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Estimation of Leaf Efficiency in Hybrid-4 Cotton (*Gossypium hirsutum L*)*

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ABSTRACT

Leaf efficiency in hybrid-4 cotton along with its parents and F_2 was estimated. Highest leaf efficiency was recorded by hybrid-4 F_1 (0.351), followed by nectariless (0.218), F_2 (0.130) and Gujarat-67 (0.057). Mid parent heterosis and inbreeding depression were 158.7% and 63.6% respectively for leaf efficiency.

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INTRODUCTION

Early (1965) suggested that when both grain yield and leaf area are measured, grain/unit leaf area should be used to express as leaf efficiency, which in turn could serve as basis in adjusting rate of planting. Ashley *et al.* (1965) found that the leaf area index (LAI) in cotton was positively correlated with yield. Bhatt (1974) reported that in monopodial plants only upper zone, with relatively less leaf area was exposed to full sunlight, whereas plants with short symbodial habit provide a greater effective leaf area. Liang *et al.* (1975) reported leaf efficiency in grain sorghum genotypes. Amount of grain produced in proportion to leaf area $(dm)^2$ was used as measure of leaf efficiency. In the present investigation leaf efficiency is expressed as the amount of seed cotton (gm) produced in proportion to leaf area $(dm)^2$.

MATERIALS AND METHODS

To estimate leaf efficiency of hybrid-4-F_1 cotton (*Gossypium hirsutum* L.) an experiment was conducted, with six replications at the department of Agricultural Botany, Rajasthan College of Agriculture, Udaipur, during Kharif 1975-76.

Along with hybrid-4-F_1, its parents and hybrid-4F_2 were also raised to measure mid parent heterosis and inbreeding depression for leaf efficiency.

Selfing was done in F_1 during 1974-75 season to get selfed seeds for F_2 during 1975-76 season. The parents of hybrid-4-F_1 are Gujarat-67 (female) and American Nectariless (male). Sowing was done on 4th July 1975. Each replication was consisted of four plots (Size 9 x 6 meter each) of five rows each. The row to row distance was 120 cm. and plant to plant distance was 60 cm.

The observations on number of leaves per plant, leaf area per plant, leaf area index and leaf efficiency were recorded on randomly selected two plants from Gujarat 67 (P_1), Nectariless (P_2) and hybrid-4-F_1 and four plants from Hybrid-4-F_2. Data are presented in Table 1.

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TABLE 1

Mean value, standard error, critical difference, co-efficient of variation and over all mean for some characters in cotton (*G. hirsutum*, L.).

Character	*Gujarat-67* (*Female*)	*Nectariless* (*Male*)	F_1	F_2	*Overall* mean	*SEM*	*CD at 5%*	*C.V.* %
No. of leaves per plant	361.33	108.33	221.59	168.80	215.14	12.08	34.40	5.6
Leaf area per plant (dm^2)	337.12	80.78	161.45	135.94	179.45	10.43	31.39	5.8
Leaf area Index (LAI)	2.34	0.56	1.14	0.95	1.25	0.07	0.22	5.8
Leaf efficiency	0.057	0.218	0.357	0.130	0.211	0.03	0.09	13.5

RESULTS AND DISCUSSION

In the present study, amount of seed cotton produced in proportion to leaf area (gm/dm^2) was used as a measures of leaf efficiency, leaf efficiency of F_1 (0.357) was found to be significantly superior to Gujarat-67 (0.057), Nectariless (0.218) and F_2 (0.130). It was interesting to note that Gujarat-67 had lowest leaf efficiency but the highest leaf area per plant (337 dm^2) followed by F_1 (161 dm^2). The probable reason for very low leaf efficiency of Gujarat-67 might be due to the monopodial nature of branches, many lower and middle zone leaves which were shaded resulted into low interception of light. Therefore, lower shaded leaves might be parasitic using more carbohydrate for respiration than they produce by photosynthesis. This was also suggested by Fernando (1959) and Army and Greer (1967). They noted that shaded lower leaves might be parasitic using more carbohydrate for respiration than they produce by photosynthesis.

In F_1 because of sympodial habit, orientation of branches was such that most of the leaves intercepted more sunlight than those of Gujarat-67, therefore, F_1's leaves might be photosynthetically useful by providing a greater effective leaf area resulting in high leaf efficiency. Similar results were reported by Bhatt (1974). He found that because of the short branching habit most of the leaves of PRS-72 intercepted more sunlight than those of M.C.U. 5, many were completely or partly shaded.

In addition to this morphological factor, it is quite possible that F_1 might show heterotic effect in photosynthetic rate per unit area and a better partitioning of photosynthates into economic yield.

Apparently a close correlation between leaf area index (LAI) and yield was not found in this experiment. LAI was highest for Gujarat-67 but it ranked third in yield per plant, whereas F_1 recorded highest yield per plant but ranked second in LAI. These results were contradictory to the report of Ashley *et al.* (1965). They found that leaf area index in cotton was positively correlated with yield. This study suggested that it was not the total LAI

but effective LAI that was more important in increasing yield per unit of leaf area. Probable reason for low LAI obtained in this experiment might be due to late sowing (4th July 1975), wide spacing (120 x 60 cms) and long cold spell (November to February). Mid-parent heterosis for leaf efficiency was 158.7%. Inbreeding depression in F_2 was 63.6%.

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