Legume Res., **33** (3) : 211 - 216, 2010

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
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STUDIES ON CHARACTERS ASSOCIATION AND PATH ANALYSIS FOR SEED YIELD AND ITS COMPONENTS IN GROUNDNUT (ARACHIS HYPOGAEA L.)

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ABSTRACT

The estimate of genotypic correlation coefficients in general higher than their corresponding phenotypic correlations indicating strong inherent association among the traits. Yield contributing characters like biological yield per plant, 100-kernel weight and harvest index had positive and significant association with pod yield per plant at phenotypic level. Phenotypic interrelationship between days to maturity and pod yield per plant was found negative and significant. Genotypic correlations of above said yield components with pod yield were also strong and with similar sign. The genotypic and phenotypic path analysis revealed the highest positive direct effects of biological yield per plant and harvest index towards pod yield. Hundred-kernel weight contributed indirectly via biological yield per plant and harvest index. Based on correlation and path analysis, biological yield per plant, 100-kernel weight and harvest index were identified as the most important yield contributing characters.

Keywords: Characters association, Path analysis, Groundnut.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is an annual legume native in South America. The major groundnut area (6.0 million ha) in India comprises marginal lands where the crop is grown under rainfed conditions. In India, groundnut is grown in an area of about 7.6 million ha with a production of 7.8 million tones of pods and 1040 kg/ha productivity. Groundnut is an allotetraploid (2n=4x = 40) with a basic chromosome number of x=10 (Stalker, 1997). It is highly self-pollinated crop and has cleistogamous flowers. Cultivated groundnuts belong to the three sub-species, *Valencia, Spanish* and *Virginia;* the *Virginia* sub-species includes both bunch and runner forms. Plant habit in groundnut varies from the compact bunch type with very little lateral spread to the spreading runner forms. Under better growing conditions the runner forms predominate. In India, the spreading Virginia types are generally grown under rainfed conditions during monsoon season while under irrigated winter or summer conditions, the Spanish bunch types predominate. Some Virginia bunch types are also grown during this season. (Reddy *et al.*, 1984). In Gujarat nowadays semi-spreading types also occupied large area during *kharif* season. But Spanish bunch types are grown during *summer* season. Most of the characters of breeder's interest are complex and are the result of interaction of a number of components. Understanding the relationships among yield and yield components is of paramount importance for making the best use of these relationships in selection. The correlation coefficient may be confounded with indirect effect due to common association inherent in trait interrelationships. Therefore information derived from the correlation coefficients can be augmented by partitioning correlations into direct and indirect effects by path coefficient analysis.

MATERIAL AND METHODS

The experimental material comprised of eighty bunch groundnut genotypes. The experimental was laid out in Randomized Block Design with three replications r at instructional Farm of College of Agriculture Junagadh Agricultural University, Junagadh under irrigated condition during during summer 2006. Each entry was accommodated in a single row of 3.0 m length with a spacing of 30 x 10 cm. The observations were recorded on five randomly selected plants from each entry and replication and their mean values were used. The phenotypic and genotypic correlation coefficients of all the characters were worked-out through covariance analysis as per Al-Jibouri *et al.* (1958).

The phenotypic as well as genotypic path coefficient analysis were done as per the method suggested by Dewey and Lu (1959).

RESULTS AND DISUSSION

In general genotypic correlations (Table 1) were higher than their phenotypic correlations in the present investigation. This indicated that though there was high degree of association between two variables at genotypic level, its phenotypic expression was deflated by the influence of environment. It has also indicated that there was an inherent relationship between the characters studied which is in agreement with the conclusions of Singh and Singh (1999), Venkataravana *et al.* (2000) and Suneetha *et al.* (2004). In most of the cases the direction and magnitude of phenotypic and genotypic correlation between various characters remained almost same. This is very helpful to plant breeder because breeder can practice selection on the basis of phenotypic expression of the character for the improvement of pod yield. The phenotypic correlation coefficients in very few cases were higher than their corresponding genotypic correlation coefficients which might be due to the non-genetic causes probably environment inflated the value of phenotypic correlation. At phenotypic level, biological yield per plant, 100-kernel weight and harvest index had highly significant and positive association with pod yield per plant. Similar results were also reported by Yogendra *et al.* (2001), Suneetha *et al.* (2004) and Golakia *et al.* (2005). Developmental trait days to maturity showed negative and significant correlation with pod yield per plant. This indicated the importance of early maturing variety for increasing the pod yield under summer sowing. Yadava *et al.* (1981) also reported the similar interrelationship between above said characters. Corresponding genotypic correlations between the above said pair of characters were also found strong with similar sign. So these attributes were more influencing the pod yield in groundnut. They can serve as marker/indicator characters for the improvement in pod yield. Other characters viz., days to 50 % flowering, number of primary and secondary branches per plant, plant height, number of aerial and underground pegs per plant, number of kernels per pod, shelling percentage and oil content did not show any relationship with pod yield per plant. Contarary to our findings, Singh and Singh (1999) and Mahalakshmi *et al.* (2005) noticed significant and positive correlation of above mentioned yield contributing characters with pod yield per plant in their investigation. This might be due to the inclusion of genetic material other than used in the present study. Characters like days to 50 % flowering and maturity which decide the earliness/ lateness of genotype had significant and positive phenotypic association with number of secondary branches per plant. It means late maturity enhanced the number of secondary branches per plant. But late maturity decreased the harvest index as evident by the negative and significant association between these two characters at phenotypic level. In this experiment, number of primary and secondary branches had also positive and significant phenotypic correlations. Odedara (2005) also reported the similar findings. Positive and significant interrelationship between 100-kernel weight and biological yield per plant confirm the earlier findings of Kuriakose and Joseph (1986) and Odedara

