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A Study of Correlation and Path Analysis in Groundnut

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Abstract : Thirteen genotypes along with four check varieties *viz*., JL-24, GPBD-4, Dh-86 and Dh-3-3-30 were evaluated for association analysis at six different locations namely Dharwad, Sankeshwar, Nippani, Bagalkot, Raichur and Kawadimatti during kharif 2003. The correlation study revealed that pod yield per plant had significant positive association with number of pods per plant, shelling per cent and SMK per cent at minimum three locations. Path analysis also indicated that three traits viz., number of pods per plant, shelling per cent and sound mature kernel per cent had the maximum direct effect on pod yield per plant at minimum three locations. This indicates that increase in pod number per plant, shelling per cent and DMA per cent would improve the pod yield of groundnut.

Introduction

Pod yield in groundnut (*Arachis hypogaea* L.) is a complex and depends upon the interplay of number of components attributes. 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, a knowledge of direction and magnitude of association between various traits is essential for plant breeders. Accordingly, the present investigation was aimed to study the association of pod yield and its component traits in elite groundnut genotypes.

Material and Methods

The experimental material consisted of 17 elite groundnut genotypes, out of which four were standard checks. These lines have been selected from the advanced generations undergoing large scale yield traits. Seventeen genotypes were evaluated during kharif 2003 to study association of pod yield and its components traits at six diverse locations *viz*., Dharwad, Sankeshwar, Nippani, Bagalkot, Raichur and Kawadimatti. The first three locations represented agro-climatic zone 8 while, Bagalkot represented zone 3 and other two locations represented zone 2. The experiment was conducted by following Randomized Block Design with three replications in each environment. Each entry was grown in five rows of 5 meter length. The row to row distance was 30 cm and plant to plant distance was 10 cm. The experiment was conducted under rainfed condition in all the locations and recommended agronomic practices were followed for raising good crop.

Observations were recorded on ten random plants from each plot for eight quantitative traits *viz*., plant height (cm), number of branches per plant, number of pods per plant, shelling per cent, sound mature kernel per cent, 100 kernel weight (g), oil content (%) and pod yield per plant (g). The data was subjected to association analysis following standard statistical procedure (Weber and Moorthy, 1952).

Results and Discussion

The results pertaining to correlation studies are presented in table 1 whereas, the direct and indirect contribution of yield

components on pod yield per plant are presented in table 2.

In the present study, pod yield per plant had strong positive association at both genotypic and phenotypic level at three locations *viz.,* Dharwad, Sankeshwar and Nippani with shelling per cent and sound mature kernel per cent, while at only genotypic level at other three locations, *viz,* Bagalkot, Raichur and Kawadimatti. Hence, simulataneous selections for these traits will be more reliable to develop high yielding groundnut genotypes over environments. Similar results of significant positive association of pod yield per plant with shelling per cent was reported by Abhay-Darshora *et al*. (2002). While, the significant positive association of pod yield per plant with sound mature kernel per cent was reported by Francis and Ramalingam (1997) and Vasanthi *et al*. (1998).

Number of pods per plant had significant positive association with pod yield per plant at both genotypic and phenotypic levels at three locations *viz.,* Sankeshwar, Raichur and Kawadimatti, while only at genotypic level at Nippani. This indicates the importance of the character towards contribution to pod yield per plant. Selection for this character will also be more reliable to derive high yielding genotypes over environments. Similar results of significant positive association of number of pods with pod yield per plant were reported by Francis and Ramalingam (1997) and Sarala and Gowda (1998).

At all the locations, hundred kernel weight and oil content had non-significant association with pod yield per plant in positive and negative directions, respectively. Similar trend of association of hundred kernel weight with pod yield per plant in positive direction was also reported by Nagda *et al*. (2001). While, the negative association of oil content with pod yield per plant was reported earlier by Francis and Ramalingam (1997).

At all the locations, shelling per cent had significant positive association with sound mature kernel per cent (Vasanthi *et al*., 1998). Plant height had significant negative association with sound mature kernel per cent at genotypic level at all the locations except Raichur. While it had positive association with pod yield per plant at three locations and negative association at other locations. Similar reports were given by Francis and Ramalingam (1997). Number of branches per plant showed non-significant positive association with pod yield per plant. Prashanthi *et al*. (1990) and Francis and Ramalingam (1997) also reported similar results.

