Andhra Pradesh J Agril. Sci : 3(3): 190-196, 2017

STUDY OF CORRELATION AND PATH ANALYSIS IN GROUNDNUT UNDER ORGANIC AND INORGANIC FERTILIZER MANAGEMENTS

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Date of Receipt: 07-06-2017 Date of Acceptance: 29-09-2017

ABSTRACT

Correlation and path co-efficient analysis were carried out for pod yield and its contributing characters in 168 germplasm lines and five checks of groundnut. Correlation studies indicated that pod yield per plant was significantly and positively associated with harvest index, 100 seed weight, kernel yield per plant, number of mature pods per plant, total number of pods per plant, shelling percentage and number of pegs per plant. Path analysis revealed that kernel yield per plant under organic management and kernel yield per plant and total number of pods per plant under inorganic fertilizer management recorded high positive direct effect on pod yield per plant. Hence, it would be rewarding to give due importance on the selection of these traits for rapid improvement in pod yield of groundnut.

KEYWORDS: Correlation, path analysis, groundnut.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) (2n = 40), highly self-pollinated legume crop grown in tropical and sub-tropical regions of the world, is a good source of oil and protein. It is a segmental allotetraploid, belongs to family Fabaceae and is the major oilseed crop in India and in Andhra Pradesh. Green revolution is one of the reason for increased use of chemical fertilizers and pesticides resulting in several harmful effects which affected the environment. Of late, organic farming is being advocated to overcome these harmful effects of inorganic management. But the major constraint for organic farming is the lack of suitable varieties specifically bred to get higher productivity and better quality (Dawson *et al.,* 2011).

In several cases varieties that perform well in organic systems have different yield ranking under inorganic fertilizer management. Hence it would be a challenge for the breeding sector to develop cultivars especially for organic condition. In organic agriculture, the immediate need is to make available greater quantity of organically produced seed. Hence there is essential need to encourage breeding programmes, designed in concert with organic management.

Correlation in combination with path analysis provides an opportunity to study the degree and direction of association of yield with its component characters. Thus, it helps in establishing suitable selection criteria for improving the yield in the target environments. 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.

MATERIAL AND METHODS

The material for the present study comprised of 168 germplasm lines and five checks of groundnut evaluated in two separate field experiments (organic and inorganic) using Augumented design II, during *kharif*, 2016 at dryland farm of S.V. Agricultural college, Tirupathi. Under each management practice whole plot is divided into six blocks. In each block 28 germplasm lines along with five checks were sown. In each management practice every germplasm line was sown in single row of 2 m length with a spacing of 30 cm between the rows and 10 cm between the plants within the row. In organic management practice, FYM @ 5 t ha^{-1} at the time of field preparation was applied. Seed treatment was done with beejamrutha before one day of sowing. Jeevamrutha was applied at 15 days interval and panchagavya was applied on 25th and 35th day after sowing and also whenever pest incidence occurred.

In inorganic fertilizer management practice, recommended dose of chemical fertilizers @ 20 kg N,

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40 kg P_2O_5 and 40 kg K_2O per hectare in the form of urea, single super phosphate and murate of potash were broadcasted before sowing. Seed treatment was done with bavistin @ 3 g $kg^{-1}$of seed For the control of insect pests chlorofenopyr @ 2 ml l^{-1} was used. Except disease and such as pest control measures, cultural practices such as weeding, gypsum (@ 500 kg ha^{-1}) application and irrigation were followed in common for both management practices to maintain good crop growth.

Observations were recorded on five randomly selected plants in each germplasm line for 14 traits *viz*., days to 50 per cent flowering, days to maturity, plant height (cm), number of primary branches per plant, number of pegs per plant, number of mature pods per plant, number of immature pods per plant, total number of pods per plant, 100 seed weight (g), shelling percent (%), sound mature kernel percentage (%), harvest index (%), kernel yield per plant (g) and pod yield per plant (g). The simple correlation coefficients were calculated using the method given by Panse and Sukhatme (1985) and path coefficient analysis as suggested by Dewey and Lu, (1959).

RESULTS AND DISCUSSION

The analysis of variance in respect of 14 characters recorded significant differences among the entries for all the characters under both organic and inorganic fertilizer managements except for number of primary branches per plant, shelling percentage and harvest index which were non-significant under organic fertilizer management and significant under inorganic fertilizer management indicating the presence of considerable amounts of genetic variation for different traits in the experimental material. The data on all the fourteen characters was subjected to statistical analysis. Simple correlation coefficients between pod yield and its components under both organic and inorganic fertilizer managements were presented in Table 1 and 2.

