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Character Association and Path Co-Efficient Analysis Studies for Yield and its Contributing Traits in Groundnut (*Arachis hypogaea* L.)

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A B S T R A C T

Correlation studies revealed that the genotypic correlations were higher than their corresponding phenotypic correlation for all the characters and the depended trait pod yield per plant was significantly and positively correlated at both phenotypic and genotypic levels with number of mature pods per plant, kernel yield per plant, shelling percent and days to 50% flowering.Path coefficient analysis revealed that kernel yield per plant, number of mature pods per plant exhibited high and positive direct effects on pod yield per plant. Whereas, 100 kernel weight, plant height, days to 50 % flowering exhibited low and positive direct effects towards pod yield.These findings suggested that emphasis should be given on these traits for selecting elite genotypes and further breeding programme.

Introduction

Groundnut is an allotetraploid (2n=4x= 40) with a basic chromosome number of x=10 and it is highly self-pollinated crop having cleistogamous flowers. Groundnut is an unpredictable crop due to its underground pods development. It is an annual legume with high quality edible oil and easily digestible protein of its kernels. Pod yield is not only polygenically controlled, but also influenced by its component characters. Direct selection of pod yield would not be reliable approach without giving due importance to its genetic nature, owing to its complex nature of inheritance. Information on phenotypic and genotypic interrelationship of pod yield with its components characters and also among the characters themselves would be very much useful to the plant breeder in developing an appropriate breeding strategy.

But, 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 path coefficient analysis permits the separation of direct effects from indirect effects and gives more realistic relationship of the characters and help in effective selection. Therefore, the present study on Spanish bunch genotypes was

conducted to study the correlation and path coefficients.

Materials and Methods

The experimental material consisted fourty genotypes of groundnut were sown in a Randomized Block Design with three replications during *Summer* 2015-16. The present investigation was carried out at Research Farm of Niger Research Station, Navsari Agricultural University, Vanarasi, Tal- Vansda, Dist-Navsari. Each entry was accommodated in a single row of 3.0 m length with a spacing of 45 x 15 cm. The experiment was surrounded by two guard rows to avoid damage and border effects. The recommended agronomical practices and plant protection measures were followed for the successful raising of the crop witheight irrigations throughout crop period.

The observations were recorded on five randomly selected plants in each entry and replication for ten characters viz., day to 50% flowering, day to maturity, plant height, number of mature pods per plant, pod yield per plant, kernel yield per plant, 100- pod weight, 100- kernel weight, shelling percentage and oil content (oil content was determined by automatic soxhlet extractor as suggested by Franz von Soxhlet) and their mean values were used for the statistical analysis. The phenotypic and genotypic correlation coefficients of all the characters were worked-out as per Al-Jibouri *et al.,* (1958) andthe path coefficient analysis was carried-out as per the method suggested by Dewey and Lu (1959).

Results and Discussion

The study of genotypic correlation gives an idea of the extent of relationship between different variables. This relationship among yield contributing characters as well as their association with pod yield provides information for exercising selection pressure for bringing genetic improvement in pod yield. In general, the values of genotypic correlations were higher than their corresponding phenotypic correlations.

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 Dolma *et al.,* (2010) and Zaman *et al.,* (2011).

The pod yield per plant had highly significant and positive correlations at both genotypic and phenotypic levels with number of mature pods per plant (rg=0.874, rp=0.780), kernel yield per plant (rg=0.986, rp=0.961), shelling percent (rg=0.892, rp=0.790) and days to 50% flowering (rg=0.306, rp=0.242), while oil content (rg=0.233) had significant but very poor association at genotypic level and also positive and non-significant correlation at phenotypic level.

Plant height (rg= -0.177, rp= -0.176), days to maturity (rg=-0.146, rp=-0.070) and 100 pod yield (rg=-0.051, rp=-0.034) had negative and non-significant correlation at both genotypic and phenotypic levels. 100 kernel yield (rg=0.061, rp=0.045) had positive and non-significant correlation at both genotypic and phenotypic levels with pod yield per plant.

The positive genotypic association has been reported between pod yield per plant and number of mature pods per plant by Bhosale *et al.,* (2011); Gupta *et al.,* (2015); Patil *et al.,* (2015); Vasanthi *et al.,* (2016) and Prabhu *et al.,* (2017), for kernel yield per plant by Meta and Monpara, (2010) and for shelling out-turn by Bhosale *et al.,* (2011) and Gupta *et al.,* (2015).

Table.1 Genotypic (r_g) and Phenotypic (r_p) correlation among ten characters in fourty genotypes of groundnut

Characters		Days to maturity	Plant height (cm)	No. of mature pods/plant	Kernel yield/plant (g)	100 pod weight (g)	100 kernel weight (g)	Shelling (%)	Oil content (%)	Pod yield per plant (g)
Days to 50% flowering	r_g	0.086	0.060	0.222*	0.288**	0.024	-0.143	0.254**	0.001	0.306**
	r_p	0.048	0.067	0.183*	0.240**	-0.005	-0.109	0.223*	0.003	0.242**
Days to maturity	r_g		0.272**	0.062	-0.182*	-0.024	-0.076	-0.232**	-0.214*	-0.146
	r_p		0.104	-0.022	-0.098	-0.005	-0.019	-0.098	-0.089	-0.070
Plant height (cm)	r_g			-0.254**	-0.183*	-0.081	0.178	-0.128	-0.007	-0.177
	r_p			-0.205*	-0.179*	-0.081	0.015	-0.124	0.024	-0.176
No. of mature pods per plant	r_g				0.821**	0.061	-0.099	0.693**	0.252**	0.874**
	r_p				0.737**	0.046	-0.117	0.592**	0.177	0.780**
Kernel yield/plant (g)	r_g					-0.021	-0.015	0.949**	0.194*	0.986**
	r_p					-0.011	-0.017	0.903**	0.140	0.961**
100-pod weight (g)	r_g						0.249**	0.039	0.211*	-0.051
	r_p						0.222*	0.038	0.169	-0.034
100-kernel weight (g)	r_g							-0.115	0.363**	0.061
	r_p							-0.100	0.286**	0.045
Shelling (%)	r_g								0.100	0.892**
	r_p								0.085	0.790**
Oil content (%)	r_g									0.233*
	r_p									0.143

