Agric. Sci. Digest., **30** (2) : 115 - 119, 2010

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
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CHARACTER ASSOCIATION AND PATH ANALYSIS OF YIELD COMPONENT TRAITS AND LATE LEAF SPOT DISEASE TRAITS IN GROUNDNUT (*ARACHIS HYPOGAEA* L.).

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ABSTRACT

High estimates of PCV, GCV, heritability (broad sense) and genetic advance as percentage of mean (GAM) were observed for late leaf spot disease severity, reducing sugar, kernel yield per plant and pod yield per plant. It indicates the role of additive gene action and hence the usefulness of phenotypic selection for bringing possible improvement. Pod yield showed positive significant association with days to 50 per cent flowering, days to maturity, kernel yield, test weight and oil content. The path analysis revealed that high positive direct effect of kernel yield exerted on pod yield as well as oil content, strong mature kernel, days to 50 per cent flowering, test weight, days to maturity, and non reducing sugar through kernel yield. Therefore, it would be rewarding to lay due emphasis on the selection of these characters for rapid improvement in pod yield.

Key words : Heritability, Coefficient of variation, Genetic advance, *Arachis hypogaea*

Late leaf spot caused by *Phaeoisariopsis personata* L. (Berk and Curt) is a major foliar disease of groundnut world wide causing reduction in pod and haulm yield of 25.33 and 53.03 per cent, respectively (Eswara Reddy and Venkateswara Rao, 1999). The knowledge of variability, nature of association and path analysis of the resistance with yield and its attributes will enable breeder to plan effective breeding programme for its transfer in to existing popular varieties.

The experimental material comparising of twenty genotypes including four checks *viz.,* JL-24, TAG-24, LGN-1 and GPBD-4 were studied in three replicate randomized block design during *Kharif* 2006 at Oilseeds Research Station, Latur. The observations were recorded on selected five plants for twelve characters *viz.*, days to 50 per cent flowering, days to maturity, kernel yield per plant, test weight, shelling percentage, oil content, strong mature kernel, harvest index, late leaf spot severity (1-9 scale of ICRISAT, Subramanyam *et al.* 1982), non reducing sugar (amount of reducing sugar subtracted from the amount of total sugar (Dubois *et al.* 1956)), reducing sugar (Millar *et al.* 1972) and pod yield per plant.

Genetic **v**ariability, heritability and genetic advance as percentage of mean (GAM), correlation and path analysis were estimated. Heritability in broad sense were estimated Allard (1960). The phenotypic and genotypic correlation coefficients were estimated using the procedure suggested by Falconer (1964). The direct and indirect effects of the component characters on pod yield according to Dewey and Lu (1959).

In the present study significant differences were observed for all the characters. The estimates of genetic parameter (Table 1) revealed that there was closer correspondence between GCV and PCV for all the characters except harvest index indicating that all the characters had interacted with the environment in some degree or the other. High GCV and PCV values were observed for late leaf spot severity (GCV = 77.25, PCV = 77.42), reducing sugar (GCV = 34.78, PCV= 35.39), kernel yield (GCV = 26.66, PCV = 28.75) and pod yield per plant (GCV = 26.26, PCV = 27.80). Conforming with the results of Vasanthi *et al.*

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(1998) and John *et al.* (2006) for late leaf spot disease severity, Misra *et al.* (2000), for reducing sugar and Venkataravana *et al.* (2007) for kernel yield and pod yield were in conformity with the above findings. Moderate GCV and PCV values were recorded for test weight (GCV = 17.96, PCV = 20.13) followed by non reducing sugar (GCV = 17.93, PCV = 18.27), and harvest index (GCV = 12.81, PCV = 18.68). Hemanth Kumar (2004) reported similar results for test weight and harvest index. The coefficient of variation indicate the magnitude of variability present in population, hence selection may, therefore, be effective for these characters. The high estimates heritability in board sense was observed for late leaf spot severity (99.0%), days to maturity (98.54%), reducing sugar (96.62%), non reducing sugar (96.36%), oil content (96.13%), pod yield per plant (89.23%), kernel yield per plant (86.0%), days to 50 per cent flowering (85.70%) and test weight (79.63%). High estimates of genetic advance as per cent of mean recorded for late leaf spot severity (158.78%), reducing sugar (70.44%), pod yield (51.10%), kernel yield (50.93%), non reducing sugar (36.24%) and test weight (33.02%). High heritability coupled with high genetic advance as per cent of mean were obtained for late leaf spot severity, reducing sugar, pod yield, kernel yield, non reducing sugar and test weight indicating the presence of additive gene action suggesting the distinct possibility of improving these traits through selections earlier reported by Vasanthi *et al.* (1998) and John *et al.* (2006) for late leaf spot severity, Chari (2005) for non reducing sugar and Venkataravana *et al.* (2007) for pod yield per plant, 100 kernel weight and kernel yield per plant.

