

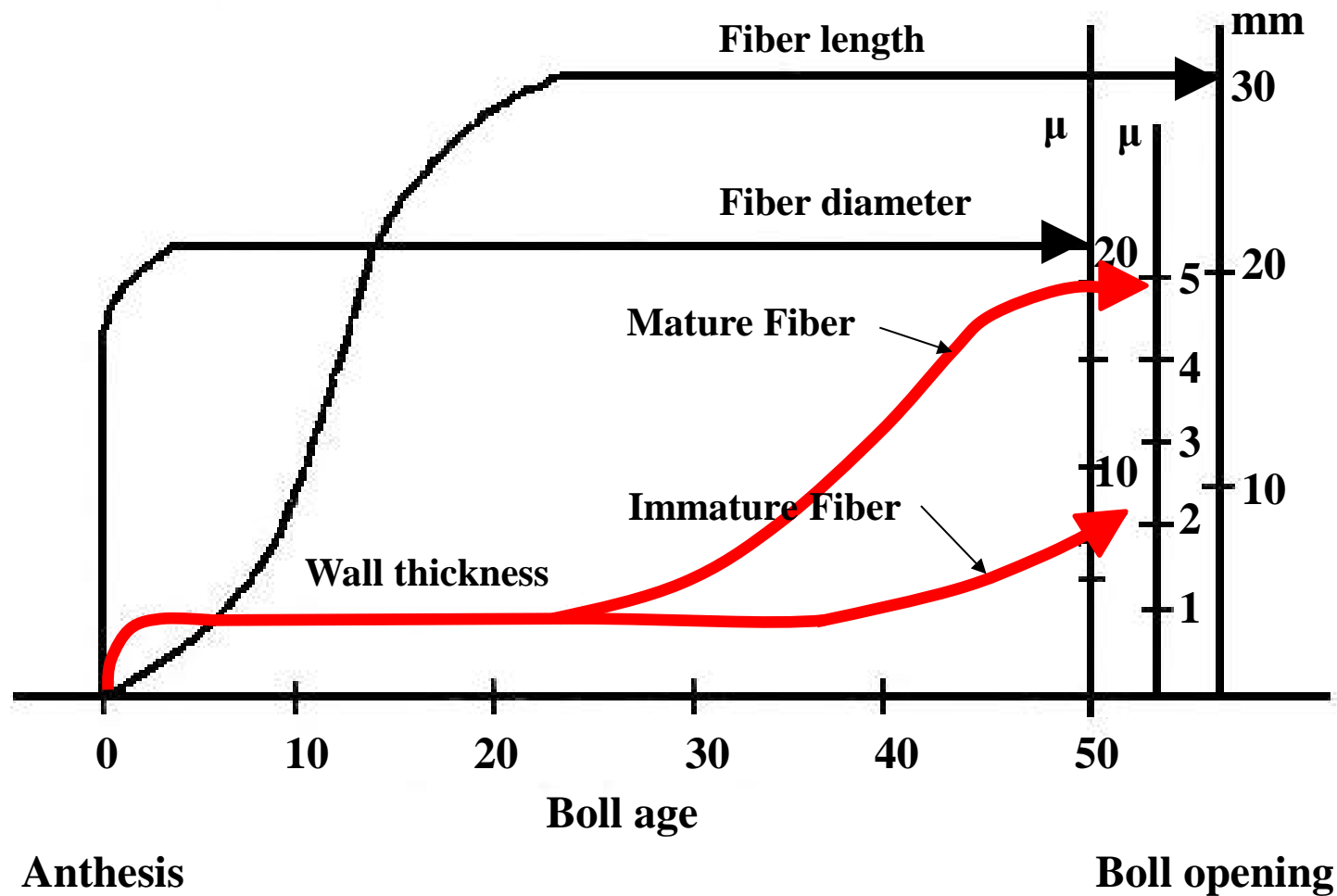
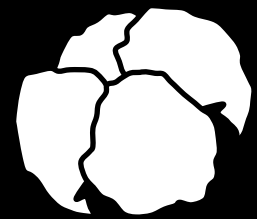
A grayscale micrograph of a cotton fiber cross-section. The image shows a central core surrounded by numerous concentric, slightly irregular rings, representing the growth layers of the fiber. The rings are more densely packed in some areas and more spread out in others, indicating varying growth rates or stages of maturity. The overall appearance is that of a natural, organic structure with a clear radial symmetry.

