Agric. Res. J. Kerala 1988, 26 (2) 175—182

CORRELATION AND PATH ANALYSIS IN GROUNDNUT IN THE SUMMER RICE FALLOWS

K. Pushkaran and V, Gopinathan Nair
College of Agriculture, Trivandrum 695 522, India

India ranks first in the world both in area and production of groundnut. In Kerala, groundnut is one of the two important annual oil seed crops. Though the traditional area for the crop is in the uplands during kharif, a potential area for large scale cultivation is the summer rice fallows. But varieties suited for the specific situation remain to be developed.

To improve yield, a complex character exhibiting continuous variation with polygenic control, information on variability, correlation of characters with yield and their direct and indirect effects on the economic trait will be useful. Thc economic produce being concealed and due to lack of clear-cut relationships between canopy characters and pod yield in groundnut, more and more studies on these lines are required as suggested by Prasad and Kaul (1980).

Materials and Methods

Eighty divergent groundnut varieties of indigenous and exotic origin selected from a germplasm were grown in a randomised block design, replicated thrice, during 1982 summer in rice fallows at the Agricultural Research Station, Mannuthy. In each variety and replication. three rows of ten plants each were grown at a spacing of 20 cm within and 30 cm between rows. Five observational plants were marked at random in each variety in each replication, avoiding the border plants. Eighteen characters were studied. The oil content was estimated by the cold percolation method of Kartha and Sethi (1957).

The significance of variation of each character between varieties was tested by the analysis of variance technique. Correlation coefficients between all the characters at the genotypic and phenotypic levels were computed by referring to the formulae of Aljibouri *et al.* (1958) and the significance of correlation coefficients was tested by Student's 't' test. Path coefficient analysis for pod yield at the genotypic level was carried out using eight selected characters as the causes and dry pod yield as the effect. The direct and indirect effects of the characters on pod yield were worked out as suggested by Wright (1921) and elaborated by Dewey and Lu (1959).

Results and Discussion

The coefficients of correlation at the genotypic and phenotypic levels between dry pod yield and the other seventeen characters and among themselves are presented in Table 1. Both at genotypic and phenotypic levels, pod yield was

highly correlated positively with plant height on the 50th day, length of top, fresh weight of pods, number of mature pods and number of immature pods. Besides, pod yield was significantly and highly correlated positively, at phenotypic level with number of flowers and haulms yield. Moderately significant positive correlation was seen at the genotypic level between pod yield and oil content. Positive significant genotypic and phenotypic correlations between pod yield and number of mature pods observed in the present study are in agreement with the results of Rao (1980). The recorded correlation between length of the first primary branch and yield by Rao (1980) is in agreement with the prassnt

Table 1

Genotypic and phenotypic correlation coefficients between yield and 17 characters and among themselves in summer rice fallows

Sl. No.	Characters	Dry pod	Duration upto flowering	Plant height on the 50th day	No. of branches on the 50th day
		X1	X2	X3	X4
X1	Dry pod yield	—	-0.209 xx	0.506 x	-0.302 xx
X2	Duration upto flowering	-0.151 x	—	-0.647 xx	0.827 xx
X3	Plant height on the 50th day	0.236 xx	-0.393 xx	—	-0.852 xx
X4	Number of branches on the 50th day	0.155x	0.187x	-0.135	—
X5	Number of leaves on the 50th day	0.098	0.443 xx	-0.209 xx	0.338 xx
X6	Duration upto maturity	-0.058	3.564 xx	-0.240 xx	0.103
X7	Number of flowers	0.253 xx	0.052	-0.126	0.697 xx
X8	Length of top	0.210 xx	0.040	0.496 xx	-0.011
X9	Number of basal primary branches	0.058	0.530 xx	-0.276 xx	0.320 xx
X10	Number of branches	-0.014	0.521 xx	-0.397 xx	0.292 xz
X11	Fresh weight of pods	0.921 xx	-0.020	0.164x	0.168x
X12	Haulms yield	0.321 xx	0.241 xx	-0.077	0.219xx
X13	Number of leaves	0.072	0.506 xx	-0.244xx	0.276 xx
X14	Number of mature pods	0.667 xx	-0.046	0.106	0.139
X15	Number of immature pods	0.295 xx	0.054	0.011	0.079
X16	100 pod weight	-0.028	-0.122	0.091	0.094
X17	100 kernel weight	0.021	0.218xx	-0.065	0.249 xx
X18	Oil content	0.084	0.210xx	-0.120	0.023

correlation batwaen yield and length of top. Positive significant correlation noticed at the genotypic level between pod yield and oil content is in consonance with the finding of Kuriakose (1981). Negative significant correlation was obtained at the genotypic level between pod yield and duration upto flowering.

