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CORRELATION AND PATH ANALYSIS IN F3 AND F4 GENERATIONS OF INTRASPECIFIC CROSSES IN GROUNDNUT

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ABSTRACT

Forty genotypes of groundnut (*Arachis hypogaea* L) comprising 33 progenies and 7 parents were studied in F_3 and F_4 generations. Correlation and path coefficient analyses were computed for yield and yield contributing characters. Yield improvement could be achieved by selection for number of mature pods, 100 kernel weight, number of flowers, number of pegs and peg flower ratio since the genotypic correlation coefficients for these characters were positive and significant and they had high direct and indirect effects on pod yield.

KEY WORDS : Groundnut, Infraspecific Crosses, Correlations, Path analysis, Selection for Yield.

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop in India and the average yield per ha is low compared to other countries. To increase the yield levels of this crop, it is essential to know the association of yield with other attributes before embarking on a breeding programme. Biometrical procedures such as correlations and path analysis establish the extent of association between yield and its attributes, so that these yield components may form the criteria for selection programme. The investigation

Table 1. Genotypic and phenotypic correlation coefficients between yield and its components in F_3 generation

		Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}
Y	G	1.000	0.262	-0.142	-0.346*	0.733**	0.740**	0.907**	0.908**	0.549**	0.580**	-0.267	-0.193	-0.106	0.081
	P	1.000	0.129	-0.002	0.270	0.888**	0.867**	0.969**	0.967**	0.113	0.185	-0.013	0.126	0.672**	0.548**
X_1	G		1.000	-0.925**	-0.196	-0.478**	-0.461**	-0.245	0.245	0.491**	0.381*	0.469**	0.096	0.630**	0.451**
	P		1.000	-0.777**	0.012	-0.085	-0.044	0.078	0.169	0.163	0.226	0.187	0.093	0.331*	0.259
X_2	G			1.000	0.499**	0.548**	0.537**	0.306*	-0.131	-0.544**	-0.491**	-0.374*	-0.091	-0.702**	-0.496**
	P			1.000	0.124	0.237	0.191	0.066	-0.058	-0.280	-0.409**	-0.218	-0.072	-0.291	-0.208
X_3	G				1.000	0.230	-0.018	-0.511**	-0.702**	-0.073	0.040	-0.188	-0.493**	-0.044	-0.529**
	P				1.000	0.316*	0.340*	0.302	0.234	-0.132	-0.055	-0.086	0.130	0.179	0.069
X_4	G					1.000	0.942**	0.873**	0.617**	-0.097	0.666**	-0.302	-0.377*	-0.648**	-0.342*
	P					1.000	0.949**	0.919**	0.859**	-0.144	0.305*	-0.025	0.053	0.364*	0.304*
X_5	G						1.000	0.841**	0.664**	0.026	0.580**	-0.147	-0.043	-0.559**	-0.493**
	P						1.000	0.896**	0.855**	-0.116	0.234	0.031	0.357*	0.397**	0.168
X_6	G							1.000	0.659**	0.143	0.748**	-0.549**	-0.280	-0.208	0.055
	P							1.000	0.934**	-0.111	0.213	-0.029	0.126	0.682**	0.576**
X_7	G								1.000	0.864**	0.457**	0.181	-0.136	-0.195	-0.118
	P								1.000	0.126	0.141	0.232	0.166	0.161	0.498**
X_8	G									1.000	0.195	0.516**	0.232	0.462**	0.223
	P									1.000	0.092	0.078	0.067	0.025	-0.071
X_9	G										1.000	0.357*	0.400**	0.305*	-0.062
	P										1.000	0.164	0.191	0.071	-0.059
X_{10}	G											1.000	0.336*	-0.097	-0.508**
	P											1.000	0.149	0.041	-0.107
X_{11}	G												1.000	0.348*	-0.343*
	P												1.000	0.189	-0.362*
X_{12}	G													1.000	0.763**
	P													1.000	0.815**
X_{13}	G														1.000
	P														1.000

Table 2. Genotypic and phenotypic correlation coefficients between yield and its components in F_4 generation.

		Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}
Y	G	1.000	0.683**	-0.658**	0.763**	0.881**	0.947**	0.972**	0.993**	0.484**	0.544**	0.104	-0.201	0.825**	0.910*
	P	1.000	0.457**	-0.433**	0.313*	0.865**	0.834**	0.937**	0.968**	0.439**	0.073	0.222	-0.022	0.639**	0.614*
X_1	G		1.000	-0.869**	0.919**	0.518**	0.675**	0.670**	0.696**	0.315*	-0.252	0.101	0.301	0.699**	0.422*
	P		1.000	-0.594**	0.391*	0.352*	0.382*	0.443**	0.418**	0.164	-0.120	0.011	0.123	0.594**	0.341*
X_2	G			1.000	-0.826**	-0.633**	-0.712**	-0.669**	-0.681**	-0.266	0.479**	-0.085	-0.039	-0.561**	-0.569*
	P			1.000	-0.327*	-0.367*	-0.362*	-0.446**	-0.410**	-0.107	0.354*	-0.044	-0.037	-0.413**	-0.366
X_3	G				1.000	0.808**	0.781**	0.769**	0.782**	0.191	-0.512**	0.175	-0.251	0.478**	0.671*
	P				1.000	0.347*	0.297	0.359*	0.295	-0.038	-0.283	-0.001	-0.086	0.166	0.263
X_4	G					1.000	0.933**	0.940**	0.913**	0.255	0.371*	0.083	-0.471**	0.609**	0.840*
	P					1.000	0.934**	0.923**	0.838**	0.091	0.165	0.134	-0.095	0.378*	0.397*
X_5	G						1.000	0.987**	0.941**	0.196	0.430**	0.172	-0.122	0.815**	0.820*
	P						1.000	0.905**	0.795**	0.044	0.152	0.098	0.258	0.452**	0.248
X_6	G							1.000	0.978**	0.263	0.483**	0.199	-0.158	0.847**	0.905*
	P							1.000	0.910**	0.106	0.148	0.177	0.027	0.684**	0.615
X_7	G								1.000	0.451**	0.493**	0.269	-0.201	0.857**	0.927
	P								1.000	0.425**	0.061	0.433**	-0.064	0.632**	0.622
X_8	G									1.000	0.167	-0.091	-0.249	0.246	0.373
	P									1.000	0.170	0.182	-0.146	0.087	0.18
X_9	G										1.000	-0.499**	-0.035	-0.112	-0.129
	P										1.000	0.011	-0.014	-0.022	-0.075
X_{10}	G											1.000	-0.202	0.377*	0.221
	P											1.000	-0.130	0.194	0.210
X_{11}	G												1.000	0.362*	-0.262
	P												1.000	0.227	-0.378*
X_{12}	G													1.000	0.819**
	P													1.000	0.744**
X_{13}	G														1.000
	P														1.000

* Significant at 5 per cent level; ** Significant at 1 per cent level.

reported here was undertaken in F_3 and F_4 generations of intra-specific crosses of groundnut.

MATERIALS AND METHODS

Five crosses were effected involving five spanish bunch and two virginia bunch cultivars during summer 1989 season at the Oilseeds Department, School of Genetics, Tamil Nadu Agricultural University, Coimbatore. From the F_2 generation, 33 progenies were selected and used for the present study along with the parents. The details of the crosses are Co-2 x R 33-1 (10 progenies), VRI-2 x R 33-1 (4 progenies), JL 24 x TMV10 (14 progenies), Co-2 x TMV 10 (3 progenies) and VRI-3 x (Ah 316/s x TMV 10) (2 progenies).

F_3 and F_4 generations were raised during March'91 and December '91 respectively. Both the generations were raised in randomised block design with three replications and adapting a spacing of 30 x 10 cm. Each progeny was raised in a single row of 3 m length. The progenies were forwarded from F_3 to F_4 based on high mature pod number and pod yield.

Data were collected on five randomly selected plants in each entry per replication on 14 characters *viz.*, plant height (X_1), number of primary branches (X_2), number of secondary branches (X_3), number of flowers (X_4), number of pegs (X_5), number of mature pods (X_6), pod yield (Y), kernel yield (X_7), 100 pod weight (X_8), 100 kernel weight (X_9), shelling pattern (X_{10}), peg-flower ratio (X_{11}), pod-flower ratio (X_{12}) and pod-peg ratio (X_{13}). Genotypic and phenotypic correlations were worked out using the formula suggested by Johnson *et al.* (1955). Path coefficient analysis was carried out in accordance with Dewey and Lu (1959).

Table 3. Direct (Diagonal) and indirect effects of different characters on pod yield in F_3 generation

