SAARC J. Agri., 12(1), 96-105(2014)

GENETIC CORRELATION AND PATH COEFFICIENT ANALYSIS IN GROUNDNUT (*Arachis hypogaea* L.)

M. K. Alam*

Plant Breeding Division, Oilseed Research Centre, Regional Agricultural Research Station, BARI, Ishurdi, Pabna, Bangladesh

ABSTRACT

Correlation and path co-efficient analysis were carried out for pod yield and its yield components characters in 45 genotypes of groundnut. The genotypic correlation co-efficient were found to be of relatively higher magnitude than the corresponding phenotypic correlation co-efficient, indicating strong inherent association between the characters. Pod yield showed significant positive association with secondary branches/plant, harvest index, 100-pod weight, 100-kernel weight, pod size, diseases incidence and canopy temperature. Path co-efficient analysis revealed high direct effects of primary branches/plant, secondary branches/plant and harvest index. Hence, it would be rewarding to give due importance on the selection of these characters for rapid improvement in pod yield of groundnut.

Keywords: Character Association, Path Analysis, Groundnut.

INTRODUCTION

Groundnut(*Arachis hypogaea* L.) being one of the most important oilseed crops of Bangladesh, still stands one of the lowest in terms of give reference. In groundnut, overall pod yield is constituted by different yield components which make 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-efficient 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

*Corresponding author email: khorshed_bari79@ yahoo.com

Received: 16.09.2013

provide a true picture of relative importance of direct and indirect effects of these component traits on pod yield. Correlation analysis is a biometrical technique to find out the nature and degree of association between various physico-chemical traits indicating yield, while path analysis splits the correlation coefficient into direct and indirect effect so as to measure the relative contribution of each variable towards yield Nunes da Luz et al., (2011). 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. Therefore information derived from the correlation coefficients can be augmented by partitioning correlations into direct and indirect effects by path coefficient analysis. In literature, several studies have demonstrated the utility of correlation analysis in peanut selection based on plant and reproductive traits Lakshmaiah et al. (1983), Bera and Das (2000), Nautiyal et al. (2002), Khan et al. (2001), Kotzamannidis et al.(2006), Sharma and Dashora (2009), Gomes and Lopez (2005). Korat et al. (2010) revealed that oil yield had signification positive association with shelling percentage, and 100 kernel weight, while days to maturity had negative correlation with oil yield. The direct and indirect effects obtained from path analysis revealed that oil yield was positively associated with 100-kernel weight and shelling percentage, while days to maturity and sound mature kernel percent (SMK%) had negative association with oil yield. Mane et al. (2008) revealed that 100-kernel weight showed the highest but non-signification correlation with oil yield. Path coefficient analysis indicated that 100-kernel weight had the highest direct effect on oil yield followed by number of pods/ plant and number of seeds/ pod and SMK %. Sharma and Dashora (2009) reported that only number of mature pods per plant was positively and significantly correlated with oil yield. Path analysis showed that 100 pods weight had height positive direct effect on oil yield. The present study was conducted to evaluate the available groundnut germplasm for yield and its parameters and to measure the extent of direct and indirect causes of association among traits through path coefficient analysis, to furnish the information for selection of suitable criteria for predicting the oil yield in groundnut.

MATERIALS AND METHODS

Forty five groundnut genotypes were evaluated to investigate the relationship among agronomic traits in groundnut under normal condition in the Bangladesh Agricultural University research field during 2010-2011.The experimental was laid out in a Randomized Complete Design with three replications. Ten plants were selected at random for 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 MStatc and MS-excel. The correlation co-efficient were used to find out the direct and indirect effects of the component characters on pod yield as per the method of R software.

