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Assessment of Genetic variability, Correlation coefficient and Path coefficient analysis in groundnut *(Arachis hypogaea* L.*)* genotypes for Yield and Quality traits

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ABSTRACT

The present experiment was conducted at School of Agriculture, ITM University, Gwalior (M.P) during *Kharif* season of 2022 the design of experiment followed after Randomized Block Design With three replications. The present investigation was conducted to examine the 12 Groundnut genotypes to study the genetic variability, correlation, and path coefficient analysis. Analysis of variance showed highly significant differences among all genotypes for 16 quantitative characters studied. Maximum GCV and PCV were recorded for number of branches plant^{-1} and plant height. High heritability coupled with genetic advance as percent of mean recorded for number of branches plant^{-1}, plant height, kernel yield plant^{-1}, days to 50% flowering and shelling percentage. Correlation coefficient analysis determined that kernel yield plant^{-1}exhibited significant and positive correlation both at genotypic and phenotypic level with number of pods plant^{-1}, shelling percentage, harvest index and pod yield plant-1. Path coefficient analysis revealed that days to 50% flowering, days to maturity, plant height, shelling percentage, biological yield, harvest index, number of seeds pod^{-1}, oil content, sound mature kernel percent, pod yield plant^{-1}showed positive direct effect on kernel yield plant^{-1}. These character can be directly selected for further breeding program.

Key words: *Variability, Heritability, Genetic advance, Correlation, Path analysis.*

Introduction

Groundnut, (*Arachis hypogaea* L.) is one of the significant oilseed crops produced in tropical and subtropical areas of the world and ranks fifth among the nine major oilseed crops in terms of production of vegetable oil (Tillman *et al*., 2009). According to the initial advance estimates, the Government of India would produce 83.69 million tonnes of *kharif* groundnuts in 2022–23, up from 83.75 million tonnes in 2021–22. Knowing the genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) can be utilized in estimating how much variation will be present in a specific assemblage of genotypes. In genetic research, traits with high GCV suggest the probability of effective selection (Sadiq and Saleem, 1986).

Due to the quantitative inheritance of the groundnut, which is made up of a variety of yield qualities, direct selection for kernel yield would not be an ac-

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curate approach. Through the research of correlation coefficient and causation of path co-efficient analysis, it would be possible to determine the contribution of each component clearly attribute that impacts an association trait.

Materials and Methods

The present investigation was carried out at School of Agriculture, ITM University, Gwalior, Madhya Pradesh, India. The experiment was conducted during 2022-2023 followed after Randomized block design (RBD) with three replications. The field is located 211.5 m above the sea level at 26°08'22.6" N latitude and 78°11'42.9" E longitude, located in the Madhya Pradesh gird Agro-climatic zone. The texture of the soil in the experimental field was sandy clay loam. The genotypes were Kadiri lepakshi-1812, Tyagulu, Nithya haritha -1157, GJG-32, Kadiri-7 Bold, Kurnool-6, Rohini, KDG-123, Kadiri- 6, Kadiri-9, Kadiri Amaravthi, Kadiri-4. The package of practices was followed as per the recommendations for raising the good and healthy crop. Observations recorded for sixteen characters *viz.*, germination percentage (GP), days to 50% flowering (DTF), days to maturity(DTM), number ofbranches plant^{-1}(NBP), plant height (cm) (PH), number of pods plant^{-1}(NPP), shelling percentage (SP), biological yield (g) (BY), harvest index (%) (HI), 100 kernel weight(g) (HI), number of seeds pod^{-1}(NSPP), oil percentage (OP), sound mature kernel percentage (%)(SMK), protein percentage (%) (PP), pod yield plant^{-1}(g) (PYPP), kernel yield plant^{-1} (g)(KYPP). Each statistical study for various characteristics used the experimental plot-wise mean values of five randomly selected plants. The heritability (h2), genetic advance as percent mean (GAM), phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), and heritability (h^2bs) of variation were all estimated (Johnson *et al.* 1955). According to the categorization proposed by Robinson *et al.* (1949), heritability percentage was used. According to Johnson *et al.* (1955), genetic advance is measured as a percentage of the mean (GAM). The correlation coefficients and path analysis were carried out following the methods of Burton (1952) and Dewey and Lu (1959) respectively.I have analyzed through R studio by 4.3.0 version.