Cotton Fiber Maturity

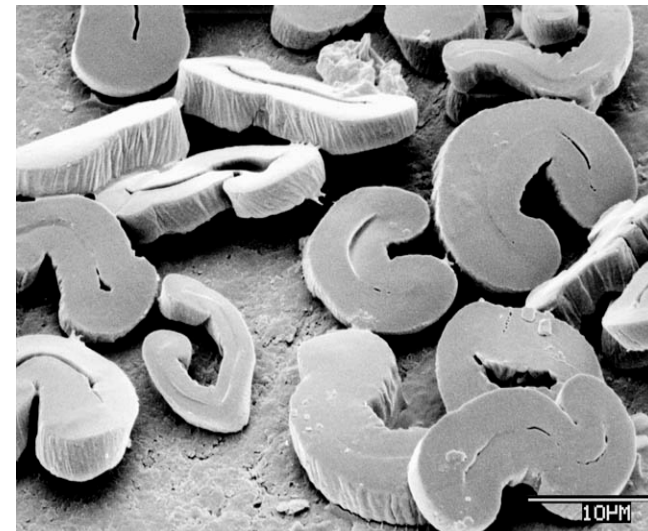
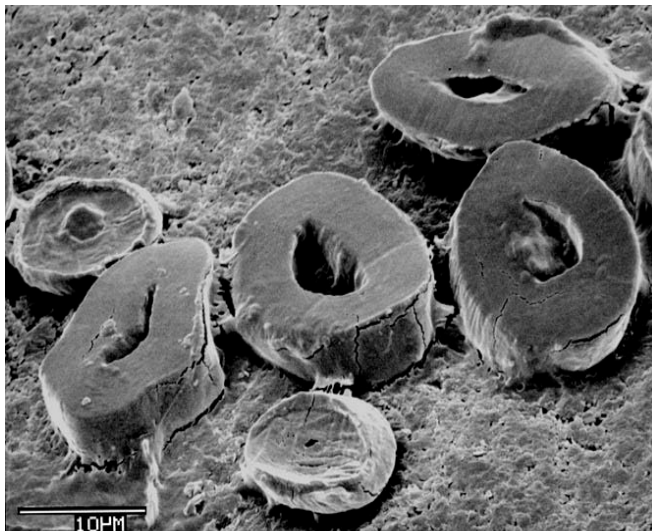
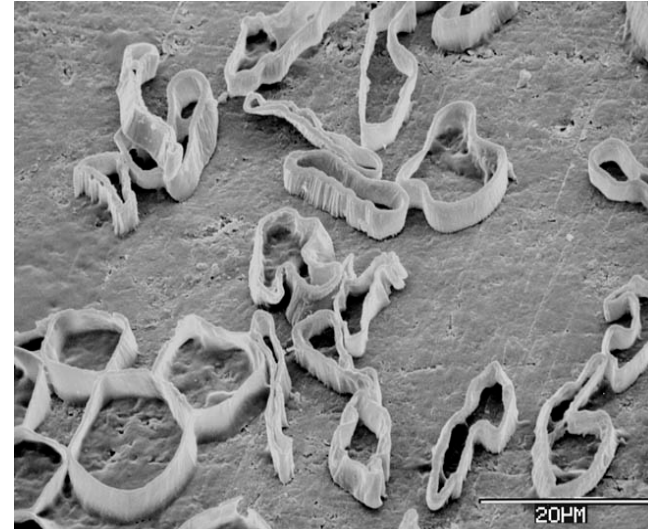
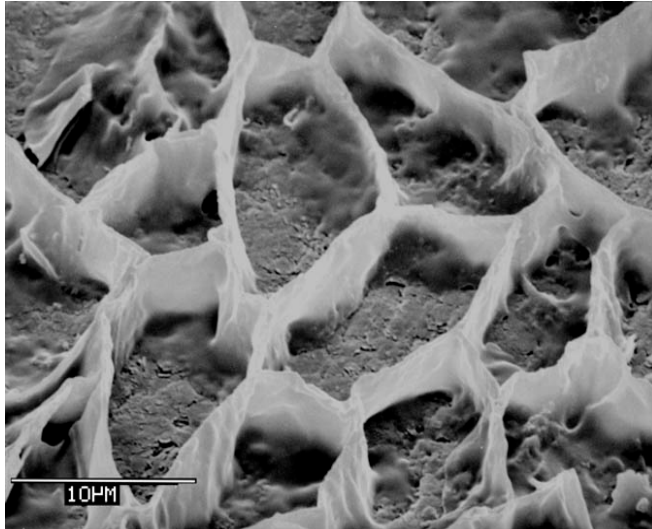
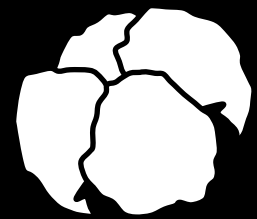
Brendan Kelly

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Cotton Fiber Development

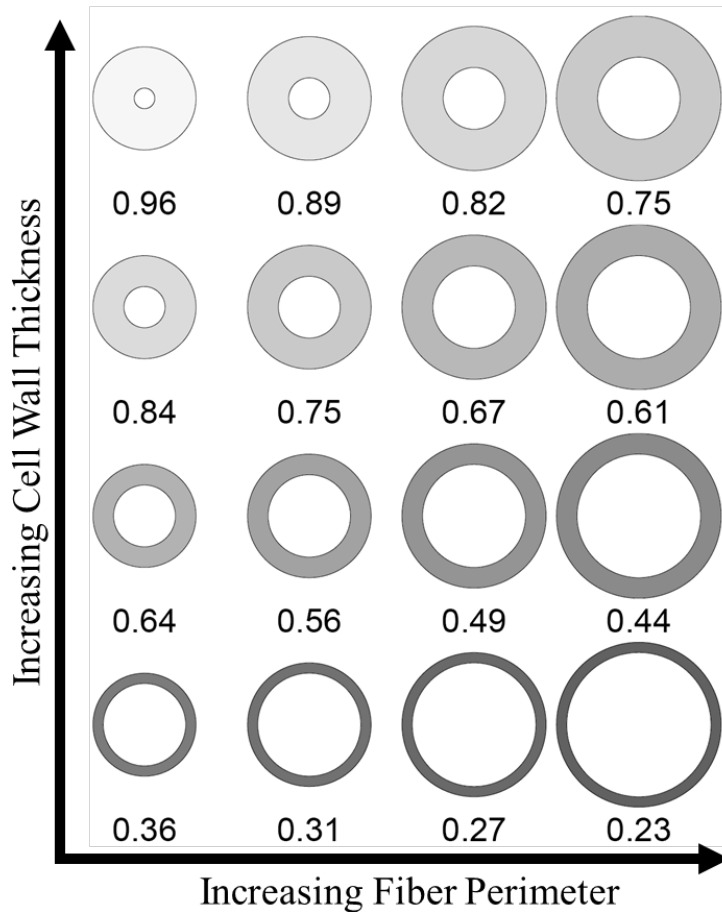
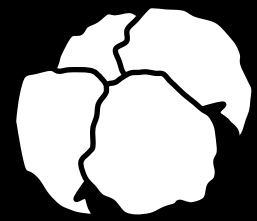