Fresh weight of pods and number of mature pods were correlated each other and they in turn were correlated with a number of other impo.tant characters. The number of mature pods per plant was correlated negatively at the genotypic level with 100 pod and kernel weights, The interrelation batween canopy characters points out that as length of top increases, the number of branches decreases leading to a reduction in number of leaves and flowers. The relationship between oil content and kernel weight was negative.

Table 1 (continued)

Si. No.	No. of leaves on the 50 th day	Duration upto maturity	No. of flowers	Length of top	No. of basal primary branches	No. of branches
	X5	X6	X7	X8	X9	X10
X1	-0.347 xx	-0.031	-0.272 xx	0.221 xx	-0.181 x	-0.185 x
X2	0.691 xx	0.516 xx	0.120	0.052	0.757 xx	0.693 xx
X3	-0.703 xx	-0.348 xx	-0.474 xx	0.328 xx	-0.607 xx	-0.732 xx
X4	0.836 xx	0.288 xx	-0.016	-0.091	1.054 xx	0.887 xx
X5	—	0.597 xx	0.328 xx	0.149	1.003 xx	0.964 xx
X6	0.388 xx	—	0.106	0.442 xx	0.546 xx	0.546,xx
X7	0.349 xx	0.645 xx	—	0.035	0.255 xx	0.420 xx
X8	0.184 x	0.218 xx	0.103	—	0.057	0.038
X9	0.779 xx	0.390 xx	0.256 xx	0.103	—	0.906 xx
X10	0.747 xx	0.416 xx	0.352 xx	0.088	0.848 xx	—
X11	0.221 xx	0.110	0.259 xx	0.276 xx	0.196 x	0.116
X12	0.458 xx	0.264 xx	0.302 xx	0.342 xx	0.473 xx	0.536 xx
X13	0.739 xx	0.526 xx	0.287 xx	0.293 xx	0.085 xx	0.840 xx
X14	0.038	0.005	0.122	0.133	0.003	-0.049
X15	0.088 xx	0.222 xx	0.157 x	0.172 x	0.301 xx	0.321 xx
X16	0.188 x	0.169 x	-0.034	0.116	0.156 x	0.165 x
X17	0.395 xx	0.329 xx	0.072	0.201 x	0.457 xx	0.393 xx
X18	0.079	0.180 x	-0.182 x	0.037	0.101	0.124

Significant negative correlation at the genotypic level between pod yield and duration upto flowering and highly significant positive correlation between duration upto flowering and maturity, but negative non-significant correlation between pod yield and days to maturity under the rice fallow condition, had got valuable implications of practical utility. The summer rice fallows have a short span of nearly 90 days only. None of the adapted promising varieties is found to matura in 90 days. It is evident from the present investigation that early flowering as well as early maturing groundnut genotypas combining high yield can be evolved through suitable breeding methods. Negative correlation between yield and duration upto maturity was recorded earlier by Patra (1980).

The direct and indirect effects of eight selected characters on dry pod yield are presented in Table 2. Fresh weight of pods had the highest direct effect on pod yield which was based on its very high positive genotypic correlation with pod yield. The character exerted positive indirect effects via number of leaves and mature pods while via other characters the indirect effects were negative. Next to fresh weight of pods, number of leaves had the highest positive direct effect, though the character had only negative non-significant correlation with yield. The observed direct effect

Table 1 (continued)

