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CHARACTER ASSOCIATION AND PATH ANALYSIS IN GROUNDNUT (ARACHIS HYPOGAEA L.)

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ABSTRACT: Correlation and path co-efficient analysis were carried out for pod yield and its component characters in 50 genotypes of groundnut. The genotypic correlation co-efficients were found to be of relatively higher magnitude than the corresponding phenotypic correlation co-efficients, indicating strong inherent association between the characters. Pod yield displayed significant positive association with kernel yield per plant, mature pods per plant, total pods per plant, harvest index, 100-seed weight, root weight, plant height and shoot weight. Path co-efficient analysis revealed high direct effects of kernel yield per plant and harvest index on pod yield. Hence, it would be rewarding to give due importance on the selection of these characters for rapid improvement in pod yield of groundnut.

Key words: Character Association, Path Analysis, Groundnut.

INTRODUCTION

Groundnut(Arachis hypogaea L.) being one of the most important oilseed crops of India, still stands one of the lowest in terms of productivity. In groundnut, overall pod yield is constituted by different yield components which makes it a quantitatively inherited trait. Direct selection of pod yield would not be a reliable approach without giving due importance to its genetic nature, owing to its complex nature of inheritance. Information on the correlation co-efficients between the yield components and pod yield is a pre-requisite for crop improvement. Though the correlations give information about the component traits, they do not provide a true picture of relative importance of direct and indirect effects of these component traits on pod yield. Hence, the present study was carried out to obtain information on the magnitude of relationship of individual yield components on yield, interrelationships among themselves and to measure their relative importance.

MATERIALS AND METHODS

The material for the present study comprised 50 groundnut genotypes, grown in a Randomized Block Design with two replications during late rabi 2004. Ten plants were selected at random each genotype in each replication for recording observations on 15 quantitative characters. The phenotypic and genotypic correlation co-efficeients were estimated using the method suggested by Johnson et al (1955). The correlation co-efficients were used to find out the direct and indirect effects of the component characters on pod yield as per the method of Dewey and Lu (1959).

RESULTS AND DISCUSSION

Correlation Co-efficient Studies:

Significant differences were observed among the 50 genotypes for all the 15 characters studied. In general, the genotypic correlation co-efficients were greater than their respective phenotypic correlation co-efficients (Table 1). This may be due to depressed phenotypic expression by environmental influence. The results revealed that pod yield had significant positive association with kernel yield per plant, mature pods per plant, total pods per plant, harvest index, 100-seed weight, root weight, plant height and shoot weight indicating the positive linear relationship of these characters with pod yield at phenotypic level. Such positive association of pod yield with kernel yield(Kumar et al.1998), mature pods per plant(Balaiah et al 1980), harvest index (Sharma and Varshney, 1995), 100-seed weight(Vaddoria and Patel, 1992), root weight(Makhan Lal
et al., 2003), plant height(Venkataravana et al., 2000) and shoot weight(Mathews et al.,2000) were reported earlier. On the contrary, negative association of pod yield with root weight(Gupta and Bali,1997) and shoot weight(Rucker et al.,1995) were also reported.

The association of pod yield was non-significant and negative with days to 50 per cent flowering, root weight to shoot weight ratio, days to maturity and SCMR. Similar indings for days to 50 per cent flowering (Bhagat et al., 1986) and root weight to shoot weight ratio (Rucker et al., 1995) were reported earlier.
Inter correlation estimates for yield components revealed that kernel yield per plant, mature pods per plant, total pods per plant, harvest index, 100-seed weight, root weight, plant height and shoot weight were significantly and positively associated with one another as well as with pod yield which indicated that these are important components for improvement of pod yield in groundnut. Ahamed (1995), Abraham and Ofori(1996) and Jayalakshmi et al(2000) have reported similar results for mature pods per plant, total pods per plant and harvest index respectively. These positive inter correlations indicate the possibility of simultaneous improvement of these traits by selection.