Results and Discussion

The analysis of variance for all sixteen characters are presented in Table 1. It revealed that the presence of considerable amount of variability in evaluated genotypes. Similar kind of results were also found by Hampannavar *et al*. (2018) and Meena (2021). The estimates of variability parameters *viz.*, genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV), heritability in broad sense (h^2_b) and genetic advance as per cent of mean (GA %

Table 1. Analysis of variance for sixteen characters of studied genotypes

Sl. No.	Characters	Mean sum of squares		
		Replication	Genotypes	Error
	Degree of Freedom	2	11	22
1	Germination (%)	0.08	7.60**	0.05
2	Days to 50% Flowering	0.27	31.56**	0.4
3	Days to maturity	2.43	184.99**	2.67
4	Number ofbranches plant^{-1}	0.01	15.42**	0.12
5	Plant Height (cm)	0.89	167.32**	0.46
6	No of pods plant^{-1}	1.33	11.36**	2.59
7	Shelling Percent	0.51	185.13**	1.27
8	Biological yield (g)	0.08	20.65**	7.53
9	Harvest Index (%)	0.01	71.75**	0.82
10	100 kernel weight (g)	10.07	33.59**	2.63
11	Number ofseeds pod^{-1}	0.006	0.016**	0.004
12	Oil content (%)	2.92	61.50**	8.44
13	Sound mature kernel percent	0.06	32.95**	0.08
14	Protein content (%)	0.09	7.81**	0.24
15	Pod yield plant^{-1} (g)	0.02	6.49**	1.46
16	Kernel yield plant^{-1} (g)	0.36	15.03**	0.87

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

mean) are given in Table 3. High estimates of PCV and GCV were observed for number ofbranches plant^{-1} and plant height. Moderate were recorded in days to 50% flowering, shelling percentage, kernel yield plant^{-1}. low were recorded in germination percentage, days to maturity, number ofpods plant^{-1}, biological yield, harvest index, 100 kernel weight, number ofseeds pod^{-1}, oil percentage, sound mature kernel percentage, protein percentage, pod yield plant^{-1}. Earlier reports by Mahesh *et al*.(2018), Bhargavi *et al.* (2016), Namrata *et al.* (2016), Kadam *et al.* (2018). High heritability was recorded for germination percentage, days to 50% flowering, days to maturity, number of branches plant^{-1}, plant height, shelling percentage, harvest index, 100 kernel weight, oil percentage, sound mature kernel percentage, protein percentage, kernel yield plant^{-1}. Similar reports by Sanjeevakumar *et al.* (2015). High genetic advance as percentage of mean was recorded for days to 50% flowering, number of branches plant^{-1}, plant height, shelling percentage, kernel yield plant^{-1}. Low genetic advance as percentage of mean was recorded for germination percentage, biological yield, number ofseeds pod^{-1}, sound mature kernel percentage, pod yield plant^{-1}. Similar reports were found earlier by Bhargavi *et al.* (2017), Chavadhari *et al.* (2017), Meena (2021), Wadikar *et al.* (2018). Correlation for sixteen characters kernel yield characters and its contributing traits among 12 genotypes of groundnut are represented in Table 3. Correlation estimates revealed that Number of pods plant^{-1}(0.644**), shelling percentage(0.865**), harvest index (0.508) and pod yield plant-1(0.697**) showed positive significant correlation with kernel yield plant^{-1}. Similar reported by Shankar *et al.* (2018), John and Reddy (2019), and Meena (2021). The importance of using the path analysis examines to divide the connection into direct and indirect impacts gains that interact with one another and the environment in which the plants grow to produce yield, which has a dependent character. Path coefficient analysis determined that direct positive effect on kernel yield plant^{-1} were observed for days to 50% flowering (0.0105), days to maturity (0.0261), plant height (0.0313), shelling percentage (0.7718), biological yield (0.3121), harvest index (0.4175), number ofseeds pod^{-1} (0.0123), oil percentage(0.0289), sound mature kernel percentage (0.018), pod yield plant^{-1}(0.2119) Residual effect (0.0136) concludes that there are no other components that effect the yield and its attributes. Earlier reported by Tulsi *et al.* (2017), Mahesh *et al.* (2018), Shankar *et al.* (2018), John and Reddy (2019) and Meena (2021).(please emphasize discussion)

Conclusion

All 12 groundnut genotypes revealed considerable genetic variation. The genotypes GJG-32, Kadiri-6, and Kadiri-4 had a good mean performance for kernel production plant-1. For the number of branches plant-1, plant height, kernel production plant-1,

Table 2. Estimation of variability, heritability, and Genetic advance for sixteen yield and quality ascribing characters among studied genotypes

