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Genetic Variability and Correlation Studies for Yield and Yield Contributing Characters in Groundnut (*Arachis hypogaea* L.)

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A B S T R A C T

Genetic parameters, variability, heritability and genetic advance were studied among 20 groundnut cultures *rabi*-2016-17 to study the variation and to identify traits of high heritability. The characters hundred kernel weight, hundred pod weight, dry pod yield and kernel yield had high GCV, heritability and GAM were found to be under the control of additive gene action, while the traits shelling percentage, sound mature kernel and final plant stand with moderate heritability and high genetic advance appeared to be under the predominant influence of additive gene action. Low GCV were recorded for days to fifty per cent flowering and duration of maturity. Correlation studies indicated that the characters, 100 seed weight (g), hundred pod weight (g), pod yield and kernel yield should be given major emphasis for the development of high yielding genotypes.

Introduction

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop of tropical and subtropical regions of the world. It is the World's thirteenth most important food crop, the fourth most important source of edible oil and the third most important source of vegetable protein (Encyclopedia of Agricultural Science 1994). It is a primary source of edible oil and has high oil content (44 -50 per cent) and protein content (25 per cent). Groundnut oil contains 46 and 32 percent of monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA), respectively. India is the largest grower and second producer after China, the average area (4.19 million ha), production (5.62 million ton.) and productivity (1341 kg/ha**)** (Annual Reports of Groundnut Research Institute, Junagarh 2011-12). Variability in genotypes for yield and contributing traits form the basic factor while making selection. The presence and magnitude of genetic variability in a gene pool is the pre-requisite of breeding programmes (Tiwari *et al.*, 2011). Heritability of a trait is important in determining its response to selection. It was found out earlier that genetic improvement of plants for quantitative traits requires reliable estimate of heritability in order to plan an efficient breeding programme. Selection of

superior parents with high heritability and genetic advance for various characters is an essential prerequisite for any yield improvement programme (Khan *et al.,* 2008).

Materials and Methods

The experimental material consisted 20 genotypes of groundnut including checks (Kadiri-6 and JCG-88). The experiment was conducted in a randomized block design with three replications during *rabi*-2016-17 at Regional Agricultural Research Station, Jagtial. Each genotype was sown in 5 rows of 5m length and 1.5 m width with a spacing of 30 cm between the rows and 10 cm within the plants.

Recommended package of practices were followed in raising the crop. Data was recorded on final plant stand, days to 50% flowering, days to maturity, shelling percentage, sound mature kernel, hundred pod weight (g), hundred kernel weight (g), kernel yield and pod yield/hectare. The mean of different characters were calculated on the basis of these individual data recorded for each character in each replication and subjected for analysis of variance (Fisher, 1936), coefficient of variation (Burton *et al.,* 1952), heritability (Burton and Devane, 1953), genetic advance (Johnson *et al.,* 1955).

Results and Discussion

The mean squares of various traits indicated that there were significant differences among the genotypes except final plant stand. Characters viz., days to 50% flowering, days to maturity, shelling percentage, sound mature kernel, hundred pod weight (g), hundred kernel weight (g), kernel yield and pod yield/hectare were presented in table 2. The genotypes, JCG-6736(2507kg/Ha) and JCG-6727(2631 Kg/Ha) were found to be best genotypes for pod yield/ha.

The minimum differences in magnitude for the estimates of GCV and PCV for all the nine characters like final plant stand, days to 50% flowering, days to maturity, shelling percentage, sound mature kernel, hundred pod weight (g), hundred kernel weight (g), kernel yield and pod yield/hectare implied that the traits were mostly governed by genetic factors with little role of environment in the phenotypic expression of these characters (Manggoel *et al.,* 2012). Hence phenotypic selection is rewarding for these traits.

The high genotypic coefficient of variation (GCV) was recorded for hundred kernel weight (15.3), hundred pod weight (11.9), dry pod yield per ha (11.2), and kernel yield per ha (10.2).

Similarly high PCV values were recorded for hundred kernel weight (17.5), hundred pod weight (13.2), dry pod yield (12.4) and kernel yield (11.9). Similar results were reported by Naazar *et al.,* (2000), Kumar and Rajamani (2004), John *et al.,* (2005), Khote *et al.,* (2009) and Shinde *et al.,* (2010).

Heritability plays an important role in deciding the stability and strategy for selection of a character.

