SCANNING ELECTRON MICROSCOPY OF COTTON OVULE EPIDERMIS

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Abstract

Cotton fibers develop from single cells found in the outer epidermis of cotton ovules. Cotton ovules at the stage of fiber initiation have been previously examined by SEM (Stewart, 1975). The Zellweger-Uster Advanced Fiber Information System (AFIS) quantifies fiber circularity (θ) and cross-sectional area, which are used for calculation of fiber perimeter, a determining factor of cotton fiber maturity (Bradow et al., 1996).

Cotton plants, *Gossypium hirsutum* L. cv. Deltapine 50, were grown under field and greenhouse conditions at SRRC. Standard plant-mapping methods were used to collect the field-grown cotton ovules at -1 day postanthesis and day of anthesis. The boll tissue was removed from the cotton flower, cut in half with a razor blade, and placed directly into vials containing 3% glutaraldehyde in 0.05 M sodium cacodylate buffer. The vials were left at room temperature for more than 48 hr. The glutaraldehyde fixative was removed from all the vials and the samples were dehydrated in a graded series of ethanol (20-100%) with several changes of 100% ethanol.

Boll samples were placed in individual porous polyurethane capsules and then transferred to a beaker containing fresh 100% absolute ethanol. The capsules were placed within a Ladd critical-point drying (CPD) apparatus. The samples were then critical-point dried from ethanol through liquid carbon dioxide by standard procedures. After CPD, all samples were transferred to a desiccator to minimize moisture contamination. After 24 hours, the ovule samples were mounted on SEM stubs using double-stick photo adhesive tabs. Ovules in the locule were numbered with the ovule closest to the apex of the bolls designated #1 and numbered consecutively towards the pedicel. The stubs were coated with 60/40% gold/palladium in a Technics Hummer II sputter coater to a thickness of 20-30 nm. A Hitachi S-510 SEM was used to view the specimens, operating at 5-10 Kv.

SEM of -1 day postanthesis cotton ovules showed no indication of fiber initiation. On the day of anthesis, SEM observation from the middle region of cotton ovules #5 and #6 revealed stages of fiber initiation and differences in perimeter. Fiber cell elongation was also evident. AFIS data of mature greenhouse cotton revealed differences in perimeter values between fiber from the micropyle and chalazal ends of the cottonseed (Table 1).

Future SEM and Image Analysis information will be correlated with AFIS determinations to relate initial fiber perimeter measurements with mature fiber perimeters to develop the understanding of the relationships between secondary cell wall deposition and fiber cell volumes.

References

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Stewart, J. M., 1975. Fiber Initiation on the Cotton Ovule (*Gossypium hirsutum*), Amer. J. Bot., 62:723-730.

Table 1: AFIS Fiber Properties. Deltapine 50 Greenhouse-grown Cotton. Locule Location of Seeds are #7 and #8.

Seed Location	Boll Location		
	Node 5 or 6 Position 1	Node 8 or 9 Position 2	Nodes 11-13 Position 1
Length (mm)			
Micropyle	27.10	23.62	22.94
Chalazal	30.05	27.01	26.93
Ribbon Width (μm)			
Micropyle	17.4	17.4	17.2
Chalazal	14.5	14.4	14.3
Theta (θ)			
Micropyle	0.715	0.716	0.716
Chalazal	0.669	0.657	0.688
Perimeter (μm)			
Micropyle	54.81	54.83	54.58
Chalazal	51.47	51.54	50.67

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1467-1468 (1997)
National Cotton Council, Memphis TN