Characters	Mean	Min	Max	GCV (%)	PCV (%)	H (bs)	GA	GA% mean
Germination (%)	92.12	88.98	93.95	1.72	1.74	98.01	3.24	3.51
Days to 50 % Flowering	30.48	25.00	34.15	10.57	10.78	96.26	6.51	21.37
Days to maturity	112.43	94.80	122.00	6.93	7.08	95.80	15.72	13.98
Number ofbranches plant^{-1}	6.95	4.67	12.67	32.50	32.88	97.69	4.60	66.16
Plant Height (cm)	28.46	19.14	42.79	26.20	26.31	99.19	15.30	53.76
No pods plant^{-1}	22.86	20.86	26.87	7.48	10.27	53.02	2.56	11.22
Shelling Percentage	74.97	66.19	88.36	10.44	10.55	97.97	15.96	21.29
Biological yield (g)	40.19	37.33	47.00	5.20	8.58	36.75	2.61	6.50
Harvest Index (%)	53.11	40.98	58.59	9.16	9.31	96.64	9.85	18.54
100 kernel weight (g)	38.11	33.67	46.00	8.43	9.44	79.67	5.91	15.50
Number ofseeds pod^{-1}	1.91	1.80	2.00	3.25	4.63	49.42	0.09	4.71
Oil percentage (%)	44.77	36.94	51.19	9.39	11.42	67.69	7.13	15.92
Sound mature kernel percent	81.82	76.56	88.07	4.05	4.06	99.31	6.80	8.31
Protein percentage (%)	26.53	22.25	28.21	5.99	6.26	91.35	3.13	11.79
Pod yield plant^{-1} (g)	21.26	19.26	23.83	6.09	8.33	53.50	1.95	9.18
Kernel yield plant^{-1} (g)	15.97	12.90	19.94	13.61	14.81	84.44	4.11	25.76

Table 3. Correlationbetweenkernelyield plant-1anditsattributing charactersingroundnut

Characters	GP	DTF	DTM	NBP	PH	NPP	SP	BY	HI	100 KW	NSPP	OC	SMK	PC	PYPP	KYPP
GP	1	0.217	0.586**	0.514**	-0.076	-0.286	-0.214	0.217	-0.215	0.199	-0.068	-0.182	0.443**	0.189	-0.125	-0.227
DTF			0.603**	0.434**	-0.587**	-0.606**	0.141	-0.067	-0.189	0.142	-0.358*	0.631**	-0.410*	-0.012	-0.327	-0.061
DTM				0.536**	-0.463**	-0.372*	0.044	0.062	-0.139	0.106	-0.256	0.111	-0.033	0.047	-0.141	-0.04
NBP					-0.286	-0.174	0.22	0.207	-0.599**	0.677**	0.126	0.158	-0.195	0.155	-0.664**	-0.187
PH						0.309	-0.195	-0.251	0.348*	0.133	0.151	-0.441**	0.435**	0.25	0.289	-0.011
NPP							0.544**	0.04	0.298	-0.25	0.449**	-0.539**	-0.007	0.189	0.491**	0.646**
SP								-0.013	0.155	-0.078	0.324	-0.084	-0.291	0.227	0.245	0.865**
BY									-0.723**	0.048	0.231	-0.379*	-0.061	0.312	-0.14	-0.063
HI										-0.578**	-0.189	0.008	0.192	-0.029	0.783**	0.508**
100 KW											0.053	0.031	0.045	-0.114	-0.757**	-0.460**
NSPP												-0.400*	-0.012	0.218	-0.059	0.214
OP													-0.610**	-0.244	-0.360*	-0.243
SMK														-0.127	0.233	-0.099
PP															0.227	0.274
PYPP																0.697**
KYPP																1

*, ** significant at 5% and 1% level, respectively.

GP=germination percentage, DTF=days to 50% flowering, DTM=days to maturity, NBP= no of branches plant^{-1}, PH=plant height, NPP=no of pods plant^{-1}, SP=shelling percentage, BY=biological yield , HI=harvest index, 100KW=100 kernel weight, NSPP=no of seeds pod^{-1}, OP=oil percentage, SMK=sound mature kernel percentage, PP=protein percentage, PYPP=pod yield plant^{-1}, KYPP=kernel yield plant^{-1}.

days to 50% flowering, and shelling percentage, high heritability along with genetic advancement as a percentage of mean was recorded. So, these traits can be used for selection. There was a significant positive correlation and direct effect between the number of pods plant^{-1}, shelling percentage, harvest index, and pod yield plant^{-1}, and kernel yield plant^{-1}. The selection of these attributes will be helpful.

