IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

CORRELATION AND PATH ANALYSIS OF F_3 PROGENIES FOR DRY POD YIELD AND ITS COMPONENT TRAITS IN SUMMER GROUNDNUT (*Arachis hypogaea* L.)

[1]S.S. Bundhe, [2]A.G. Waman, [3]V.L. Amolic, [4]D.S. Thakare, [5]N.K. Mhaske
[1]Student (M. Sc. Agriculture), [2]Student (M. Sc. Agriculture), [3]Professor of Agricultural Botany,
[4]Assistant Professor of Agricultural Botany, [5]Student (M. Sc. Biotechnology)
Department of Agricultural Botany, Post Graduate Institute,
Mahatma Phule krishi Vidyapeeth, Rahuri-413 722, Dist., Ahmednagar, India

Abstract: The investigation on correlation and path analysis of F_3 progenies for dry pod yield and its component traits in summer Groundnut (*Arachis hypogaea* L.) was undertaken to study the characters association and direct and indirect contribution of component traits towards dry pod yield. Ten observations were recorded on dry pod yield and its component characters viz., days to 50% flowering, number of mature pod/plants, dry haulm yield/plant (g), dry pod yield/plant (g), hundred kernel weight (g), shelling (%), harvest index (dry wt. basis) (%), sound mature kernel (%), oil content (%), protein content (%). Days to 50% flowering, number of mature pods/plants, dry haulm yield/plant (g), hundred kernel weight (g), shelling (%), harvest index (dry wt. basis) (%), sound mature kernel (%), oil content (%) showed significant positive correlation with dry pod yield plant^{-1} at both genotypic and phenotypic level. Path analysis studies revealed that sound mature kernel, hundred kernel weight, dry haulm yield/plant, number of mature pods/plant, harvest index, shelling % had positive direct effect on dry pod yield plant^{-1}.

Keywords: Groundnut (Arachis hypogaea L.), correlation, path analysis, yield

I. INTRODUCTION:

Groundnut *(Arachis hypogaea* L.) is an important oilseed crop of the world. Which have origin in Brazil in South America now presently cultivated throughout tropical, sub-tropical, warm temperate regions of the world. It is a major source of edible oil and vegetable protein. Groundnut kernel contain 47-53% oil and 25-36% protein. Family of Groundnut is Leguminaceae or Fabaceae. It is a self-pollinating (autogamous) crop, allotetraploid with basic chromosome number ten (2n=4x=40) and genome size 2800 Mb (Guo *et al.*, 2009). Groundnut accounts for approximately 45 percent of total oilseed acreage and 55 percent of total oilseed production in India.

Correlation coefficient is a statistical measure, for investigating degree and direction of interrelation among two or more variables. In present study, correlation coefficient analysis measures the mutual relationship between various plant traits. Thus, correlation coefficient analysis provides significant information about directions for selection to combine high yield potential with desired traits. In present study, the genotypic and phenotypic correlation coefficient of different traits with dry pod yield per plant were studied.

Path coefficient analysis is an effective method for understanding the direct and indirect effects of related characters on the dry pod yield per plant (dependant variable). In the current study, path coefficient analysis was performed to assess the direction and size of the direct and indirect effects of numerous yield contributing traits on dry pod yield plants^{-1}.

II. MATERIAL AND METHOD

The experiment was conducted in a randomized block design (RBD) with two replications. The material used in the present study consisted of eighty F_3 progenies of 4 crosses and one check Phule Unnati (Table-1). The lines were obtained from the Groundnut Breeder, All India Co-ordinated Research Project on Groundnut, Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722(M.S.). Genotypic and phenotypic coefficients of correlation calculated as described by Singh and Chaudhary (1977) and Johnson *et al.*, (1955). Direct and indirect effects calculated by the path coefficient analysis as suggested by Dewey and Lu (1959) at genotypic levels.