In the present study high heritability was observed for traits viz., sound mature kernel (87.3), shelling per cent (87.2), dry pod yield per ha (81.3), hundred pod weight (81.0), hundred kernel weight (76.3) and kernel yield (72.8), while moderate heritability was recorded for days to maturity (55.9).

Similar results were obtained by Azad and Hamid (2000) and Parameshwarapp *et al.,* (2005). It suggests high components of heritable portion of variation that can be exploited by breeders in the selection of superior genotypes on the basis of phenotypic performance (Table 1).

Table.1 Per se performance of different yield and yield contributing characters in groundnut genotypes

Genotype	FPS	DIF	DFF	DM	S%	HKW	HPW	SMK	KY/ ha	DPY/ ha
JCG-6707	191	28	31	109	71	23.3	69.0	89	1578	2230
JCG-6708	205	28	30	109	66	18.0	77.3	91	1564	2353
JCG-6709	189	27	29	110	69	23.0	56.7	92	1374	1991
JCG-6714	200	28	30	109	71	22.7	70.0	91	1387	1960
JCG-6722	191	27	29	110	66	27.7	64.7	87	1314	1991
JCG-6724	202	27	30	108	73	20.3	66.3	91	1390	1906
JCG-6727	202	27	29	107	55	22.3	60.7	75	1456	2631
JCG-6728	194	26	29	112	73	27.3	48.0	72	1729	2377
JCG-6736	197	27	29	111	56	28.3	74.3	89	1413	2508
JCG-6737	183	27	29	109	72	23.0	71.0	85	1263	1759
JCG-6738	188	27	30	108	72	22.0	80.7	89	1765	2446
JCG-6739	193	27	30	109	69	27.0	68.0	91	1526	2207
JCG-6740	175	27	29	108	71	18.7	79.7	92	1348	1898
JCG-6741	190	27	30	109	66	19.3	69.7	91	1271	1921
JCG-6742	197	27	29	109	68	28.7	81.3	88	1327	1968
JCG-6743	171	27	30	110	71	27.0	76.0	93	1584	2230
JCG-6745	184	27	29	109	65	17.3	81.0	90	1225	1883
JCG-6746	194	29	31	108	57	27.3	77.3	88	1250	2207
Kadiri-6	184	28	30	105	63	27.7	69.7	86	1570	2292
JCG-88	179	28	30	108	67	20.3	66.3	79	1439	2137
Mean	190	27	30	109	67	23.6	70.4	87	1439	2155
C.V.	6.1	3.1	3.4	1.0	3.0	8.5	5.7	2.4	6.2	5.4
C.D. 5%	19.2	-	-	1.7	3.4	3.3	6.7	3.5	148.1	191.4
Range Lowest	170.7	26.3	28.7	105.0	55.3	17.3	48.0	71.7	1224.6	1759.3
Range Highest	204.7	28.7	31.3	111.7	73.0	28.7	81.3	92.7	1765.0	2631.2

FPS= Final plant stand, DFF= Duration of fifty per cent flowering, DM= Duration of maturity, S%= Shelling percentage, HKW= Hundred kernel weight, HPW=Hundred pod weight, SMK= Sound mature kernel, DPY= Dry pod yield and KY= Kernel yield.

Table.2 Analysis of variance (Mean Squares) for yield and yield components in Groundnut

Source of variation	Df	FPS	DIF	DFF	DM	S%	HKW	HPW	SMK	Kernel Yield/ Ha	DPY
Replications	2	181.7	5.81**	9.65**	16.46**	151.71**	42.11**	10.31	37.61**	0.012**	0.0001
Treatments	19	251.1	0.89	1.35	5.26**	88.86**	43.02**	225.23**	99.44**	0.013**	0.035**
Error	38	135.6	0.69	1.01	1.09	4.15	4.02	16.31	4.58	0.001	0.002

Table.3 Phenotypic and genotypic correlation coefficients among yield and other parameters in groundnut genotypes

