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Barad SH
Ph.D., Student, Department of Genetics and Plant Breeding, JAU, Junagadh, Gujarat, India

Jivani LL
Senior Scientist and Head, Krishi Vigyan Kendra, JAU, Gor Khijadia, Morbi, Gujarat, India

Madariya RB
Associate Research Scientist, Main Oil Seeds Research Station, JAU, Junagadh, Gujarat, India

Solanki HV
Assistant Professor, College of Agriculture, JAU, Porbandar, Gujarat, India

Chetariya CP
Ph.D., Student, Department of Genetics and Plant Breeding, JAU, Junagadh, Gujarat, India

Memon Juned
Ph.D., Student, Department of Genetics and Plant Breeding, JAU, Junagadh, Gujarat, India

Corresponding Author:
Barad SH
Ph.D., Student, Department of Genetics and Plant Breeding, JAU, Junagadh, Gujarat, India

Character association studies in Virginia bunch groundnut (*Arachis hypogaea* L.) Of yield and its Attributing characters under four different environments

Barad SH, Jivani LL, Madariya RB, Solanki HV, Chetariya CP and Memon Juned

Abstract
Fifty Virginia bunch groundnut genotypes sown under four different environments. Correlation analysis revealed that for all environments significant and positive genotypic and phenotypic correlations of pod yield per plant were observed with number of secondary branches per plant, number of matured pods per plant, kernel yield per plant, biological yield per plant and harvest index. The path coefficient analysis revealed high and positive direct effects of kernel yield per plant on pod yield per plant, while biological yield per plant and harvest index have moderate to low direct effect on pod yield per plant under all four environments. Thus, these characters turned-out to be the major components of pod yield. Number of secondary branches per plant, number of matured pods per plant, sound mature kernel, 100-kernel weight, biological yield per plant and harvest index had low to moderate positive direct effect but it have high and positive indirect effect on pod yield per plant via kernel yield per plant.

Keywords: Correlation coefficient, path analysis, Virginia bunch groundnut

Introduction
Groundnut (*Arachis hypogaea* L.) is one of the most important annual unpredictable legumes, both in subsistence and commercial agriculture in arid and semi-arid regions of the world. It is one of the principal economic crops of the world. The botanical name of groundnut (*Arachis hypogaea* L.) is derived from two Greek words, *Arachis* means a legume and *hypogaea* means below ground, referring to the formation of pods in the soil. It is a member of the order *Fabales* and family *Fabaceae* also known as *Leguminosae*. It is widely grown annual crop with self-pollinated and dicotyledonous behavior. It is an allotetraploid having chromosome number 2n=4x=40.

Correlation studies provide better understanding of yield components which helps the plant breeder during selection. A positive correlation between desirable characters is favourable to the plant breeder because, it helps in simultaneous improvement of both the characters. Yield being a complex character. It is a result of action and interaction of many yield contributing characters and it is highly influenced by environment. Hence, it becomes necessary to partition the observed variability into heritable and non-heritable components.

Path analysis splits the correlation coefficient into direct and indirect effects. Path analysis, showing direct and indirect effects, is effective to get high selection response simultaneously for several characters from the diverse populations and analysis could provide a more realistic picture of the interrelationship.

Materials and Methods
The field experiment was conducted during *kharif* 2019 and *kharif* 2020 at two locations; Main Oilseeds Research Station, JAU, Junagadh and Oilseeds Research Station, JAU, Manavadar. The pure seeds of these genotypes were obtained from Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh. Fifty genotypes of Virginia bunch groundnut were sown at two locations for two years, in a Randomized Block Design with three replications, which created four environments to study correlation and path coefficient of genotypes over the years and locations. Each line was sown in a single row plot of 1.5 m length with a spacing of 60 x 15 cm.

All the recommended crop production and protection practices were followed timely for the successful raising of crop. The detail of locations, date of sowing and year of experimentation is given below:

Location of experiment	Detail of environments	Date of sowing
Junagadh	E_1: *Kharif*-2019	19th June, 2019
	E_2: *Kharif*-2020	15th June, 2020
Manavadar	E_3: *Kharif*-2019	25th July, 2019
	E_4: *Kharif*-2020	3rd July, 2020

The observations were recorded on five randomly selected plants from each genotype and replication for fifteen quantitative characters *viz.*, Days to 50% flowering (Days), Days to maturity (Days), Number of primary branches per plant, Number of secondary branches per plant, Plant height (cm), Number of matured pods per plant, Number of immature pods per plant, Sound mature kernel (%), 100-kernel weight (g), Shelling out-turn (%), Pod yield per plant (g), Kernel yield per plant (g), Biological yield per plant (g), Harvest index (%) and Oil content (%); their mean values were used for statistical analysis. Phenotypic and genotypic correlation coefficients for all the pair wise characters will be worked out as per Al-Jibouri *et al*. (1958). Path coefficient analysis will be carried out according to the procedure suggested by Dewey and Lu (1959).

Results and Discussion

Correlation coefficients

In the present investigation, for both sowing conditions most of the character pairs had higher values of genotypic correlations than their corresponding phenotypic correlations. Such high amount of genotypic correlations could result due to masking or modifying effect of environmental on the association of characters. This indicates 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 was also indicated that there was inherent relationship between the characters studied which is in agreement with the findings of Venkataravana *et al*. (2000a) [20], Nagda & Joshi (2004) [11] and Sonone & Thaware (2009) [15].