III. RESULT AND DISCUSSION

Association of dry pod yield with other characters

The characters viz., Days to 50% flowering (0.611, 0.445), number of mature pods/plants (0.982, 0.979), dry haulm yield/plant (g) (0.729, 0.744), hundred kernel weight (g) (0.992, 0.960), shelling (%) (0.260, 0.189), harvest index (dry wt. basis) (%) (0.346, 0.389), sound mature kernel (%) (0.989, 0.979), oil content (%) (0.447, 0.200) showed significant positive correlation with dry pod yield per plant at both genotypic and phenotypic level, respectively. Protein content (%) (-0.661, -0.414) showed significant negative correlation with dry pod yield per plant at both genotypic and phenotypic level, respectively shown in Table-2.

Kasule (2010) also reported in Groundnut there was significant positive correlation between hundred kernel weight, harvest index and dry pod yield per plant. Other scientist also discovered significant positive correlation with dry pod yield per plant viz., Shoba *et al*. (2013) of number of mature pod/plants; Pavan *et al*. (2014) of 100 kernel weight; Kumar and Shekhar (2016) of shelling percentage; Dhakar *et al*. (2017) of sound mature kernel; Dhaygude (2017) of dry haulm yield per plant; Meena and Chandra (2022) of harvest index, sound mature kernel and kernel yield per plant. Thus, this all confirms the present findings.

In present investigation for most of the characters, genotypic correlation was higher than corresponding phenotypic correlation indicated that these characters are useful in yield improvement.

Association among dry pod yield component traits

Days to 50% flowering

Days to 50% flowering recorded significant positive correlation with number of mature pod/plants (0.601, 0.429), dry haulm yield/plant (0.356, 0.281), hundred kernel weight (0.647, 0.437), harvest index (dry wt. basis) (0.404, 0.297), sound mature kernel (0.620, 0.460), oil content (0.631, 0.363) at both genotypic and phenotypic levels, respectively. Shelling% showed significant positive correlation (0.225) and non-significant positive correlation (0.119) at genotypic and phenotypic levels, respectively. Protein content showed negative significant correlation (-0.849, -0.495) at genotypic and phenotypic levels, respectively.

Number of mature pod/plants

Number of mature pod/plants recorded significant positive correlation with dry haulm yield/plant (0.732, 0.744), hundred kernel weight (0.978, 0.946), shelling (0.230, 0.181), harvest index (dry wt. basis) (0.312, 0.351), sound mature kernel (0.966, 0.956), oil content (0.458, 0.189) at genotypic and phenotypic levels, respectively. Protein content showed significant negative correlation (-0.614, -0.400) at genotypic and phenotypic levels, respectively.

Dry haulm yield/plant

Dry haulm yield/plant recorded significant positive correlation with hundred kernel weight (0.734, 0.721), sound mature kernel (0.687, 0.712) at genotypic and phenotypic levels, respectively. Oil content showed significant positive correlation (0.217) and non-significant positive correlation (0.065) at genotypic and phenotypic levels, respectively. Harvest index (-0.363, -0.287) showed significant positive correlation at genotypic and phenotypic levels, respectively.

Hhundred kernel weight

Hhundred kernel weight recorded significant positive correlation with shelling (0.257, 0.182), harvest index (dry wt. basis) (0.334, 0.376), sound mature kernel (0.974, 0.945), oil content (0.463, 0.183) at genotypic and phenotypic levels, respectively. Protein content showed significant negative correlation (-0.709, -0.425) at genotypic and phenotypic levels, respectively.

Shelling (%)

Shelling (%) recorded significant positive correlation with harvest index (dry wt. basis) (0.279, 0.187), sound mature kernel (0.269, 0.187), oil content showed significant positive correlation (0.173) and non-significant correlation (0.134) at genotypic and phenotypic levels, respectively. Protein content showed significant negative correlation (-0.346, -0.249) at genotypic and phenotypic levels, respectively.

Harvest index (dry wt. basis) (%)

Harvest index (dry wt. basis) (%) recorded significant positive correlation with sound mature kernel (0.383, 0.403), oil content (0.389, 0.228) at genotypic and phenotypic levels, respectively. Protein content showed significant negative correlation (-0.613, -0.411) at genotypic and phenotypic levels, respectively.