Cotton Fiber Maturation



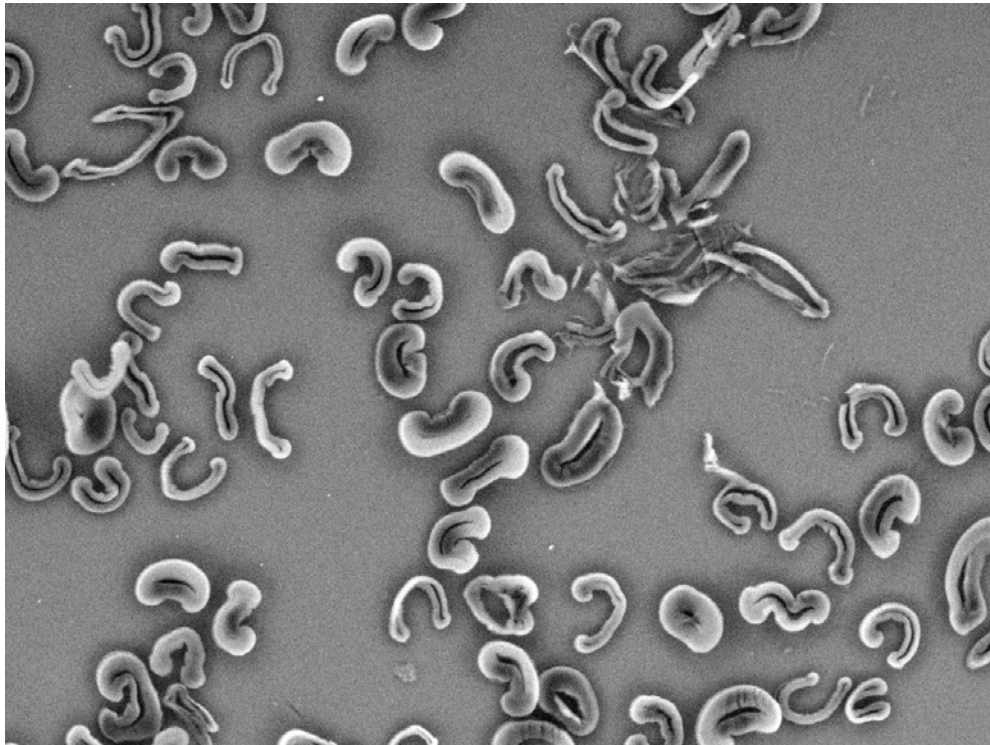
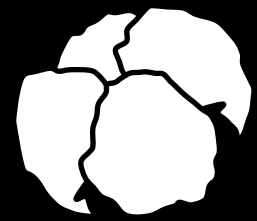
Pictures: R. Goynes

Defining Fiber Maturity



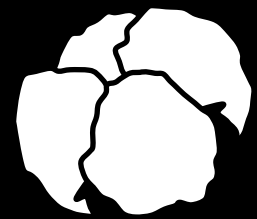
- **Maturity(θ)** is the area of the cell wall, A_w , relative to the area of a circle having the same perimeter, P_2 , as the fiber section.
- Fiber maturity (θ) is expressed as a value between 0 and 1.

Typical cotton fiber cross-sections

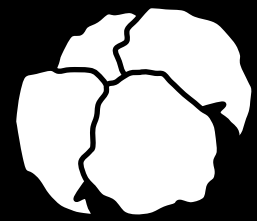


- There is variation in fiber maturity within every bale, even “mature” bales.
- Immature fibers can cause problems during processing, and can degrade yarn and fabric quality.

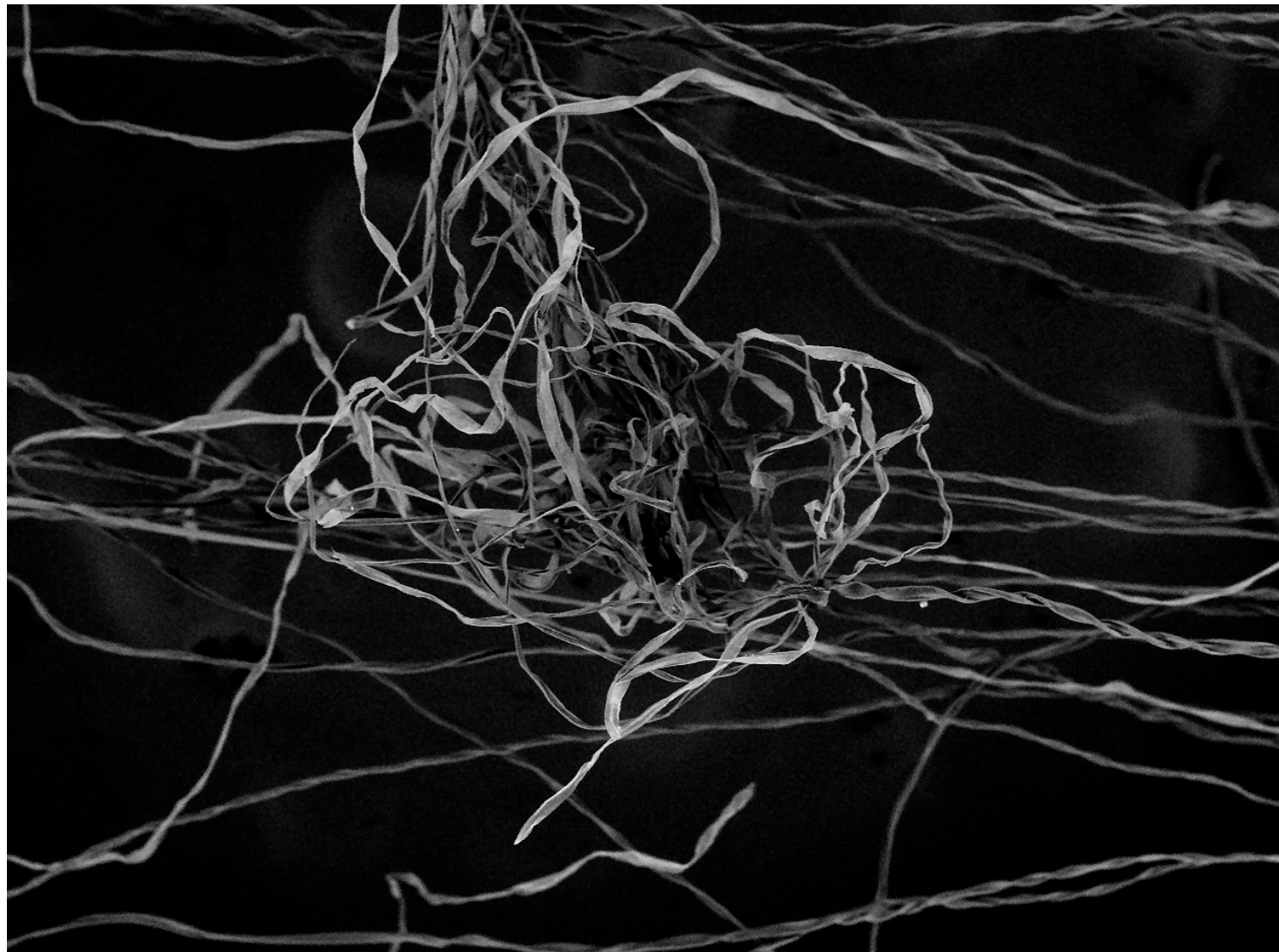
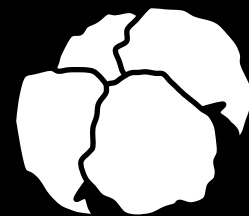
Effect of maturity on dye uptake



