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Review Article:

Formulation of Selection Index for yield in Cambodia Cotton (*Gossypium hirsutum L.*): Correlation studies on yield components — *A Review*

by

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Synopsis: An extract from the Dissertation on the formulation of selection index for yield in Cambodia cotton has been presented. A review of the work done in this regard in different crops with special reference to cotton has been made and the possibility of selection for yield in crop improvement discussed. Literature pertaining to correlation studies of component characters has been reviewed in principal cereal crops and cotton and the importance of this study in the computation of selection index for yield has been discussed.

Selection work in plant breeding was in earlier years effected based directly on the yield exhibited by the crops. A method of plant selection was developed by Fisher (1936) and Smith (1936), wherein it was shown that selections for yield and quality could be made more efficient if the basis of component traits that go to make up the crop yield and the relationship between those characters and yield were studied. This formed the basis for the formulation of selection index.

Selection index is an index which serves to assess the improvement or efficiency in selection for yield and quality in crop plants, and it serves as a method or basis of selecting superior genotypes.

Yield is a complex factor composed of a number of genes or multiple factors which are cumulative, duplicate and non-dominant and affect the yield. For a given genotype itself, the actual phenotypic values are highly fluctuating due to the influence of environment. Besides, a number of morphological characters which are qualitative and quantitative in inheritance also have a bearing on yield. An interaction between heritable and non-heritable agencies make the yield a highly complex problem for the breeder to solve. Therefore, selection, if to be efficient, has to be based on genotypical values (Panse 1957, Hazel 1934, Hazel and Lush 1942). The technique of computation of selection index which gives due weightage to the phenotypic traits in terms of genotypic values is termed "Discriminant function Technique".

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Investigations on the usefulness of this technique in plant breeding was made in principal crops, viz., wheat, rice, groundnut, cotton etc. Component characters in cereal crops that go to make up the yield, viz., number of tillers per plant, number of ears per tiller, number of grains per ear and weight of 1000 grains were taken up for the study. Simlote (1947) showed in *durum* wheats that tiller numbers and grain weight were highly correlated with the genetic yield of the varieties. The discriminant function proved superior to simple selection for yield to the extent of 16% by including the number of tillers per plant in the formula in addition to number of ears. Sikka and Jain (1958) worked out suitable selection index as an aid in breeding in *aestivum* wheats under rainfed conditions. The genetic advance obtained from the discriminant score based on ear number, grain number and 1000 grain weight did not show greater efficiency than straight selection. In the varietal studies in rice, Abraham *et al.* (1954) proved that the discriminant score using yield components in addition or alternative to yield did not improve selection efficiency over straight selections in respect of yield. In groundnut Mishra (1958) studied correlations between seed size and leaf characters. Sikka and Gupta (1949) worked out in gingelly multiple correlations, partial correlations and partial regression coefficients and relative contributions of the number of branches, number of capsules, number of locules and plant height with the plant yield.

In cotton, Panse and Khargonker (1949) applied the discriminant formula for yield in varietal and progeny row trials at Indore. Number of bolls per plant, number of loculi per boll, seeds per locule, seed index and lint index were the component characters studied. It was concluded by them that the discriminant score gave very little extra improvement as compared to straight selection. They suggested selection of single plants from all the replications of the progeny rows on the basis of deviations of individual plant values from the respective plot means as a means of selecting superior genotypes. Manning (1956), in the study of selection index technique to bring about the yield improvement in B. P. 52, an upland variety of cotton from Africa, pointed out that genetic advance to an extent of 35% was recorded in the material after six generations of selection. Selection based on the component lint index proved to be more efficient than *adhoc* selection for gross yield. Walker (1960) concluded that the most convenient index was that which utilises yield, seeds per boll and lint per seed. The technique facilitated inter-progeny selection and was responsible for the considerable yield improvement effected in B. P. 52.

Genotypic and environmental variance and covariances in American upland cottons and their implication in the construction of selection indices were determined by Miller *et al* (1958). High negative correlations between

lint yield and seed index and lint yield and number of bolls per plant was recorded. Lint index which was closely associated with lint yield gave better selection index i.e. served as a better indicator of the genetic yield potential than mere yield. Al-ji-bouri *et al* (1958) studied genotypic and environmental variances and covariances in an upland cross of interspecific origin. Limayee (1957) reported high positive correlation between lint density index and ginning percent in his study of inheritance of fibre density in hybrid between upland and Sea Island cotton *(G. hirsutum* x G. *barbadense)*. Kearney (1928) studied correlations existing among the characters of bolls, seeds and fibres of cotton in Arizona on several populations of cotton of the Egyptian type in a few second generation hybrids between upland *hirsutum* x *barbadense* (Egyptian). Negative correlation between seed index and number of seeds per boll, seed index and ginning out-turn and lint index and number of seeds per boll was reported in the study. Grifee *et al* (1929) observed some correlations between yield of seed-cotton and ginning percent and yield of lint and seed index (as reported by Brown, 1958).

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