

A close-up photograph of a cotton plant branch. Several white, fluffy cotton bolls are visible, some in sharp focus and others blurred in the background. The bolls are attached to dark brown, woody stems. The background is a soft-focus mix of more cotton bolls and some dried, brown leaves.

# Defoliation, Harvest, and Cotton Quality....

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*University of Georgia*

# Fiber Quality

*Determined by Many Factors*

- Physiology of the plant
- Variety
- Defoliation Timing
- Harvest Timing
- Agronomic Practices



# Fiber Development

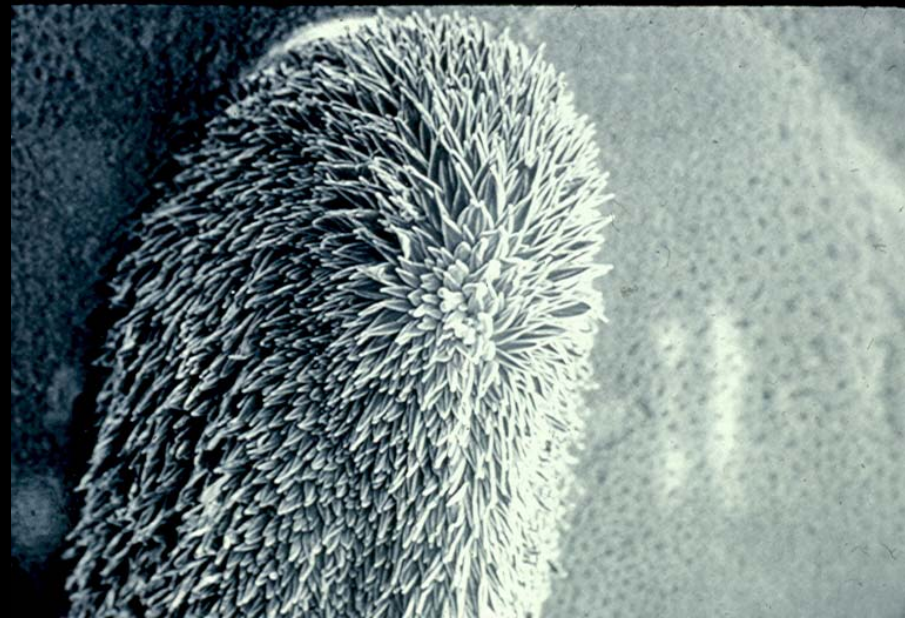
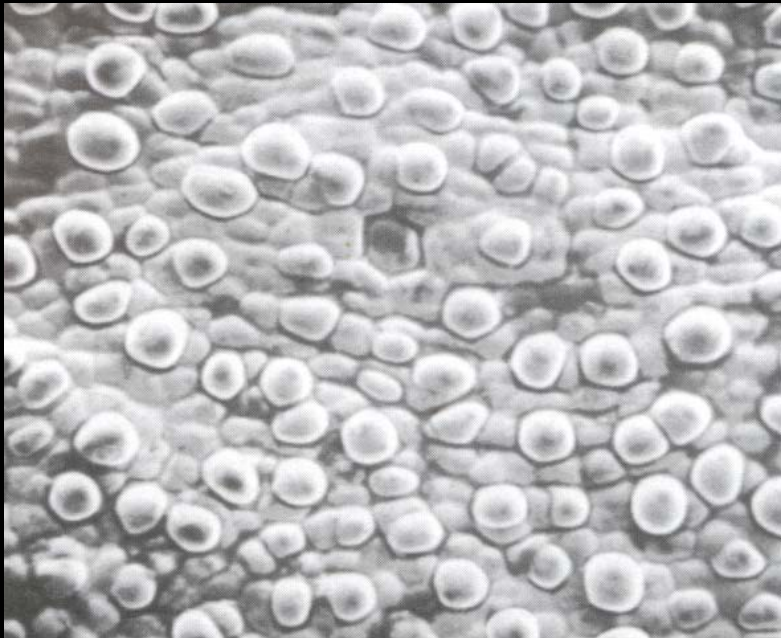
- Initiated at pollination of the cotton flower.
- 3 stages of development
  - Elongation
  - Secondary wall thickening (maturation)
  - Drying





# Fiber Development

- Cotton fibers originate from the outer epidermal cells of the ovule. “Seed Hair”