Correlation analysis revealed that number of pods per plant, shelling per cent and sound mature kernel per cent were observed to be important yield contributing characters in groundnut irrespective of the environment. Hence, selection criteria should consider these traits for the improvement of pod yield per plant in groundnut.

Across locations three traits *viz*., number of pods per plant, shelling per cent and hundred kernel weight had high direct contribution towards pod yield per plant except at Raichur where hundred kernel weight had negative direct effect and its contribution towards pod yield per plant was indirectly through SMK per cent. This indicates that increase in number of pods per plant, shelling per cent. This indicates that increase in number of pods per plant, shelling per cent and sound mature kernel per cent would improve the pod yield of groundnut. Abhay-Darsora *et al*. (2002) for shelling per cent and Mathews *et al*. (2000) for sound mature kernel per cent reported similar findings in groundnut. Hence, selection for these traits would improve pod yield per plant.

Other characters, which had direct positive influence on pod yield per plant were number of branches per plant and plant height. However, at Raichur, Sankeshwar and Nippani, contribution of number of branches per plant was mainly through number of pods per plant. As

Table 1. Correlation among the eight characters related to pod yield per plant of groundnut at different locations

Locations/ characters	Dharwad							Sankeshwar							Nippani						
	NB	NP	SP	SMK	HKW	OC	YPP	NB	NP	SP	SMK	HKW	OC	YPP	NB	NP	SP	SMK	HKW	OC	YPP
PH	0.299	0.071	-0.372	-0.436	-0.407	0.358	0.124	-0.194	-0.228	0.059	-0.726**	-0.293	0.228	-0.047	-0.231	0.070	0.027	-0.429*	-0.407	0.184	-0.068
	0.299	0.68	-0.258	-0.330	-0.385	0.303	0.124	-0.188	-0.226	0.048	-0.362	-0.285	0.214	-0.047	-0.230	0.058	0.030	-0.276	-0.340	0.171	-0.067
NB		-0.123	0.331	-0.012	-0.025	0.075	0.138		0.410	-0.719**	-0.504*	-0.156	-0.084	0.079		0.403	0.476*	0.476*	0.016	0.301	0.306
		-0.119	0.114	-0.007	-0.028	0.063	0.140		0.391	-0.552*	-0.226	-0.135	-0.080	0.074		0.359	0.376	0.272	-0.005	0.261	0.294
NP			0.415*	0.380	-0.178	0.282	0.436*			0.434*	0.416*	-0.266	0.261	0.559**			0.473*	0.422*	-0.182	0.341	0.197
			0.286	0.274	-0.176	0.233	0.382			0.377	0.360	-0.236	-0.236	0.544			0.349	0.250	-0.164	0.229	0.183
SP				0.487*	-0.349	0.132	0.481*				0.475*	-0.047	0.357	0.578**				0.416*	-0.137	0.298	0.461*
				0.267	-0.270	0.103	0.439*				0.053	-0.035	0.239	0.416*				0.356	-0.214	0.246	0.447*
SMK					0.421*	0.010	0.625**					0.796**	-0.157	0.325					0.526*	-0.017	0.528*
					0.373	0.074	0.420*					0.415*	-0.110	00.156					0.347	0.046	0.447*
HKW						-0.385	0.159						0.043	0.365						0.269	0.390
						-0.265	0.132						-0.002	0.351						0.235	0.351
CC							-0.555*							-0.339							-0.361
							-0.440*							-0.306							-0.242

Above genotypic correlation values and below phenotypic correlation values

**Significant at 1% probability level,*Significant at 5% probability level

PH = Plant height SMK = Sound matured kernels per cent NB = Number of branches per plant HKW = Hundred kernels weight (g)

NP = Number of pods per plant OC = Oil content (%) SP = Shelling per cent YPP = Pod yield per plant

Table 1. Contd....

