

Leaf Trichomes of Upland Cotton Varieties¹

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THE rapid increase in use of machines for harvesting upland cotton, *Gossypium hirsutum* L., has resulted in a demand for cotton varieties with small numbers of leaf trichomes. These are commonly referred to as "smooth-leaf" varieties. Large number of trichomes account for a consequent increase in leaf trash in ginned cotton which, in turn, lowers the grade of lint.

Trichomes may be simple and erect or stellate and recumbent (4). Observations indicate trichomes are more numerous on the underside of the leaf. The leaf blade in pubescent varieties produces abundant trichomes, Figure 1. On the upper surface trichomes occur mostly along the major and intermediate venation.

Little attention has been given to leaf trichomes by breeders developing varieties for hand picking. However, following the release of 'Deltapine Smooth Leaf' in 1957, interest in smooth-leaf varieties has developed rapidly. Information on trichome numbers of present commercial varieties and on methods for determining trichome numbers is needed by breeders. A standard for leaf-trichome number for varieties designated as smooth leaf has not been established in the seed trade.

The present paper (1) gives results of a study of commercial cotton varieties and strains with respect to number and distribution of trichomes on different leaf parts, (2) proposes a standard for trichome numbers for smooth leaf varieties, and (3) suggests a method of determining trichome numbers.

MATERIALS AND METHODS

Thirty-one variety and strain entries in the 1962 variety test conducted on the Agronomy Farm, Auburn, Alabama, were scored for pubescence. One mature leaf was collected from the upper part of each of five plants of each variety. Trichomes were counted under a wide-field microscope with ocular arrangements giving a field 6 mm. in diameter. Two trichome counts were made on the underside of each leaf, one to the right and one to the left of the mid-vein near the confluence of the two subtending large veins. One field per leaf was counted on the petiole, mid-vein, and margin. The average number of branches in stellate trichomes was estimated microscopically.

An estimate of the total number of trichomes on the lower surface of a leaf of average size was calculated by multiplying number

per unit area by total area. Leaf area was estimated by the method of Ashley et al. (1) where area = leaf length \times leaf width \times .77, and the number per unit area of leaf blade was taken directly from the microscopic data. Leaves of the varieties surveyed are essentially of the same size and the mean size of all varieties, 10750 sq. mm., was used to estimate total trichomes per leaf.

Distribution of leaf-blade trichomes on different parts of the plant was studied by counting blade trichomes on 10 consecutive leaves from bottom to top.

RESULTS AND CONCLUSIONS

The results in Table 1 indicate that 'Delta Station 723 (D₂)' is essentially glabrous except for the leaf margin. 'Dwarf Smooth Leaf' and 'Deltapine Smooth Leaf' appear similar for distribution and number of trichomes and are only slightly more pubescent than Delta Station 723 (D₂). A majority of the commercial varieties showed 10 to 20 times as many trichomes as did 'Deltapine Smooth Leaf', a widely grown commercial variety. As a group, 'Empire' and the Empire-derived varieties ('All-in-One', 'Dixie King', and 'Rex') were the most pubescent. Other eastern varieties, which include 'Auburn 56', 'Coker 100A', 'Carolina Queen', 'DeKalb', 'Plains', and 'Stoneville', were intermediate in pubescence. The southwestern varieties, 'Acala 4-42' and 'Lankart 57', were relatively smooth.

A fairly consistent relation for number of trichomes exists in different leaf parts (Table 1). Simple correlations, (r), between numbers of trichomes on the blade and numbers on the petiole, mid-vein and margin were .814, .913 and .768, respectively. Correlation between the petiole and mid-vein numbers was .879; between the petiole and margin .703; and between mid-vein and margin .821. Only Delta Station 723 (D₂) had glabrous petioles and mid-veins.

Distribution of leaf trichomes from top to bottom of plants indicated that two conditions occur. Trichomes may be (a) fairly uniform in number over the entire plant or (b) reduced on several bottom leaves and more or less uniformly distributed on the remainder of the plant.

Variation in pubescence among entries within varieties (Table 1) suggests that much improvement in breeding for leaf smoothness could be accomplished by selection. Smooth-leaf varieties of Empire and of the Empire-type derivatives could best be developed by hybridization with smooth-leaf stocks. One source of smooth leaf available to breeders is the Delta Smooth Leaf and Dwarf Smooth Leaf type. With this type, pubescence is controlled by one major

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Table 1. Trichomes and branches per trichome on different leaf parts of cotton varieties.