# FIBER ELONGATION

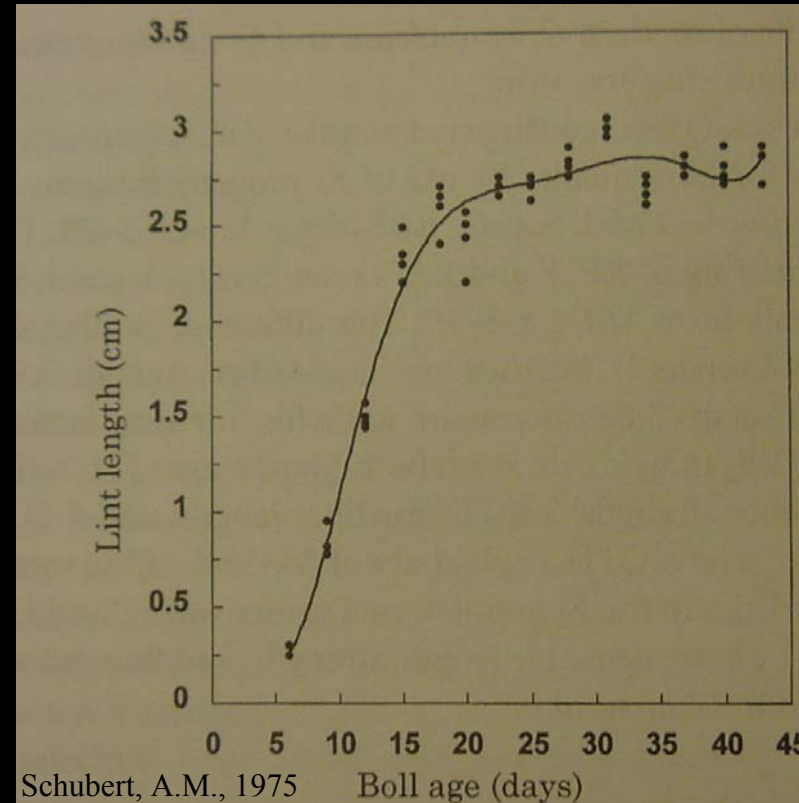
Stage 1

# Fiber Elongation

## *Stage 1*



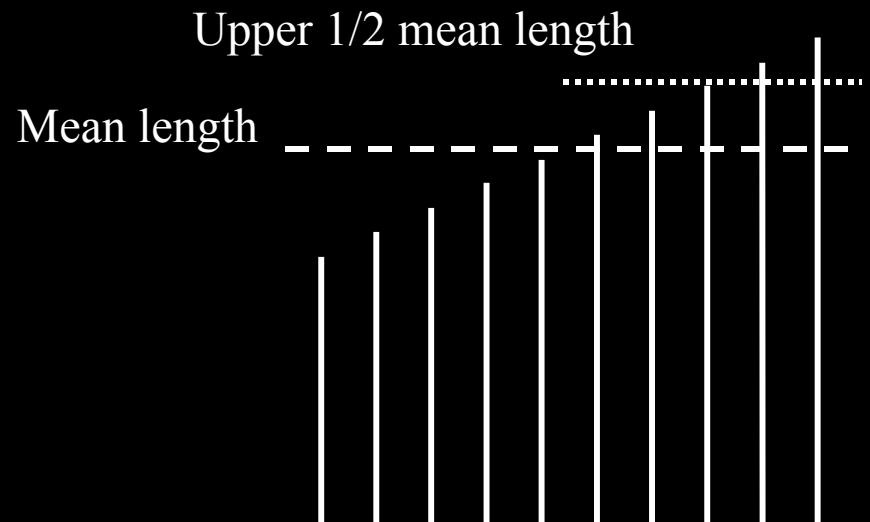
- Elongation of the fiber is driven by the internal water pressure of the elongating cell.
- Length
  - Determined in the 18 to 21 days after pollination.
  - Cell expansion.
  - Variety sets the bar
    - influenced by environment.



