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Correlation of Lint Yield and its Components in Cotton (*G. arboreum* L.)*

by

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Synopsis: Correlations between lint yield and its components were studied in eighteen varieties of *G. arboreum*, representing all the six races. Among the seven characters studied the number of seeds per boll, number of bolls per plant and lint index besides yield of seed-cotton are considered as most important for exercising selection for high lint yield as they alone showed a high measure of correlation in most of the varieties and the races studied.

Introduction: For evolving selective factors for yielding capacity, plant breeders often employ such indices as ears and tillers or between grain and straw weights in cereals, and number of bolls per plant, number of seeds per boll, weight of lint per seed and ginning percentage in cotton (Panse, 1949). These selective factors are based on the correlation of characters with yield and with each other. Correlation of characters serves as a measure and forms the basis of selection index as it gives the strength of relationship between the characters studied. Correlation studies are, therefore, an important asset to the crop breeder.

The relationships of various plant characters with yield and with each other have been extensively investigated in cotton, with a view to obtain suitable indices for evaluating the yielding potentialities of the strains or of the plants in the segregating populations. Sikka and Joshi (1960) have given an exhaustive account on correlation of characters in cotton. The present study was undertaken with a view to compute the correlations between lint yield and its components in *G. arboreum*.

Material and Methods: A total number of 18 varieties in the species *G. arboreum*, representing all the six races formed the material for study.

The crop was raised under rainfed conditions, in conformity with the practices prevailing in the Madras State. 'Randomised Replicated Block design' was adopted. The plot size for each variety was a single row of ten plants spaced at one foot and replicated four times.

The following characters were studied:

(i) *Plant yield:* The total quantity of seed-cotton harvested from each plant was recorded to the nearest decigram. The lint obtained by ginning was weighed to the nearest decigram to arrive at the lint yield per plant.

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(ii) *Boll production per plant:* The total number of dehisced bolls till the completion of harvest was recorded in each plant.

(iii) *Boll size (boll index):* The number of bolls that would yield a pound of seed-cotton (known as boll index) was computed to serve as an indication of boll size.

(iv) *Ginning per cent:* The entire produce of seed-cotton from each plant was ginned and the ginning outturn was calculated.

(v) *Number of seeds per boll:* This was arrived at by counting the number of seeds obtained by ginning the seed-cotton from each plant and dividing by the total number of bolls harvested from the plant.

(vi) *Lint index:* This was calculated by dividing the weight of lint obtained in each plant by the number of seeds produced in that plant and was expressed in milligram.

(vii) *Seed index:* The weight of 100 seeds known as "seed index" was recorded to the nearest decigram.

Correlation coefficients were calculated for each variety and race. The significance was tested by means of Fisher's 't' test.

Results: The correlation coefficients obtained between lint yield and its components for the eighteen varieties studied are furnished in Table I and for the six races, in Table II.

All the seven characters studied were significantly correlated with lint yield when considered for the species as a whole, the order being yield of seed-cotton, number of bolls per plant, ginning percentage, number of seeds per boll, lint index, seed index and boll index. While all other characters were positively correlated, boll index alone showed negative correlation.

As regards varieties and races, significantly strong correlation existed between lint yield and seed-cotton yield in all the eighteen varieties and the six races studied.

The ginning per cent, in general, showed a significant correlation with lint yield. Ten out of eighteen varieties and four out of six races studied, were positively and significantly correlated.

Lint index was significantly correlated with lint yield in twelve out of eighteen varieties and four of the six races. The strength of association was the highest in race *bengalense* and least in race *sinense*.

The correlation between lint yield and seed index was positive. But the strength of association differed widely. Among the eighteen varieties studied, five showed significant correlation; non-significant correlation existed in twelve; and negative and non-significant correlation in one variety. The highest correlation was present in race *bengalense*. The race *indicum* exhibited the lowest association.

TABLE I.

