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HERITABILITY ANALYSIS OF YIELD AND QUALITY COMPONENTS IN *GOSSYPIUM HIRSUTUM* L.

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Abstract

Studies on genotypic and phenotypic variance, heritability and expected genetic advance for G.O.T. %, staple length, lint index, fibre strength, fibre fineness and seed cotton yield in 10 genotypes of *Gossypium hirsutum* L. indicated that these estimates varied considerably within traits studied. The magnitude of genetic and phenotypic variance ranged between 0.032 (fibre fineness) to 407.34 (seed cotton yield). Heritability in broad sense showed high estimates (ranging from 89.75 % to 99.74%) for all the characters, indicating the involvement of additive type of gene action. G.O.T %, staple length and fibre fineness exhibited low genetic advances irrespective of their high heritability estimates, probably due to non-additive gene (dominance and epistasis) effects.

Introduction

Plant breeders are interested in heritability estimates because these serve as basic tool to measure the potential value of selection of particular trait in various populations as an index of transmissibility and to assess the effectiveness in the selection of genotypes based on phenotypic performance. The higher the heritability, the simpler the selection process and greater the response to selection. Tomar & Singh (1991) and Ansari (1996) observed additive type of gene action for seed cotton yield and some quality components of *Gossypium hirsutum* due to high heritability and genetic advance estimates. Considering the importance of this type of research, it was contemplated to ascertain heritability and genetic advance in cotton genotypes. Such information can profitably be exploited in expanding our knowledge of developmental allometry (Hamid & Grafius 1978) and can further be heplful in formulating efficient selection programme for synthesis and development of new cotton ideotypes with improved yield and quality components.

Materials and Methods

The investigation pertaining to heritability and genetic advance in 10 *Gossypium hirsutum* genotypes for seed cotton yield and quality components was undertaken at the Department of Plant Breeding and Genetics, Sindh Agriculture University, Tandojam, Pakistan during the year 1994-95. The experimental material was planted in a randomized complete block design with 3 replications. Homogeneous delinted seeds were drilled in rows 75 cm apart by single coulter hand driven drill @ 35 Kg/ha. Before first irrigation the seedlings were thinned to maintain plant to plant distance of

30 cm. A 3.75 x 14.2 meter plot size was maintained. All the required cultural practices were adopted uniformly in all the plots throughout the growth period. Ten plants per replication from each genotype were selected at random for recording the data on seed cotton yield and quality components. Data thus obtained for each character was subjected to statistical analysis (Gomez & Gomez, 1984). The analysis of variance for all the traits was carried out separately. The pertinent mean squares and parameters estimated in each analysis were computed according to the method suggested by Breese (1972).

Source of variation	DF	Mean squares	Mean square expectations
Gonetypes	(v-1)	MSG	$O^2e + rOp^2$
Error	(r-1) (v-1)	MSE	O^2e2

Genetic selection parameters were determined using the above analysis similar to Larik *et al.* (1987) as follows:

1. Genetic variance = (MSG - MSE)/r
2. Phenotypic variance = MSG/r
3. Heritability (b.s.) hw = O^2g/O^2ph
4. Genetic Advance = hw x O^2ph x k

where MSG and MSE are genotypic and error mean squares respectively from analysis of variance, r is the number of replications and k is constant = 2.06 at 5% selection intensity.

Results and Discussion

Mean varietal performance for seed cotton yield and other quality components tested through Tukey's Honestly Significant Difference Test and consolidated ANOVA (mean squares) is presented in Table 1. Data reveals that varieties TH-202/87 and TH-230/87 displayed significantly highest (37.00%) and the lowest (34.00%) G.O.T %. In case of staple length varieties TH-230/87 and Qalandri were significantly superior (28.00 mm), while TH-228/87 produced lowest (26.40 mm) staple length. Variety Rehmani was significaly superior in lint index (4.84 gm) and seed index (8.91 gm) as compared to all other varieties. On the contrary, variety TH-228/87 showed significant superiority in fibre strength and fibre fineness (Table 1). Maximum seed cotton yield was displayed by variety TH-179/87 (158.00 gm)/plant) and the lowest (87.15 gm/plant) by the variety TH-171/87.

ANOVA for all the traits demonstrate that the mean squares for genotypes were significant at 1% level of probability. Highly significant mean squares (Table 1) attributable to genotypes indicate that significant genetic variability existed among the varieties for all the traits studied for further evaluation.

