The Andhra Agric. J 60(4)780-784, 2013

Studies on Genetic Variability for Late Leafspot Resistance, Yield and Yield Components in Groundnut (*Arachis hypogaea* L.)

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ABSTRACT

Fifteen F_1 crosses along with eight parents (five lines and three testers) were evaluated for variability, heritability and genetic advance during *Kharif,* 2011. Analysis of variance revealed highly significant differences among the genotypes for all the fourteen characters indicating sufficient variability in the material studied. The estimates of PCV and GCV were high for number of secondary branches per plant, number of leaves affected by late leaf spot per plant at 90 DAS, kernel yield per plant, pod yield per plant, number of mature pods per plant, number of leaves at harvest and harvest index. High heritability coupled with high genetic advance as per cent of mean was observed for majority of characters except for number of primary branches per plant, days to 50% flowering, days to maturity, per cent pod set and shelling per cent indicating that these traits were mainly governed by additive gene action and response to selection could be effected for further improvement of these traits through simple selection.

Key words : Genetic advance,Groundnut, Heritability, Late leafspot resistance, Variability.

Groundnut is not only a principal oilseed crop but also a premier nutritious and palatable food crop of India. Even though India occupies the highest area of 4.93 million hectares in the world, China leads in production (15.70 million tonnes) and productivity (3454 kg ha^{-1}), followed by India with a production of 5.64 million tonnes and with a productivity of 1144 kg ha^{-1} (FAO, 2010). The low productivity of the crop in India and several African countries is ascribed to many biotic and abiotic stresses in the cultivation of the crop. Among the biotic factors, late leafspot caused by *Phaeoisariopsis personata* [(Berk. and Curt.) Deighton] is one of the most economically important foliar diseases of groundnut which can cause yield losses up to 80% (Grichar *et al*., 1998) Development of cultivars resistant/tolerant to these diseases could be effective in decreasing the production costs, improving product quality and reducing the detrimental effects of chemicals on our ecosystem. Genetic variability is the basic requirement for crop improvement as this provides wider scope for selection. Thus, effectiveness of selection is dependent upon the nature, extent and magnitude of genetic variability present in material and the extent to which it is heritable. In the present study, variability and other genetic parameters were studied for late leafspot resistance, yield and yield components in groundnut.

MATERIAL AND METHODS

The experimental material comprised of 23 genotypes of which five were lines (TPT-4, TCGS-888, TCGS-913, ICGV-91114 and TG-47), three were testers (GPBD-4, ICG-13919 and ICG-15234) and fifteen were F_1s derived out of a line x tester design. Crossing was undertaken during *Rabi*, 2010 and 15 F_1s along with their parents were raised in a randomized block design with four replications at Regional Agricultural Research Station, Tirupati during *Kharif*, 2011. Each treatment was sown in one row of 3 m length by adopting a spacing of 30 cm x 10 cm. Observations were recorded on randomly chosen ten competitive plants for characters viz., plant height (cm), number of primary branches per plant, number of secondary branches per plant, number of mature pods per plant, pod yield per plant (g), kernel yield per plant (g), per cent pod set, shelling per cent, harvest index (%), late leaf spot score (LLS) at 90 days after sowing, number of leaves at harvest and number of leaves affected by late leaf spot per plant at 90

Table 1. Analysis of variance for 14 quantitative characters in groundnut.

S.No.	Character	Mean sum of squares		
		Replications	Treatments	Error
		(df = 3)	(df = 22)	(df = 66)
1	Plant Height (cm)	1.13	148.38**	1.25
2	No. of primary branches	0.08	2.44**	0.07
3	No. of Secondary branches	0.09	42.48**	0.09
4	Days to 50% flowering	0.30	5.37**	0.24
5	Days to maturity	0.33	25.58**	0.65
6	No. mature pods per plant	0.64	53.14**	0.82
7	Pod yield per plant (g)	0.93	58.85**	0.62
8	Kernel yield per plant (g)	0.03	12.34**	0.07
9	Per cent pod set	11.72	177.81**	13.73
10	Shelling per cent	8.40	110.30**	6.24
11	Harvest index (%)	3.38	206.91**	2.38
12	LLS score at 90 DAS	0.15	23.90**	0.12
13	No. of leaves at harvest	4.23	544.27**	6.82
14	No. leaves affected by LLS at 90 DAS	0.10	159.60**	0.49

** Significant at P = 0.01

days after sowing. The characters viz., days to 50% flowering and days to maturity were recorded on per plot basis. Disease severity for late leaf spot was estimated on plant basis and scoring was done according to 1-9 point field scale (Subramanyam *et al.,* 1982). The score was transformed to percentage using arc-sine transformation (Subrahmanyam *et al.,* 1982). Analysis of variance was carried out as per the method suggested by Panse and Sukhatme (1979). The phenotypic and genotypic co-efficients of variation (Burton, 1952), heritability in broadsense (Allard, 1960) and genetic advance as per cent of mean (Johnson *et al.,* 1955) were computed.

RESULTS AND DISCUSSION

The analysis of variance for 14 characters in 23 genotypes revealed that the genotypes diffeved significantly for all the characters indicating the existence of sufficient variability in the material studied (Table 1). The range of mean variation observed for the characters revealed that highest range of mean variation was noted for days to maturity, whereas the range was found to be the least for number of primary branches per plant. The highest magnitudes of genotypic and phenotypic variance were observed for number of leaves per plant at harvest while the least estimates were recorded for number of primary branches per plant. The magnitude or phenotypic co-efficient of variation was of high magnitude than the genotypic co-efficient of variation for all the characters indicating the influence of environment in expression of the traits (Table 2). Similar kind of observations were also reported by Korat *et al.* (2009) and Savaliya *et al.* (2009) which corroborates the findings of the present study.

