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CORRELATION AND PATH ANALYSIS IN F_2 POPULATIONS OF GROUNDNUT (*Arachis hypogaea* L.) FOR YIELD AND YIELD ATTRIBUTES IN KADIRI 6 × J 11 CROSS

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ABSTRACT

The experiment was conducted at dryland farm of S. V. Agricultural College, Tirupati during *kharif,* 2021. In the cross Kadiri 6 × J 11, number of primary branches plant^{-1}, number of mature pods plant^{-1}, harvest index, dry haulms yield plant^{-1}, kernel yield plant^{-1} showed positive significance for pod yield plant^{-1}. Based on the path analysis, kernel yield plant^{-1} exhibited high positive direct effect with pod yield plant^{-1} in all six crosses; hence importance should be given in selection process for the improvement of pod yield in groundnut.

KEYWORDS: Correlation, path analysis, groundnut, yield attributes.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a vital crop among oilseeds, also known as "The king of oilseeds". It is a self-pollinated crop, an allotetraploid with a chromosome number 2n = 4x = 40. The cultivated groundnut belongs to family Fabaceae, sub family Papilionaceae. In the world, it is cultivated in 29.92 m ha, with a total production of 55.30 m t and productivity of 1851 kg ha^{-1} during 2021 (FAOSTAT, 2021). Globally, 41 per cent of groundnut produced is used for food purposes and 49 per cent is crushed for extraction of oil. In India, the total cultivated area of groundnut is 6.09 m ha, production is 10.21 m t with a productivity of 1676 kg ha^{-1}. In Andhra Pradesh, it is cultivated in an area of 0.87 m ha with a production of 0.78 m t and an average productivity of 894 kg ha^{-1} (Directorate of Economics and Statistics, 2021).

In the F_2 population, correlation and path analysis have to be studied to establish interrelationship among various yield attributes and also their contribution towards pod yield. Correlation coefficient analysis is useful to find out the nature and degree of association between various physiochemical traits including yield. Path coefficient analysis splits the correlation coefficient into direct and indirect effect towards yield as correlation analysis alone do not give a complete picture of the causal basis of association.

MATERIAL AND METHODS

The field experiment was conducted at dryland farm of S.V. Agricultural College, Tirupati during *kharif,* 2021 in Southern agro-climatic zone of Andhra Pradesh. Each F_2 generation of Kadiri 6 × J 11 cross along with the parents was raised in unreplicated plots. Data was recorded for the characters, plant height, number of primary branches plant^{-1}, number of secondary branches plant^{-1}, number of immature pods plant^{-1}, number of mature pods plant^{-1}, shelling per cent, harvest index, dry haulms yield plant^{-1}, kernel yield plant^{-1}, pod yield plant^{-1}. The data of the above have been subjected to statistical analysis for Character association (Johnson *et al*., 1955) and Path coefficient analysis (Dewey and Lu, 1959).

RESULTS AND DISCUSSION

Observations were recorded for 90 individual plants separately in Kadiri 6 × J 11 cross for all the characters. Yield is a complex character influenced by the environment and controlled by a large number of genes. The study of inter-relationships is necessary for understanding the association of simple traits with complex yield attributing traits. In the cross Kadiri 6 × J 11, pod yield plant^{-1} showed positive correlation with number of primary branches plant^{-1}, number of mature pods plant^{-1}, harvest index, dry haulms yield plant^{-1}, kernel yield plant^{-1}. Positive and significant correlation of pod yield with haulms yield, number of mature pods was reported by Pushkaran and Nair (1993). Similar findings were found by John *et al.* (2008) among six crosses and reported significant and positive association of pod yield plant^{-1} with number of mature pods plant^{-1}, kernel yield plant^{-1} and harvest index. Byadagi *et al.* (2018) reported significant and positive association of pod yield plant^{-1} with branches plant^{-1} among three crosses.

Plant height showed positive and significant

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association with dry haulms yield plant^{-1} (0.6401). It had negative and significant correlation with harvest index (-0.4462). Number of primary branches plant^{-1} exhibited positive and significant association with number of mature pods plant^{-1} (0.3502), dry haulms yield plant^{-1} (0.2947), kernel yield plant^{-1} (0.2314) and pod yield plant^{-1} (0.2398).

Number of mature pods plant^{-1} revealed positive and significant association with shelling per cent (0.3709), harvest index (0.3616), dry haulms yield plant^{-1} (0.3764), kernel yield plant^{-1} (0.8694) and pod yield plant^{-1} (0.8349). Shelling per cent showed positive and significant association with kernel yield plant^{-1} (0.4728).

Harvest index registered positive and significant association with kernel yield plant^{-1} (0.4472) and pod yield plant^{-1} (0.4998). It had negative and significant correlation with dry haulms yield plant^{-1} (-0.5421). Dry haulms yield plant^{-1} exhibited positive and significant association with kernel yield plant^{-1} (0.3596) and pod yield plant^{-1} (0.3865). Kernel yield plant^{-1} performed high positive and significant association with pod yield plant^{-1} (0.9293). Number of secondary branches plant^{-1} and number of immature pods plant^{-1} showed no significant association with any other traits.