Sl. No.	Fresh weight of pods	Haulms yield	No. of leaves	No. of mature pods	No. of immature pods
	X11	X12	X13	X14	X15
X1	0.783 xx	0.094	-0.150	0.509 xx	0.229 xx
X2	0.104	0.483 xx	0.669 xx	-0.001	0.160x
X3	0.350 xx	-0.316 xx	-0.582 xx	0.203 xx	-0.016
X4	-0.246 xx	0.803 xx	0.809 xx	-0.803 xx	0.011
X5	-0.084	0.682 xx	0.989 xx	-0.383 xx	0.332 xx
X6	0.368 xx	0.487 xx	0.695 xx	0.053	0.457 xx
X7	-0.329 xx	0.231 xx	0.293 xx	-Q,319xx	0.041
X8	0.437 xx	0.374 xx	0.327 xx	0.108	0.093
X9	0.113	0.644 xx	0.890 xx	-0.230 xx	0.242 xx
X10	0.101	0.782 xx	0.914 xx	-0.199x	0.353 xx
X11	—	-0.032	0.176x	0.362 xx	0.445 xx
X12	0.447 xx	—	0.832 xx	-0.098	0.437 xx
X13	0.224 xx	0.532 xx	—	-0.103	0.240 xx
X14	0.628 xx	0.188x	0.062	—	0087
X15	0.369 xx	0.287 xx	0.360 xx	0.210 xx	—
X16	0.119	0.187x	0.175x	-0.354 xx	0.187x
X17	0.129	0.303 xx	0.474 xx	-0.244 xx	0.113
X18	0.088	0.0v9	0.135	0.070	0.181 x

of number of leaves can be due to its significant correlation with number of flowers, length of top, fresh weight of pods, 100 pod and kernel weights.

Another character with appreciable direct positive effect was the number of flowers, though the trait recorded negative significant correlation with yield. The number of flowers exerted positive indirect effects via number of leaves and 100 pod weight whereas that through length of top, fresh weight of pods, haulms yield and number of mature pods were negative.

Number of mature pods per plant had only low positive direct effect, even though the character recorded vary high positive genotypic and phenotypic correlation with yield which is in disagreement with the report by Singh *et al.* (1979). The very high positive indirect effect of this character through fresh weighf of pods which contributed to the highest positive direct effect justifies the high positive correlation. As such, a direct selection for this character will be effective in improving the yield.

The highest negative direct effect on pod yield was exerted by haulms yield. This is in conformity with the result of Kuriakose (1981). Number of basal primary

Table 1 (continued)

Sl. No.	100 pod weight	100 kernel weight	Oil content
	X16	X17	X18
X1	-0.049	0.039	0.164 x
X2	-0.142	0.248xx	0.262 xx
X3	0.141	0.083	-0.019
X4	0.236 xx	0.089	0.090
X5	0.261 xx	0.543 xx	0.119
X6	0.185x	0.363 xx	0.215 xx
X7	-0.040	0.080	-0.145
X8	0.198 x	0.345xx	0.081
X9	0.197x	0.577 xx	0.131
X10	0.189x	0.452 xx	0.143
X11	0.246 xx	0.267 xx	0.195x
X12	0.298 xx	0.479 xx	0.137
X13	0.209 xx	0.568 xx	0.166x
X14	-0.584 xx	-0.397 xx	0.133
X15	0.316 xx	0.286 xx	0.308 xx
X16	—	0.532 xx	-0.122
X17	0.531 xx	—	-0.086
X18	-0.135	-0.093	—

x Significant at 5 per cent probability
xx Significant at 1 par cent probability

Genotypic correlation coefficients above the diagonal.
Phenotypic correlation coefficients below the diagonal.

Table 2

Direct and indirect effects of eight component characters on pod yield

Sl. No,	Components	Direct effects	Indirect effects via								Totai correla-tions
			No. of flowers	Length of top	No. of basal primary branches	Fresh weight of pods	Haulms yield	No. of leaves	No. of mature pods	100 pod weight	
1	Number of flowers	0.174	—	-0.006	-0.087	-0.362	-0.081	0.086	-0.002	0.007	-0.272
2	Length of top	-0.179	0.006		-0.019	0.480	-0.131	0.096	0.001	-0.032	0.221
3	Number of basal primary branches	-0.341	0.044	-0.168		0.125	-0.067	0.261	-0.002	-0.032	-0.181
4	Fresh weight of pods	1.100	-0.057	-0.078	-0.039		-0.158	0.052	0.003	-0.040	0.783
5	Haulms yield	-0.350	0.040	-0.067	-0.220	0.496		0.244	-0.001	-0.049	0.094
6	Number of leaves	0.293	0.051	-0.059	-0.304	0.194	-0.291		-0.001	0.034	-0.150
7	Number of mature pods	0.007	-0.056	-0.019	0.078	0.399	0.035	-0.030		0.095	0.509
8	100 pod weight	-0 163	-0.007	-0,036	-0.067	0.271	-0.104	0.061	-0.004	-	-0.049