Table 1 : Genotypic (r_g) and phenotypic (r_p) correlation coefficients among 14 characters of 80 bunch groundnut genotypes

Characters		Days to 50% flowering	Days to maturity	Number of primary branches per plant	Number of secondary branches per plant	Plant height (cm)	Number of aerial pegs per plant	Number of under ground pegs per plant	Biological yeild per plant (g)	Number of kernels per Pod	100-kernel weight (g)	Harvest index (%)	Shelling percent age (%)	Oil Content (%)
Pod yield per plant (g)	rg	-0.308	-0.264	0.014	-0.055	0.052	-0.249	0.169	0.622	0.192	0.822	0.608	0.184	0.132
	rp	-0.202	-0.227*	0.037	-0.047	0.078	-0.201	0.173	0.608**	0.125	0.583**	0.547**	0.140	0.119
Days to 50% flowering	rg		1.031	0.207	0.411	0.235	0.172	-0.180	0.101	-0.051	-0.204	-0.485	-0.102	0.115
	rp		0.807**	0.137	0.286**	0.144	0.116	-0.095	0.030	-0.025	-0.108	-0.247*	-0.095	0.065
Days to maturity	rg			0.171	0.422	0.242	0.165	-0.233	0.046	-0.085	-0.190	-0.350	-0.168	0.139
	rp			0.080	0.356**	0.190	0.147	-0.152	-0.001	-0.047	-0.129	-0.257*	-0.128	0.115
Number of primary Branches per plant	rg				0.320	0.059	0.184	0.238	0.188	0.226	0.083	-0.153	-0.104	0.228
	rp				0.237*	0.030	0.149	0.170	0.163	0.128	0.053	-0.111	-0.080	0.156
Number of secondary Branches per plant	rg					0.060	0.190	0.001	0.144	0.126	0.171	-0.173	-0.160	0.124
	rp					0.058	0.177	-0.002	0.104	0.116	0.149	-0.134	-0.148	0.120
Plant height (cm)	rg						-0.021	-0.203	0.191	0.113	-0.018	-0.148	0.249	-0.045
	rp						-0.036	-0.173	0.161	0.105	-0.016	-0.074	0.252*	-0.049
Number of aerial pegs per plant	rg							0.284	-0.116	0.152	-0.224	-0.184	0.121	0.017
	rp							0.260*	-0.088	0.121	-0.177	-0.135	0.115	0.016
Number of underground pegs per plant	rg								0.050	0.131	0.095	0.235	-0.025	0.144
	rp								0.068	0.126	0.055	0.218	-0.024	0.102
Biological yield per plant (g)	rg									0.215	0.617	-0.249	0.295	0.038
	rp									0.119	0.439**	-0.250*	0.217	0.019
Number of kernels per pod	rg										0.107	0.019	0.171	-0.003
	rp										0.107	0.038	0.134	-0.003
100-kernel weight (g)	rg											0.438	-0.023	0.194
	rp											0.216	-0.030	0.145
Harvest index (%)	rg												-0.081	0.125
	rp												-0.073	0.111
Shelling percent age (%)	rg													-0.198
	rp													-0.183

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

Table 2 : Path coefficient analysis showing direct (diagonal) and indirect (non-diagonal) effects of seven characters on pod yield in 80 genotypes of bunch groundnut