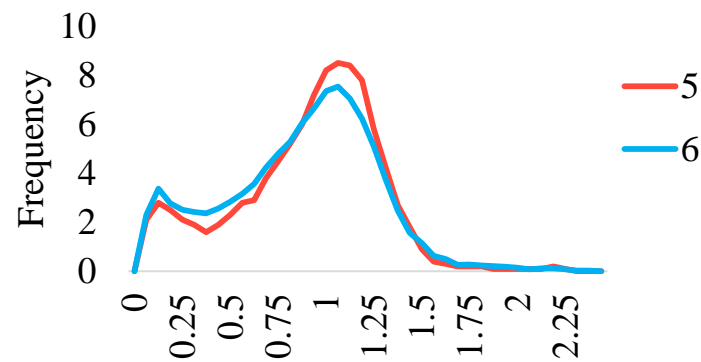
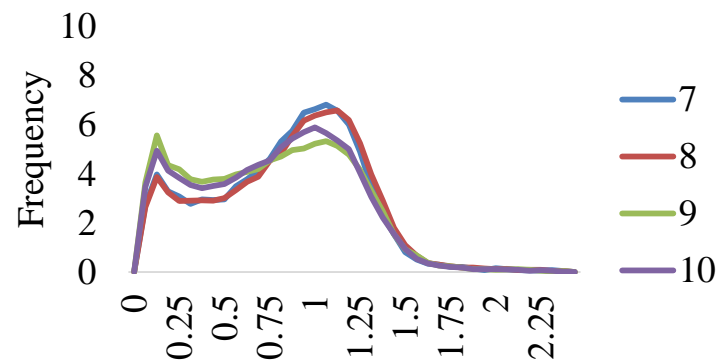
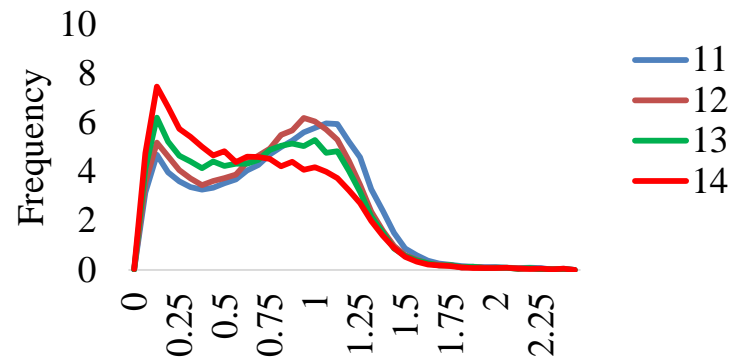
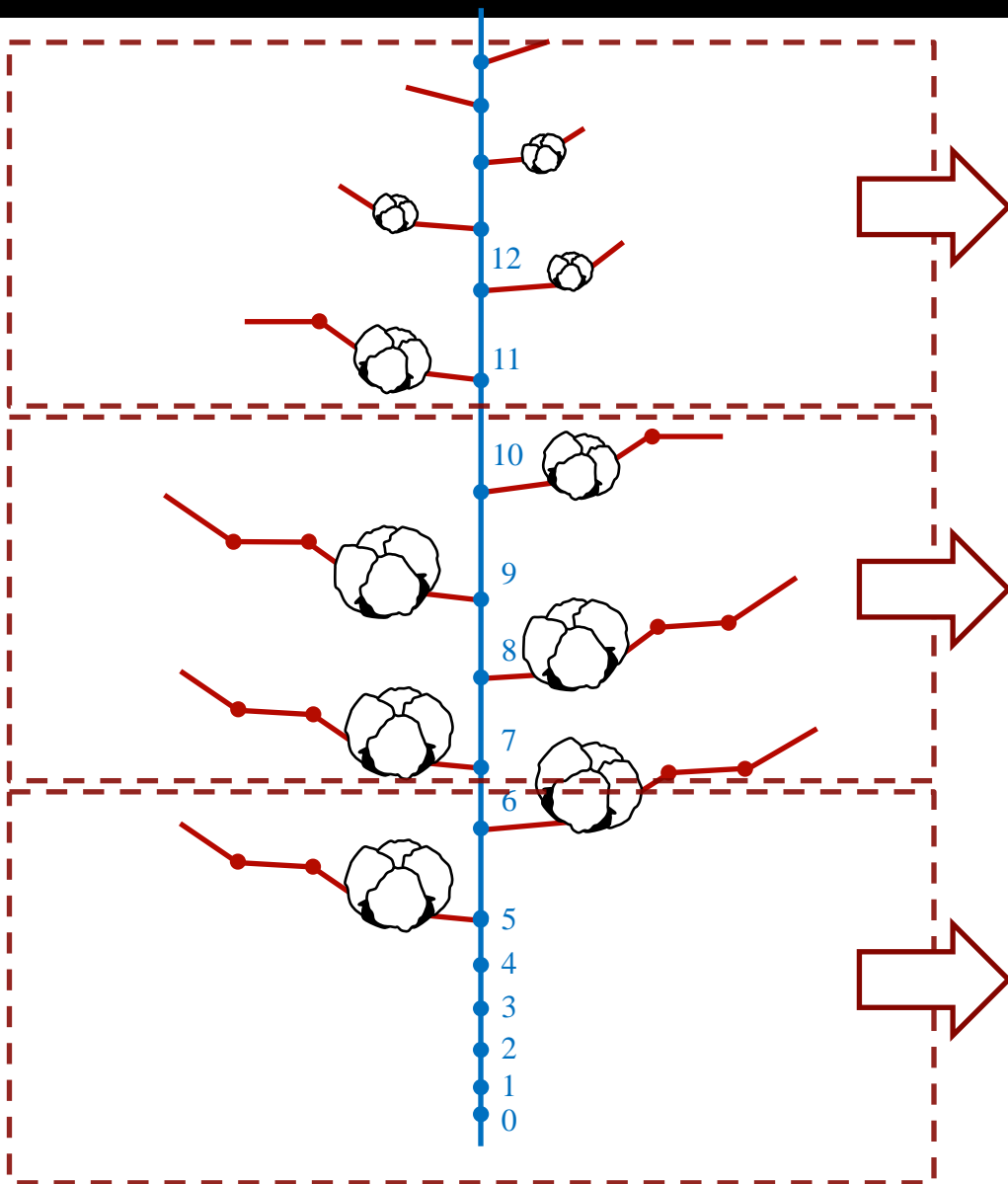
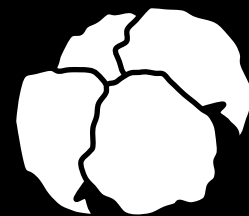
Dye imperfection barré