High magnitude of PCV and GCV of about 56.07 per cent and 55.82 per cent, respectively were noticed for number of secondary branches per plant followed by number of leaves affected by late leaf spot per plant at 90 DAS (41.64 and 41.38), kernel yield per plant (24.83 and 24.54), pod yield per plant (22.87 and 22.40), number of mature pods per plant (21.89 and 21.23), number of leaves at harvest (21.31 and 20.79) and harvest index (20.16 and 19.71) indicating that most of the characters had sufficient variability to effect selection to

Table 2. Variability, heritability and genetic advance for 14 quantitative characters in groundnut.

Character	Mean	Range	Genotypic variance	Phenotypic variance	Coefficient of variation		Heritability in broad sense (%)	Genetic Advance	Genetic advance as % of mean
					Genotypic (%)	Phenotypic (%)			
Plant Height	35.06	23.18 - 43.60	36.78	38.03	17.30	17.59	97	12.29	35.05
No. of primary branches	6.64	5.40 - 8.10	0.59	0.66	11.61	12.23	90	1.51	22.68
No. of Secondary branches	5.83	2.25 - 12.20	10.60	10.69	55.82	56.07	99	6.68	114.49
Days to 50% flowering	26.47	24.75 - 28.75	1.28	1.52	4.28	4.66	84	2.14	8.09
Days to maturity	99.66	96.00 - 105.50	6.23	6.88	2.51	2.63	91	4.90	4.91
No. mature pods per plant	17.04	11.20 - 22.90	13.08	13.90	21.23	21.89	94	7.23	42.42
Pod yield per plant	17.03	9.33 - 22.60	14.56	15.17	22.40	22.87	96	7.70	45.20
Kernel yield per plant	7.14	3.71 - 10.64	3.07	3.14	24.54	24.83	98	3.57	49.97
Per cent pod set	58.20	50.50 - 74.03	41.02	54.75	11.01	12.71	75	11.42	19.62
Shelling per cent	42.13	34.73 - 54.60	26.01	32.25	12.11	13.48	81	9.44	22.40
Harvest index	36.29	24.75 - 48.68	51.13	53.51	19.71	20.16	96	14.40	39.68
LLS score	13.01	6.55 - 15.25	5.94	6.06	18.74	18.93	98	4.97	38.24
No. of leaves at 90 DAS	55.76	37.80 - 82.40	134.36	141.18	20.79	21.31	95	23.29	41.77
Leaf fall at 90 DAS	15.24	0.70 - 22.60	39.78	40.27	41.38	41.64	99	12.91	84.73

effectively improve these characters. Further, moderate values of PCV and GCV were registered for LLS scores (18.93% and 18.74%), plant height (17.59% and 17.30%), shelling per cent (13.48% and 12.11%), per cent pod set (12.71% and 11.01%), number of primary branches per plant (12.23% and 11.61%). For days to 50 per cent flowering (4.66% and 4.28%), days to maturity (2.63% and 2.51%) both PCV and GCV values were low. Reports of high GCV by Dixit *et al.* (1970), Lakshmaiah (1978) and Korat *et al.* (2009) for number of secondary branches per plant were in conformity with findings or the present study.

The estimates of nature and magnitude of genetic variability along with heritability are useful in providing basic information regarding genetic architecture of germplam, production and formulation of appropriate breeding procedures, which will boost up the crop improvement programme. High heritability was recorded for all the traits ranging from 75% for per cent pod set to 99% for both number of secondary branches per plant and number of leaves affected by late leaf spot per plant at 90 DAS indicating lower environmental influence and larger influence or of additive genetic variance on the characters studied.

However, the estimates of heritability alone will not be of much value for selection on and genetic gain should be considered in conjunction with heritability estimates (Johnson *et al.,* 1955). High heritability was found to be associated with high genetic advance for number of secondary branches per plant (h^2_b = 99%, GAM = 114.49%), number of leaves affected by late leaf spot per plant at 90 DAS (99%, 84.73%), kernel yield per plant (98%, 49.97%), pod yield per plant (96%, 45.20%), number of mature pods per plant (94%, 42.42%), number of leaves at harvest (95%, 41.77%), LLS score (98%, 38.24%), harvest index (96%, 39.68%) and plant height (97%, 35.05%) indicating that inheritance of these characters was most likely due to additive gene effects. Phenotypic selection for the improvement of these characters would be effective in the later generations. The reports of high heritability coupled with high GAM for late leaf spot severity by Venkataravana *et al.* (2008), Venkataravana and Injeti (2008) and Giri *et al.* (2009) were in conformity with findings of the present study. High heritability coupled with moderate genetic advance was observed for the traits number of primary branches per plant (90%, 22.68%), per cent pod set (81%, 22.40%) and shelling per cent (75%, 19.62%) indicating the role of both additive and non-additive gene action, hence hybridization followed by selection would be effective to capitalize both additive and non-additive gene effects observed in these traits. For days to 50% flowering and days to maturity, heritability was high (84% and 91%) and GAM was low (8.09% and 4.91%) indicating that high heritability was due to favourable influence of environment rather than genotypic effects and selection for such traits may not be rewarding.

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(Received on 17.05.2012 and revised on 09.12.2012)