The study of genotypic correlation coefficient indicates the extent of relationship between different variables. This relationship among yield contributing characters as well as their association with yield provides information for exercising selection pressure for bringing genetic improvement in pod yield. In the present study, for all environments pod yield per plant was found to be highly significant and positively correlated with number of secondary branches per plant, number of matured pods per plant, kernel yield per plant, biological yield per plant and harvest index at both the genotypic and phenotypic levels. Pod yield per plant also exhibited highly significant and positive correlation both at genotypic and phenotypic level with sound mature kernel under E_1, E_2 and E_4. In case of E_1 and E_2 pod yield per plant exhibited significant and positive correlation at genotypic and phenotypic level with 100-kernel weight. Correlation with oil content of pod yield per plant was highly significant and positive both at genotypic and phenotypic level under E_3, while it was significant and positive at genotypic level only under E_4. This indicates that these attributes were more influencing the pod yield in groundnut and therefore, were important for bringing improvement in pod yield. Johnson *et al.*, (1955) [6] emphasized that these correlated yield attributes can serve as indicator characters for improving pod yield. They have further emphasized that such improvement depends not only on genotypic correlations but phenotypic correlations also play an important role.

Such positive interrelationships in groundnut with pod yield per plant have also been reported for number of secondary branches per plant by Venkataravana *et al*. (2000a) [20] and Kadam *et al.* (2009) [7]; for number of matured pods per plant by Venkataravana *et al*. (2000a) [20], Jayalakshmi and Lakshmikantha (2003) akshmikantha and Kadam *et al*. (2009) [7]; for kernel yield per plant by Venkataravana *et al*. (2000a) [20], Giri *et al.* (2009) [3] and Sonone and Thaware (2009) [15]; for biological yield per plant by Golakia *et al.* (2004) [4] and Vekariya *et al.* (2010) [19]; for harvest index by Venkataravana *et al*. (2000a) [20], Jayalakshmi and Lakshmikantha (2003) [5] and Golakia *et al.* (2004) [4]; for sound mature kernel by Venkataravana *et al*. (2000a) [20], Mane *et al.* (2008) and Channayya *et al.* (2011) [22]; for 100-kernel weight by Venkataravana *et al*. (2000a) [20], Golakia *et al.* (2004) [4] and Kadam *et al.* (2009) [7]; for oil content by Venkataravana *et al*. (2000a) [20], Golakia *et al.* (2004) [4] and Siddiquey *et al.* (2006) [14].

In all four environments number of secondary branches per plant had highly significant and positive correlation with number of matured pods per plant, number of matured pods per plant had highly significant and positive correlation with sound mature kernel, 100-kernel weight had significant and positive correlation with harvest index, kernel yield per plant had highly significant and positive correlation with biological yield per plant. In case of E_1, E_2 and E_4 sound mature kernel had significant and positive correlation with kernel yield per plant. This indicates there is inter correlation of characters which are correlated with pod yield per plant. This relationship indicated that the improvement in one will bring the improvement in another which, in turn, automatically lead to increase in pod yield. Such an inter correlation was also been reported by Golakia *et al.* (2004) [4], Kadam *et al.* (2009) [7] and Nirmala & Jayalakshmi (2015) [13].

Path coefficient analysis

In all environments positive and highest direct effect on pod yield per plant was found by kernel yield per plant, while biological yield per plant and harvest index have moderate to low direct effect on pod yield per plant. These characters also have high and positive phenotypic correlation with pod yield per plant. Shelling out-turn had negative and low to moderate direct effect on pod yield per plant, while its correlation with pod yield per plant was positive and low, which was nullified by high and positive indirect effect via kernel yield per plant. Positive direct effect on pod yield per plant were also reported by Methews *et al.* (2001) [10], Nagda and Joshi (2004) [11], Awatade *et al.* (2009) [1] and Vekariya *et al.* (2010) [19] for kernel yield per plant; by Suneetha *et al.* (2004) [16], Khanpara *et al.* (2010) [8], Vaithiyalingan *et al*. (2010) [18] and Vekariya *et al.* (2010) [19] for biological yield per plant; by Nagda and Joshi (2004) [11], Suneetha *et al.* (2004) [16] Vekariya *et al.* (2010) [19] for harvest index.

Character like number of secondary branches per plant, number of matured pods per plant, sound mature kernel, 100-kernel weight, biological yield per plant and harvest index had positive and high correlation with pod yield per plant, which have low to moderate positive direct effect but it have high

and positive and indirect effect on pod yield per plant via kernel yield per plant. High indirect effect via kernel yield per plant by these positively correlated characters with pod yield per plant were also reported by Giri *et al.* (2009) [3], Namrata *et al.* (2016) [12] and Sushree *et al*. (2017) [17].

For all environments the residual effect was of low magnitude suggesting that the majority of the yield attributing characters have been included in the path analysis. It was apparent from the path analysis that higher direct effects were exerted by kernel yield per plant, biological yield per plant and harvest index. These all characters also exhibited significant and positive association with pod yield per plant and hence, these may be considered as most important yield contributing characters and due emphasis should be placed on these components while breeding for high yield in groundnut.

It can also be concluded that the characters which are most important for correlation studies are also important for path analysis. Thus, it can be suggested that correlation and path analysis study should be consider together for rapid gain for final improvement in yield.