# Fiber Quality

## *Length*

- Reported to the nearest 32<sup>nd</sup> of an inch.
- Upper 1/2 mean length



# Fiber Quality

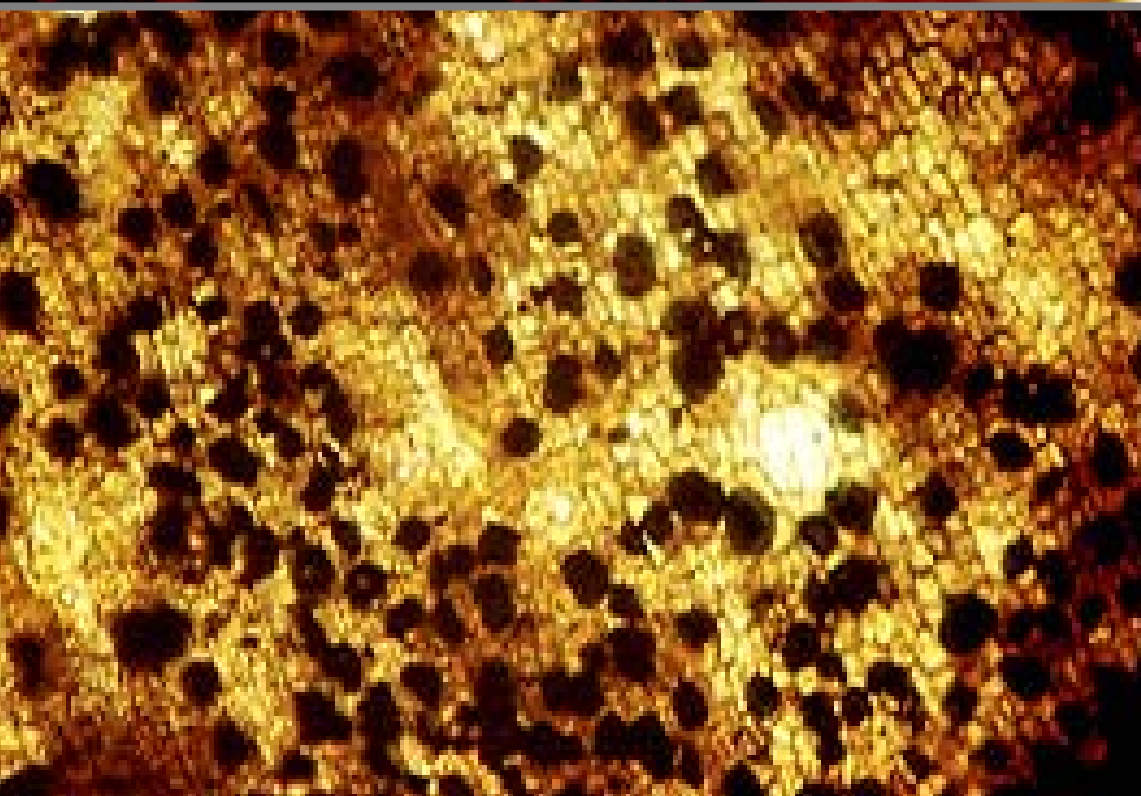
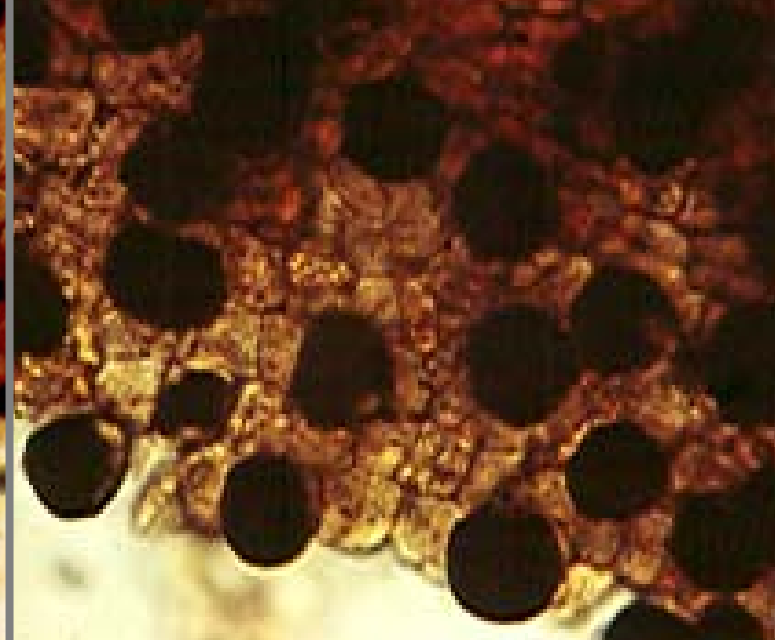
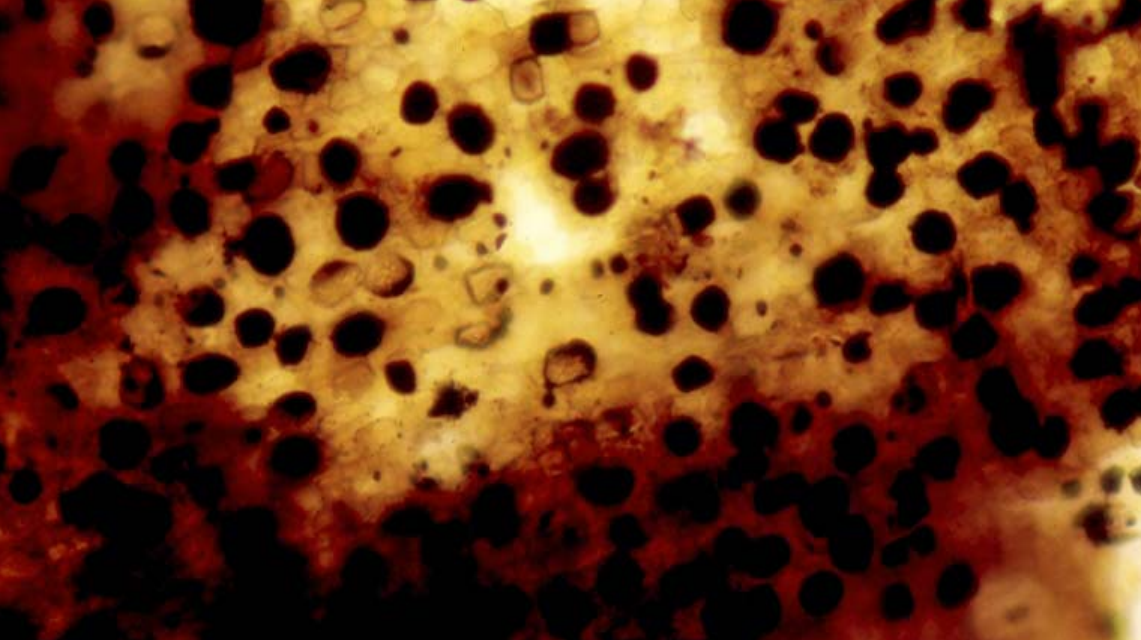
## *Length*

