187	-0.0004	-0.0484	-0.0001	0.0004	-0.0608	-0.1726
	Pg	0.0267	0.1038	-0.2093	0.2647	-0.0183	-0.0995	-0.033	0.0335	0.0015	-0.0271	0.0049	-0.1597	-0.1118

to significant and negative association (r_p= -0.5580**and r_g= -0.6793**) with dry pod yield per plant. Hence, balanced selection needs to be adopted while effecting simultaneous improvement for these traits. Further, secondary branches per plant (P_g= 0.8542) had also recorded high positive direct effects on dry pod yield per plant. However, the association with dry pod yield per plant was noticed to be non-significant in the present investigation indicating the need for adoption of restricted simultaneous selection model to nullify the undesirable indirect effects and make use of the direct effect. High negative direct effects were noticed for days to maturity (P_g= -0.7035) and primary branches per plant (P_g= -0.7916) on dry pod yield per plant in the present investigation. However, the association of these traits with dry pod yield per plant was observed to non-significant indicating a major role of indirect effects. Further, sound mature kernel per cent had recorded low negative direct effect on pod yield per plant, in addition to non- significant associations with dry pod yield per plant, indicating the role of indirect effects and the need for consideration of indirect effects traits in the groundnut pod yield improvement programmes, The findings are in agreement with the reports of Venkatesh *et al.* (2017).

CONCLUSION

Mature pods per plant and fresh pod yield per plant are identified as effective selection criteria for dry pod yield improvement in groundnut.

Acknowledgement

The senior author is highly thankful to ICAR and ANGRAU for financial assistance rendered in the form of JRF for conduct of the present investigation.

LITERATURE CITED

Devi B R, Lal Ahamed M, Ratna Babu D and Madhumathi T 2017 Correlation and path analysis for morphological traits in maize (*Zea mays* L.) inbred lines. *The Andra Agricultural Journal*. 64 (1): 87-90.

Dewey D and Lu K H 1959 A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agronomy Journal*. 51: 515-518.

Falconer D S 1964 *Introduction to Quantitative Genetics*. Second Edition, Oliver and Boyd Ltd. Edinburgh. 312-324**.**

Hampannavar M R, Khan H, Temburne B V, Janila P and Amaregouda A 2018 Genetic variability, correlation and path analysis studies for yield and yield attributes in groundnut (*Arachis hypogaea* L.). *Journal of Pharmacognosy and Phytochemistry*. 7(1); 870-874.

Korat V P, Pithia M S, Savaliya J J, Pansuriya A G and Sodavadiya P R 2010 Studies on character association and path analysis for seed yield and its components in groundnut (*Arachis hypogaea* L.). *Legume Research*. 33(3); 211-216.

Kyaw H, Winn K, Lin T and Htwe N V 2017 Correlation and path coefficient analysis in groundnut (*Arachis hypogaea* L.) under monsoon and post monsoon. *International Journal of Advanced Research*. 5(12); 175-183.

Lenka D and Mishra B 1973 Path coefficient analysis of yield in rice varieties. *The Indian Journal Agricultural Science*. 43(4), p.376.

Memon J T, Kachhadia V H, Dedaniya A P and Patel R 2019 Character association and path coefficient analysis in F2 generation of groundnut (*Arachis hypogaea* L.). *International Journal of Chemical Studies*. 7(3); 1329-1334.

Meta M R and Monpara B A 2010 Genetic variation and trait relationships in summer groundnut (*Arachis hypogaea* L.). *Journal of Oilseeds Research*. 27(1); 8-11.

Naik M B, Satish Y and Babu D R 2017 Correlation and path coefficient analysis for yield and yield component traits in american cotton (*Gossypium hirsutum* L.). *The Andra Agricultural Journal*. 64 (1): 97-100.

Kumar C P, Rekha R, Venkateswarulu O and Vasanthi R P 2014 correlation and path coefficient analysis in groundnut (*Arachis hypogaea* L.). *International Journal of Applied Biology and Pharmaceutical Technology*. 5(1); 8-10.

Reddy A L, Srinivas T, Rajesh A P and Umamaheswari P 2017 Genetic variability and association analysis for yield, physiological and quality traits in drought tolerant groundnut genotypes. *Journal of Food Legumes*. 30(2): 27-30.

Reddy A L, Srinivas T, Rajesh A P and Umamaheswari P 2018 Genetic variability and association analysis for yield and yield component traits in Groundnut. *Green Farming*. 9(4): 586-590.

Venkatesh K, Srinivas T, Rajesh A P and Umamaheswari P 2017 Genetic variability and association analysis for quantitative and physiological traits of drought tolerant groundnut genotypes. *Environment and Ecology*. 35(4A): 2981-2989.

Yusuf Z, Zeleke H, Mohammed W, Hussein S and Hugo A 2017 Correlation and path analysis of groundnut (*Arachis hypogaea* L.) genotypes in Ethiopia. *International Journal of Plant Breeding and Crop Science*. 4(2): 197-204.

Received on 22.09.2021 and Accepted on 26.10.2021