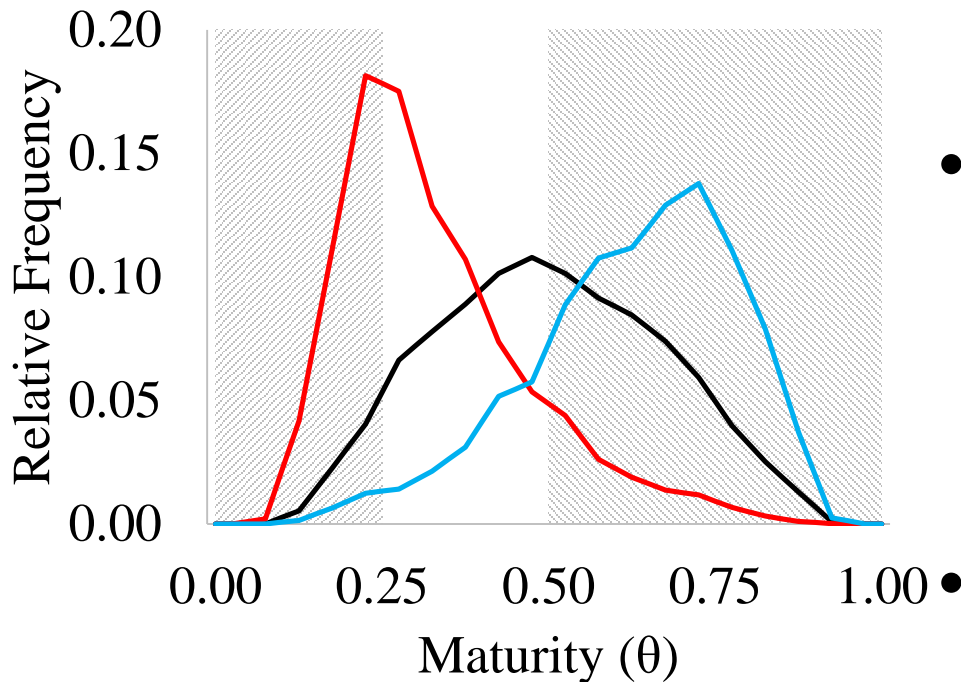
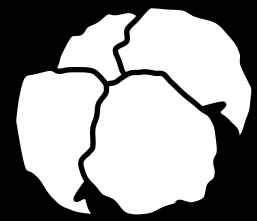
Fiber nep



Fiber breakage related to immature fibers

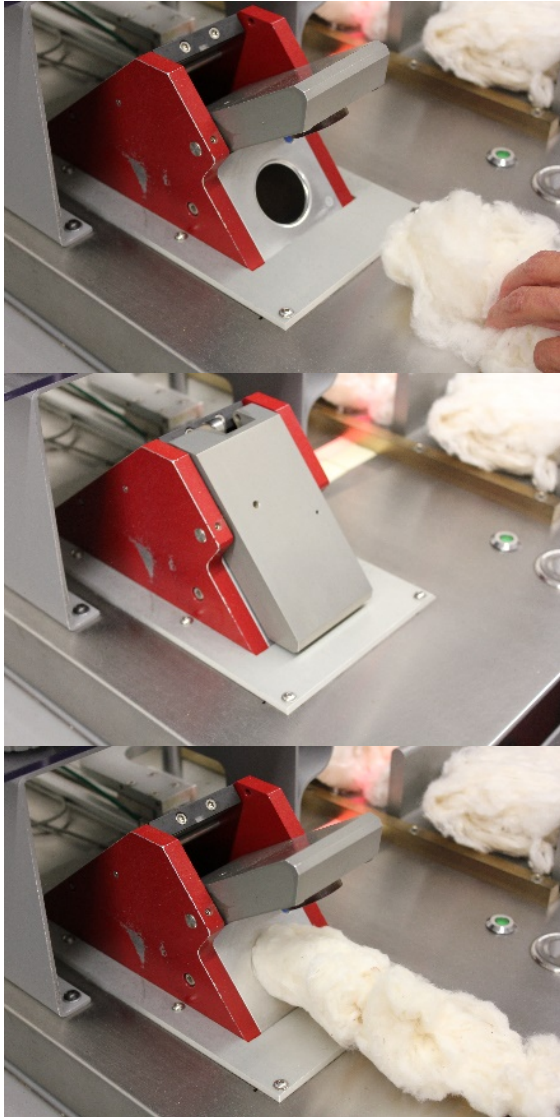
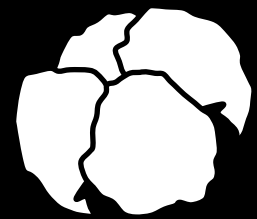


Problems caused by immature fibers



- Poor secondary cell wall development can result in poor dye performance, or dying imperfections.
- Immature fibers have a poor secondary cell wall development, are weaker, and will tend to break and entangle during processing.
- Fiber breakage during processing degrades fiber quality and can cause imperfections in spun yarn quality.