Residue 0.479

branches also had appreciable negative direct effect and the negative correlation noticed between the character and yield explains the direct effect. Another trait with negative direct effect was length of top though it had positive significant correlation with yield. The low residual value testify that a very high proportion of the genetic variability towards pod yield had been included in the analysis.

An ideal plant type for the rice fallow condition during summer will be one with compact medium tall canopy with moderate number of basal primary branches of short internodes bearing moderate number of dark green leaves, early in flowering, producing more flowers and setting more number of pods of medium size with heavy kernels of high oil content. The plants will mature early and give a heavy yield of fresh pods. In unit area, more number of such plants can be accommodated efficiently, resulting in high level of productivity.

Summary

Pod yield and seventeen other characters were studied in eighty groundnut varieties raised in summer rice fallows. Correlation coefficients at the genotypic and phenotypic levels were computed between these characters and path analysis for pod yield was carried out considering eight components.

Dry pod yield was highly correlated positively with plant height on the 50th day, length of top, fresh weight of pods, number of mature pods and number of immature pods both at the genotypic and phenotyic levels. Pod yield was also correlated highly and positively with number of flowers and haulms yield phenotypically. Pod yield recorded highly significant negative correlation with duration upto flowering, number of branches and leaves on the 50th day and number of flowers while it was moderate with number of branches. Positive correlation of duration upto flowering and maturity and lack of significant correlation of the latter with pod yield suggest the possibility of recombining high yield with short duration.

Fresh weight of pods had the highest positive direct effect on dry pod yield. Number of leaves, flowers and mature pods also had positive direct effects in that order. Number of mature pods exarted positive indirect effects via fresh weight of pods, number of basal primary branches, haulms yield and 100 pod weight. Length of top, number of basal primary branches, haulms yield and 100 pod weight had negative direct effects on pod yield, of which that by haulms yield was the highest.

Acknowledgement

This forms part of Ph. D thesis submitted to the Kerala Agricultural University in 1983 by the first author. He is thankful to the Kerala Agricultural University for granting study leave.

References

Al-jibouri, H. A., Miller, P. A. and Robinson, H. F. 1958, Genotypic and environmental variances and covariances in an upland cotton cross of interspecific origin. *Agron. J.* 50: 633-636.

Dewey, D. R. and Lu, K. H. 1959. A correlation and path coefficient analysis of components of crested wheat grass for seed production. *Agron. J.* 51: 515-518.

Kartha, A, R. S. and Sethi, A. S. 1957. A cold percolation method for rapid gravimetric estimation of oil in small quantities of oil seeds. *Indian J. agric. sci. 27:* 211-218.

Kuriakose, K. P. 1981. Yield components and selection index in groundnut *(Arachis hypogaea* L.) M. Sc. (Ag) thesis, Kerala Agricultural University. Trichur,

Patra, G. J. 1980. Multiple selection criteria for the genetic improvement in some hybrid populations of groundnut *(Arachis hypogaea* L.) *National Seminar on the Application of Genetics to the Improvement of Groundnut.* Tamil Nadu Agrl. University, Coimbatore, pp. 27-38.

Prasad, M. R. V. and Kaul, S. 1980. Problems and prospects in the genetic improvement of groundnut. *National Seminar on the Application of Genetics to the Improvement of Groundnut.* Tamil Nadu Agricultural University Coimbatore, pp. 127-139.

Rao, S. T. 1980. Assessment of genetic variability in bunch groundnut. *National Seminar on the Application of Genetics to the Improvement of Groundnut.* Tamil Nadu Agrl. University, Coimbatore, pp. 239-243.

Singh, A. S., Singh, M. and Labana, K. S. 1979. Variability and correlation studies in groundnut after hybridisation. *Madras agric. J.* 66: 565-570

Wright, S. 1921. Correlation and causation. *J. agric. Res.* **20:** 557-585.