RESULTS AND DISCUSSION

Correlation Co-efficient studies:

The results of the correlation coefficient among the forty five genotypes during 2011 are shown in Table 1. Significant differences were observed among the genotypes for all 15 characters. In general, the genotypic correlation co-efficient were greater than their respective phenotypic correlation co-efficient. This may be due to depressed phenotypic expression by environmental influence. The results revealed that for genotypic correlation coefficient of pod yield recorded in significant positive association with secondary branches/plant (r=0.44**), harvest index (r=0.78**), 100-pod weight(r=0.28*), 100-kernel weight (r=0.76**), pod size (r=0.58**), diseases incidence (r=0.30*) and canopy temperature (r=0.80**) indicating the positive linear relationship of these characters but recorded a negative, significant genotypic correlation coefficient of -0.46** for 50% flowering, similarly no. of pods/ plant, no. of pops/ plant, plant height, pod index, and SPAD meter reading showed significant negative correlation. Furthermore, the genotypic correlation coefficient between 50% flowering and no. of pods/plant (r=0.36*), SPAD meter reading (r=0.42**) were significant, positive and high in magnitude. A significant negative genotypic correlation coefficient was recorded between 50% flowering and harvest index (r=-0.30*), 100 kernel weight (r=-0.40**) and pod size (r=-0.30*). Also significant genotypic positive correlation were observed between no. of pod with no. of pops/plant (r=0.50**), primary branches (r=0.44**) and SPAD meter reading (r=0.28*). Accordingly significant positive genotypic correlation coefficient results were found from no. of pops/plant with plant height (r=0.45**) and SPAD meter reading (r=0.56). Primary branches with SPAD meter reading (r=0.31*). Secondary branches with plant height (r=0.44**), harvest index (r=0.30*), 100 kernel weight (r=0.31*), pod size(r=0.27*) and canopy temperature(r=0.71**). Harvest index with 100 pod weight (r=0.53**), 100 kernel weight (r=0.57**), pod size (r=0.57**) and canopy temperature (r=0.56**). 100-pod weight with pod size (r=0.37**). 100-kernel weight with pod size (r=0.48**) and canopy temperature (r=0.74**). And pod size with canopy temperature (r=0.56**).

For the phenotypic correlation coefficient among the characters studied that significant positive phenotypic correlation coefficient was recorded in the association between pod yield with secondary branches (r=0.27*), harvest index (r=0.61**), 100 kernel weight(r=0.39**), pod size(r=0.47**) and canopy temperature(r=0.64**). Conversely, a negative significant phenotypic correlation coefficient was observed between pod yield and 50% flowering (r=-0.42**). Other pod yield components no. of pops per plant (r=-0.38**), pod index(r=-0.53**) and SPAD meter reading (r=-0.34**) recorded a negative phenotypic correlation coefficient. Phenotypic correlation coefficient were observed in the association between 50% flowering with no. of pods/ plant (r=0.28*), no. of pops (r=0.26), primary branches (r=0.11), secondary branches (r=-0.10), plant height (r=0.07), harvest index (r=-0.22), pod size (r=-0.26) diseases incidence (r=-0.32), SPAD meter reading (r=0.30*) and canopy temperature(r=-0.33*). All theses correlation coefficient were not statistically significant. In furtherance, the no. of pods/plant showed a positive phenotypic correlation with no. of pops (r=0.27*), primary branches (r=0.36**), plant height (r=0.23) and SPAD meter reading (r=0.21). No. of pops with plant height (r=0.34**) and SPAD meter reading (r=0.27*). Secondary branches with plant height (r=0.24), harvest index (r=-0.19), 100 kernel weight(r=0.41), pod size (r=-0.15), diseases incidence (r=-0.11), SPAD meter reading (r=0.13) and canopy temperature(r=-0.30*). Plant height with pod index (r=0.13) and SPAD meter reading (r=0.38**). Harvest index with 100 pod weight (r=0.36**), 100 kernel weight (r=0.23), pod size (r=0.41**), diseases incidence (r=-0.11) and canopy temperature (r=0.35**). 100-pod weight with pod size (r=0.28*). 100-kernel weight with pod size (r=0.23) and canopy temperature (r=0.32*). And pod size with canopy temperature (r=0.36**).