- Base is 34
  - Below 34 incurs discounts
  - Above 34 may incur premiums depending on color.
- How bad can it hurt?
  - 33 = -2.2 cents
  - 32 = -3.85 cents
  - 35 = 1.40 cents



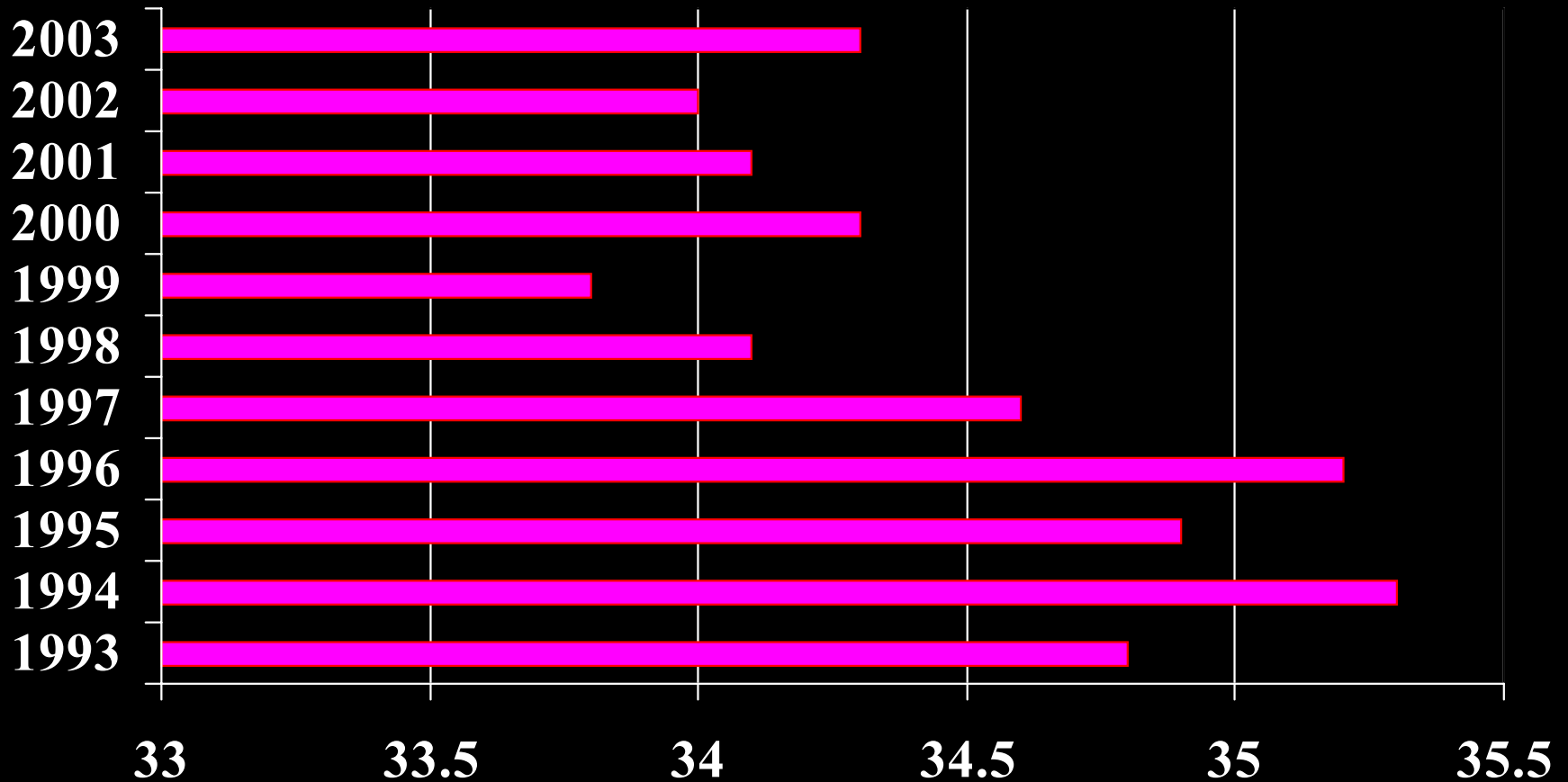
# Factors Influencing Fiber Elongation

- Temperature
  - Affected by extremes in temperature early in development.
- Plant Nutrition
  - K is essential for maintaining internal water pressure.
- Variety!
- Water
  - Length usually not affected by water deficit, yield is much more susceptible. ??