Sound mature kernel (%)

Sound mature kernel (%) recorded significant positive correlation with oil content (0.405, 0.163) at genotypic and phenotypic levels, respectively. Protein content showed significant negative correlation (-0.664, -0.431) at genotypic and phenotypic levels, respectively.

Oil content (%)

oil content (%) showed significant negative correlation with protein content (-1.019, -0.364) at genotypic and phenotypic levels, respectively.

Direct effects

Path coefficient analysis revealed that the sound mature kernel (0.321) showed higher direct effect on dry pod yield per plant followed by HKW (0.277), dry haulm yield per plant (0.220), number of mature pods per plant (0.208), harvest index (0.144), shelling % (0.019). While days to 50% flowering (-0.056), oil content (-0.026), protein content (-0.047) showed negative direct effect on dry pod yield.

Saini and Sharma (2018) observed kernel yield plant^{-1} had high positive direct effect on pod yield plant^{-1} followed by harvest index, number of branches plant^{-1}, days to 50% flowering and hundred kernel weight; Vadher and Kachhadia (2020) observed maximum positive direct effect on number of mature pod/plants.

Indirect effect of different independent traits on dry pod yield

Days to 50% flowering

Days to 50% flowering exhibited negative direct effect of magnitude (-0.056), however, it had significant and positive association with dry pod yield (0.612). It was due to positive indirect effect via, number of mature pod/plants (0.125), dry haulm yield/plant (0.078), hundred kernel weight (0.179), shelling (0.004), harvest index (dry wt. basis) (0.058), sound mature kernel (0.199), protein content (0.040).

Number of mature pods/plants

Number of mature pods/plants exhibited positive direct effect of magnitude (0.208) and its association with dry pod yield was highly significant and positive (0.983). It was due to positive indirect effect via dry haulm yield/plant (0.161), hundred kernel weight (0.271), shelling (0.004), harvest index (dry wt. basis) (0.045), sound mature kernel (0.310), protein content (0.029).

Dry haulm yield/plant (g)

Dry haulm yield/plant (g) exhibited positive direct effect of magnitude (0.220) and its association with dry pod yield was significant and positive (0.730). It was due to positive indirect effect via number of mature pod/plants (0.152), hundred kernel weight (0.204), shelling (0.000), sound mature kernel (0.221), protein content (0.012).

Hundred Kernel weight (g)

Hundred Kernel weight (g) exhibited positive direct effect of magnitude (0.277) and its association with dry pod yield was highly significant and positive (0.993). It was due to positive indirect effect via number of mature pod/plants (0.203), dry haulm yield/plant (0.162), shelling (0.005), harvest index (0.048), sound mature kernel (0.313), protein content (0.033).

Shelling percentage

Shelling (%) exhibited positive direct effect of magnitude (0.019) and its association with dry pod yield was significant and positive (0.261). It was due to positive indirect effect via, number of mature pod/plants (0.048), hundred kernel weight (0.071), harvest index (dry wt. basis) (0.040), sound mature kernel (0.087), protein content (0.016).

Harvest index (dry wt. basis)

Harvest index (dry wt. basis) exhibited positive direct effect of magnitude (0.144) and its association with dry pod yield was significant and positive (0.346). It was due to positive indirect effect via, number of mature pod/plants (0.065), hundred kernel weight (0.093), shelling % (0.005), sound mature kernel (0.123), protein content (0.029).

Sound mature kernel

Sound mature kernel exhibited positive direct effect of magnitude (0.321) and its association with dry pod yield was highly significant and positive (0.989). It was due to positive indirect effect via, number of mature pod/plants (0.201), dry haulm yield/plant (0.151), hundred kernel weight (0.270), shelling % (0.005), harvest index (0.055), protein content (0.031).

oil content (%)

oil content (%) exhibited negative direct effect of magnitude (-0.026), however, it had significant and positive association with dry pod yield (0.447). It was due to positive indirect effect via, number of mature pod/plants (0.095), dry haulm yield/plant (0.048), hundred kernel weight (0.128), shelling (0.003), harvest index (dry wt. basis) (0.056), sound mature kernel (0.130), protein content (0.048).