Simple correlation coefficients of characters with lint yield (for varieties)

Sl. No.	Race	Variety	Seed cotton yield	Ginning per cent	Lint index	Seed index	No. of seeds/ boll	No. of bolls/ plant	Boll index
1.	*Indicum*	K. 2	0·995†	0·410*	0·208	0·120	0·986†	0·894*	—0·333
2.	,,	K. 5	0·995*	0·021	0·151	0·172	0·963†	0·151	—0·181
3.	,,	K. 6	0·997†	0·422*	0·476†	—0·158	0·990†	0·900†	—0·481*
4.	,,	9877	0·971†	0·011	0·276	0·625†	0·985†	0·765†	—0·296
5.	,,	B. 32–48	0·995†	0·457*	0·584†	0·125	0·988†	0·903†	—0·448*
6.	,,	5001	0·995†	0·354	0·410*	0·375*	0·983†	0·781†	—0·461*
7.	,,	Tellapathi	0·980†	0·553†	0·451*	0·305	0·961†	0·612†	—0·502*
8.	*Cernuum*	Garo hill	0·981†	0·628†	0·670†	0·514†	0·909†	0·734†	—0·378*
9.	*Bengalense*	N. R. 5	0·976†	0·005	0·366*	0·319	0·879†	0·638†	—0·219
10.	,,	J. Virnar	0·993†	0·483†	0·576†	0·381*	0·985†	0·821†	—0·313
11.	,,	C. 530	0·995†	0·582†	0·587†	0·243	0·990†	0·928†	—0·538†
12.	,,	197–3	0·998†	0·519†	0·277	0·006	0·977†	0·866†	—0·387†
13.	,,	H. 420	0·995†	0·300	0·480†	0·286	0·958†	0·932†	—0·534†
14.	,,	Jarila	0·994†	0·410*	0·523†	0·237	0·985†	0·927†	—0·411*
15.	,,	231 R	0·990†	0·019	0·470†	0·345	0·985†	0·915†	—0·478†
16.	*Burmanicum*	Burma C. 19	0·997†	0·266	0·162	0·130	0·987†	0·915†	—0·418*
17.	*Soudanense*	N. M. D.	0·994†	0·406*	0·692†	0·721*	0·984†	0·849†	—0·440*
18.	*Sinense*	Kamugan	0·979†	0·045	0·070	0·087	0·971†	0·931†	—0·045

* Significant at 5% level.
† Significant at 1% level.

TABLE II.

Simple correlation coefficients of characters with lint yield (for races)

S. No.	Race	Seed cotton yield	Ginning per cent	Lint index	Seed index	No. of seeds/ boll	No. of bolls/ plant	Boll index
1.	*Indicum*	0·971†	0·641†	0·612†	0·009	0·582†	0·841†	—0·802
2.	*Cernuum*	0·981†	0·628†	0·670†	0·541	0·909†	0·734†	—0·378*
3.	*Bengalense*	0·761*	0·641†	0·852†	0·749†	0·231†	0·121†	—0·712
4.	*Burmanicum*	0·997†	0·266	0·162	0·130	0·987†	0·915†	—0·418*
5.	*Soudanense*	0·994†	0·400*	0·692	0·721†	0·984†	0·849†	—0·440*
6.	*Sinense*	0·979†	0·045	0·070	0·087	0·971†	0·931†	—0·045
	For *G. arboreum*	0·994†	0·974†	0·971†	0·971†	0·973†	0·978†	—0·916†

* Significant at 5% level.

† Significant at 1% level.

The number of seeds per boll had a positive and significant correlation with lint yield in all the eighteen varieties. The correlation was very high, even approaching unity, in the races *burmanicum*, *soudanense*, *sinense* and *cernuum*, in the order mentioned.

The correlation between number of bolls per plant and lint yield was high, positive and significant in seventeen varieties. Highest correlation existed in races *sinense* and *burmanicum*, while race *bengalense* exhibited the least association.

Boll index was negatively correlated with lint yield. The correlation was negative and significant in twelve out of eighteen varieties and five out of six races. Among the six races, *indicum* showed the highest negative correlation with lint yield while *sinense* showed the least.

Discussion: Measures of correlation are important to the crop breeder as they serve as an aid in determining the relationship between any two characters and form the basis of selection index.

Among the seven characters studied for lint yield, six characters *viz.*, yield of seed-cotton, ginning percentage, lint index, seed index, number of seeds per boll and number of bolls per plant showed positive correlation, while the remaining one i. e. boll index showed a negative correlation. This was because, boll index is an inverse measure of boll size—the smaller the boll index, bigger is the boll, in size.