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	Correlation with yield (G)
X_1	0.037	0.041	0.003	-0.024	0.126	-0.110	0.158	0.065	-0.001	-0.165	0.013	0.086	0.033	0.262
X_2	-0.034	-0.044	-0.008	0.050	-0.146	0.137	-0.084	-0.072	-0.001	0.131	-0.012	-0.096	0.037	-0.142
X_3	-0.007	-0.022	-0.017	0.212	0.005	-0.229	-0.452	-0.010	0.000	0.066	-0.068	0.137	0.039	-0.346*
X_4	-0.018	-0.024	-0.004	0.092	-0.257	0.391	0.397	-0.013	0.002	0.106	-0.052	0.088	0.025	0.733**
X_5	-0.017	-0.024	0.000	0.087	-0.272	0.377	0.427	-0.003	0.006	0.052	-0.006	0.076	0.037	0.740**
X_6	-0.009	-0.014	0.008	0.080	-0.229	0.448	0.424	-0.019	0.039	0.193	-0.038	0.028	-0.004	0.907**
X_7	0.009	0.006	0.012	0.057	-0.181	0.295	0.643	0.114	0.002	-0.066	-0.019	0.027	0.009	0.908**
X_8	0.018	0.024	0.002	-0.009	-0.007	0.064	0.555	0.132	-0.001	-0.181	0.032	-0.063	-0.017	0.549**
X_9	0.014	0.022	-0.001	0.061	-0.158	0.335	0.294	-0.026	0.156	-0.125	0.055	-0.042	-0.005	0.580**
X_{10}	0.017	0.017	0.003	-0.028	0.040	-0.246	0.116	0.068	-0.001	-0.350	0.046	0.013	0.038	-0.267
X_{11}	0.004	0.004	0.008	-0.035	0.012	-0.125	-0.088	0.031	-0.001	-0.118	0.137	-0.047	0.025	-0.193
X_{12}	0.023	0.031	0.017	-0.060	0.152	-0.093	-0.125	0.061	-0.001	0.034	0.048	-0.136	-0.057	-0.106
X_{13}	0.017	0.022	0.009	-0.032	0.134	0.025	-0.075	0.029	-0.001	0.178	-0.047	-0.104	-0.074	0.081

R = 0.1 * Significant at 5 per cent level; ** Significant at 1 per cent level. (G) - Genotypic

RESULTS AND DISCUSSION

Correlations

The correlation coefficients for the fourteen characters are presented in Tables 1 and 2 for F_3 and F_4 generations respectively. In the present investigation, genotypic correlations were slightly higher than the phenotypic correlations for most of the characters studied both in F_3 and F_4 generations. It may be that the phenotypic expression of the correlations were depressed by environmental influence (Deshmukh *et al.*, 1987).

The pod yield had significant positive genotypic correlation with number of flowers, number of pegs, number of mature pods, kernel yield, 100 pod weight and 100 kernel weight in both the generations. Swamy Rao *et al.* (1988) reported the positive association of number of flowers and number of pegs with pod yield while Reddy *et al.* (1987) showed positive association of number of mature pods and kernel yield with pod yield. Deshmukh *et al.* (1987) reported positive association of 100 pod weight with pod yield and positive association of 100 kernel weight and pod yield was reported by Chhonkar and Arvindkumar (1986).

In the present study, pod yield exhibited a positive significant association with plant height, number of secondary branches, pod- flower ratio and pod-peg ratio in F_4 generation. Such positive association of pod yield with number of secondary branches and pod- flower ratio Sivakumar *et al.*, (1989 pod-peg ratio (Ravindranath *et al.*, 1988) and negative association with number of primary branches in F_4 generation (Pushkaran and Gopinathan Nair, 1988) were reported earlier.

The inter correlation estimated for the yield components revealed that number of flowers, number of pegs, number of mature pods, kernel yield and 100 kernel weight were significantly and positively associated with one another in both the generations. It indicates the possibility of simul taneous improvement of these traits by selection. This, in turn, will improve the pod yield since they are positively correlated with the pod yield.

Path Coefficient Analysis.

The direct and indirect effects of path-coefficients are presented in Tables 3 and 4 for F_3 and F_4 respectively. The number of flowers,

Table 4. Direct (Diagonal) and indirect effects of different characters on pod yield in F_4 generation

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	Correlation with yield (G)
X_1	0.067	-0.108	-0.039	0.535	-0.660	0.256	0.505	0.034	0.022	-0.016	0.080	0.144	-0.137	0.683**
X_2	-0.058	0.124	0.035	-0.654	0.696	-0.255	-0.494	-0.029	-0.043	0.013	-0.010	-0.115	0.131	-0.658**
X_3	0.061	-0.103	-0.042	0.835	-0.764	0.293	0.567	0.021	0.045	-0.027	-0.067	0.098	-0.155	0.763**
X_4	0.035	-0.079	-0.034	0.997	-0.913	0.358	0.662	0.027	0.033	-0.013	-0.125	0.125	-0.192	0.881**
X_5	0.045	-0.088	-0.033	0.965	-0.978	0.377	0.682	0.021	0.038	-0.026	-0.032	0.168	-0.189	0.947**
X_6	0.045	-0.083	-0.033	0.971	-0.966	0.381	0.709	0.028	0.025	-0.030	-0.042	0.174	-0.209	0.972**
X_7	0.046	-0.085	-0.033	0.944	-0.920	0.373	0.725	0.048	0.026	0.041	-0.053	0.176	-0.214	0.993**
X_8	0.021	-0.033	-0.081	0.264	-0.191	0.172	0.327	0.107	-0.015	0.014	-0.066	0.051	-0.086	0.484**
X_9	-0.017	0.060	0.022	-0.384	0.421	0.108	0.213	0.018	0.089	0.076	-0.009	-0.023	-0.030	0.544**
X_{10}	0.007	-0.011	-0.007	0.086	-0.168	0.076	0.195	-0.010	0.044	-0.152	0.054	0.078	-0.051	0.140
X_{11}	0.020	-0.005	0.011	-0.487	0.120	-0.060	-0.145	-0.027	0.003	-0.031	0.266	0.075	0.060	-0.201
X_{12}	0.047	-0.070	-0.020	0.629	-0.797	0.323	0.621	0.026	0.010	-0.057	0.096	0.206	-0.189	0.825**
X_{13}	0.040	-0.071	-0.028	0.868	-0.802	0.345	0.672	0.040	0.011	-0.034	-0.070	0.169	-0.231	0.910**