Table 1: Genotypic (r_g) and phenotypic (r_p) correlation coefficients among 15 characters in 50 genotypes of groundnut at Junagadh during *Kharif*-2019 (E_1)

Characters		Days to maturity	No. of primary branches per plant	No. of secondary branches per plant	Plant height (cm)	No. of matured pods per plant	No. of immature pods per plant	Sound mature kernel (%)	100-kernel weight (g)	Shelling out-turn (%)	Kernel yield per plant (g)	Biological yield per plant (g)	Harvest index (%)	Oil content (%)	Pod yield per plant (g)
Days to 50% flowering	r_g	0.454**	0.099	-0.007	0.290*	-0.237	0.161	-0.164	-0.228	0.010	-0.293*	-0.313*	-0.136	-0.232	-0.306*
	r_p	0.349*	0.086	-0.008	0.269	-0.216	0.150	-0.158	-0.222	0.020	-0.255	-0.287*	-0.110	-0.221	-0.270
Days to maturity	r_g		-0.283	-0.058	0.076	-0.187	0.002	-0.135	-0.155	-0.113	-0.130	0.007	-0.198	-0.065	-0.110
	r_p		-0.222	-0.044	0.074	-0.135	0.018	-0.091	-0.134	-0.069	-0.114	-0.023	-0.143	-0.041	-0.104
No. of primary branches per plant	r_g			0.450**	-0.109	0.232	-0.007	0.099	-0.044	0.224	0.167	0.002	0.159	0.077	0.127
	r_p			0.412**	-0.096	0.211	0.002	0.093	-0.034	0.194	0.151	0.022	0.127	0.070	0.119
No. of secondary branches per plant	r_g				-0.282	0.548**	0.143	0.286*	0.106	0.096	0.556**	0.247	0.580**	0.233	0.572**
	r_p				-0.255	0.528**	0.138	0.277	0.109	0.095	0.523**	0.235	0.543**	0.229	0.536**
Plant height (cm)	r_g					-0.192	-0.102	-0.227	-0.013	0.111	-0.123	-0.068	-0.121	-0.135	-0.137
	r_p					-0.176	-0.095	-0.209	-0.013	0.121	-0.105	-0.064	-0.104	-0.118	-0.123
No. of matured pods per plant	r_g						0.201	0.568**	0.111	0.283	0.923**	0.687**	0.673**	0.369*	0.928**
	r_p						0.191	0.540**	0.113	0.258	0.861**	0.651**	0.625**	0.348*	0.866**
No. of immature pods per plant	r_g							0.191	-0.217	0.195	0.106	-0.033	0.148	0.179	0.069
	r_p							0.188	-0.218	0.181	0.108	-0.028	0.151	0.172	0.075
Sound mature kernel (%)	r_g								0.403**	0.015	0.462**	0.478**	0.285*	0.097	0.507**
	r_p								0.390**	0.022	0.437**	0.456**	0.268	0.099	0.478**
100-kernel weight (g)	r_g									-0.101	0.347*	0.245	0.322*	-0.382**	0.384**
	r_p									-0.091	0.322*	0.227	0.300*	-0.369*	0.356*
Shelling out-turn (%)	r_g										0.393**	0.126	0.170	0.454**	0.217
	r_p										0.386**	0.111	0.165	0.425**	0.201
Kernel yield per plant (g)	r_g											0.723**	0.691**	0.306*	0.982**
	r_p											0.722**	0.701**	0.282	0.980**
Biological yield per plant (g)	r_g												0.051	0.170	0.756**
	r_p												0.071	0.163	0.757**
Harvest index (%)	r_g													0.169	0.688**
	r_p													0.152	0.699**
Oil content (%)	r_g														0.237
	r_p														0.217

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

Table 2: Genotypic (r_g) and phenotypic (r_p) correlation coefficients among 15 characters in 50 genotypes of groundnut at Junagadh during *Kharif*-2020 (E_2)

Characters		Days to maturity	No. of primary branches per plant	No. of secondary branches per plant	Plant height (cm)	No. of matured pods per plant	No. of immature pods per plant	Sound mature kernel (%)	100-kernel weight (g)	Shelling out-turn (%)	Kernel yield per plant (g)	Biological yield per plant (g)	Harvest index (%)	Oil content (%)	Pod yield per plant (g)
Days to 50% flowering	r_g	0.465**	0.119	-0.046	-0.046	-0.090	-0.181	0.098	-0.194	-0.104	-0.126	-0.016	-0.100	-0.221	-0.079
	r_p	0.389**	0.112	-0.033	-0.069	-0.080	-0.168	0.094	-0.184	-0.093	-0.094	0.007	-0.092	-0.209	-0.053
Days to maturity	r_g		-0.067	-0.191	-0.328*	-0.201	-0.263	-0.014	-0.153	-0.062	-0.170	0.152	-0.411**	-0.292*	-0.176
	r_p		-0.086	-0.175	-0.271	-0.164	-0.205	-0.017	-0.131	-0.063	-0.124	0.154	-0.339*	-0.269	-0.122
No. of primary branches per plant	r_g			0.475**	-0.047	0.527**	0.133	0.317*	-0.010	0.114	0.264	0.206	0.158	-0.026	0.266
	r_p			0.444**	-0.055	0.461**	0.111	0.294*	-0.004	0.094	0.218	0.152	0.151	-0.018	0.221
No. of secondary branches per plant	r_g				0.032	0.485**	0.405**	0.527**	0.123	0.134	0.567**	0.246	0.488**	0.246	0.562**
	r_p				0.033	0.452**	0.384**	0.499**	0.122	0.127	0.526**	0.220	0.458**	0.231	0.521**
Plant height (cm)	r_g					-0.103	0.191	-0.008	-0.143	0.249	0.141	0.187	-0.086	0.104	0.076
	r_p					-0.097	0.174	-0.004	-0.123	0.230	0.110	0.147	-0.076	0.099	0.049
No. of	r_g						0.201	0.572**	0.059	0.125	0.637**	0.327*	0.513**	0.399**	0.639**