In the current study, traits like number of mature pod/plants, dry haulm yield/plant, hundred kernel weight, shelling percentage, harvest index (dry wt. basis), sound mature kernel showed high to moderate estimates of positive direct effects along with significant correlation with dry pod yield, showing true and perfect relationship between them. Therefore, suggesting that selection of these traits will be more worthy for improving the dry pod yield.

The traits like number of mature pod/plants, dry haulm yield/plant, hundred kernel weight, sound mature kernel showed positive indirect effect on majority of component traits studied.

The residual effect observed was 0.054 which indicates that about 90 % variability was due to the characters considered for the studies.

IV. CONCLUSION

Considering correlation coefficient and path analysis simultaneously, number of mature pods/plant, dry haulm yield/plant, hundred kernel weight, sound mature kernel were found to be true components of dry pod yield in Groundnut and emphasis should be given on these traits for dry pod yield improvement in the present set of progenies.

Table 1- List of four crosses used for study

Sr. No.	Name of Cross	No. of progenies
1	ICGV-15301 × Phule Unnati	20
2	ICGV-10008 × Phule Unnati	20
3	Girnar-4 × Phule Unnati	20
4	SB XI × RHRG-06150	20
5	Check: Phule Unnati	01
	Total	81

Table 2- Estimates of genotypic (above diagonal) and phenotypic (below diagonal) correlation coefficient with dry pod yield and yield contributing ten characters in Eighty-one progenies (80 progenies + 1 checks) of four crosses of F_3 generation of Groundnut.

Characters	Days to 50% flowering	Number of mature pods/plants	Dry haulm yield/plant (g)	Hundred Kernel weight (g)	Shelling (%)	Harvest index (dry wt. basis) (%)	Sound mature kernel (%)	oil content (%)	Protein content (%)	Genotypic correlation with Dry pod Yield/plant (g)
Days to 50% flowering	**1.000**	0.601**	0.356**	0.647**	0.225**	0.404**	0.620**	0.631**	-0.849	0.611**
Number of mature pods/plants	0.429**	**1.000**	0.732**	0.978**	0.230**	0.312**	0.966**	0.458**	-0.614	0.982**
Dry haulm yield/plant (g)	0.281**	0.744**	**1.000**	0.734**	-0.016	-0.363	0.687**	0.217**	-0.253	0.729**
Hundred Kernel weight (g)	0.437**	0.946**	0.721**	**1.000**	0.257**	0.334**	0.974**	0.463**	-0.709	0.992**
Shelling (%)	0.119	0.181*	0.016	0.182*	**1.000**	0.279**	0.269**	0.173*	-0.346	0.260**
Harvest index (dry wt. basis) (%)	0.297**	0.351**	-0.287**	0.376**	0.182*	**1.000**	0.383**	0.389**	-0.613	0.346**
Sound mature kernel (%)	0.460**	0.956**	0.712**	0.945**	0.187*	0.403**	**1.000**	0.405**	-0.664	0.989**
oil content (%)	0.363**	0.189*	0.065	0.183*	0.134	0.228**	0.163*	**1.000**	-1.019	0.447**
Protein content (%)	-0.495**	-0.400**	-0.157	-0.425	-0.249	-0.411	-0.431**	-0.364	**1.000**	-0.661**
Phenotypic correlation with Dry pod yield/plant (g)	0.445**	0.979**	0.744**	0.960**	0.189*	0.389**	0.979**	0.200**	-0.414**	**1.000**

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

Table 3- Direct (diagonal) and indirect (above and below diagonal) path coefficient for ten characters in Eighty-one progenies (80 progenies + 1 checks) of four crosses of F_3 generation of Groundnut.