Path Co-efficient Studies:
The path co-efficient studies (Table 2) indicated that kernel yield per plant had the highest positive direct effect on pod yield followed by harvest index and shoot weight while shelling percentage exerted the maximum negative direct effect on pod yield followed by mature pods per plant. These results were similar to the previous reports of Reddy et al.,(1986) for kernel yield per plant and Bera and Das(2000) and Nagda and Joshi(2004) for harvest index.
Indirect effects of the component characters were high through kernel yield per plant on pod yield. The character mature pods(0.6644) per plant exerted maximum indirect effect on pod yield through kernel yield per plant, followed by Total pods per plant (0.5219), harvest index (0.5138), shelling percentage (0.5080) and hundred seed weight (0.3422). The low residual effects indicated that most of the important yield components have been included in the present study for path analysis. The results were in agreement with the reports of Ahamed (1995) for mature pods per plant and Lakshmidevamma et al., (2004) for 100-seed weight indicating high and positive indirect contribution to pod yield.
To summarize the present study, it can be concluded that pod yield had strong positive correlation with kernel yield per plant, 100-seed weight, mature pods per plant, total pods per plant, harvest index, root weight, plant height and shoot weight. Further, kernel yield followed by harvest index and shoot weight had high positive direct effects on pod yield. Hence, improvement in any of these characters would also improve pod yield and direct selection to pod yield using these traits will be effective.

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Table 1 : Phenotypic (r_p) and genotypic (r_g) correlation co-efficients among fifteen characters in 50 genotypes of Groundnut

S. No.	Character		SCMR	Days to maturity	Primary branches per plant	Plant height	Total pods per plant	Mature pods per plant	Kernel yield per plant	Shelling percentage	Root weight	Shoot weight	Root weight to shoot weight ratio	Harvest index	Hundred seed weight	Pod yield per plant
1.	Days to 50 per cent flowering	r_p	0.2434*	0.4298**	0.3936**	0.0258	0.2908**	0.1534	-0.3231**	-0.5447**	0.4950**	0.6651**	-0.3482**	-0.7000**	-0.2962**	-0.1823
		r_g	0.2751	0.5366	0.4814	0.0122	0.3327	0.1699	-0.3491	-0.5868	0.5424	0.7111	-0.3681	-0.7443	-0.3184	-0.1881
2.	SCMR	r_p		0.2007*	-0.0120	-0.2702**	-0.2185*	-0.2705**	-0.2342*	-0.1902	0.3133**	0.0258	0.2151*	-0.1295	0.3639**	-0.1646
		r_g		0.2614	0.0167	-0.3340	-0.2902	-0.3709	-0.2622	-0.2024	0.3388	0.0269	0.2301	-0.1260	0.3837	-0.1893
3.	Days to maturity	r_p			0.3888**	0.0878	0.0513	-0.0060	-0.2141*	-0.3207**	0.2031*	0.1390	0.1109	-0.1843	-0.0175	-0.1253
		r_g			0.5216	0.1454	0.1279	0.0657	-0.2038	-0.3722	0.2444	0.1644	0.1319	-0.1783	-0.0109	-0.0923
4.	Primary branches per plant	r_p				0.0671	0.3338**	0.2435*	0.0370	-0.3860**	0.4643**	0.5443**	-0.1679	-0.3135**	-0.0789	0.1943
		r_g				0.0582	0.3951	0.2981	0.0285	-0.4792	0.5212	0.6213	-0.2025	-0.3726	-0.0972	0.2361
5.	Plant height	r_p					0.1191	0.2105*	0.2092*	0.0277	0.0628	0.0756	-0.0631	0.1056	-0.0467	0.2148*
		r_g					0.1489	0.2898	0.2128	0.0374	-0.1016	0.0849	-0.0946	0.1074	-0.0557	0.2237
6.	Total pods per plant	r_p						0.9468**	0.5140**	-0.1298	0.3153**	0.5216**	-0.3960**	-0.0815	-0.2850**	0.6110**
		r_g						0.9587	0.5311	-0.1468	0.3312	0.5827	-0.4644	-0.1401	-0.3185	0.6477
7.	Mature pods per plant	r_p							0.6285**	-0.0018	0.2193*	0.4109**	-0.3656**	0.0445	-0.2355*	0.6888**
		r_g							0.6762	0.0073	0.2191	0.4690	-0.4485	0.0050	-0.2683	0.7495
8.	Kernel yield per plant	r_p								0.4876**	0.0492	0.0157	-0.0512	0.5351**	0.3300**	0.9417**
		r_g								0.5170	0.0240	0.0027	-0.0681	0.5229	0.3482	0.9389
9.	Shelling percentage	r_p									0.4787**	-0.5480**	0.1973*	0.5810**	0.1736	0.1766
		r_g									-0.4958	-0.5578	0.2015	0.6036	0.1717	0.1996
10.	Root weight	r_p										0.6565**	0.0360	-0.4628**	0.2725**	0.2415*
		r_g										0.6610	0.0180	-0.4892	0.2799	0.2312
11.	Shoot weight	r_p											-0.6688**	-0.7855**	-0.1559	0.2153*
		r_g											-0.6777	-0.8085	-0.1565	0.2145
12.	Root weight to shoot weight ratio	r_p												0.5681**	0.3574**	-0.1206
		r_g												0.5803	0.3629	-0.1458
13.	Harvest index	r_p													0.2927**	0.3994**
		r_g													0.3032	0.3741
14.	Hundred seed weight	r_p														0.3409**
		r_g														0.3699