Table.2 Genotypic path coefficient analysis showing direct (diagonal and bold) and indirect effects of different charecters on pod yield of groundnut genotypes

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of mature pods per plant	Kernel yield/plant (g)	100 pod weight (g)	100 kernel weight (g)	Shelling (%)	Oil content (%)	Genotypic correlation with pod yield/plant
Days to 50% flowering	**0.0497**	0.0043	0.0030	0.0110	0..0143	0.0012	-0.0071	0.0126	0.0000	0.3056**
Days to maturity	-0.0030	**-0.0342**	-0.0093	-0.0021	0.0062	0.0008	0.0026	0.0079	0.0073	-0.1464
Plant height (cm)	0.0006	0.0027	**0.0100**	-0.0026	-0.0018	-0.0008	0.0018	-0.0013	-0.0001	-0.1772
No. of mature pods per plant	0.0586	0.0165	-0.0671	**0.2639**	0.2166	0.0162	-0.0263	0.1828	0.0666	0.8743**
Kernel yield per plant (g)	0.2374	-0.1501	-0.1509	0.6771	**0.8251**	-0.0175	-0.0124	0.7827	0.1604	0.9860**
100 pod weight (g)	-0.0018	0.0017	0.0060	-0.0046	0.0016	**-0.0743**	-0.0185	-0.0029	-0.0157	-0.0519
100 kernel weight (g)	-0.0173	-0.0091	0.0215	-0.0120	-0.0018	0.0301	**0.1207**	-0.0138	0.0438	0.0611
Shelling (%)	-0.0187	0.0171	0.0094	-0.0510	-0.0698	-0.0028	0.0084	**-0.0736**	-0.0074	0.8924**
Oil content (%)	0.0000	0.0047	0.0001	-0.0056	-0.0043	-0.0047	-0.0080	-0.0022	**-0.0220**	0.2330*

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

Residual effect, R = 0.0031, N.B.: Values at diagonal indicate direct effects of respective character

The days to 50% flowering which had highly significant and positive association with number of mature pods per plant and kernel yield per plant at both genotypic and phenotypic levels while day to maturity had non- significant and negative association (Kumar *et al.,* 2014) is an important component in identifying and deciding the duration of the crop.

Thus, on the basis of correlations, number of mature pods per plant, kernel yield per plant, day to 50% flowering and shelling out-turn were proved to be the outstanding characters influencing pod yield in groundnut and they can serve as marker indicator characters for improvement in pod yield and need to be given importance in selection to achieve higher pod yield.

The path coefficient analysis revealed that the number of mature pods per plant and kernel yield per plant exhibited high and positive direct effects on pod yield per plant. Thus, these characters turned-out to be the major components of pod yield and direct selection for these traits will be rewarding for yield improvement. Similar reported by Raut *et al.*, (2010), Vekariya *et al.,* (2010). The character like days to 50% flowering, 100 kernel weight and plant height exhibited low and positive direct effects with pod yield per plant. While, days to maturity (Patel and Shelke 1992), 100 pod weights, shelling percent and oil content had low and negative direct effect towards pod yield per plant. The kernel yield per plant traits exhibited positive indirect effects *via* days to 50% flowering, number of mature pods per plant, shelling percent and oil content. Shelling percent had negative indirect effect on pod yield per plant *via* days to 50% flowering, number of mature pods per plant, kernel yield per plant, 100 pod weight and oil content. Oil content also had negative indirect effect on pod yield per plant *via* number of mature pods per plant, kernel yield per plant, 100 pod weight, 100 kernel weight and shelling percent whereas remaining characters *viz*., days to maturity and plant height had negligible and positive indirect effects on pod yield per plant. This finding are in accordance with Raghuvansi *et al.,* (2015); Bhargavi *et al.,* (2017); Ram *et al.,* (2017).

It was clear from the path analysis that the maximum direct effects as well as appreciable indirect influences were exerted by number of mature pods per plant, kernel yield per plant, shelling percent, oil content and day to 50% flowering. These characters also exhibited highly significant and positive associations 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 selecting for high yielding types in groundnut.

From the above discussion, it is clear that pod yield per plant was found to be significantly and positively correlated with number of mature pods per plant, kernel yield per plant, shelling percent and days to 50% flowering at genotypic and phenotypic levels while path coefficient analysis showed kernel yield per plant, number of mature pods per plant exhibited high and positive direct effects on pod yield per plant and also 100 kernel weight, plant height, days to 50 % flowering exhibited low but positive direct effects towards pod yield. Hence, these traits were considered as the most important yield contributors and due emphasis should be given while attempting pod yield improvement in groundnut.

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