matured pods per plant	r_p						0.197	0.535**	0.058	0.115	0.587**	0.302*	0.471**	0.371**	0.589**
No. of immature pods per plant	r_g							0.143	0.019	0.240	0.115	-0.197	0.320*	0.277	0.050
	r_p							0.140	0.019	0.224	0.125	-0.169	0.310*	0.263	0.066
Sound mature kernel (%)	r_g								-0.023	0.177	0.531**	0.316*	0.384**	0.228	0.526**
	r_p								-0.024	0.167	0.499**	0.295*	0.360**	0.217	0.493**
100-kernel weight (g)	r_g									0.030	0.369*	0.084	0.431**	-0.353*	0.367*
	r_p									0.031	0.342*	0.070	0.408**	-0.339*	0.339*
Shelling out-turn (%)	r_g										0.284	-0.122	0.161	0.196	0.005
	r_p										0.283	-0.107	0.146	0.230	0.004
Kernel yield per plant (g)	r_g											0.638**	0.602**	0.214	0.959**
	r_p											0.647**	0.585**	0.207	0.958**
Biological yield per plant (g)	r_g												-0.165	0.030	0.701**
	r_p												-0.169	0.026	0.706**
Harvest index (%)	r_g													0.173	0.583**
	r_p													0.155	0.571**
Oil content (%)	r_g														0.167
	r_p														0.148

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

Table 3: Genotypic (r_g) and phenotypic (r_p) correlation coefficients among 15 characters in 50 genotypes of groundnut at Manavadar during *Kharif*-2019 (E_3)

Characters		Days to maturity	No. of primary branches per plant	No. of secondary branches per plant	Plant height (cm)	No. of matured pods per plant	No. of immature pods per plant	Sound mature kernel (%)	100-kernel weight (g)	Shelling out-turn (%)	Kernel yield per plant (g)	Biological yield per plant (g)	Harvest index (%)	Oil content (%)	Pod yield per plant (g)
Days to 50% flowering	r_g	0.542**	0.028	-0.015	0.186	-0.166	-0.047	-0.093	-0.109	0.116	0.005	0.137	-0.133	-0.275	0.001
	r_p	0.335*	0.025	-0.019	0.151	-0.153	-0.043	-0.076	-0.100	0.099	0.001	0.115	-0.113	-0.251	-0.004
Days to maturity	r_g		-0.298*	-0.474**	0.102	-0.270	-0.141	-0.088	-0.056	-0.266	-0.240	-0.082	-0.216	-0.095	-0.188
	r_p		-0.205	-0.333*	0.037	-0.196	-0.082	-0.095	-0.044	-0.102	-0.142	-0.040	-0.144	-0.051	-0.118
No. of primary branches per plant	r_g			0.446**	0.196	0.365*	0.271	0.251	0.232	0.152	0.203	0.035	0.290*	0.048	0.187
	r_p			0.401**	0.172	0.333*	0.238	0.217	0.223	0.155	0.189	0.029	0.259	0.030	0.169
No. of secondary branches per plant	r_g				0.155	0.526**	0.103	0.262	0.306*	0.250	0.428**	0.167	0.487**	0.167	0.399**
	r_p				0.129	0.500**	0.097	0.241	0.293*	0.205	0.396**	0.148	0.450**	0.154	0.373**
Plant height (cm)	r_g					0.037	-0.035	0.094	-0.095	0.015	0.047	0.222	-0.190	0.180	0.050
	r_p					0.037	-0.035	0.080	-0.077	-0.006	0.035	0.174	-0.150	0.146	0.042
No. of matured pods per plant	r_g						0.536**	0.517**	-0.067	0.149	0.539**	0.287*	0.546**	0.518**	0.525**
	r_p						0.520**	0.483**	-0.061	0.133	0.508**	0.271	0.497**	0.490**	0.497**
No. of immature pods per plant	r_g							0.182	-0.149	0.164	0.155	0.040	0.161	0.089	0.125
	r_p							0.179	-0.148	0.148	0.141	0.033	0.142	0.087	0.112
Sound mature kernel (%)	r_g								-0.134	-0.093	0.143	-0.013	0.302*	0.255	0.161
	r_p								-0.128	-0.090	0.131	-0.012	0.269	0.235	0.150
100-kernel weight (g)	r_g									-0.029	0.230	0.063	0.359*	-0.258	0.247
	r_p									-0.024	0.219	0.059	0.337*	-0.246	0.236
Shelling out-turn (%)	r_g										0.243	0.043	0.155	0.367*	0.095
	r_p										0.251	0.053	0.121	0.309*	0.086
Kernel yield per plant (g)	r_g											0.817**	0.698**	0.506**	0.988**
	r_p											0.810**	0.667**	0.474**	0.985**
Biological yield per plant (g)	r_g												0.182	0.293*	0.832**
	r_p												0.139	0.269	0.824**
Harvest index (%)	r_g													0.406**	0.692**
	r_p													0.380**	0.669**
Oil content (%)	r_g														0.454**
	r_p														0.429**

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

Table 4: Genotypic (r_g) and phenotypic (r_p) correlation coefficients among 15 characters in 50 genotypes of groundnut at Manavadar during *Kharif*-2020 (E_4)