Under organic fertilizer management practice pod yield per plant showed highly significant and positive correlation with kernel yield per plant (r = 0.963**) followed by number of mature pods per plant (r = 0.832**), total number of pods per plant (r = 0.828**), harvest index (r = 0.604**), 100 seed weight (r = 0.485**), days to maturity (r = 0.447**), number of pegs per plant (r = 0.464**), days to 50% flowering (r = 0.276**) and shelling percentage (r = 0.340**). These results indicate that increase in these traits leads to increase in pod yield.

Under inorganic fertilizer management pod yield per plant exhibited highly significant and positive relationship with kernel yield per plant (r = 0.955**), total number of pods per plant (r = 0.796**), number of mature pods per plant (r = 0.794**), harvest index (r = 0.692**), 100 seed weight (r = 0.545**), number of pegs per plant (r = 0.446**), shelling percentage (r = 0.277**), number of immature pods per plant (r = 0.265**), plant height (r = 0.244**) and number of primary branches per plant (r= 0.162*) indicating that increase in these traits would result in increase in the pod yield.

Results of significant and positive association of pod yield per plant with harvest index, total number of pods per plant and 100 seed weight was reported by Maunde *et al.* (2015). Significant and positive correlation of pod yield per plant with kernel yield per plant and number of mature pods per plant was registered by Kumar *et al.* (2012) and Jain *et al.* (2016) and for number of primary branches per plant by Vasanthi *et al.* (2015). The results of significant and positive association for number of pegs per plant, days to 50 per cent flowering and shelling percentage were in accordance with the reports of Mahalakshmi *et al.* (2005), Satish (2014) and Shukla and Rai (2014) respectively.

Path coefficient analysis of pod yield per plant as dependent variable and characters with significant association with pod yield as independent variables was conducted for organic and inorganic fertilizer managements and the results were furnished in Table 3 and 4.

Under organic fertilizer management the trait kernel yield per plant (1.09086) exhibited very high positive direct effect and shelling percentage recorded high negative direct effect (-0.29621) on pod yield per plant. Similar high negative direct effect of shelling percentage on pod yield per plant was registered by Kumar *et al.* (2012) and Rao *et al.* (2014).

On the other hand 100 seed weight (0.02057), number of pegs per plant (0.00426), number of mature pods per plant (0.09194) exhibited negligible positive direct effects on pod yield per plant. Days to 50 per cent flowering (-0.00112), days to maturity (-0.02554), total number of pods per plant (-0.03970) and harvest index (-0.00817) showed negligible negative direct effects on pod yield per plant. Negligible negative direct effect of days to 50 per cent flowering on pod yield per plant was

Table 1. Simple correlation coefficients (r) among pod yield per plant and its components in groundnut under organic fertilizer management

Character	DF	DM	PH	NPB	NPEGP	NMP	NIMP	NPP	100SW	SP	SMK%	HI	KYP	PYP
DF	**1.000**	0.445**	-0.228**	0.120	-0.034	0.205**	0.006	0.200**	0.330**	-0.039	-0.035	0.124	0.239**	0.276**
DM		**1.000**	-0.192*	0.068	0.023	0.416**	-0.042	0.392**	0.377**	0.135	0.032	0.342**	0.445**	0.447**
PH			**1.000**	-0.176*	0.244**	-0.027	0.133	0.012	-0.199**	0.088	0.041	-0.264**	0.011	-0.003
NPB				**1.000**	0.238**	0.167*	0.100	0.191*	0.048	0.120	-0.020	-0.067	0.160*	0.140
NPEGP					**1.000**	0.572**	0.208**	0.614**	-0.019	0.230**	-0.086	-0.037	0.459**	0.464**
NMP						**1.000**	-0.042	0.960**	0.262**	0.341**	0.101	0.449**	0.812**	0.832**
NIMP							**1.000**	0.241**	-0.006	-0.115	-0.048	-0.020	0.044	0.071
NPP								**1.000**	0.252**	0.299**	0.085	0.430**	0.801**	0.828**
100SW									**1.000**	0.331**	0.365**	0.424**	0.515**	0.485**
SP										**1.000**	0.346**	0.237**	0.563**	0.340**
SMK%											**1.000**	0.230**	0.180*	0.108
HI												**1.000**	0.604**	0.604**
KYP													**1.000**	0.963**
PYP														**1.000**

* Significant at 5% level; ** Significant at 1 % level; NS = Non-significant

DF: Days to 50% flowering; DM: days to maturity; PH: Plant height (cm); NPB: Number of primary branches per plant (No); NPEGP: Number of pegs per plant (No); NMP: Number of mature pods per plant (No); NIMP: Number of immature pods per plant (No); NPP: Total number of pods per plant (No); 100SW: 100 seed weight(g); SP: Shelling percentage(%); SMK%: Sound mature kernel percentage(%); HI: Harvest index (%); KYP: Kernel yield per plant (g); PYP: Pod yield per plant (g).