The genotypic correlation coefficients were higher than the corresponding phenotypic correlation coefficients suggesting strong inherent association among the character studied (Table 2). Pod yield exhibited positive significant association with days to 50 per cent flowering, days to maturity, kernel yield, test weight and oil content. Similar kind of association reported by Mathews *et al.* (2000) for days to 50 per cent flowering, 100 kernel weight and kernel yield and Makhan Lal *et al.* (2003) for days to maturity. On the contrary, negative significant association of pod yield with late leaf spot disease severity and reducing sugar was reported by reported by Das and Roy (1995).

The positive but non significant association exhibited by pod yield with harvest index, strong mature kernel, and non reducing sugar earlier reported by Kumar *et al.* (1998) for strong mature kernel. On contrary, negative non

Table 1 : Parameters of genetic variability for yield and late leaf spot disease resistance in groundnut.

Parameters	Range	Mean	Genotypic variance (δ^2 g)	Phenotypic variance (δ^2 p)	GCV (%)	PCV (%)	Heritability (BS) (%)	Genetic advance as % of mean
Days to 50 % flowering	28.66-33.33	30.81	1.9553	2.2816	4.5375	4.9015	85.70	8.6536
Days to maturity	100.66-119.66	111.08	34.7272	35.2430	5.3050	5.3443	98.54	10.8480
Kernel yield/ plant (g)	2.13-6.53	4.05	1.1678	1.3579	26.6622	28.7505	86.0	50.9345
Test weight (g)	22.0-41.33	30.66	30.3588	38.1246	17.9670	20.1343	79.63	33.028
Shelling (%)	45.15-68.15	58.77	21.8596	36.3345	7.9551	10.2561	60.16	12.7108
Oil content (%)	40.0-48.76	46.11	7.7816	8.0951	6.0487	6.1693	96.13	12.2166
Strong mature kernel (%)	75.68-89.51	84.34	12.4115	23.5945	4.1769	5.7590	52.60	6.2406
Harvest index (%)	25.79-41.70	32.87	17.7451	37.7312	12.8128	18.6833	47.03	18.1008
Late leaf spot disease severity (%)	0.44-69.99	37.38	833.39	837.63	77.2530	77.4261	99.0	158.785
Non reducing (sugar mg/g)	7.85-15.83	11.65	4.3654	4.5333	17.9313	18.2730	96.36	36.2477
Reducing sugar (mg/g)	0.717-2.433	1.602	0.310	0.321	34.7886	35.3923	96.62	70.4419
Pod yield / plant	4.66-10.40	6.89	3.2821	3.6781	26.2621	27.8016	89.23	51.1043

Table 2 : Estimates of genotypic and phenotypic correlation coefficients among pod yield and late leaf spot disease resistance in groundnut