R = 0.025 * Significant at 5 per cent level; ** Significant at 1 per cent level. (G) - Genotypic

number of mature pods, kernel yield, 100 pod weight, 100 kernel weight, peg-flower ratio and plant height and positive direct effect on pod yield in both generations. Deshmukh *et al.* (1987) had reported positive direct effects of number of mature pods, 100 pod weight and 100 kernel weight on pod yield, while Rao *et al.* (1983) reported positive direct effects of kernel yield and plant height on pod yield. Number of primary branches and pod-flower ratio exhibited negative direct effect in F_3 but showed positive direct effect on pod yield in F_4 while number of secondary branches showed a negative direct effect on pod yield in both generations. Similar findings were reported by Chandola *et al.* (1973).

The negative direct effects were recorded for number of pegs, shelling outturn and pod-peg ratio in both generations. In F_3 generation, kernel yield and number of mature pods besides their direct effect, also showed high positive indirect effects. But in F_4 generation, the maximum positive indirect effects were exerted through number of flowers followed by kernel yield and number of mature pods. The path analysis showed that pod yield was highly influenced by number of flowers, number of pegs, number of mature pods, kernel yield and 100 kernel weight both directly and indirectly. The genotypic correlation coefficients for these characters were also positive and highly significant. Hence, an emphasis on these traits in selection for groundnut improvement may be rewarding.

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EFFECT OF DATES OF SOWING AND GROWTH REGULATORS ON SEED COTTON YIELD OF IRRIGATED COTTON

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ABSTRACT

A field experiment was conducted at the Tamil Nadu Agricultural University, Coimbatore during winter 1989, summer 1990 and summer 1991 seasons to study effect of different dates of sowing and growth regulators on seed cotton yield of the cotton variety MCU.11. The results revealed that sowing on 15th August during winter and on 15th February during summer were found to be optimum dates for higher seed cotton yield. Application CCC at 40 ppm alternated with DAP one per cent would promote seed cotton yield with normal dates of sowing and compensate the yield losses due to delayed sowings during winter and summer seasons under irrigated conditions.

KEY WORDS : Cotton, Sowing, Dates, Growth, Regulators, Yield.

Cotton is very specific to its climatic requirements and reacts unfavourably for any shift in dates of sowing from normal period. Delay in time of sowing resulted in reduced yield and this was mainly due to premature shedding of buds and bolls. Excessive shedding could be effectively controlled by spraying growth regulators at appropriate time. Hence, the present study was conducted to study the efficiency of growth regulators on seed cotton yield with varied dates of sowing.

MATERIALS AND METHODS

Field experiments were conducted during winter 1989, summer 1990 and summer 1991 seasons at the Department of Agronomy. Agricultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore to find out the effect growth regulators under varied dates of sowing. The soil type in different soils was clay loam, with 150-270 kg ha^{-1} of available N, 13.5 - 17.2 kg ha^{-1} of available P_2O_5 and 500 - 656 kg available K_2O. The treatments, comprise four dates of sowing (Ist August, 15th August, 1st September and 15th September during winter and 1st February, 15th February, 1st March and 15th March during summer) in the main plots and spraying 5 ppm triacontanol at 40, 60 and 80 days after sowing DAS (G$_1$), spraying 40 ppm of triacontanol CCC (2 chloro ethyl trimethyl ammonium chloride) at 70 and 80 DAS (G$_2$, spraying 1 per cent Di-ammonium phosphate (DAP) at 70, 80 and 90 DAS (G$_3$), spraying 40 ppm of CCC alternated with 1 per cent DAP at 60, 70, 80 and 90 DAS (G$_4$) and water spray at 60, 70 and 90 DAS (G$_5$ on the sub-plots. The experiment was laid out in split plot design with three replications. A basal dressing of 40 kg. N, 40 Kg P_2O_5 and 40 kg of K_2 per hectare each were applied to all the treatments and 40 kg N was top dressed at the time of earthing up. Irrigations were given based on the necessity and required plant protection measures were taken based on the recommendations. The growth regulators were