Characters		Days to maturity	No. of primary branches per plant	No. of secondary branches per plant	Plant height (cm)	No. of matured pods per plant	No. of immature pods per plant	Sound mature kernel (%)	100-kernel weight (g)	Shelling out-turn (%)	Kernel yield per plant (g)	Biological yield per plant (g)	Harvest index (%)	Oil content (%)	Pod yield per plant (g)
Days to 50% flowering	r_g	0.450**	0.014	0.125	-0.023	-0.081	-0.130	-0.004	0.019	0.131	0.000	0.115	-0.144	-0.279	-0.023
	r_p	0.298*	-0.011	0.100	-0.018	-0.063	-0.117	-0.003	0.013	0.114	0.002	0.111	-0.135	-0.243	-0.019
Days to maturity	r_g		-0.047	-0.249	-0.343*	-0.257	-0.186	-0.139	-0.260	-0.164	-0.173	0.294*	-0.476**	-0.337*	-0.133
	r_p		-0.097	-0.138	-0.227	-0.151	-0.091	-0.071	-0.163	-0.101	-0.101	0.182	-0.285*	-0.219	-0.077
No. of primary	r_g			0.624**	0.191	0.433**	0.291*	0.319*	0.041	0.189	0.311*	0.121	0.287*	0.109	0.275
	r_p			0.562**	0.164	0.386**	0.245	0.275	0.033	0.197	0.271	0.097	0.239	0.089	0.230

branches per plant															
No. of secondary branches per plant	r_g				0.390**	0.598**	0.338*	0.335*	0.203	0.277	0.655**	0.444**	0.455**	0.178	0.596**
	r_p				0.321*	0.553**	0.318*	0.317*	0.201	0.251	0.602**	0.388**	0.433**	0.155	0.550**
Plant height (cm)	r_g					0.090	-0.029	0.111	0.112	0.007	0.157	0.353*	-0.114	0.146	0.164
	r_p					0.063	-0.023	0.107	0.091	0.002	0.143	0.318*	-0.105	0.146	0.152
No. of matured pods per plant	r_g						0.374**	0.584**	0.040	0.027	0.772**	0.471**	0.691**	0.509**	0.767**
	r_p						0.384**	0.552**	0.037	0.024	0.734**	0.464**	0.642**	0.465**	0.734**
No. of immature pods per plant	r_g							0.152	-0.106	-0.024	0.014	-0.104	0.095	0.256	0.018
	r_p							0.155	-0.101	-0.024	0.041	-0.056	0.097	0.234	0.047
Sound mature kernel (%)	r_g								-0.035	-0.223	0.435**	0.367*	0.391**	0.177	0.492**
	r_p								-0.027	-0.211	0.402**	0.330*	0.372**	0.166	0.461**
100-kernel weight (g)	r_g									0.044	0.221	-0.029	0.333*	-0.363*	0.215
	r_p									0.046	0.212	-0.031	0.323*	-0.336*	0.205
Shelling out-turn (%)	r_g										0.162	-0.176	0.034	0.353*	-0.085
	r_p										0.185	-0.160	0.042	0.288*	-0.071
Kernel yield per plant (g)	r_g											0.702**	0.788**	0.401**	0.969**
	r_p											0.702**	0.769**	0.347*	0.966**
Biological yield per plant (g)	r_g												0.189	0.145	0.761**
	r_p												0.167	0.125	0.762**
Harvest index (%)	r_g													0.308*	0.778**
	r_p													0.270	0.762**
Oil content (%)	r_g														0.308*
	r_p														0.270

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

Table 5: Phenotypic path coefficient analysis showing direct (diagonal and bold) and indirect effects of different characters on pod yield per plant in 50 genotypes of groundnut at Junagadh during *Kharif*-2019 (E_1)

Characters	**Days to 50% flowering**	**Days to maturity**	**No. of primary branches per plant**	**No. of secondary branches per plant**	**Plant height (cm)**	**No. of matured pods per plant**	**No. of immature pods per plant**	**Sound mature kernel (%)**	**100-kernel weight (g)**	**Shelling out-turn (%)**	**Kernel yield per plant (g)**	**Biological yield per plant (g)**	**Harvest index (%)**	**Oil content (%)**	**Phenotypic correlation with pod yield/plant (g)**
Days to 50% flowering	0.005	0.000	0.000	0.000	0.003	0.001	-0.001	-0.003	0.002	-0.003	-0.211	-0.047	-0.014	-0.001	-0.270
Days to maturity	0.002	0.000	0.000	0.000	0.001	0.000	0.000	-0.002	0.001	0.011	-0.094	-0.004	-0.019	0.000	-0.104
No. of primary branches per plant	0.000	0.000	0.000	0.004	-0.001	0.000	0.000	0.002	0.000	-0.031	0.125	0.004	0.017	0.000	0.119
No. of secondary branches per plant	0.000	0.000	0.000	0.010	-0.003	-0.001	-0.001	0.005	-0.001	-0.015	0.432	0.038	0.071	0.001	0.535**
Plant height (cm)	0.001	0.000	0.000	-0.003	0.011	0.000	0.001	-0.004	0.000	-0.020	-0.087	-0.010	-0.014	0.000	-0.123
No. of matured pods per plant	-0.001	0.000	0.000	0.005	-0.002	-0.002	-0.001	0.009	-0.001	-0.042	0.712	0.106	0.082	0.001	0.866**
No. of immature pods per plant	0.001	0.000	0.000	0.001	-0.001	0.000	-0.006	0.003	0.002	-0.029	0.089	-0.005	0.020	0.001	0.075
Sound mature kernel (%)	-0.001	0.000	0.000	0.003	-0.002	-0.001	-0.001	0.017	-0.003	-0.004	0.361	0.075	0.035	0.000	0.478**
100-kernel weight (g)	-0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.007	-0.008	0.015	0.267	0.037	0.039	-0.001	0.356*
Shelling out-turn (%)	0.000	0.000	0.000	0.001	0.001	-0.001	-0.001	0.000	0.001	-0.161	0.319	0.018	0.022	0.001	0.201
Kernel yield per plant (g)	-0.001	0.000	0.000	0.005	-0.001	-0.002	-0.001	0.007	-0.003	-0.062	0.827	0.118	0.092	0.001	0.979**
Biological yield per plant (g)	-0.001	0.000	0.000	0.002	-0.001	-0.001	0.000	0.008	-0.002	-0.018	0.597	0.164	0.009	0.001	0.756**
Harvest index (%)	-0.001	0.000	0.000	0.005	-0.001	-0.001	-0.001	0.005	-0.002	-0.027	0.579	0.012	0.131	0.000	0.698**
Oil content (%)	-0.001	0.000	0.000	0.002	-0.001	-0.001	-0.001	0.002	0.003	-0.068	0.233	0.027	0.020	0.003	0.217