Correlation coefficient is important in plant breeding in that it measures the degree of association, genetic or non genetic between two or more characters. Adebisi et al. (2004) reported that crop improvement depends upon the magnitude of genetic variability has been ascertained in a crop, improvement is possibility by using an appropriate selection method. Correlation studies between have been great value in the determination of the most effective procedures for selection of superior genotype. In this study, it was observed that estimates of genotypic correlations were in the most cases higher than their corresponding phenotypic correlation. This is the agreement with the findings of Johnson et al. (1955), Paroda and Joshi (1970) and Kamboj and Mani, (1983). It is also showed more significant genotypic association between the different pairs of characters than the phenotypic correlation, indicating that the characters are more related genotypically than phenotypically. 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 significant and negative with days to 50% flowering, number of pod/plant, number of pops/plant, plant height, pod index and SPAD meter reading. Similar findings for days to 50% flowering Bhagat et al. (1986) was reported earlier. Inter correlation estimates for yield components revealed that number of pods/plant, primary branch/plant, plant height, 100-pod weight, 100-kernel weight, pod size, SPAD meter reading and canopy temperature 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 harvest index had the highest positive direct effect on pod yield followed by secondary branch per plant and primary branch per plant while SPAD meter reading exerted the maximum negative direct effect on pod yield followed by pod index. These results were similar to the previous reports of Nagda and Joshi (2004) for harvest index.

Indirect effects of the component characters were high through pod index on pod yield. The character harvest index (0.189872) exerted maximum indirect effect on pod yield through pod index, followed by 100-kernel weight (0.169055), pod size (0.169055) and 100-pod weight (0.157192) through harvest index on pod yield. 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 secondary branches/plant, harvest index, 100-pod weight, 100-kernel weight, pod size, diseases incidence and canopy temperature. Further, harvest index had the highest positive direct effect on pod yield followed by secondary branches/plant and primary branches/plant while SPAD meter reading exerted the maximum negative direct effect on pod yield followed by pod index. Hence, improvement in any of these characters would also improve pod yield and direct selection to pod yield using these traits will be effective.

REFERENCES

Adebesi, M. A., Ariyo, O.J. and Kehinde, O.B. 2004. Variation and correlation studies in quantitative characters in soybean. *The Ogun J. Agri. Sci.* 3(1): 134-142

Ahamed,S.N. 1995.Heterosis combining ability and interrelationships among yield and yield attributes in groundnut (*Arachis hypogaea* L.) M. Sc (Ag.) Thesis submitted to the Andhra Pradesh Agricultural University, Hyderabad.

Balaiah,C., Reddy, P.S. and Reddy, M.V.1980. Correlation studies of some yield components in the segregating population of the groundnut cross J 11 x Gujarat narrow leaf mutant. *Indian Journal of Agricultural Science,* 50: 213-215

Bera, S.K. and Das, P.K. 2000.Path co-efficient analysis in groundnut at different locations and years. *Agricultural Science Digest*, 20(1): 9-12

Bhagat,N.R., Taslim Ahmad, Lalwani,H.B. and Natraj,G.1986. Variation, character association and path analysis in improved groundnut varieties. *Indian Journal of Agricultural Science,* 56: 300- 302

Gomes, R.L.F. and Lopez, A.C.D.A. 2005. Correlation and path analysis in peanut. Crop Breed. *Applied Bio technology*, 5: 105-110

Gupta, S. K. and Bali,S.V.1997. Association of various root traits with pod yield in groundnut (*Arachis hypogaea* L.) under drought conditions. *Journal of Oilseeds Research*, 14(1): 118-121

Jayalakshmi,V., Reddy, C.R., Reddy, P.V. and Reddy, G.L. 2000. Character association among morpho-physiological attributes in parental genotypes and groundnut hybrids. *Legume Research*, 23: 102-105