*Significant at 5% level

** Significant at 1% level

Table 2 : Phenotypic (P) and genotypic (G) path co-efficients among pod yield per plant and yield components in 50 genotypes of groundnut

S. No.	Character		Days to 50% flowering	SCMR	Days to maturity	Primary branches per plant	Plant height	Total pods per plant	Mature pods per plant	Kernel yield per plant	Shelling per-centage	Root weight	Shoot weight	Root weight to shoot weight ratio	Harvest index	Hundred seed weight	Correlation with pod yield per plant
1.	Days to 50 per cent flowering	P	**-0.0391**	0.0038	0.0025	0.0017	-0.0002	-0.0013	0.0016	-0.3031	0.1693	0.0203	0.1167	0.0196	-0.1631	-0.0111	-0.1823
		G	**-0.1287**	0.0007	0.0535	-0.0307	0.0000	0.0216	-0.0365	-0.3431	0.1790	0.0873	0.2343	0.0546	-0.3012	0.0212	-0.1881
2.	SCMR	P	-0.0095	**0.0156**	0.0012	-0.0001	0.0019	0.0010	-0.0028	-0.2197	0.0591	0.0128	0.0045	-0.0121	-0.0302	0.0136	-0.1646
		G	-0.0354	**0.0025**	0.0261	-0.0011	0.0008	-0.0188	0.0798	-0.2577	0.0617	0.0546	0.0088	-0.0341	-0.0510	-0.0255	-0.1893
3.	Days to maturity	P	-0.0168	0.0031	**0.0058**	0.0017	-0.0006	-0.0002	-0.0001	-0.2008	0.0997	0.0083	0.0244	-0.0063	-0.0430	-0.0007	-0.1253
		G	-0.0690	0.0006	**0.0998**	-0.0333	-0.0004	0.0083	-0.0141	-0.2002	0.1135	0.0393	0.0541	-0.0195	-0.0721	0.0007	-0.0923
4.	Primary branches per plant	P	-0.0154	-0.0002	0.0023	**0.0044**	-0.0005	-0.0015	0.0025	0.0347	0.1200	0.0190	0.0955	0.0095	-0.0731	-0.0029	0.1943
		G	-0.0619	0.0000	0.0520	**-0.0638**	-0.0001	0.0256	-0.0641	0.0280	0.1462	0.0839	0.2047	0.0300	-0.1508	0.0065	0.2361
5.	Plant height	P	-0.0010	-0.0042	0.0005	0.0003	**-0.0072**	-0.0006	0.0022	0.1963	-0.0086	-0.0026	0.0133	0.0036	0.0246	-0.0017	0.2148*
		G	-0.0016	-0.0008	0.0145	-0.0037	**-0.0025**	0.0097	-0.0623	0.2091	-0.0114	-0.0164	0.0280	0.0140	0.0435	0.0037	0.2237
6.	Total pods per plant	P	-0.0114	-0.0034	0.0003	0.0015	-0.0009	**-0.0046**	0.0098	0.4821	0.0404	0.0129	0.0915	0.0223	-0.0190	-0.0106	0.6110**
		G	-0.0428	-0.0007	0.0128	-0.0252	-0.0004	**0.0649**	-0.2061	0.5219	0.0448	0.0533	0.1920	0.0688	-0.0567	0.0212	0.6477