Locations/ characters	Bagalkot							Sankeshwar							Nippani						
	NB	NP	SP	SMK	HKW	OC	YPP	NB	NP	SP	SMK	HKW	OC	YPP	NB	NP	SP	SMK	HKW	OC	YPP
PH	-0.405	-0.149	0.086	-0.692**	-0.447*	0.073	0.205	-0.258	-0.537*	0.157	-0.372	-0.287	0.345	-0.386	0.084	-0.031	-0.044	0.422*	-0.438*	-0.391	0.063
	-0.396	-0.152	0.030	-0.535*	-0.410	0.038	0.199	-0.260	-0.531*	0.126	-0.138	-0.253	0.327	-0.378	0.082	-0.030	-0.031	0.209	-0.426*	-0.257	0.061
NB		0.348	0.448*	-0.354	-0.250	0.258	0.380		0.758**	0.398	0.625**	-0.035	-0.245	0.545*		0.534*	0.293	-0.131	-0.144	0.381	0.542*
		0.237	0.437*	-0.253	-0.251	0.124	0.380		0.734**	0.305	0.202	-0.011	-0.236	0.523*		0.489	0.123	-0.029	-0.132	0.189	0.517*
NP			0.816**	0.429*	-0.225	0.551*	0.426*			0.256	0.442*	0.224	-0.187	0.696**			0.426*	0.645**	-0.163	0.286	0.517*
			0.273	0.322	-0.215	0.202	0.422			0.234	0.191	0.192	-0.170	0.676**			0.315	0.360	-0.171	0.137	0.493*
0SP				0.431*	0.127	-0.404	0.420*				0.486*	-0.011	0.015	0.455*				0.275	-0.115	-0.144	0.436*
				0.193	0.060	-0.148	0.207				0.314	-0.036	-0.007	0.319				0.114	-0.060	0.066	0.310
SMK					0.492*	0.085	0.442*					0.422*	-0.041	0.491*					0.447*	-0.311	0.473*
					0.391	0.058	0.347					0.281	-0.117	0.217					0.141	-0.130	0.207
HKW						-0.036	0.201						0.325	0.392						-0.230	0.248
						-0.139	0.175						0.244	0.341						-0.069	0.217
CC							-0.225							-0.281							-0.248
							-0.083							-0.236							-0.202

Above genotypic correlation values and below phenotypic correlation values

**Significant at 1% probability level,*Significant at 5% probability level

PH = Plant height SMK = Sound matured kernels per cent NB = Number of branches per plant HKW = Hundred kernels weight (g)

NP = Number of pods per plant OC = Oil content (%) SP = Shelling per cent YPP = Pod yield per plant

Table 2. Direct (diagonal) and indirect effects of yield components on pod yield per plant (phenotypic level) of groundnut at different locations

Locations/ characters	Dharwad								Sankeshwar								Nippani							
	PH	NB	NP	SP	SMK	HKW	OC	r_p	PH	NB	NP	SP	SMK	HKW	OC	r_p	PH	NB	NP	SP	SMK	HKW	OC	r_p
PH	0.180	0.039	0.012	0.010	0.106	-0.082	-0.141	0.124	0.424	-0.005	-0.176	0.010	-0.015	-0.185	-0.054	-0.047	-0.098	-0.017	0.013	-0.007	0.066	-0.051	0.028	-0.067
NB	0.054	0.130	-0.021	0.017	0.008	-0.007	-0.029	0.140	-0.080	0.026	0.305	-0.120	-0.011	-0.088	0.043	0.074	0.023	0.072	0.084	0.056	0.020	-0.003	0.042	0.294
NP	0.100	-0.017	0.173	0.132	0.129	-0.045	0.089	0.382	-0.096	0.010	0.780	0.001	-0.001	-0.126	0.059	0.544	-0.006	0.005	0.221	-0.036	0.060	-0.081	0.020	0.183
SP	0.061	0.113	0.162	0.272	-0.053	0.068	-0.048	0.439	0.020	-0.102	0.311	0.217	0.103	-0.047	-0.086	0.416	-0.003	-0.017	0.133	0.238	0.137	-0.072	0.040	0.447
SMK	0.005	-0.068	-0.016	0.129	0.300	0.069	0.001	0.420	-0.153	-0.006	-0.05	0.017	0.049	0.271	0.028	0.156	0.020	0.020	0.030	0.037	0.162	0.171	0.007	0.447
HKW	0.060	-0.064	-0.070	-0.076	-0.095	0.254	0.123	0.132	-0.121	-0.003	-0.184	-0.008	0.020	0.652	0.007	0.351	0.033	0.055	-0.036	0.051	-0.083	0.293	0.038	0.351
OC	0.055	0.008	0.040	0.018	-0.026	-0.067	-0.460	-0.440	0.091	-0.028	-0.184	0.074	-0.005	-0.002	-0.262	-0.306	-0.318	0.019	0.151	-0.159	-0.111	0.158	-0.162	-0.242