***,** ** Significant at 5% and 1% levels, respectively
Residual effect, R = 0.0357

Table 6: Phenotypic path coefficient analysis showing direct (diagonal and bold) and indirect effects of different characters on pod yield per plant in 50 genotypes of groundnut at Junagadh during *Kharif*-2020 (E_2)

Characters	Days to 50% flowering	Days to maturity	No. of primary branches per plant	No. of secondary branches per plant	Plant height (cm)	No. of matured pods per plant	No. of immature pods per plant	Sound mature kernel (%)	100-kernel weight (g)	Shelling out-turn (%)	Kernel yield per plant (g)	Biological yield per plant (g)	Harvest index (%)	Oil content (%)	Phenotypic correlation with pod yield/plant (g)
Days to 50% flowering	0.020	-0.009	0.000	0.000	0.001	0.000	0.001	0.001	0.001	0.020	-0.073	0.001	-0.016	0.000	-0.053
Days to maturity	0.008	-0.023	0.000	-0.002	0.002	0.000	0.001	0.000	0.001	0.014	-0.095	0.033	-0.060	0.000	-0.122
No. of primary branches per plant	0.002	0.002	0.003	0.004	0.000	0.001	-0.001	0.004	0.000	-0.020	0.168	0.032	0.027	0.000	0.221
No. of secondary branches per plant	-0.001	0.004	0.001	0.009	0.000	0.001	-0.003	0.006	-0.001	-0.027	0.405	0.047	0.081	0.000	0.520**
Plant height (cm)	-0.001	0.006	0.000	0.000	-0.008	0.000	-0.001	0.000	0.001	-0.050	0.085	0.031	-0.013	0.000	0.049
No. of matured pods per plant	-0.002	0.004	0.001	0.004	0.001	0.002	-0.001	0.006	0.000	-0.025	0.452	0.064	0.083	0.000	0.588**
No. of immature pods per plant	-0.003	0.005	0.000	0.003	-0.001	0.000	-0.006	0.002	0.000	-0.049	0.097	-0.036	0.055	0.000	0.066
Sound mature kernel (%)	0.002	0.000	0.001	0.004	0.000	0.001	-0.001	0.012	0.000	-0.036	0.385	0.062	0.063	0.000	0.493**
100-kernel weight (g)	-0.004	0.003	0.000	0.001	0.001	0.000	0.000	0.000	-0.006	-0.007	0.263	0.015	0.072	0.000	0.339*
Shelling out-turn (%)	-0.002	0.002	0.000	0.001	-0.002	0.000	-0.001	0.002	0.000	-0.217	0.218	-0.023	0.026	0.000	0.004
Kernel yield per plant (g)	-0.002	0.003	0.001	0.005	-0.001	0.001	-0.001	0.006	-0.002	-0.062	0.771	0.137	0.103	0.000	0.958**
Biological yield per plant (g)	0.000	-0.004	0.001	0.002	-0.001	0.001	0.001	0.004	0.000	0.023	0.499	0.212	-0.030	0.000	0.706**
Harvest index (%)	-0.002	0.008	0.001	0.004	0.001	0.001	-0.002	0.004	-0.002	-0.032	0.451	-0.036	0.176	0.000	0.570**
Oil content (%)	-0.004	0.006	0.000	0.002	-0.001	0.001	-0.002	0.003	0.002	-0.050	0.159	0.006	0.027	-0.001	0.148

*, ** Significant at 5% and 1% levels, respectively
Residual effect, R = 0.0410

Table 7: Phenotypic path coefficient analysis showing direct (diagonal and bold) and indirect effects of different characters on pod yield per plant in 50 genotypes of groundnut at Manavadar during *Kharif*-2019 (E_3)