7.	Mature pods per plant	P	-0.0060	-0.0042	0.0000	0.0011	-0.0015	-0.0044	**0.0104**	0.5896	0.0086	0.0090	0.0721	0.0206	0.0104	-0.0088	0.6888**
		G	-0.0219	-0.0009	0.0066	-0.0190	-0.0007	0.0622	**-0.2150**	0.6644	-0.0022	0.0353	0.1545	0.0665	0.0020	0.0179	0.7495
8.	Kernel yield per plant	P	0.0126	-0.0037	-0.0012	0.0002	-0.0015	-0.0024	0.0065	**0.9381**	-0.1516	0.0020	0.0028	0.0029	0.1247	0.0123	0.9417**
		G	0.0449	-0.0006	-0.0203	-0.0018	-0.0005	0.0345	-0.1454	**0.9826**	-0.1577	0.0039	0.0009	0.0101	0.2116	-0.0232	0.9389
9.	Shelling percentage	P	0.0213	-0.0030	-0.0019	-0.0017	-0.0002	0.0006	0.0000	0.4574	**-0.3109**	-0.0196	-0.0962	-0.0111	0.1354	0.0065	0.1766
		G	0.0755	-0.0005	-0.0371	0.0306	-0.0001	-0.0095	-0.0016	0.5080	**-0.3051**	-0.0798	-0.1838	-0.0299	0.2443	-0.0114	0.1996
10.	Root weight	P	-0.0194	0.0049	0.0012	0.0020	0.0005	-0.0015	0.0023	0.0462	0.1488	**0.0409**	0.1152	-0.0020	-0.1079	0.0102	0.2415*
		G	-0.0698	0.0008	0.0244	-0.0333	0.0003	0.0215	-0.0471	0.0236	0.1512	**0.1610**	0.2178	-0.0027	-0.1980	-0.0186	0.2312
11.	Shoot weight	P	-0.0260	0.0004	0.0008	0.0024	-0.0005	-0.0024	0.0043	0.0148	0.1704	0.0269	**0.1755**	0.0377	-0.1830	-0.0058	0.2153*
		G	-0.0915	0.0001	0.0164	-0.0397	-0.0002	0.0378	-0.1008	0.0027	0.1702	0.1064	**0.3294**	0.1005	-0.3272	0.0104	0.2145
12.	Root weight to shoot weight ratio	P	0.0136	0.0034	0.0006	-0.0007	0.0005	0.0018	-0.0038	-0.0481	-0.0613	0.0015	-0.1174	**-0.0564**	0.1324	0.0134	-0.1206
		G	0.0474	0.0006	0.0132	0.0129	0.0002	-0.0301	0.0964	-0.0670	-0.0615	0.0029	-0.2232	**-0.1482**	0.2349	-0.0242	-0.1458
13.	Harvest index	P	0.0274	-0.0020	-0.0011	-0.0014	-0.0008	0.0004	0.0005	0.5020	-0.1806	-0.0189	-0.1379	-0.0320	**0.2330**	0.0109	0.3994**
		G	0.0958	-0.0003	-0.0178	0.0238	-0.0003	-0.0091	-0.0011	0.5138	-0.1841	-0.0788	-0.2633	-0.0860	**0.4047**	-0.0202	0.3741
14.	Hundred seed weight	P	0.0116	0.0057	-0.0001	-0.0003	0.0003	0.0013	-0.0024	0.3096	-0.0540	0.0112	-0.0274	-0.0202	0.0682	**0.0374**	0.3409**
		G	0.0410	0.0009	-0.0011	0.0062	0.0001	-0.0207	0.0577	0.3422	-0.0524	0.0451	-0.0515	-0.0538	0.1227	**-0.0665**	0.3699

Phenotypic residual effect = 0.0613
Genotypic residual effect = 0.0470

Bold : Direct effects
Normal : Indirect effects