Table 2b. Contd..

Locations/ characters	Bagalkot								Raichur								Kawadimatti							
	PH	NB	NP	SP	SMK	HKW	OC	r_p	PH	NB	NP	SP	SMK	HKW	OC	r_p	PH	NB	NP	SP	SMK	HKW	OC	r_p
PH	0.915	-0.201	-0.063	-0.049	-0.248	-0.159	0.004	0.199	0.177	-0.022	-0.356	0.025	-0.081	-0.092	-0.029	0.378	0.056	0.023	-0.007	-0.001	0.022	-0.055	0.022	0.061
NB	-0.362	0.608	0.181	0.005	0.118	-0.097	0.027	0.380	-0.046	0.003	0.492	-0.037	-0.025	0.066	0.070	0.523	0.003	0.368	0.206	-0.006	0.034	-0.017	-0.003	0.517
NP	-0.149	0.222	0.414	0.016	0.039	-0.139	0.019	0.422	-0.094	0.034	0.671	-0.099	0.062	0.048	0.054	0.676	-0.002	0.246	0.420	-0.001	-0.147	-0.022	-0.002	0.493
SP	0.027	-0.017	0.013	0.163	0.017	0.023	-0.014	0.207	0.022	0.060	-0.1057	0.434	-0.072	0.002	0.030	0.319	-0.027	-0.045	0.206	0.145	0.065	-0.008	-0.026	0.310
SMK	-0.289	0.129	0.044	-0.011	0.464	0.004	0.006	0.347	-0.024	0.001	0.128	-0.033	0.126	0.033	-0.014	0.217	0.012	-0.087	0.150	0.005	0.143	-0.018	0.002	0.207
HKW	-0.175	-0.021	-0.089	-0.003	0.088	0.388	-0.013	0.175	-0.045	0.001	0.129	-0.015	0.321	-0.069	0.019	0.341	-0.004	-0.005	-0.002	-0.003	0.102	0.128	0.001	0.217
CC	0.035	0.063	-0.084	0.009	0.011	-0.054	-0.035	-0.083	0.058	-0.002	-0.114	0.021	0.078	-0.281	0.002	0.238	-0.014	-0.107	0.058	0.003	-0.012	0.009	-0.115	-0.202

PH = Plant height
NB = Number of branches per plant
NP = Number of pods per plant
SP = Shelling per cent
SMK = Sound matured kernels per cent
HKW = Hundred kernels weight (g)
OC = Oil content (per cent)
Tp= Phenotypic correlation with pod yield per plant

observed in earlier studies Sah *et al.*(2000), in this study also oil content had negative direct effect on pod yield per plant, except at Raichur, which indicate its inverse relation with pod yield per plant. So selection for improvement of oil content will lead to reduction in pod yield. Similarly, plant height had direct positive effect with per yield per plant at all locations except at number of pods per plant.

From the results of path coefficient analysis in groundnut, it may be concluded that improvement in pod yield per plant could be brought through by selection for component characters like number of pods per plant, shelling per cent and sound mature kernel per cent irrespective of environments. However, indirect selection through hundred kernel weight and number of branches would also be effective for improvement of pod yield per plant.

The study revealed a change in pattern of association of characters and also in their direct or indirect effect contribution towards pod yield from location to location. This is obvious in view of range of enviornments influencing genetic manifestation of genotypes for a characer due to role of G x E interactions.

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