Character		FPS	DIF	DFF	DM	S%	HKW	HPW	SMK	KY/ha	DPY/ha
FPS	**P**	**1.000**	-0.022	-0.065	0.1281	-0.1879	-0.0034	-0.157	-0.139	0.012	0.152
	G	**1.000**	0.951**	0.395	0.053	-0.486**	0.036	-0.365**	-0.244	0.019	0.205
DIF	**P**		**1.000**	0.780**	-0.204	-0.172	0.092	0.102	0.119	0.007	0.116
	G		**1.000**	1.057**	-0.758	-0.782**	-0.025	0.396**	0.217	-0.208	-0.266
DFF	**P**			**1.000**	-0.150	-0.0036	-0.060	0.101	0.093	0.133	0.101
	G			**1.000**	-0.611**	-0.206	-0.191	0.470**	0.184	0.163	0.200
DM	**P**				**1.000**	0.1648	0.124	-0.249	-0.047	0.076	-0.059
	G				**1.000**	0.196	0.201	-0.311**	-0.076	0.075	0.087
S%	**P**					**1.000**	-0.211	-0.057	0.199	0.293*	-0.457**
	G					**1.000**	-0.239	-0.114	0.203	0.284*	0.230
HKW	**P**						**1.000**	-0.206	-0.157	0.128	0.275*
	G						**1.000**	-0.172	-0.192	0.225	-0.176
HPW	**P**							**1.000**	0.561**	-0.208	-0.165
	G							**1.000**	0.643**	-0.254*	0.342
SMK	**P**								**1.0000**	-0.212	-0.359**
	G								**1.000**	-0.317*	0.506
KY/Ha	**P**									**1.000**	0.711**
	G									**1.000**	0.186
DPY/Ha	**P**										**1.000**
	G	Significance levels		0.05	0.01						**1.000**
		If correlation 'r'		0.254	0.330						

P= Phenotypic correlation coefficients, G= Genotypic correlation coefficients *= Significant at P<0.05, **= Significant at P<0.0

Table.4 Components of genetic variability for ten characters in groundnut genotypes

Character	Range		GCV	PCV	h² (Broad Sense)	GAM (at 5%)
	Min	Max				
Final plant stand	170.1	204.7	3.3	6.9	22.1	3.2
Days to initial flowering	26.6	28.7	1.0	3.2	8.8	0.6
Days to 50% flowering	28.7	31.3	1.1	3.6	9.8	0.7
Days to maturity	105.0	111.7	1.1	1.5	55.9	1.7
Shelling%	55.3	73.0	7.9	8.5	87.2	15.2
Hundred kernel weight	17.3	28.7	15.3	17.5	76.3	27.5
Hundred pod weight	48.0	81.3	11.9	13.2	81.0	22.0
Sound mature kernel	71.7	92.7	6.4	6.9	87.3	12.4
Dry Pod Yield/ Ha	1759.3	2631.2	11.2	12.4	81.3	20.8
Kernel Yield/ Ha	1224.6	1765.0	10.2	11.9	72.8	17.9

Maximum genetic advance was recorded for hundred kernel weight (27.5), Hundred pod weight (22.0) and dry pod yield (20.8). Moderate amount of genetic advance was recorded for kernel yield (17.9), Sound mature kernel (12.4) and shelling percentage (15.2). In the present study hundred kernel weight, hundred pod weight, shelling percentage, dry pod yield per ha and kernel yield showed high genetic advance along with high heritability, genotypic and phenotypic coefficient of variation which suggested that these characters can be considered as favorable attributes for the improvement through selection and this may be due to additive gene action.

At phenotypic level pod yield showed significant positive correlation with hundred kernel weight (0.275), kernel yield (0.711) and negative correlation for shelling per cent (-0.457) and sound mature kernel (-0.359). Kernel yield showed significant positive correlation with shelling per cent (0.293) while, sound mature kernel showed significant positive correlation with hundred pod weight (0.561). Days to fifty per cent flowering showed significant positive correlation with duration of initial flowering (0.780) (Table 3).

At genotypic level Kernel yield per ha recorded highly significant positive correlation with shelling percentage (0.284) and negative correlation with hundred pod weight (-0.254) and sound mature kernel (-0.317). Sound mature kernel showed significant positive correlation with hundred pod weight (0.643). Hundred pod weight recorded highly significant positive correlation with duration of initial flowering (0.396), fifty per cent flowering (0.470) and negative correlation with final plant stand (-0.365) and duration of maturity (-0.311). Shelling per cent showed negative correlation with final plant stand (-0.486), duration of initial flowering (-0.782) and duration of maturity recorded negative correlation with duration of fifty percent flowering (-0.611). Duration of initial flowering showed positive correlation with final plant stand (0.951) (Table 4).

Eighteen genotypes were studied for genetic variability and correlation studies, among these two genotypes were recorded highest per se values for yield viz., JCG-6727 (2631 kg/ha) and JCG-6736 (2508 kg/ha). Whereas six entries recorded more than 70 per cent of shelling out turn. These genotypes can be used as parental material for crossing programme to improve the specific yield attributing characters in groundnut.

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