Kamboj, R. K. and Mani S.C. 1983. Correlation and path analysis in hexaploied triticali. *Indian Journal of Agriculture Science,* 53(60): 394-397

Khan, A., Bano, A and Malik, N.J. 2001. Relationship in various yield traits of exotic groundnut genotypes under moisture stress condition in Swat. *Pakistan Journal of Biological Sciences*, 1: 24-26

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

Kotzamanidis, S.T., Stavropoulos, N. and Ipsilandis, C.G. 2006. Correlation studies of 21 traits in F2 generation of groundnut (*Arachis hypogaea* L.). *Pakistan Journal of Biological Science,* 9: 929-934

Kumar, R., Ghosh, J. and Sah, J. 1998. Variability and correlation studies in mutant cultures. *Journal of Applied Biology*, 8(2): 20-23

Lakshamaiah, B., Reddy, P.S. and Reddy, B.M. 1983. Selection criteria for improving yield in groundnut (*Arachis hypogaea* L.). Oleagineux, 38: 607-611

Lakshmidevamma, T.N., Byre gowda, M. and Mahadevu, P. (2004) Character association and path analysis in groundnut (*Arachis hypogaea* L.). *Mysore Journal of Agricultural Sciences,* 38(2): 221-226

Mathews, C., Nagda, A.K. and Sharma, U.C. 2000. A study of path analysis in groundnut. Madras Agricultural Journal 87(7-9): 480-481

Makhan, L., Roy, D. and Ojha, O.P. 2003. Genetic variability and selection response for root and other characters in groundnut (*Arachis phypogaea* L.). *Legume Research*, 26(2): 128-130.

Mane, P.S., Lad, D.B. and Jagtap, P. K. 2008. Correlation and path coefficient analysis in summer bunch groundnut. *Journal of Maharashtra Agricultural Uni*versity, 33(2): 174-176

Nagda, A.K. and Joshi, V.N. 2004. Correlation and path coefficient analysis in drought tolerant genotypes of groundnut pp. 51-52. Short papers presented at the National Symposium on "Enhancing Productivity of Groundnut for Sustaining Food and Nutritional Security" 11-13 October 2004 at NRCG, Junagadh

Nautiyal, P.C., Nageswara-rao, R.C. and Joshi, Y.C. 2002. Moisture-deficit-induced changes in leaf-water content, leaf carbon exchange rate and biomass production in groundnut cultivars differing in specific leaf area. *Field Crops Research*, 74: 67-79

Nunes da Luz, L., R. Cavalcanti dos Santos and P. Albuquerque Melo Filho, 2011. Correlations and path analysis of peanut traits associated with the peg. *Crop Breeding & Applied Biotechnology*, 11(1):88-93

Ofori, I. 1996. Correlation and path coefficient analysis of components of seed yield in Bambara groundnut. Euphytica 91: 103-107

Paroda, R.S. and Joshi, A. B.1970. Correlation, path coefficient and the implication of discriminate function for selectionin wheat (*Triticum aestivum*). Heredity, 25: 383-392

Sharma, M. and Dashora, A. 2009. Character association and path analysis in groundnut (*Arachis hypogaea* L.). *Journal of Oilseeds Research*, 26: 614-616

Sharma, V.K. and Varshney, S.K.1995. Analysis of harvest index in groundnut. *Journal of Oil Seeds Research,* 12: 171-175

Vaddoria, M.A. and Patel, V.J.1992. Character association and path analysis of Virginia runner groundnut (*Arachis hypogaea* L.). *Madras Agricultural journal*, 79(9): 500-504

Venkataravana, P., Sheriff, R.A., Kulkarni, R.S., Shankaranarayana, V. and Fathima, P.S. (2000).Correlation and path analysis in groundnut (*Arachis hypogaea* L.). *Mysore Journal of Agricultural Science*, 34: 321-325

Table 1. Genotypic (r_g) and phenotypic (r_p) correlation coefficients for different morpho-physiological agronomic traits of 10×10 half diallel cross of groundnut.