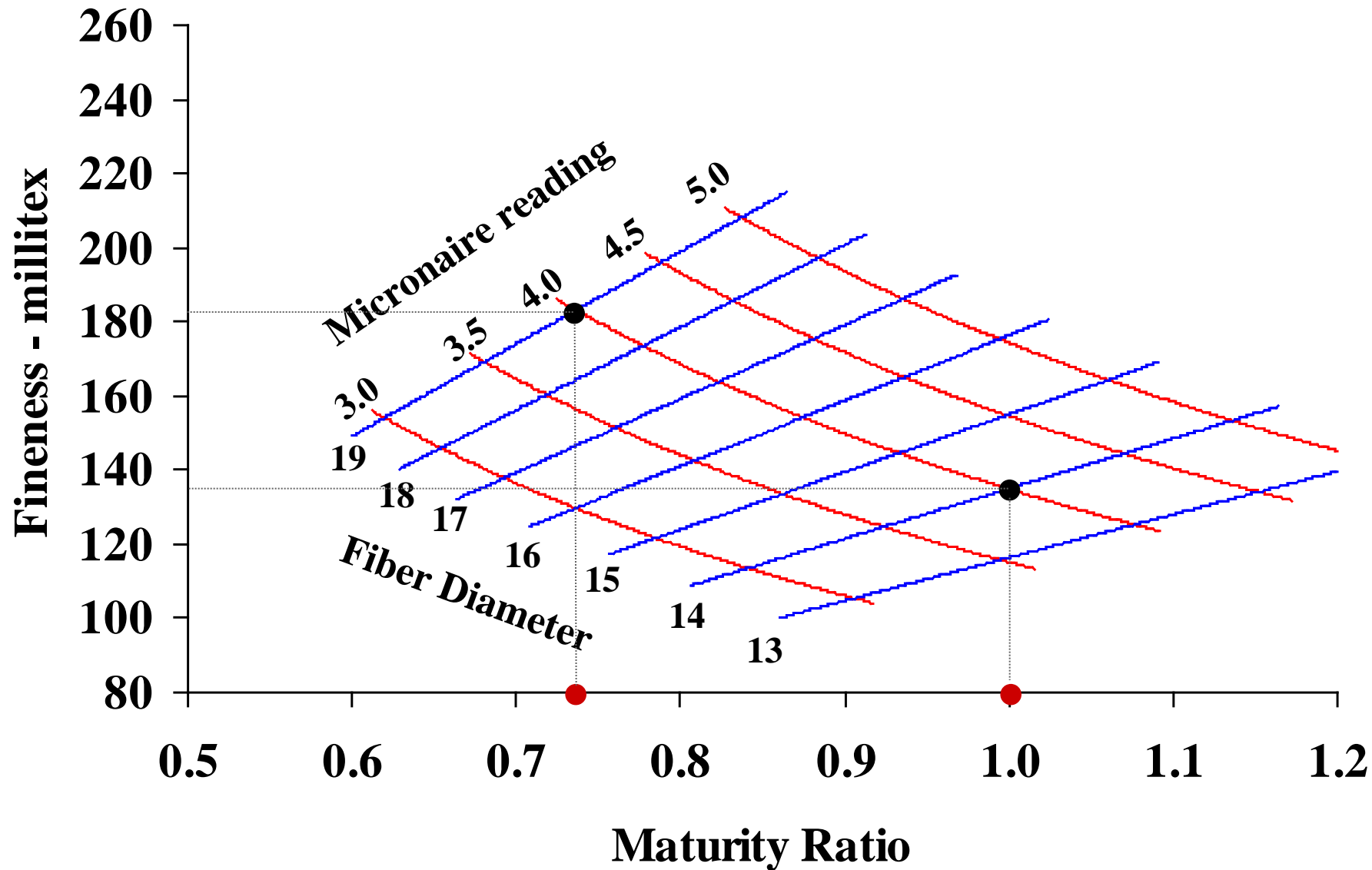
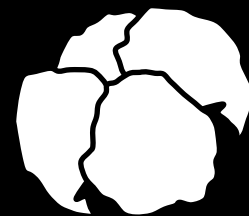
High Volume Instrument (HVI) Micronaire



High Volume Instrument (HVI) micronaire provides an indirect measure of maturity and fineness using a laminar flow of air.

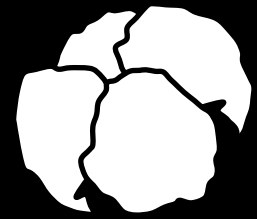
- **Micronaire (Mic):** “...a function of both fineness and maturity and is related to mill processing performance and to the quality of the end products (ASTM D1448.5.2)”.

Relationship MR-H-Micronaire-Diameter

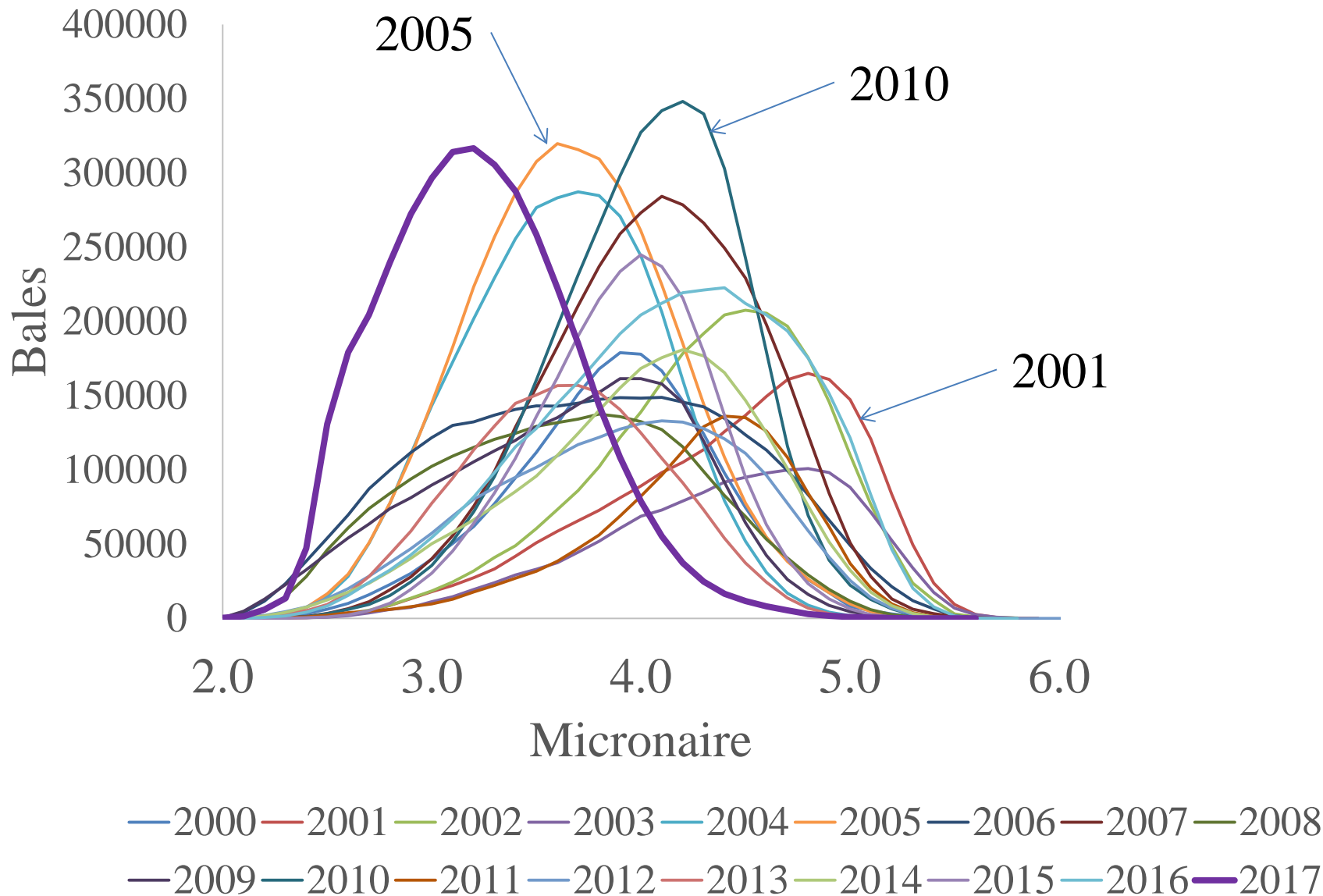
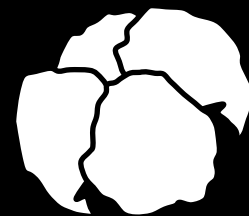