The highly significant and positive correlation between lint yield and seed-cotton was in agreement with Griffe *et al* (1929). The influence of seed-cotton on lint yield was naturally high, since the influence of ginning outturn was positive. Since lint obtained was the product of ginning seed-cotton, the influence of ginning per cent on seed-cotton should be considerable in lint production.

The lack of uniformity in the strength of correlation between ginning outturn and lint yield among the varieties and the races studied was due to the complex nature of ginning percentage. Ginning percentage is governed by many variables such as fibre length, fibre weight, number of fibres per seed, lint index and seed weight. Fibre length was found to be negatively correlated with ginning percentage (Sikka and Afzal, 1947, Humphrey, 1940; and Christidis and Harrison, 1955). On the other hand, Brown (1935) and Stroman (1949) concluded the correlation to be non-significant. Dunlavy (1923), Kearney (1926) and Stroman (1949) reported positive correlation between ginning percentage and lint index. Kearney (1926) and Turner (1929) observed a negative correlation between ginning percentage and seed weight. Between ginning percentage and fibre weight, Sikka and Afzal (1947) recorded a positive trend in *arboreum* while stroman (1949) found it to be negative in *hirsutum*.

According to Stroman (1949) ginning percentage and boll weight was positively correlated. Kearney (1926) pointed out positive correlation between ginning per cent on the one hand and weight of seed-cotton per boll, boll size and number of seeds per boll, on the other.

Ginning percentage, thus, depended primarily on seed weight and lint weight, which in turn, were influenced by various factors. It did not by itself give precise information about the total production of lint when a number of genotypes or varieties were under study. Selection for high ginning value might often result in the evolution of types with light seeds without necessarily stepping up lint production per seed and hence per plant. Hence, Cook (1908) stressed the danger of persistant selection for ginning outturn. Increase in seed weight, without corresponding increase in the number of fibres per seed, staple length or fibre weight, would have affected ginning percentage, and hence the ultimate lint yield. Lint index, therefore, is considered to be a more reliable measure of lint production.

Lint index represents the absolute weight of lint produced per seed and this character is, therefore, considered by some breeders to be more useful in breeding work than ginning percentage. In *G. arboreum*, lint index exhibited positive correlation to lint yield to varying degrees of significance. Harland (1934) showed that in Sea Island cotton *(G. barbadense)*, lint index was strongly correlated with lint yield. He observed that in cotton breeding in India, lint index should receive special emphasis in selection programmes.

The correlation between lint yield and seed index was not only feeble but also was not uniform. The lack of uniformity in the correlation might be due to the fact that the seed index itself is influenced by several characters. Kearney (1926), Turner (1929), and Sikka and Afzal (1947) reported strong negative correlation between seed weight and ginning percentage. Patel and Mankad (1926) and Afzal (1930) showed positive correlation between seed index and lint index.

Number of seeds per boll showed uniformly a positive and highly significant correlation with lint yield. This was in conformity with the findings of Kearney (1926) who reported a positive correlation between ginning percentage and number of seeds per plant.

The correlation between lint yield and number of bolls per plant was generally highly positive. This was in agreement with findings of Stroman (1930).

Lint yield and boll index showed uniformly, a negative correlation. Stroman (1930) found similar relationship in *arboreum* and *hirsutum* varieties respectively. Since boll index is inversely proportional to the size of boll, lint yield was negatively correlated with boll index.

Summary and Conclusion: The correlation set up for lint yield and its seven components in *G. arboreum* revelead the strength of association of characters with lint yield, in the order of (1) yield of seed-cotton (2) number of seeds per boll (3) number of bolls per plant (4) lint index (5) boll index (6) ginning percentage and (7) seed index. Of these seven characters, apart from the yield of seed-cotton, three others *viz.*, number of seeds per boll, number of bolls per plant and lint index are the most important for exercising selection for high lint yield, since they alone showed a high measure of correlation in most of the varieties and the races studied. They were also adjudged by Panse (1949) and Manning (1956) as highly correlated with lint yield.

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