Character		NPOD	NPOP	PB	SB	PH	HI	100 P Wt	100 K Wt	PS	PI	DI	SPAD	CT	Y
50%FL	G	0.36*	0.41**	0.11	-0.20	0.10	-0.30*	0.11	-0.40**	-0.30*	-0.07	-0.32*	0.42**	-1.07	-0.46**
	P	0.28*	0.26	0.11	-0.10	0.07	-0.22	0.10	-0.18	-0.26	-0.06	-0.32*	0.30*	-0.33*	-0.42**
NPOD	G		0.50**	0.44**	-0.26	0.20	-0.39**	-0.19	-0.34*	-0.40**	0.05	-0.41**	0.28*	-0.40**	-0.44**
	P		0.27*	0.36**	-0.01	0.23	-0.21	-0.12	-0.19	-0.29*	0.06	-0.26	0.21	-0.20	-0.26
NPOP	G			0.19	-0.37**	0.45**	-0.38**	-0.05	-0.73**	-0.70**	0.25	-0.13	0.56**	-0.48**	-0.56**
	P			0.17	0.03	0.34**	-0.24	-0.05	-0.25	-0.35**	0.13	-0.05	0.27*	-0.29*	-0.38**
PB	G				0.11	0.21	-0.03	-0.09	-0.03	0.06	-0.23	-0.10	0.31*	-0.26	-0.01
	P				0.09	0.13	-0.02	-0.05	0	0.07	-0.17	-0.05	0.25	-0.23	0.02
SB	G					0.44**	0.30*	-0.17	0.31*	0.27*	-0.21	0.13	-0.05	0.71**	0.44**
	P					0.24	0.19	-0.10	0.41	0.15	-0.13	0.11	0.13	0.30*	0.27*
PH	G						-0.29*	-0.10	-0.71**	-0.24	0.14	-0.21	0.65**	-0.21	-0.37**
	P						-0.12	-0.08	-0.67**	-0.18	0.13	-0.06	0.38**	-0.10	-0.23
HI	G							0.53**	0.57**	0.57**	-0.73**	0.15	-0.22	0.56**	0.78**
	P							0.36**	0.23	0.41**	-0.58	0.11	-0.12	0.35**	0.61**
100PWt	G								0.03	0.37**	-0.44**	-0.10	0.06	0.06	0.28*
	P								0.04	0.28*	-0.37	-0.09	0.06	0.06	0.25
100KWt	G									0.48**	-0.32*	0.20	-0.76**	0.74**	0.76**
	P									0.23	-0.19	0.04	-0.33*	0.32*	0.39**
PS	G										-0.31*	-0.08	-0.47**	0.56**	0.58**
	P										-0.26	-0.03	-0.31*	0.36**	0.47**
PI	G											-0.05	0.03	-0.31*	-0.63**
	P											-0.04	0.03	-0.25	-0.53**
DI	G												-0.06	0.29	0.30*
	P												0.01	0.12	0.19
SPAD	G													-0.64**	-0.53**
	P													-0.55**	-0.34**
CT	G														0.80**
	P														0.64**

* and ** indicating significance at 0.05 and 0.01 level of probability, respectively

Legend: 50% FL=50% flowering, NPOD= No. of pods/plant, NPOP= No. of pops/plant, PB=Primary branches/plant, SB= Secondary branches/plant, PH= Plant height, HI=harvest index, 100PWt=100Pod weight, 100KWt= 100 kernel weight, PS= Pod size, PI= Pod index, DI= Diseases infection, SPAD= SPAD meter reading, CT= Canopy temperature, Y= Yield/hectare.

