

VARIABILITY AND ASSOCIATION ANALYSIS ON PHYSIOLOGICAL TRAITS IN COWPEA (*Vigna unguiculata* L.)

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ABSTRACT

Estimates of variability, heritability, genetic advance, correlation and path analysis were carried out in 32 genotypes of cowpea for physiological traits. The highest genotypic coefficient of variation and genetic advance as per cent of mean were observed for total chlorophyll content, primary leaf area and leaf area index. This shows that genotypic variance for these characters is probably owing to high additive gene effect. Harvest index was positively and significantly correlated with seed yield. Harvest index, leaf area index, total chlorophyll content, plant height and primary leaf area had high positive direct effect on seed yield. The studies suggested that selection for primary leaf area and leaf area index is important to evolve high yielding varieties of cowpea.

Key Words : Sesame, Physiological traits, Correlation

Physiological traits are responsible for the difference in yielding capacity of pulses (Pathik *et al.*, 1993). However, this approach is seriously handicapped by the lack of knowledge with regard to physiological systems involved in crop productivity. The information in respect to extent of variability, heritability, correlation etc., regarding characters which are known to be directly or indirectly related to yield is inadequate. The present investigation was therefore, undertaken to study the extent of variability for physiological traits in different cowpea genotypes and its relationship with yield.

MATERIALS AND METHODS

The experiment comprising 32 genotypes was laid out in randomized block design with three replications at Agricultural College and Research Institute, Madurai during Kharif, 1993. Each entry was raised in a single row of 3 metre length with a spacing of 40 cm x 15 cm. Seven plants selected at random from each entry in each replication were utilised for recording following seven characters namely plant height, primary leaf area, days to first flowering, total chlorophyll content, leaf area index, harvest index and seed yield. Total chlorophyll content was estimated as suggested by Yoshida (1976). Leaf area was measured using leaf area meter

Table 1. Estimates of different variability parameters in cowpea.

Characters	Mean	Coefficient of variation		Heritability (%)	Genetic advance as per cent of mean
		Phenotypic	Genotypic		
Plant height (cm)	62.67	14.67	14.05	92.00	27.73
Primary leaf area (cm ²)	16.69	41.04	39.34	95.27	78.38
Days of first flowering	39.63	10.09	9.09	84.04	20.37
Total chlorophyll Content (g/g fresh weight)	0.001	88.99	87.83	97.39	178.56
Leaf area index	1.67	47.71	44.64	85.83	97.59
Harvest index (%)	35.69	24.03	18.05	56.41	58.59
Seed yield/plant (g)	16.32	20.24	16.11	63.32	39.36

Model LI-3000. Genotypic and phenotypic coefficient of variation (Burton, 1952) heritability and genetic advance (Johnson *et al.*, 1955) and correlation (Al-Jibouri *et al.*, 1958) were estimated for all the characters.

RESULTS AND DISCUSSION

The analysis of variance indicated that the differences between the genotypes in respect of all the characters studied were significant. The physiological traits namely total chlorophyll content, leaf area index and primary leaf area showed high PCV and GCV estimates (Table 1) suggesting that the selection based on these characters would facilitate successful isolation of desirable genotypes.

The close values of GCV and PCV for plant height, primary leaf area, days to first flowering and total chlorophyll content indicated greater role of genetic factors influencing the expression of these traits offering ample scope for improvement. A similar trend has been reported for days to first flowering by Tewari *et al.*, (1989) whereas selection would not be effective for harvest index as evinced from the presence of highest difference between GCV and PCV.

High heritability estimates were observed for total chlorophyll content followed by primary leaf area and plant height with the range of 56.41 to 97.39 per cent. This indicated the greater role of genetic factors causing variation in these characters. Heritability estimates along with genetic gain are more important for selection than heritability alone (Lerner, 1958). The genetic advance as per cent of mean and heritability were maximum for total chlorophyll content, primary leaf area and leaf area index. These traits also recorded high variability estimates. This situation shows that genotypic variance for these characters is probably owing to high additive gene effect. A similar result has been reported for leaf area index and primary leaf area by Renganayaki and Sree Ranganayaki (1992).

The economic trait, seed yield per plant had positive and strong association with harvest index (Table 2). Days to first flowering was negatively associated with seed yield per plant which is in consonance with the results of Tewari and Gautam (1989) and Vijendra Das (1995). Other physiological traits had non-significant correlations with seed yield.

Table 2. Phenotypic and genotypic correlation coefficients for seven traits in cowpea.

Characters		Plant height	Primary leaf area	Days to first flowering	Total chlorophyll content	Leaf area index	Harvest index	Seed yield/plant
Plant height	P	1.000	0.018	0.272	0.043	0.108	0.118	0.170
	G	1.000	0.015	0.252	0.037	0.107	0.126	0.172
Primary leaf area	P		1.000	-0.094	0.175	0.280	-0.128	0.082
	G		1.000	-0.096	0.178	0.280	-0.130	0.089
Days to first flowering	P			1.000	0.175	-0.025	-0.263	-0.249
	G			1.000	0.182	-0.026	-0.270	-0.282
Total chlorophyll content	P				1.000	0.074	0.168	0.227
	G				1.000	0.075	0.176	0.257
Leaf area index	P					1.000	0.093	0.250
	G					1.000	0.092	0.271
Harvest index	P						1.000	0.754*
	G						1.000	0.857**
Seed yield/plant	P							1.000
	G							1.000

* and ** significant at P=0.05 and P=0.01 respectively.

Table 3. Path co-efficient analysis showing direct (bold figures) and indirect effects of physiological traits on seed yield of cow pea.

Characters	Plant height	Primary leaf area	Days to first flowering	Total chlorophyll content	Leaf area index	Harvest index	Seed yield/plant
Plant height	0.101	0.002	0.028	0.005	-0.027	0.086	0.172
Primary leaf area	0.002	0.069	0.013	0.023	0.044	-0.089	0.089
Days to first flowering	0.029	-0.009	-0.136	0.023	-0.004	-0.184	-0.282
Total Chlorophyll content	0.004	0.017	0.025	0.128	0.012	0.120	0.257
Leaf area index	0.011	0.027	0.004	0.009	0.156	0.063	0.271
Harvest index	0.013	-0.012	0.037	0.023	0.014	0.683	0.857**

Residual value = 0.138

The path analysis revealed that harvest index, leaf area index, total chlorophyll content, plant height and primary leaf area had high positive direct effect on seed yield. High positive direct effect as well as significant correlation co-efficient indicated that selection may be exercised as evinced from variability studies. The direct effect of days to flowering was negative, indicating that the contribution of this character was meager for yield improvement. Total chlorophyll content had positive indirect effect through harvest index on seed yield. Similarly primary leaf area, leaf area index and harvest index had positive indirect effects through plant height, days to first flowering and total chlorophyll content on seed yield. Hence it would be rewarding to lay emphasis on total chlorophyll content, primary leaf area and leaf area index in selection programme of cowpea.

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