Lubbock Classing Office (2000-2017)

Average Micronaire

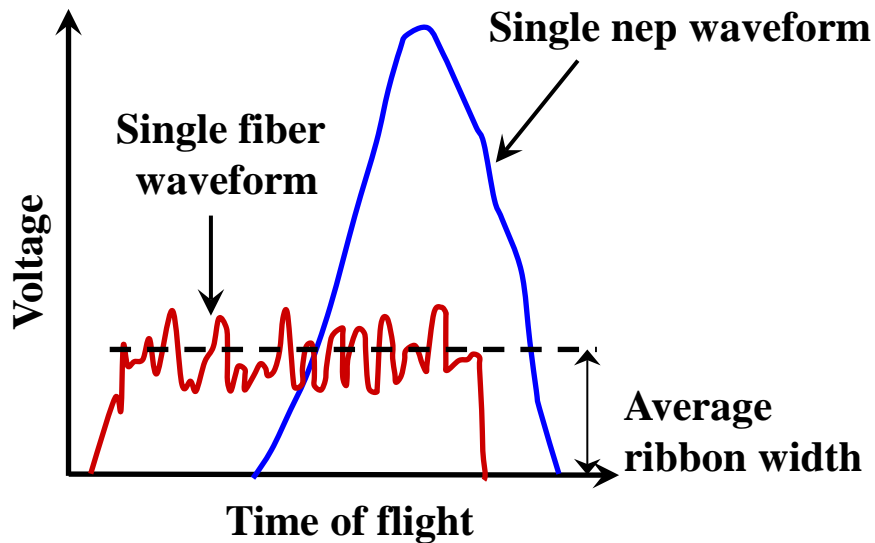
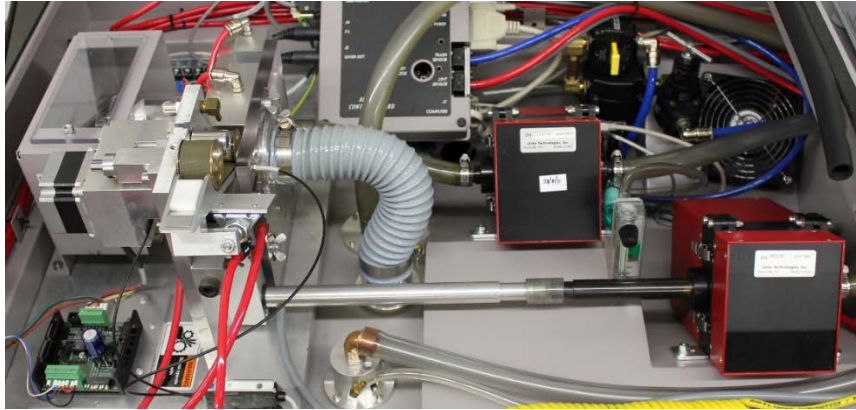
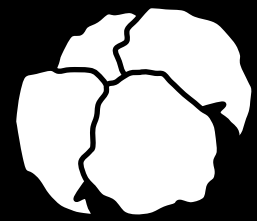


Lubbock Classing Office (2000-2017) Distribution of Micronaire



Advanced Fiber Information System (AFIS)