Characters	Days to 50% flowering	Days to maturity	No. of primary branches per plant	No. of secondary branches per plant	Plant height (cm)	No. of matured pods per plant	No. of immature pods per plant	Sound mature kernel (%)	100-kernel weight (g)	Shelling out-turn (%)	Kernel yield per plant (g)	Biological yield per plant (g)	Harvest index (%)	Oil content (%)	Phenotypic correlation with pod yield/plant (g)
Days to 50% flowering	0.007	0.002	0.000	0.000	0.001	-0.001	0.000	0.000	0.001	-0.015	0.001	0.010	-0.008	0.001	-0.004
Days to maturity	0.002	0.006	0.000	0.001	0.000	-0.002	0.001	0.000	0.000	0.016	-0.128	-0.004	-0.010	0.000	-0.118
No. of primary branches per plant	0.000	-0.001	0.001	-0.001	0.001	0.003	-0.002	0.000	0.001	-0.024	0.170	0.003	0.019	0.000	0.169
No. of secondary branches per plant	0.000	-0.002	0.000	-0.003	0.001	0.004	-0.001	0.000	0.002	-0.031	0.358	0.013	0.033	0.000	0.372**
Plant height (cm)	0.001	0.000	0.000	0.000	0.005	0.000	0.000	0.000	-0.001	0.001	0.031	0.015	-0.011	0.000	0.042
No. of matured pods per plant	-0.001	-0.001	0.000	-0.001	0.000	0.008	-0.004	0.000	0.000	-0.020	0.458	0.024	0.036	-0.001	0.496**
No. of immature pods per plant	0.000	-0.001	0.000	0.000	0.000	0.004	-0.008	0.000	-0.001	-0.023	0.127	0.003	0.010	0.000	0.112
Sound	-0.001	-0.001	0.000	-0.001	0.000	0.004	-0.001	-0.001	-0.001	0.014	0.119	-0.001	0.019	-0.001	0.150

mature kernel (%)															
100-kernel weight (g)	-0.001	0.000	0.000	-0.001	0.000	-0.001	0.001	0.000	0.006	0.004	0.198	0.005	0.024	0.001	0.236
Shelling out-turn (%)	0.001	-0.001	0.000	-0.001	0.000	0.001	-0.001	0.000	0.000	-0.153	0.227	0.005	0.009	-0.001	0.086
Kernel yield per plant (g)	0.000	-0.001	0.000	-0.001	0.000	0.004	-0.001	0.000	0.001	-0.038	0.902	0.072	0.048	-0.001	0.985**
Biological yield per plant (g)	0.001	0.000	0.000	0.000	0.001	0.002	0.000	0.000	0.000	-0.008	0.731	0.088	0.010	-0.001	0.823**
Harvest index (%)	-0.001	-0.001	0.000	-0.001	-0.001	0.004	-0.001	0.000	0.002	-0.018	0.602	0.012	0.072	-0.001	0.668**
Oil content (%)	-0.002	0.000	0.000	0.000	0.001	0.004	-0.001	0.000	-0.001	-0.047	0.428	0.024	0.027	-0.003	0.428**

*, ** Significant at 5% and 1% levels, respectively
Residual effect, R = 0.0395

Table 8: Phenotypic path coefficient analysis showing direct (diagonal and bold) and indirect effects of different characters on pod yield per plant in 50 genotypes of groundnut at Manavadar during *Kharif*-2020 (E_4)

Characters	**Days to 50% flowering**	**Days to maturity**	**No. of primary branches per plant**	**No. of secondary branches per plant**	**Plant height (cm)**	**No. of matured pods per plant**	**No. of immature pods per plant**	**Sound mature kernel (%)**	**100-kernel weight (g)**	**Shelling out-turn (%)**	**Kernel yield per plant (g)**	**Biological yield per plant (g)**	**Harvest index (%)**	**Oil content (%)**	**Phenotypic correlation with pod yield/plant (g)**
Days to 50% flowering	0.007	-0.002	0.000	0.000	0.000	0.001	-0.001	0.000	0.000	-0.027	0.002	0.007	-0.006	0.000	-0.019
Days to maturity	0.002	-0.008	-0.001	0.000	0.000	0.001	-0.001	0.000	-0.001	0.024	-0.095	0.012	-0.013	0.000	-0.077
No. of primary branches per plant	0.000	0.001	0.010	-0.001	0.000	-0.003	0.001	-0.001	0.000	-0.047	0.252	0.007	0.011	0.000	0.230
No. of secondary branches per plant	0.001	0.001	0.006	-0.002	0.000	-0.005	0.002	-0.001	0.001	-0.060	0.561	0.026	0.019	0.000	0.550**
Plant height (cm)	0.000	0.002	0.002	-0.001	0.001	-0.001	0.000	0.000	0.001	-0.001	0.133	0.021	-0.005	0.000	0.152
No. of matured pods per plant	0.000	0.001	0.004	-0.001	0.000	-0.009	0.002	-0.001	0.000	-0.006	0.684	0.031	0.028	0.000	0.734**
No. of immature pods per plant	-0.001	0.001	0.003	-0.001	0.000	-0.003	0.006	0.000	-0.001	0.006	0.038	-0.004	0.004	0.000	0.047
Sound mature kernel (%)	0.000	0.001	0.003	-0.001	0.000	-0.005	0.001	-0.002	0.000	0.050	0.375	0.022	0.016	0.000	0.460**
100-kernel weight (g)	0.000	0.001	0.000	0.000	0.000	0.000	-0.001	0.000	0.006	-0.011	0.198	-0.002	0.014	0.000	0.205
Shelling out-turn (%)	0.001	0.001	0.002	-0.001	0.000	0.000	0.000	0.000	0.000	-0.238	0.172	-0.011	0.002	0.000	-0.071
Kernel yield per plant (g)	0.000	0.001	0.003	-0.001	0.000	-0.007	0.000	-0.001	0.001	-0.044	0.933	0.047	0.034	0.000	0.966**
Biological yield per plant (g)	0.001	-0.001	0.001	-0.001	0.000	-0.004	0.000	-0.001	0.000	0.038	0.655	0.067	0.007	0.000	0.761**
Harvest index (%)	-0.001	0.002	0.002	-0.001	0.000	-0.006	0.001	-0.001	0.002	-0.010	0.717	0.011	0.044	0.000	0.761**
Oil content (%)	-0.002	0.002	0.001	0.000	0.000	-0.004	0.001	0.000	-0.002	-0.069	0.323	0.000	0.012	-0.001	0.270