Variety	Aver. No. trichomes * on				Total leaf area†	Trichome‡ branches
	Peti-ole	Mid-vein	Blade	Mar-gin		
Delta Station 723 (D ₂)	0	0	0.6	5	228	2.0
Dwarf Smooth Leaf	4	5	0.9	12	343	1.9
Deltapine Smooth Leaf	7	6	1.4	20	532	1.7
Acala 4-42	17	17	6.1	20	2321	2.4
Lankart 57	16	15	7.2	15	2740	2.6
Stoneville 579	8	21	14.4	18	5479	3.4
Caroline Queen	15	30	15.2	21	5784	2.4
Stoneville 7	6	32	15.8	22	6012	1.6
DeKalb 108-175-1	29	30	16.5	21	6278	2.4
Deltapine 15	20	25	17.3	20	6583	1.8
Auburn 56B	27	46	17.3	27	6583	1.2
Auburn M	31	36	17.7	22	6734	2.6
Deltapine 5332M	24	33	17.8	24	6773	3.4
H4912 BBR	29	42	18.3	29	6963	1.8
DeKalb 108-150	28	28	18.6	26	7077	1.4
Deltapine 5540M	25	28	20.6	27	7839	3.0
Auburn 56 BBR	24	26	21.0	28	7990	1.6
Stoneville 451	25	46	21.6	28	8218	1.4
All-in-One	36	41	22.6	30	8599	2.2
Coker 60-801	26	47	22.9	30	8714	1.2
Dixie King 560	16	30	24.1	22	9170	2.8
Plains	37	39	24.3	26	9246	1.8
DeKalb 108	34	42	25.2	28	9589	1.6
Auburn 56-55	23	34	25.2	23	9589	2.4
Coker 100A	26	40	28.4	25	10807	2.2
Dixie King	39	56	29.1	37	11073	1.8
Auburn 56	48	58	30.6	30	11644	1.2
Empire 61	62	60	31.5	30	11966	2.2
All-in-One 516D	28	48	32.4	42	12329	1.4
Rex	49	60	36.2	26	13775	2.6
All-in-One 521	54	75	57.6	35	21917	1.6

* Figures for petiole, mid-vein, and margin are averages of 5 trichome counts, and figures for blade are averages of 10 counts; all with 6 mm. microscopic field.

† Calculated from blade trichomes on lower surface and mean leaf area of 10750 sq. mm. for all varieties. ‡ Number of trichome branches are averages of 5 estimates.

gene and modifying genes, which produce multiple-factor ratios in crosses with ordinary upland cotton (2). A second source of smooth leaf (D₂ Smoothness) is derived from *G. Armourianum* Kearney (3). In this material a single dominant gene, *Sm*, gives almost glabrous leaves. Observation of D₂ hybrids indicated that several characters deleterious to yield may be associated with this gene. They are delayed fruiting, longer internodes, larger leaves, and

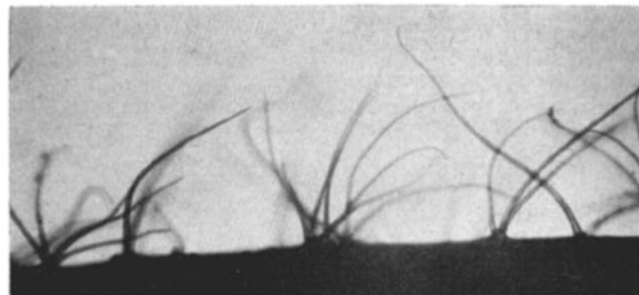


Figure 1. Side view of trichomes on blade margin of Empire variety.

stronger stems. The polygenic types (2) of smooth leaf appear to be preferable gene sources when hybridization must be used for developing more glabrous varieties.

Deltapine Smooth Leaf might be used as a standard variety for comparing trichome numbers of varieties designated as smooth leaf. This variety is widely accepted by growers, and there is no evidence of deleterious characters associated with its low level of pubescence.

Trichome counts on the lower surface of leaf blades taken from the middle to upper part of plants would give sufficient information for rating varieties. This is suggested in view of the high correlations in trichome numbers of different leaf parts.

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