Table 2. Genotypic (G) path co-efficient among pod yield and yield components in 45 genotypes of groundnut

Character	50%fl	NPOD	NPOP	PB	SB	PH	HI	100PWT	100KWT	PS	PI	DI	SPAD	CT	Genptypic correlation with pod yield
50%Fl	**-0.0606**	-0.04322	-0.00429	0.017985	-0.04931	-0.01455	-0.08898	0.00955	0.033226	0.021302	0.018207	-0.02951	-0.15177	-0.11807	-0.46**
NPOD	-0.02181	**-0.12**	-0.00523	0.071942	-0.0641	-0.0291	-0.11567	-0.01649	0.028242	0.028402	-0.013	-0.03781	-0.10118	-0.04414	-0.44**
NPOP	-0.02484	-0.06002	**-0.0105**	0.031066	-0.09122	-0.06549	-0.1127	-0.00434	0.060638	0.049704	-0.06502	-0.01199	-0.20236	-0.05297	-0.56**
PB	-0.00666	-0.05282	-0.00199	**0.1635**	0.027118	-0.03056	-0.0089	-0.00781	0.002492	-0.00426	0.059823	-0.00922	-0.11202	-0.02869	-0.01
SB	0.012116	0.031213	0.00387	0.017985	**0.24653**	-0.06403	0.088977	-0.01476	-0.02575	-0.01917	0.054621	0.011988	0.018068	0.078345	0.44**
PH	-0.00606	-0.02401	-0.00471	0.034336	0.108472	**-0.1455**	-0.08601	-0.00868	0.058977	0.017041	-0.03641	-0.01937	-0.23488	-0.02317	-0.37**
HI	0.018174	0.046819	0.003975	-0.00491	0.073958	0.042202	**0.29659**	0.046012	-0.04735	-0.04047	0.189872	0.013832	0.079499	0.061793	0.78**
100Pwt	-0.00666	0.022809	0.000523	-0.01472	-0.04191	0.014552	0.157192	**0.08682**	-0.00249	-0.02627	0.114443	-0.00922	-0.02168	0.006621	0.28*
100Kwt	0.024232	0.040817	0.007636	-0.00491	0.076424	0.103322	0.169055	0.002604	**-0.0831**	-0.03408	0.083232	0.018443	0.274633	0.081656	0.76**
PS	0.018174	0.04802	0.007322	0.00981	0.066563	0.034926	0.169055	0.032122	-0.03987	**-0.071**	0.080631	-0.00738	0.169839	0.061793	0.58**
PI	0.004241	-0.006	-0.00261	-0.03761	-0.05177	-0.02037	-0.21651	-0.0382	0.026581	0.022012	**-0.2601**	-0.00461	-0.01084	-0.03421	-0.63**
DI	0.019385	0.04922	0.00136	-0.01635	0.032049	0.03056	0.044488	-0.00868	-0.01661	0.00568	0.013005	**0.09222**	0.021682	0.032	0.3*
SPAD	-0.02544	-0.03361	-0.00586	0.050686	-0.01233	-0.09459	-0.06525	0.005209	0.06313	0.033372	-0.0078	-0.00553	**-0.3614**	-0.07062	-0.53**
CT	0.06482	0.04802	0.005021	-0.04251	0.175035	0.03056	0.166089	0.005209	-0.06147	-0.03976	0.080631	0.026743	0.23127	**0.11035**	0.8**
Residual Effect		R2	-	0.130115											

* and ** indicating significance at 0.05 and 0.01 level of probability, respectively

Legend: 50% FL=50% flowering, NPOD= No. of pods/plant, NPOP= No. of pops/plant, PB=Primary branches/plant, SB= Secondary branches/plant, PH= Plant height, HI=harvest index, 100PWt=100Pod weight, 100KWt= 100 kernel weight, PS= Pod size, PI= Pod index, DI= Diseases infection, SPAD= SPAD meter reading, CT= Canopy temperature, Y= Yield/hectare.