*, ** Significant at 5% and 1% levels, respectively
Residual effect, R = 0.0363

Conclusion

Correlation study revealed that number of secondary branches per plant, number of matured pods per plant, kernel yield per plant, biological yield per plant and harvest index were correlated with pod yield per plant and path coefficient analysis also revealed high direct and indirect effect of these characters, therefore, due weightage should be given to these traits for selection in groundnut.

References

1. Awatade SM, Thaware BL, Jadhav BB, Gaikwad KJ. Correlation, path and diversity analysis in groundnut. J. Maharashtra Agric. Univ. 2009;35:29-31.
2. Channayya H, Nadaf HL, Ganapathi M, Praveenkumar B. Induced mutants in groundnut (*Arachis hypogaea* L.). Karnataka J. Agric. Sci. 2011;23(2):327-329.
3. Giri RR, Toprope VN, Jagtap PK. Genetic variability, character association and path analysis for yield and its component traits in groundnut. Internat. J. Plant Sci 2009;4:551-555.
4. Golakia PR, Makne VG, Monpara BA. Character association in Virginia runner groundnut (*Arachis hypogaea* L.). Paper presented in the National Symposium on "Enhancing productivity of groundnut for sustaining food and nutritional security" held at NRCG, Junagadh during 2004.
5. Jayalakshmi V, Lakshmikantha G, RG. Genetic variability and correlation studies in groundnut hybrids. Agric. Sci. Digest 2003;23(4):247-250.
6. Johnson HW, Robinson HF, Comstock RE. Genotypic correlation in soybean and their implication in selection. Agron. J. 1955;47:477-483.
7. Kadam PS, Desai DT, Chinchane VN, Sharma V. Correlation and path coefficient analysis in groundnut (*Arachis hypogaea* L.). J. Oilseeds Res 2009;26:63-65.
8. Khanpara MD, Shinde PP, Jivani LL, Vachhani JH, Kachhadia VH. Character association and path coefficient analysis in groundnut (*Arachis hypogaea* L.). Plant Archives 2010;10:695-698.
9. Mane PS, Lad DB, Jagtap PK. Correlation and path coefficient analysis in summer bunch groundnut. J. Maharashtra agric. Univ 2008;8(33):174-176.
10. Methews C, Nagada AK, Sharma UC. A study of path analysis in groundnut. Madras Agric. J. 2001;87:480-481.
11. Nagda AK, Joshi VN. Correlation and path coefficient analysis in drought tolerant genotypes of groundnut (*Arachis hypogaea* L.). Paper presented in the National Symposium on "Enhancing productivity of groundnut for sustaining food and nutritional security" held at NRCG, Junagadh during, 2004.
12. Namrata HS, Ranwah BR, Prashant B. Variability assessment and path coefficient analysis in groundnut (*Arachis hypogaea* L.) genotypes in sub- humid southern plains of Rajasthan. Trends in Biosciences 2016;9(11):642-646.
13. Nirmala D, Jayalakshmi V. Association studies of drought tolerant attributes in groundnut (*Arachis hypogaea* L.). Electron. J. Plant Breed. 2015;6(2):630-638.
14. Siddiquey MNH, Haque MM, Ara MJF, Ahmed MR, Roknuzzaman M. Correlation, path and genetic diversity analysis of groundnut. Intl. J. Sust. Agric. Tech 2006;2:6-10.
15. Sonone NG, Thaware BL. Study on genetic diversity in groundnut. Ann. Plant Physiol, 2009;23:54-56.
16. Suneetha K, Dasarda C, Rami Reddy, Ramana JV. Genetic variability and character association in groundnut (*Arachis hypogaea* L.). Paper presented in the National Symposium on "Enhancing Productivity of Groundnut for Sustaining Food and Nutritional Security" held at NRCG, Junagadh during 2004.
17. Sushree SS, Kedareswar P, Bibhu SB. Variation, correlation and path coefficient study in groundnut breeding lines of Odisha. *J. Pharmacogn. Phytochem.*, 2017;6(5):1966-1973.
18. Vaithiyalingan M, Manoharan V, Ramamoorthi N. Association analysis among the yield and yield attributes of early season drought tolerant groundnut (*Arachis hypogaea* L.). Electron J. Plant Breed 2010;1(5):1347-1350.
19. Vekariya HB, Khanpara MD, Vachhani JH, Jivani LL, Vagadiya KJ, Revar HJ. Correlation and path analysis in bunch groundnut (*Arachis hypogaea* L.). Intl. J. Plant Sci. 2010;6:11-15.
20. Venkataravana P, Sheriff RA, Kulkarni RS, Shankaranarayana V, Fathima PS. Correlation and path analysis in groundnut (*Arachis hypogaea* L.). Mysore J. agric. Sci 2000a;34:321-325.