Estimates of genetic selection parameters are shown in Table 2. Results revealed that all the traits exhibited very wide range of genotypic and phenotypic variance ranging from 0.032 (fibre finencess) to 407.34 (seed cotton yield). Second maximum value of phenotypic (20.28) and genotypic (20.23) variances were shown by the trait

Table 1. Mean performance and ANOVA(mean squares) for ten cotton genotypes for yield and quality components.

Traite / Genotypes	G.O.T. %	Staple length (gm)	Lint index (gm)	Fibre strength 1000lb/inch	Fibre fineness µg/inch	Seed cotton yield/plant (gm)
TH-171/87	35.15c	27.80ab	3.67g	80.45cd	4.1ab	87.15h
TH-173/83	36.20b	27.10bc	3.84f	81.64b	4.28b	126.80efg
TH-179/87	35.95b	27.45ab	4.53c	81.68b	4.23b	158.10a
TH-198/87	34.30de	27.80ab	4.69b	79.93d	4.20b	155.10ab
TH-202/87	37.00a	27.80ab	4.35d	80.05d	4.20b	116.00g
TH-224/87	35.05c	27.75ab	4.45cd	81.42bc	4.21b	122.10fg
TH-228/87	35.05e	26.40c	3.43h	86.49ab	4.43a	139.30cd
TH-230/87	34.00e	28.00a	4.22e	73.65e	3.98c	134.70cde
Rehmani	34.85c	27.75ab	4.84a	72.69e	3.81d	145.6bc
Qalandri	34.20cd	28.00a	3.74fg	73.15e	3.96c	129.90def
			Mean Squares			
Source of variation D.F.						
Replication 3	0.028	0.097	0.005	0.492	0.0001	66.30
Genotypes 9	3.874**	0.976**	0.917**	81.116**	0.130**	1714.80**
Error 27	0.047	0.101	0.003	0.204	0.002	85.50

**Significant at 1% level of probability.

fibre strength Heritability in broad sense indicates the effectiveness with which the selection of a genotype can be based on phenotypic performance. The traits G.O.T.%, staple length, lint index and fibre fineness displayed higher estimates of broad sense heritability (Table 2). However, these traits failed to show higher estimates of expected genetic advance espressed as percentage of means. This indicates that higher heritability in broad sense does not necessarily provide higher values of genetic advance and hence heritability alone provide no indication for the amount of genetic progress that can be achieved through selection (Hussain *et al.*, 1991). High heritability associated with low genetic advance for these traits is probably due to nonadditive gene (dominance and epistasis) effects (Aher *et al.*, 1989, Sharma & Tyagi, 1990, 1991). However, when the estimates of heritability are used in conjunction with genetic advance it indicates the feasibility of improvement in different traits.

The trait seed cotton yield exhibited 95.01% broad sense heritability coupled with 31.17% expected genetic advance Although the yield is a complex polygenic character, its inheritance has been characterized as the most fluctuative showing high heritability and genetic advance (Larik *et al.*, 1987). This suggests the existence of sufficient amount of genetic variability for the improvement of this trait and indicates that the trait is more amenable for selection and could be improved easily. The character lint index also showed high values of broad sense heritability (99.56%) and expected genetic advance (25.28%). High heritability accompanied with geater genetic advance for seed

Table 2. Estimation of genetic selection parameters for yield and quality components in *gossypium hirsutum* L.

Character studed	Varietal Variance MSG	Varietal Variance MSE	Genotypic Variance MSG-MSE / r	Phenotypic Variance MSG/r	Heritability % (b.s)	Expected genetic Advance % of means
G.O.T%	3.874	0.047	0.957	0 968	98 86	5.701
Staple length	0.976	0.101	0.219	0.244	89 75	3.284
Lint index	0.917	0.003	0.228	0 229	99.56	25.179
Fibre strength	81.116	0.204	20.228	20 279	99.74	11.500
Fibre fineness	0.130	0.002	0.032	0.325	98.46	8.690
Seed cotton Yield/plant	714.89	85.540	407.340	428 420	95.01	31 169

cotton yield and lint index indicates the importance of additive type of gene effects for their inheritance (Tyagi, 1987; Tomar & Singh 1991). High phenotypic and genotypic variances for these traits resulted in high heritability and GA-values which revealed the improvement of these traits by simple selection method.

The present study revealed that the selection based on seed cotton yield per plant and lint index could be exploited for the improvement of yield and quality in *Gossypium hirsutum*.

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