Table 2. Simple correlation coefficients (r) among pod yield per plant and its components in groundnut under inorganic fertilizer management

Character	DF	DM	PH	NPB	NPEGP	NMP	NIMP	NPP	100SW	SP	SMK%	HI	KYP	PYP
DF	**1.000**	0.445**	-0.228**	0.120	-0.034	0.205**	0.006	0.200**	0.330**	-0.039	-0.035	0.124	0.239**	0.276**
DM		**1.000**	-0.192*	0.068	0.023	0.416**	-0.042	0.392**	0.377**	0.135	0.032	0.342**	0.445**	0.447**
PH			**1.000**	-0.176*	0.244**	-0.027	0.133	0.012	-0.199**	0.088	0.041	-0.264**	0.011	-0.003
NPB				**1.000**	0.238**	0.167*	0.100	0.191*	0.048	0.120	-0.020	-0.067	0.160*	0.140
NPEGP					**1.000**	0.572**	0.208**	0.614**	-0.019	0.230**	-0.086	-0.037	0.459**	0.464**
NMP						**1.000**	-0.042	0.960**	0.262**	0.341**	0.101	0.449**	0.812**	0.832**
NIMP							**1.000**	0.241**	-0.006	-0.115	-0.048	-0.020	0.044	0.071
NPP								**1.000**	0.252**	0.299**	0.085	0.430**	0.801**	0.828**
100SW									**1.000**	0.331**	0.365**	0.424**	0.515**	0.485**
SP										**1.000**	0.346**	0.237**	0.563**	0.340**
SMK%											**1.000**	0.230**	0.180*	0.108
HI												**1.000**	0.604**	0.604**
KYP													**1.000**	0.963**
PYP														**1.000**

* Significant at 5% level; ** Significant at 1 % level; NS = Non-significant

DF: Days to 50% flowering; DM: days to maturity; PH: Plant height (cm); NPB: Number of primary branches per plant (No); NPEGP: Number of pegs per plant (No); NMP: Number of mature pods per plant (No); NIMP: Number of immature pods per plant (No); NPP: Total number of pods per plant (No); 100SW: 100 seed weight(g); SP: Shelling percentage(%); SMK%: Sound mature kernel percentage(%); HI: Harvest index (%); KYP: Kernel yield per plant (g); PYP: Pod yield per plant (g).

Table 3. Path coefficient analysis for pod yield per plant and its components in groundnut under organic fertilizer management

Character	DF	DM	NPEGP	NMP	NPP	100SW	SP	HI	KYP	r PYP
DF	**-0.00112**	-0.01137	-0.00014	0.01881	-0.00796	0.00679	0.01147	-0.00102	0.26024	**0.276****
DM	-0.00050	**-0.02554**	0.00010	0.03823	-0.01556	0.00776	-0.04008	-0.00280	0.48508	**0.447****
NPEGP	0.00004	-0.00060	**0.00426**	0.05261	-0.02439	-0.00039	-0.06800	0.00030	0.50022	**0.464****
NMP	-0.00023	-0.01062	0.00244	**0.09194**	-0.03810	0.00539	-0.10113	-0.00367	0.88593	**0.832****
NPP	-0.00022	-0.01001	0.00262	0.08822	**-0.03970**	0.00519	-0.08867	-0.00352	0.87408	**0.828****
100SW	-0.00037	-0.00964	-0.00008	0.02407	-0.01002	**0.02057**	-0.09802	-0.00347	0.56224	**0.485****
SP	0.00004	-0.00346	0.00098	0.03139	-0.01188	0.00681	**-0.29621**	-0.00194	0.61418	**0.340****
HI	-0.00014	-0.00875	-0.00016	0.04125	-0.01708	0.00872	-0.07017	**-0.00817**	0.65892	**0.604****
KYP	-0.00027	-0.01136	0.00195	0.07467	-0.03181	0.01060	-0.16677	-0.00494	**1.09086**	**0.963****

Residual Effect : **0.0113**

Bold: Direct effects; Normal: Indirect effects. * Significant at 5% level; ** Significant at 1 % level; NS = Non-significant

DF: Days to 50% flowering; DM: days to maturity; PH: Plant height (cm); NPB: Number of primary branches per plant (No); NPEGP: Number of pegs per plant (No); NMP: Number of mature pods per plant (No); NIMP: Number of immature pods per plant (No); NPP: Total number of pods per plant (No); 100SW: 100 seed weight(g); SP: Shelling percentage(%); SMK%: Sound mature kernel percentage(%); HI: Harvest index (%); KYP: Kernel yield per plant (g); PYP: Pod yield per plant (g).