Path analysis provides information about the cause and effect of different yield components, which gives better index for selection other than mere correlation coefficients. In this cross, plant height exhibited positive correlation (0.1428) and negligible positive (0.0029) direct effect, number of primary branches plant^{-1} revealed a significant positive correlation (0.2398) and negligible positive (0.0222) direct effect, number of secondary branches plant^{-1} displayed a positive correlation (0.0898) and negligible positive (0.0251) direct effect, number of immature pods plant^{-1} displayed a positive correlation (0.0536) and negligible positive (0.0046) direct effect and number of mature pods plant^{-1} exhibited a significant positive correlation (0.8349) and negligible positive (0.0280) direct effect on pod yield.

Shelling per cent exhibited a positive correlation (0.1557) and negligible negative (-0.2824) direct effect, harvest index exhibited a significant positive correlation (0.4998) and moderate positive (0.2342) direct effect, dry haulms yield plant^{-1} revealed significant positive correlation (0.3865) and moderate positive (0.2149) direct effect and kernel yield plant^{-1} revealed significant positive correlation (0.9293) and high positive (0.8486) direct effect on pod yield (Table 2).

With regard to indirect effects, plant height showed low positive indirect effect *via* dry haulms yield plant^{-1} (0.1375), kernel yield plant^{-1} (0.1213); negligible positive indirect effects *via* other traits *viz.,* number of primary branches plant^{-1} (0.0041), number of immature pods plant^{-1} (0.0001), number of mature pods plant^{-1} (0.0040). It showed negligible negative indirect effect through number of secondary branches plant^{-1} (-0.0029), shelling per cent (-0.0197) and low indirect effect *via* harvest index (-0.1045).

Number of primary branches plant^{-1} showed low positive indirect effect *via* kernel yield plant^{-1} (0.1964); negligible positive indirect effects *via* other traits *viz.,* plant height (0.0005), number of mature pods plant^{-1} (0.0098), shelling per cent (0.0225) and dry haulms yield plant^{-1} (0.0633). It showed negligible negative indirect effect through number of secondary branches plant^{-1} (-0.0048), number of immature pods plant^{-1} (-0.0001) and harvest index (-0.0200).

Number of secondary branches plant^{-1} showed negligible positive indirect effects *via* other traits *viz.,* number of immature pods plant^{-1} (0.0007), harvest index (0.0333) and kernel yield plant^{-1} (0.0658). On the contrary, it showed negligible negative indirect effect through plant height (-0.0003), number of primary branches plant^{-1} (-0.0042), shelling per cent (-0.0222) and dry haulms yield plant^{-1} (-0.0083).

Number of immature pods plant^{-1} showed negligible positive indirect effects *via* other traits *viz.,* number of secondary branches plant^{-1} (0.0040), number of mature pods plant^{-1} (0.0008), harvest index (0.0031) and dry haulms yield plant^{-1} (0.0150), kernel yield plant^{-1} (0.0667). On the contrary, it showed negligible negative indirect effect through number of primary branches plant^{-1} (-0.0003), shelling per cent (-0.0404).

Number of mature pods plant^{-1} recorded high positive indirect effect *via* kernel yield plant^{-1} (0.7377); negligible positive indirect effects *via* other traits *viz.,* plant height (0.0004), number of primary branches plant^{-1} (0.0078), number of immature pods plant^{-1} (0.0001), harvest index (0.0847) and dry haulms yield plant^{-1} (0.0809). Conversely, it showed low negative indirect effect through shelling per cent (-0.1047).

Shelling per cent recorded high positive indirect effect *via* kernel yield plant^{-1} (0.4012); negligible positive indirect effects *via* other traits *viz.,* plant height (0.0002), number of secondary branches plant^{-1} (0.0020), number of immature pods plant^{-1} (0.0007), number of mature pods plant^{-1} (0.0104), harvest index (0.0065) and dry haulms yield plant^{-1} (0.0189). Conversely, it showed

Table 1. Phenotypic correlation for yield attributes in F_2 generation of Kadiri 6 × J 11 cross

	PH	NPB	NSB	NIMP	NMP	SP	HI	DHYP	KYPP	PYPP
PH	1.0000	0.1868	-0.1170	0.0155	0.1420	0.0698	-0.4462**	0.6401**	0.1429	0.1428
NPB		1.0000	-0.1900	-0.0144	0.3502**	-0.0796	-0.0855	0.2947**	0.2314*	0.2398**
NSB			1.0000	0.1578	-0.0010	0.0786	0.1420	-0.0387	0.0775	0.0898
NIMP				1.0000	0.0275	0.1429	0.0131	0.0700	0.0787	0.0536
NMP					1.0000	0.3709**	0.3616**	0.3764**	0.8694**	0.8349**
SP						1.0000	0.0279	0.0880	0.4728**	0.1557
HI							1.0000	-0.5421**	0.4472**	0.4998**
DHYP								1.0000	0.3596**	0.3865**
KYPP									1.000	0.9293**
PYPP										1.0000