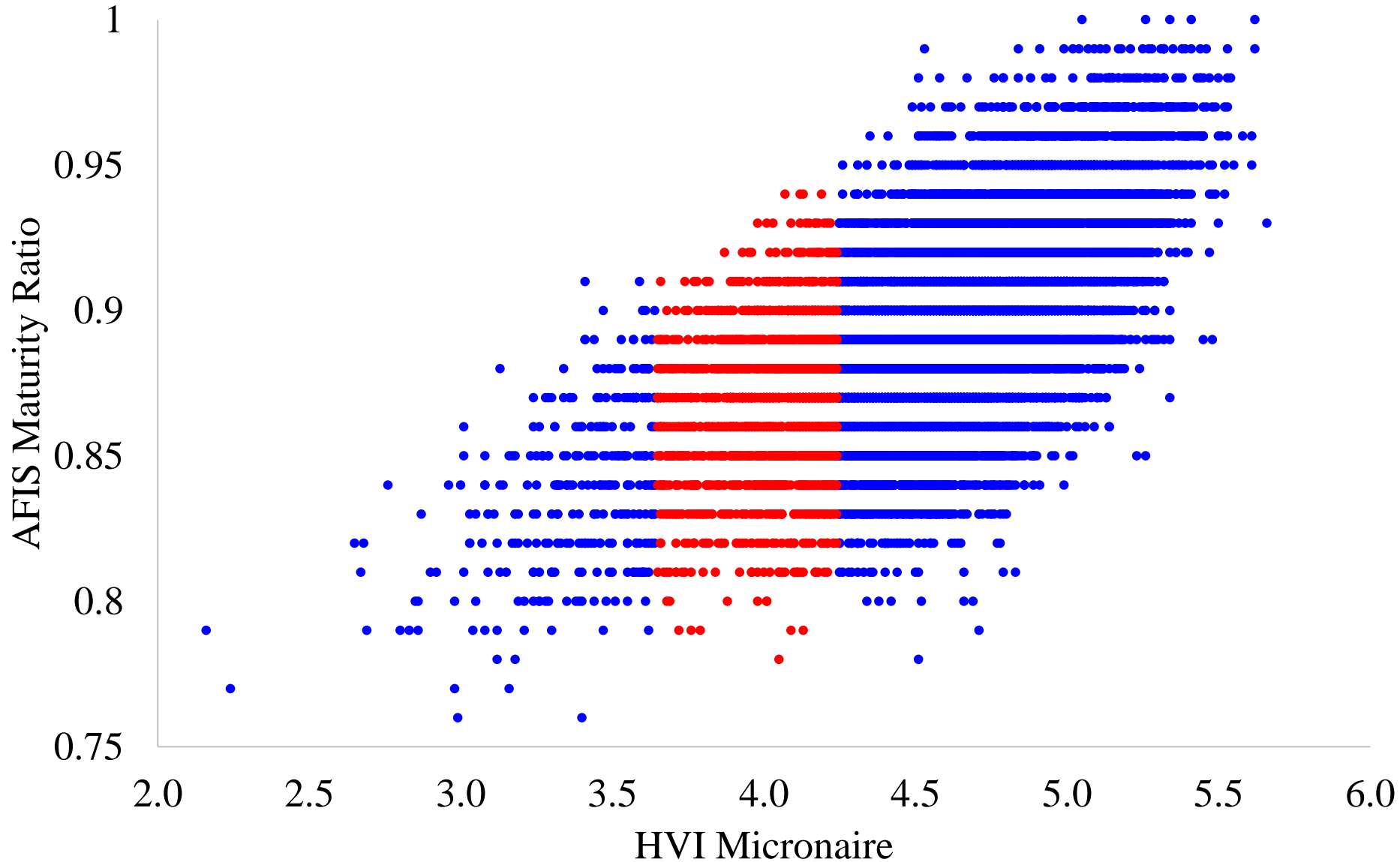
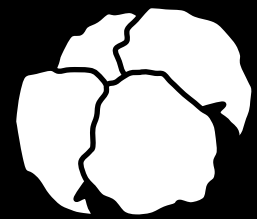
Maturity and Fineness



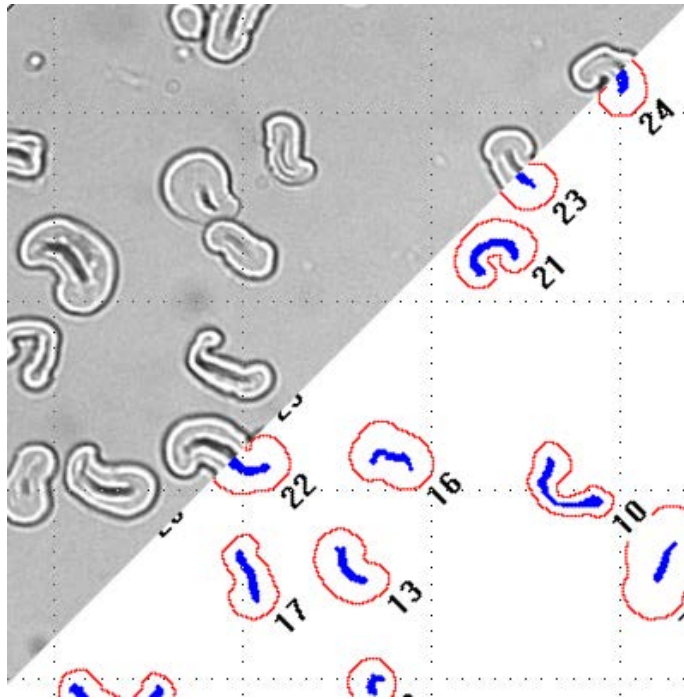
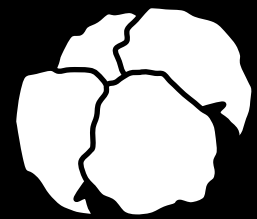
- AFIS is an individual fiber tester.
- It uses electro-optical sensors to measure the length, maturity, and fineness of individual fibers in the sample.
- We can compare HVI Micronaire with AFIS Maturity.

Measurement Comparison

AFIS Maturity Ratio vs. HVI Micronaire

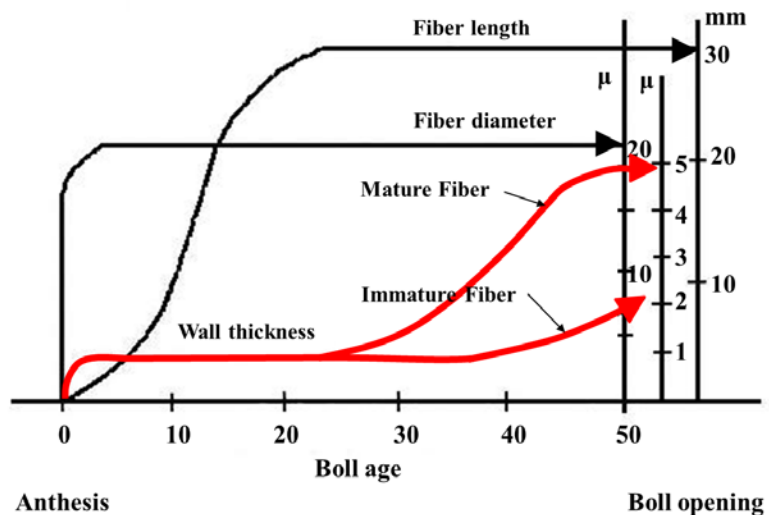
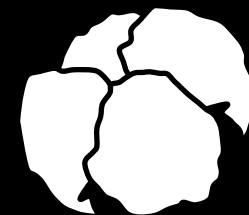


Discussion



- The within bale distribution of fiber maturity and fineness are important quality concerns.
- HVI Micronaire alone is not enough to measure fiber maturity or fiber fineness separately.
- Faster methods are needed for evaluating the maturity and fineness complex.

Current Research



- Using varietal estimates of standard fineness to estimate fiber maturity from Micronaire.

- Creation of reference material to support the calibration of existing instruments, and the development of new maturity measurements.