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Table 4. Path coefficient showing direct and indirect effects of different yield and quality ascribing characters on kernel yield plant^{-1}

Characters	GP	DTF	DTM	NBP	PH	NPP	SP	BY	HI	100 KW	NSPP	OP	SMK	PP	PYPP	KYPP
GP	**-0.0074**	0.0023	0.0153	-0.0165	-0.0024	0.0004	-0.1653	0.0677	-0.0898	-0.0008	-0.0008	-0.0053	0.008	-0.0058	-0.0265	-0.227
DTF	-0.0016	**0.0105**	0.0158	-0.014	-0.0184	0.0008	0.1089	-0.021	-0.0788	-0.0006	-0.0044	0.0182	-0.0074	0.0004	-0.0693	-0.061
DTM	-0.0043	0.0063	**0.0261**	-0.0172	-0.0145	0.0005	0.0343	0.0194	-0.0582	-0.0004	-0.0031	0.0032	-0.0006	-0.0015	-0.0299	-0.04
NBP	-0.0038	0.0045	0.014	**-0.0322**	-0.0089	0.0002	0.1696	0.0647	-0.25	-0.0028	0.0015	0.0046	-0.0035	-0.0047	-0.1406	-0.187
PH	0.0006	-0.0061	-0.0121	0.0092	**0.0313**	-0.0004	-0.1502	-0.0782	0.1454	-0.0005	0.0019	-0.0127	0.0079	-0.0077	0.0613	-0.011
NPP	0.0021	-0.0063	-0.0097	0.0056	0.0097	**-0.0013**	0.4195	0.0124	0.1246	0.001	0.0055	-0.0156	-0.0001	-0.0058	0.1041	0.646**
SP	0.0016	0.0015	0.0012	-0.0071	-0.0061	-0.0007	**0.7718**	-0.0039	0.0649	0.0003	0.004	-0.0024	-0.0053	-0.007	0.052	0.865**
BY	-0.0016	-0.0007	0.0016	-0.0067	-0.0078	-0.0001	-0.0097	**0.3121**	-0.3019	-0.0002	0.0028	-0.011	-0.0011	-0.0096	-0.0296	-0.063
HI	0.0016	-0.002	-0.0036	0.0193	0.0109	-0.0004	0.12	-0.2257	**0.4175**	0.0024	-0.0023	0.0002	0.0035	0.0009	0.1658	0.508**
100 KW	-0.0015	0.0015	0.0028	-0.0218	0.0042	0.0003	-0.0605	0.0151	-0.2412	**-0.0041**	0.0006	0.0009	0.0008	0.0035	-0.1605	-0.460**
NSPP	0.0005	-0.0037	-0.0067	-0.0041	0.0047	-0.0006	0.25	0.0721	-0.079	-0.0002	**0.0123**	-0.0116	-0.0002	-0.0067	-0.0126	0.214
OC	0.0014	0.0066	0.0029	-0.0051	-0.0138	0.0007	-0.065	-0.1184	0.0033	-0.0001	-0.0049	**0.0289**	-0.011	0.0075	-0.0763	-0.243
SMK	-0.0033	-0.0043	-0.0009	0.0063	0.0136	0	-0.2248	-0.0191	0.0802	-0.0002	-0.0002	-0.0176	**0.018**	0.0039	0.0493	-0.099
PC	-0.0014	-0.0001	0.0012	-0.005	0.0078	-0.0002	0.1756	0.0974	-0.0123	0.0005	0.0027	-0.007	-0.0023	**-0.0306**	0.0481	0.274
PYPP	0.0009	-0.0034	-0.0037	0.0213	0.0091	-0.0006	0.1894	-0.0436	0.3268	0.0031	-0.0007	-0.0104	0.0042	-0.007	**0.2119**	0.697**

Residual effect: 0.0136, *, ** significant at 5% and 1% level, respectively.

GP=germination percentage, DTF=days to 50% flowering, DTM=days to maturity, NBP= no of branches plant^{-1}, PH=plant height, NPP=no of pods plant^{-1}, SP=shelling percentage, BY=biological yield , HI=harvest index, 100KW=100 kernel weight, NSPP=no of seeds pod^{-1}, OP=oil percentage, SMK=sound mature kernel percentage, PP=protein percentage, PYPP=pod yield plant^{-1}, KYPP=kernel yield plant^{-1}.

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