Character		Days to 50% flowering	Days to maturity	Biological yield per plant (g)	Number of kernel per pod	100- kernel weight (g)	Harvest index (%)	Oil Content (%)	Genotypic and phenotypic correlation with pod yield per plant
Days to 50% flowering	G	**-0.095**	0.070	0.098	0.001	0.036	-0.420	0.002	-0.308
	P	**0.015**	-0.041	0.023	0.000	-0.006	-0.194	0.001	-0.202
Days to maturity	G	-0.097	**0.068**	0.045	0.001	0.340	-0.317	0.003	-0.264
	P	0.012	**-0.051**	-0.001	0.000	-0.007	-0.183	0.003	-0.227*
Biological yield per plant (g)	G	-0.010	0.003	**0.965**	-0.003	-0.109	-0.225	0.001	0.622
	P	0.000	0.000	**0.759**	0.000	0.025	-0.177	0.000	0.608**
Number of kernels per pod	G	0.005	-0.006	0.208	**-0.012**	-0.019	0.017	0.000	0.192
	P	0.000	0.002	0.090	**0.000**	0.006	0.027	0.000	0.125
100 kernel weight (g)	G	0.019	-0.013	0.595	-0.001	**-0.177**	0.396	0.004	0.822
	P	-0.002	0.007	0.333	0.000	**0.056**	0.185	0.003	0.583**
Harvest index (%)	G	0.044	-0.024	-0.241	0.000	-0.077	**0.904**	0.002	0.608
	P	-0.004	0.013	-0.190	0.000	0.015	**0.710**	0.002	0.547**
Oil content (%)	G	-0.011	0.009	0.036	0.000	-0.340	0.113	**0.018**	0.132
	P	0.001	-0.006	0.015	0.000	0.008	0.079	**0.022**	0.119

Residual effect :-
R=0.1065 (Phenotypic path)
R=-0.0156 (Genotypic path)

*,** significant at 5% and 1% levels, respectively
N.B. G=Genotypic path and P = Phenotypic path
Diagonal values (Bold letters) indicate direct effects of respective characters

(2005). It is interesting to note from the results of character association that two important attributes i.e. number of aerial and underground pegs exhibited positive association at phenotypic level. As the aerial pegs increased simultaneously underground pegs also increased. In all above said cases the genotypic correlations were also strong and with similar sign. It suggested that phenotypic association were due to genetic relationship. The present results on correlation coefficient thus, revealed that the days to maturity, biological yield per plant, 100-kernel weight and harvest index were the most important attributes and may contribute considerably towards higher pod yield. The interrelationship among yield components would help in increasing the yield levels and therefore, more emphasis should be given to these components while selecting better types in groundnut especially under irrigated condition in summer season. Most of the characters of breeder's interest are complex and are the result of interaction of a number of components. Correlation between yield components are of paramount importance. But the correlation coefficient may be confounded with indirect effect due to common association inherent in trait interrelationships. Therefore information derived from the correlation coefficients were augmented by partitioning genotypic and phenotypic correlation into direct and indirect effects by path-coefficient analysis.

In the present study, seven yield components were considered as causal variables of pod yield. Results (Table 2) revealed that the biological yield per plant and harvest index exhibited high and positive direct effects on pod yield per plant. Thus, these characters turned-out to be the major components of pod yield. In all the above said cases the genotypic path coefficients were of higher magnitude than their corresponding phenotypic path coefficients. Such positive and high direct effects of these variables have also been reported by Bera and Das (2000), Yogendra *et al.* (2001), Nagda and Joshi (2004) and Suneetha *et al.* (2004). Therefore above said characters are of immense importance for groundnut improvement programme. Breeder can consider the above characters on the basis of their phenotypic performance because all these character also possessed higher genotypic path values.

Days to 50 % flowering did not contributed directly towards pod yield per plant as evident from its low direct effects and non-significant association with pod yield per plant. But this character exerted considerable genotypic as well as phenotypic indirect effects via harvest index. While days to maturity had negative significant phenotypic association with pod yield per plat. But it did not reflected in direct effect. However this character contributed indirectly through harvest index. These results confirm the earlier reports of Khunti (1980) and Odedara (2005). Positive and significant phenotypic association along with strong genotypic correlation of 100-kernel weight with pod yield per plant reflected as a high indirect effect via biological yield per plant and harvest index. This finding is also in agreement with Odedara (2005). Residual effects of phenotypic and genotypic path analysis were low and negative, respectively indicated the inclusion of all possible important yield contributing characters. It was apparent from the path analysis that maximum direct effects as well as appreciable indirect influences were exerted by biological yield per plant, 100-kernel weight and harvest index. These characters also exhibited significant and positive association with pod yield per plant and hence, they may be considered as the most important yield contributing characters and due emphasis should be placed on these components while breeding for high yielding types in summer groundnut.

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