Table 4. Path coefficient analysis for pod yield per plant and its components in groundnut under inorganic management

Character	DF	DM	PH	NPB	NPEGP	NMP	NIMP	NPP	100SW	SP	HI	KYP	r PYP
DF	**-0.00233**	0.00823	-0.00597	0.00310	0.00000	0.40774	-0.07546	-0.32807	0.00013	0.11968	-0.01419	-0.28244	**-0.170***
DM	-0.00098	**0.01960**	-0.00668	0.00273	0.00000	0.40200	-0.06885	-0.32945	0.00024	0.11092	-0.01405	-0.30048	**-0.185***
PH	0.00058	-0.00547	**0.02392**	-0.00310	0.00000	-0.27219	0.09397	0.17205	-0.00037	-0.00667	0.00398	0.23743	**0.244****
NPB	-0.00072	0.00530	-0.00735	**0.01010**	-0.00001	-0.15920	-0.14080	0.31142	-0.00010	0.03899	-0.00963	0.11418	**0.162***
NPEGP	0.00023	-0.00204	0.00161	0.00319	**-0.00004**	-0.91565	-0.13753	1.06727	-0.00007	-0.05952	0.00272	0.48553	**0.446****
NMP	0.00068	-0.00559	0.00462	0.00114	-0.00003	**-1.40893**	-0.07630	1.49652	-0.00046	-0.13076	0.02908	0.88395	**0.794****
NIMP	-0.00042	0.00325	-0.00542	0.00343	-0.00001	-0.25920	**-0.41473**	0.70678	-0.00012	0.01979	0.00700	0.20421	**0.265****
NPP	0.00049	-0.00414	0.00264	0.00202	-0.00003	-1.35197	-0.18795	**1.55957**	-0.00045	-0.11292	0.02838	0.86013	**0.796****
100SW	0.00016	-0.00237	0.00440	0.00050	0.00000	-0.32276	-0.02561	0.35160	**-0.00199**	-0.10219	0.01791	0.62541	**0.545****
SP	0.00093	-0.00722	0.00053	-0.00131	-0.00001	-0.61188	0.02726	0.58491	-0.00068	**-0.30108**	0.01873	0.56648	**0.277****
HI	0.00068	-0.00566	0.00196	-0.00200	0.00000	-0.84227	-0.05970	0.90982	-0.00073	-0.11593	**0.04864**	0.75690	**0.692****
KYP	0.00062	-0.00551	0.00531	0.00108	-0.00002	-1.16492	-0.07922	1.25473	-0.00117	-0.15953	0.03444	**1.06911**	**0.955****

Residual Effect : **0.0128**

Bold: Direct effects; Normal: Indirect effects. * Significant at 5% level; ** Significant at 1 % level; NS = Non-significant

DF: Days to 50% flowering; DM: days to maturity; PH: Plant height (cm); NPB: Number of primary branches per plant (No); NPEGP: Number of pegs per plant (No); NMP: Number of mature pods per plant (No); NIMP: Number of immature pods per plant (No); NPP: Total number of pods per plant (No); 100SW: 100 seed weight(g); SP: Shelling percentage(%); SMK%: Sound mature kernel percentage(%); HI: Harvest index (%); KYP: Kernel yield per plant (g); PYP: Pod yield per plant (g).

reported by Korat *et al*. (2010) and similar trend for harvest index by Venkateswarlu *et al*. (2007) and for days to maturity by Pavankumar *et al*. (2014) was reported.

Under inorganic fertilizer management the traits, total number of pods per plant (1.55957) and kernel yield per plant (1.06911) showed very high positive direct effects whereas number of mature pods per plant (-1.40893) recorded very high negative direct effect on pod yield per plant. Similar results were also found by Kumar *et al*. (2012), Rao *et al*. (2014) and Jain *et al*. (2016), who reported a very high positive direct effect of kernel yield per plant with pod yield per plant and Patil et al. (2006) have reported a positive direct effect of total number of pods per plant with pod yield.

From the result of present investigation, it could be concluded that kernel yield per plant under organic management and kernel yield per plant and total number of pods per plant under inorganic fertilizer management were major contributing characters for pod yield. Therefore, these traits should be given due consideration for indirect selection to improve pod yield to obtain superior genotypes under target environment.

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