Sr.No.	Characters	Days to 50% flowering	Number of mature pods/plants	Dry haulm yield/plant (g)	Hundred Kernel weight (g)	Shelling (%)	Harvest index (dry wt. basis)	Sound mature kernel	oil content (%)	Protein content (%)	Genotypic correlation with Dry pod yield/plant(g)
1	Days to 50% flowering	**-0.056**	0.125	0.078	0.179	0.004	0.058	0.199	-0.016	0.040	0.612
2	Number of mature pods/plants	-0.033	**0.208**	0.161	0.271	0.004	0.045	0.310	-0.012	0.029	0.983
3	Dry haulm yield/plant (g)	-0.020	0.152	**0.220**	0.204	0.000	-0.052	0.221	-0.006	0.012	0.730
4	Hundred Kernel weight (g)	-0.036	0.203	0.162	**0.277**	0.005	0.048	0.313	-0.012	0.033	0.993
5	Shelling (%)	-0.013	0.048	-0.004	0.071	**0.019**	0.040	0.087	-0.005	0.016	0.261
6	Harvest index (dry wt. basis) (%)	-0.023	0.065	-0.080	0.093	0.005	**0.144**	0.123	-0.010	0.029	0.346
7	Sound mature kernel (%)	-0.035	0.201	0.151	0.270	0.005	0.055	**0.321**	-0.011	0.031	0.989
8	oil content (%)	-0.035	0.095	0.048	0.128	0.003	0.056	0.130	**-0.026**	0.048	0.447
9	Protein content (%)	0.047	-0.128	-0.056	-0.197	-0.007	-0.088	-0.213	0.026	**-0.047**	-0.661

Residual effect: 0.054, Bold features indicate direct effect

V. LITERATURE CITED

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

Dhakar T. R., Sharma H., Kumar R. and Kunwar R. 2017. Correlation and path analysis for yield and its contributing traits in Groundnut (*Arachis hypogaea* L.). International Journal of Agriculture sciences. 9:3997-3999.

Dhaygude S. 2017. Identification of summer Groundnut genotypes for high oil content. M.Sc (Agri.) Thesis, M.P.K.V. Rahuri (M.S.)

Guo B., Chen X., Hong Y., Liang X., Dang P., Brenneman T., Holbrook C., Culbreath A. 2009. Analysis of gene expression profiles in leaf tissues of cultivated peanuts and development of EST-SSR markers and gene discovery International Journal Plant Genomics 2009:1-14

Johnson, H.W., Robinson, H.F. and Comstock, R.E. 1955. Genotypic and phenotypic correlation in soybean and their implication in selection. Agron. J 47:477-48

Kasule, P.A. 2010. Genetical studies of germplasm in summer groundnut. M.Sc. (Agri.) Thesis, M.P.K.V., Rahuri (M.S.).

Kumar Sapam Rajesh and Sekhar M. Reddi. 2016. Correlation and path analysis studies on F2 generation of Groundnut (*Arachis hypogaea* L.) for yield and its attributes. The bioscan, 11 (3):1895-1898.

Meena and Chandra 2022. Genetic Variability, Correlation and Path Analysis in Groundnut (*Arachis hypogaea* L.) (Doctoral dissertation, MPUAT, Udaipur).

Pavan Kumar C., Rekha R., Venkateswarulu O., Vasanthi, R.P. 2014. Correlation and path coefficient analysis in groundnut (*Arachis* hypogaea L.) 2014. *Int. J. Appl. Biol.Pharma. Technol*. 5(1):8-11.

Saini Harkesh and Sharma M.M. 2018. Genetic variability and character association study in a RIL population for yield and quality traits in Groundnut *(Arachis hypogea* L.). *International Journal of Chemical Studies;* 6(6):2179-2185.

Shoba, D., Manivannan, N. and Vindhiyavarman, P. 2013. Correlation and path coefficient analysis in Groundnut (*Arachis hypogaea* L.). *Madras Agricultural Journal*, 99 (1/3) 18-20

Singh, R.K., and Chaudhary, B.D. 1977. Biometrical Methods in Quantitative Genetic Analysis. Kalyani Publishers, New Delhi.

Vadher, P.A. and Kachhadia, V.H. 2020. Correlation and Path Analysis Studies for Quantitative Traits in F_3 Generations of Groundnut (*Arachis hypogaea* L.). *Indian Journal of Pure & Applied Biosciences*, 8(5): 385-398h