SN	Character		Days to maturity	Kernel yield / pklant (g)	Test weight (g)	Shelling (%)	Oil conent (%)	Strong mature kernel (%)	Harvest index (%)	Late leaf spot severity (%)	Non reducing sugar (mg./g)	Reducing sugar (mg./g)	Pod yield /plant (g)
1	Days to 50 % flowering	G	0.594*	0.639*	0.388	-0.197	0.458	0.181	-0.186	-0.774**	0.068	-0.493*	0.705**
		P	0.544**	0.530**	0.332*	-0.166	0.388*	0.149	-0.053	-0.713**	0.075	-0.43**	0.591**
2	Days to maturity	G		0.483*	0.352	-0.250	0.348	0.464*	-0.160	-0.488*	0.524*	-0.298	0.557*
		P		0.446*	0.301*	-0.187	0.336*	0.341*	-0.094	-0.484**	0.518**	-0.285*	0.518*
3	Kernel yield/ plant (g)	G			0.610*	0.163	0.763**	0.746	0.071	-0.805**	0.321	-0.569*	0.971**
.		P			0.588**	0.288*	0.707**	0.460**	0.045	-0.740**	0.283*	-0.51**	0.915**
4	Test weight (g)	G				-0.179	0.589*	0.786	-0.377	-0.530	0.169	-0.077	0.668*
		P				-0.048	0.523**	0.458**	-0.247	-0.466**	0.141	-0.065	0.595**
5	Shelling (%)	G					0.010	0.016	0.126	0.092	0.126	0.125	-0.104
		P					0.0312	0.033	0.047	0.070	0.079	0.104	-0.056
6	Oil content (%)	G						0.426	-0.108	-0.757**	0.423	-0.435	0.782**
		P						0.303*	-0.098	-0.738**	0.393**	-0.43**	0.729**
7	Strong matu-re kernel (%)	G							0.019	-0.283	0.075	-0.219	0.781
		P							0.013	-0.213	0.055	-0.141	0.451*
8	Harvest index (%)	G								0.209	-0.190	-0.316	0.070
		P								0.109	-0.110	-0.211	0.0193
9	Late leaf spot severity (%)	G									-0.348	0.698**	-0.84**
		P									-0.344*	0.680**	-0.79**
10	Non reducing sugar (mg/g)	G										-0.116	0.281
		P										-0.083	0.261*
11	Reducing sugar (mg/g)	G											-0.598*
		P											-0.55**

Indicates significant at 5% level. **Indicates significant at 1% level.
G = Genotypic correlation coefficient P = Phenotypic correlation coefficient

Table 3 : Direct (Diagonal) and indirect effect of yield and late leaf spot disease resistance character on pod yield in groundnut.

Sr. No.	Character		Days to 50% Flower-uing	Days to maturity	Kernel yield / plant (g)	Test weight (g)	Shelling (%)	Oil content (%)	Strong mature kernel (%)	Harvest index (%)	Late leaf spot severity (%)	Non reducing sugar (mg/g)	Reducing sugar (mg/g)	Pod yield /plant (g)
1	Days to 50 % flowering	G	-0.0961	0.0764	0.5838	-0.0481	0.0398	0.0440	0.0135	-0.0143	0.1957	-0.0123	-0.0879	0.7041
		P	-0.0529	0.0193	0.5111	-0.0088	0.0532	0.0156	0.0000	-0.0005	0.0922	-0.0047	-0.2083	0.5905
2	Days to maturity	G	-0.0571	0.1286	0.4412	-0.0436	0.0506	0.0334	0.0346	-0.0141	0.1235	-0.0940	-0.0532	0.5574
		P	-0.0288	0.0355	0.4306	-0.0079	0.0601	0.0135	-0.0001	-0.0010	0.0626	-0.0324	-0.0183	0.5185
3.	Kernel yield/ plant (g)	G	-0.0614	0.0621	0.9140	-0.0755	-0.0330	0.0733	0.0554	0.0079	0.2035	-0.0576	-0.1013	0.9719
		P	-0.0280	0.0158	0.9646	-0.0147	-0.0925	0.0284	-0.0001	0.0005	0.0957	-0.0177	-0.0332	0.9115
4	Test weight (g)	G	-0.0373	0.0453	0.5571	-0.1239	0.0363	0.0565	0.0585	-0.0272	0.1340	-0.0302	-0.0137	0.6679
		P	-0.0175	0.0107	0.5830	-0.0264	0.0154	0.0210	-0.0001	-0.0027	0.0603	-0.0088	-0.0042	0.5945
5	Shelling (%)	G	0.0189	-0.0322	0.1493	0.0222	-0.2022	0.0010	0.0010	0.0093	-0.0234	-0.0226	0.0223	-0.1045
		P	0.0088	-0.0066	0.2778	0.0013	-0.3212	0.0013	0.0000	0.0005	-0.0091	-0.0049	0.0067	-0.0560
6	Oil content (%)	G	-0.0441	0.0448	0.6972	-0.0729	-0.0020	0.0961	0.0317	-0.0061	0.1915	-0.0760	-0.0776	0.7812
		P	-0.0205	0.0119	0.6816	-0.0138	-0.0100	0.0402	-0.0001	-0.0011	0.0955	-0.0246	-0.0280	0.7279
7	Strong mature kernel (%)	G	-0.0175	0.0598	0.6810	-0.0975	-0.0028	0.0409	0.0743	0.0018	0.0717	-0.0136	-0.0391	0.7805
		P	-00079	0.0121	0.4436	-0.0121	-0.0105	0.0122	-0.0002	0.0001	0.0275	-0.0035	-0.0091	0.4518
8	Harvest index (%)	G	0.0160	-0.0210	0.0837	0.0392	-0.0220	-0.0068	0.0015	0.0860	-0.0397	0.0323	-0.0632	0.0704
		P	0.0027	-0.0034	0.0436	0.0065	-0.0154	-0.0039	0.0000	0.0108	-0.0142	0.0069	-0.0137	0.0193
9	Late leaf spot severity (%)	G	0.0744	-0.0628	-0.7353	0.0656	-0.0187	-0.0727	-0.0211	0.0135	-0.2530	0.0625	0.1243	-0.8437
		P	0.0377	-0.0172	-0.7139	0.0123	-0.0226	-0.0297	0.0000	0.0012	-0.1294	0.0215	0.0438	-0.7946
10	Non reducing sugar (mg/g)	G	-0.0066	0.0674	0.2934	-0.0209	-0.0254	0.0407	0.0056	-0.0155	0.0881	-0.1795	-0.0207	0.2804
		P	-0.0040	0.0184	0.2727	-0.0037	-0.0253	0.0158	0.0000	-0.0012	0.0445	-0.0626	-0.0053	0.2609
11	Reducing sugar (mg/g)	G	0.0474	-0.0384	-0.5196	0.0096	-0.0253	-0.0418	-0.0163	-0.0305	-0.1765	0.0208	0.1781	-0.5989
		P	0.0232	-0.0101	-0.4971	0.0017	-0.0333	-0.0175	0.0000	-0.0023	-0.0880	0.0052	0.0644	-0.5538