Table 2. Phenotypic Path analysis of yield attributes in F_2 generation of Kadiri 6 × J 11 cross

	PH	NPB	NSB	NIMP	NMP	SP	HI	DHYP	KYPP	PYPP
PH	**0.0029**	0.0041	-0.0029	0.0001	0.0040	-0.0197	-0.1045	0.1375	0.1213	**0.1428**
NPB	0.0005	**0.0222**	-0.0048	-0.0001	0.0098	0.0225	-0.0200	0.0633	0.1964	**0.2398****
NSB	-0.0003	-0.0042	**0.0251**	0.0007	0.0000	-0.0222	0.0333	-0.0083	0.0658	**0.0898**
NIMP	0.0000	-0.0003	0.0040	**0.0046**	0.0008	-0.0404	0.0031	0.0150	0.0667	**0.0536**
NMP	0.0004	0.0078	0.0000	0.0001	**0.0280**	-0.1047	0.0847	0.0809	0.7377	**0.8349****
SP	0.0002	-0.0018	0.0020	0.0007	0.0104	**-0.2824**	0.0065	0.0189	0.4012	**0.1557**
HI	-0.0013	-0.0019	0.0036	0.0001	0.0101	-0.0079	**0.2342**	-0.1165	0.3795	**0.4998****
DHYP	0.0018	0.0065	-0.0010	0.0003	0.0105	-0.0249	-0.1270	**0.2149**	0.3051	**0.3865****
KYPP	0.0004	0.0051	0.0019	0.0004	0.0243	-0.1335	0.1047	0.0773	**0.8486**	**0.9293****

Residual effect (Phenotypic) = 0.1502
Bold: Direct effects; **Normal**: Indirect effects
** : significant at 1% level, * : significant at 5% level

PH: Plant height; **NPB:** Number of primary branches plant^{-1}; **NSB:** Number of secondary branches plant^{-1}; **NIMP:** Number of immature pods plant^{-1}; **NMP:** Number of mature pods plant^{-1}; **SP:** Shelling per cent; **HI:** Harvest index ; **DHY:** Dry haulms yield plant^{-1}; **KYP:** Kernel yield plant^{-1} ; **PYP:** Pod yield plant^{-1}

negligible negative indirect effect through number of primary branches plant^{-1} (-0.0018).

Harvest index recorded high positive indirect effect *via* kernel yield plant^{-1} (0.3795); negligible positive indirect effects *via* other traits *viz.,* number of secondary branches plant^{-1} (0.0036), number of immature pods plant^{-1} (0.0001) and number of mature pods plant^{-1} (0.0101). In contrast, it showed negligible negative indirect effect through plant height (-0.0013), number of primary branches plant^{-1} (-0.0019), shelling per cent (-0.0079) and dry haulms yield plant^{-1} (-0.1165).

Dry haulms yield plant^{-1} recorded high positive indirect effect *via* kernel yield plant^{-1} (0.3051); negligible positive indirect effects *via* other traits *viz.,* plant height (0.0018), number of primary branches plant^{-1} (0.0065), number of immature pods plant^{-1} (0.0003) and number of mature pods plant^{-1} (0.0105). In contrast, it showed negligible negative indirect effect through number of secondary branches plant^{-1} (-0.0010), shelling per cent (-0.0249) and harvest index (-0.1270).

Kernel yield plant^{-1} recorded low positive indirect effect *via* harvest index (0.1047); negligible positive indirect effects *via* other traits *viz.,* plant height (0.0004), number of primary branches plant^{-1} (0.0051), number of secondary branches plant^{-1} (0.0019), number of immature pods plant^{-1} (0.0004), number of mature pods plant^{-1} (0.0243) and dry haulms yield plant^{-1} (0.0773). In contrast, it showed low negative indirect effect through shelling per cent (-0.1335).

The results obtained from path analysis indicated that kernel yield plant^{-1} had high positive direct effect; harvest index and dry haulms yield plant^{-1} had moderate positive direct effect. Hence, due emphasis should be given to these traits in selection programme to improve pod yield plant^{-1}.

Harvest index exhibited moderate positive direct effect on pod yield and these results were in agreement with the findings of Suneetha *et al.* (2004) in fifteen F_1 s of groundnut. Dry haulms yield plant^{-1} exhibited a positive direct effect and the results obtained in the present study are in conformity with the findings of Moinuddin (1997) and John *et al.* (2011). Kernel yield plant^{-1} showed a high positive direct effect and these results were in accordance with the reports of Rao *et al.* (2012) on pod yield plant^{-1} in groundnut.

By and large, based on correlation coefficient analysis, it was concluded that the traits *viz.,* number of mature pods plant^{-1}, harvest index and kernel yield plant^{-1} had positive significant correlation with pod yield plant^{-1} in the cross studied. The data on path analysis elucidates the importance of kernel yield plant^{-1} to improve pod yield plant^{-1} in the F_2 populations studied.

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