Residual effect : Genotypic = 1.0192; Phenotypic = 0.2073. Diagonal entries (bold figures) are direct effects; off diagonal entries are indirect effects

significant association of pod yield with shelling percentage was reported by Moinuddin (1997).

The interrelationships was positive and significant among components of yield and late leaf spot disease resistance characters like reducing sugar with late leaf spot disease severity, days to maturity with non reducing sugar, strong mature kernel with days to maturity, oil content with kernel yield and test weight, test weight with kernel yield and kernel yield with days to maturity and days to 50 per cent flowering. Similar kind of interrelationships reported by Lakshmidevamma *et al.* (2004) for days to 50 per cent flowering, days to maturity, test weight and kernel yield. Venkataramana (2001) for oil content with 100 kernel weight, strong mature kernel and kernel yield.

Path analysis gives a more realistic relationship of characters and helps to identify the effective components of pod yield in groundnut.

A perusal of path coefficients (Table 3) among the characters which showed significant positive correlation with pod yield revealed that kernel yield per plant exerted the highest positive direct effect on pod yield earlier reported by Lakshmidevamma *et al.* (2004), whereas shelling percentage exerted high but negative direct effect on pod yield. It was also observed that the high indirect effect exerted through kernel yield per

Plant on pod yield through days to 50 per cent flowering, days to maturity, oil content, strong mature kernel and test weight. This is in accordance with the findings of Lakshmidevamma *et al.* (2004). Late leaf spot disease severity also exerted negative direct as well as indirect effect through days to maturity, kernel yield per plant, shelling per cent and oil content on pod yield.

High GCV, h^2 and GAM for late leaf spot indicate additive gene action, which is amenable for selection for late leaf spot resistance. It is evident that kernel yield per plant emerged as major components of pod yield to emphasize selection. Since, oil content, strong mature kernel, days to 50 per cent flowering, days to maturity and non reducing sugar through kernel yield, these characters also be included in formulating the selection criterion for improving pod yield in groundnut.

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