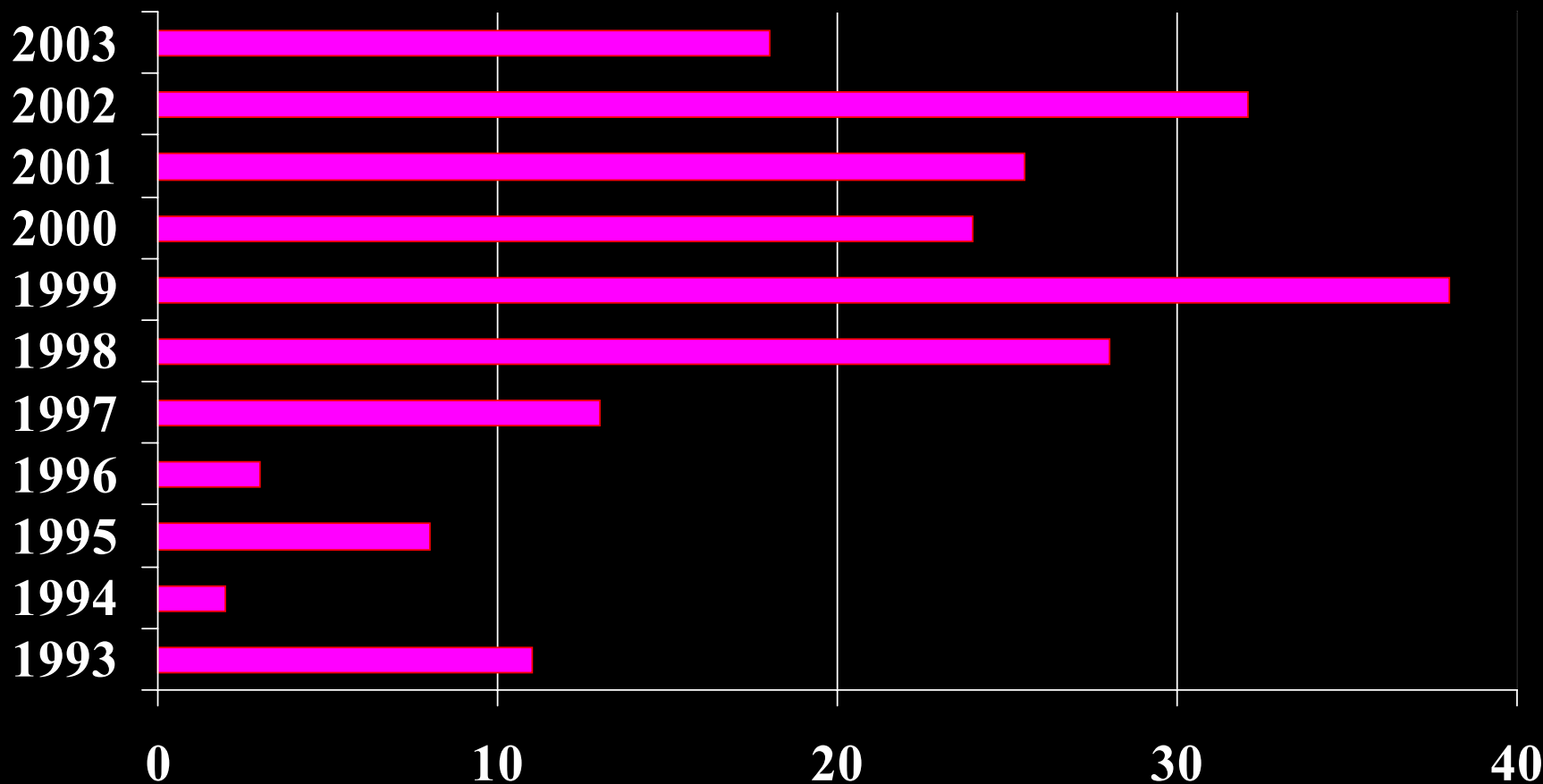


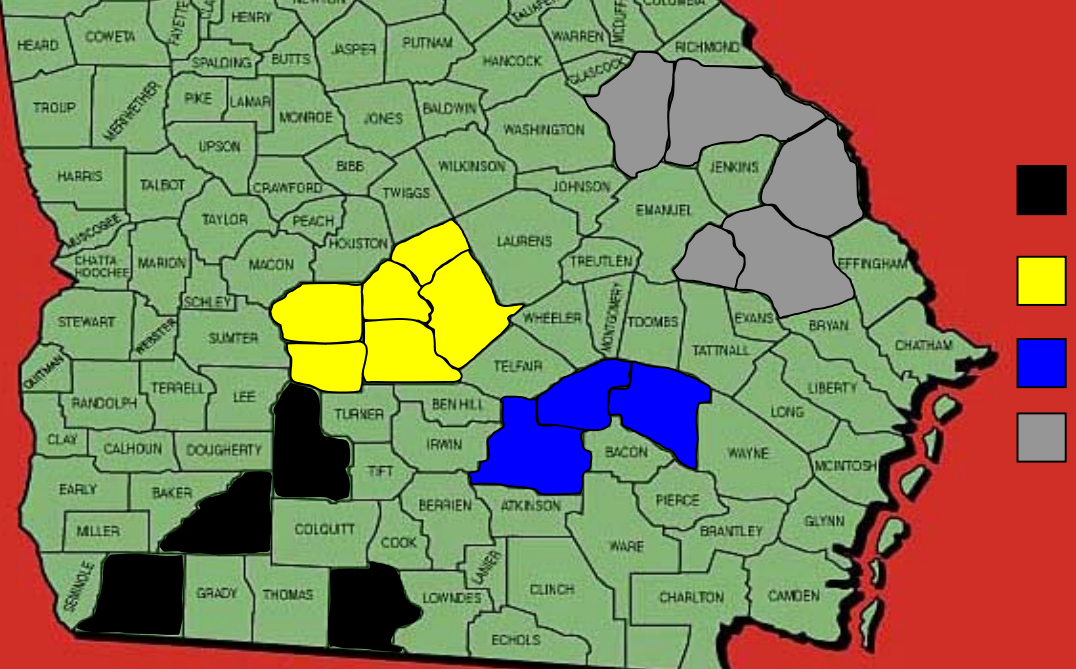
**$K^+$  accumulates  
in primordial  
fiber cells at  
initiation of  
expansion**

# Fiber Length (1993 - 2003)



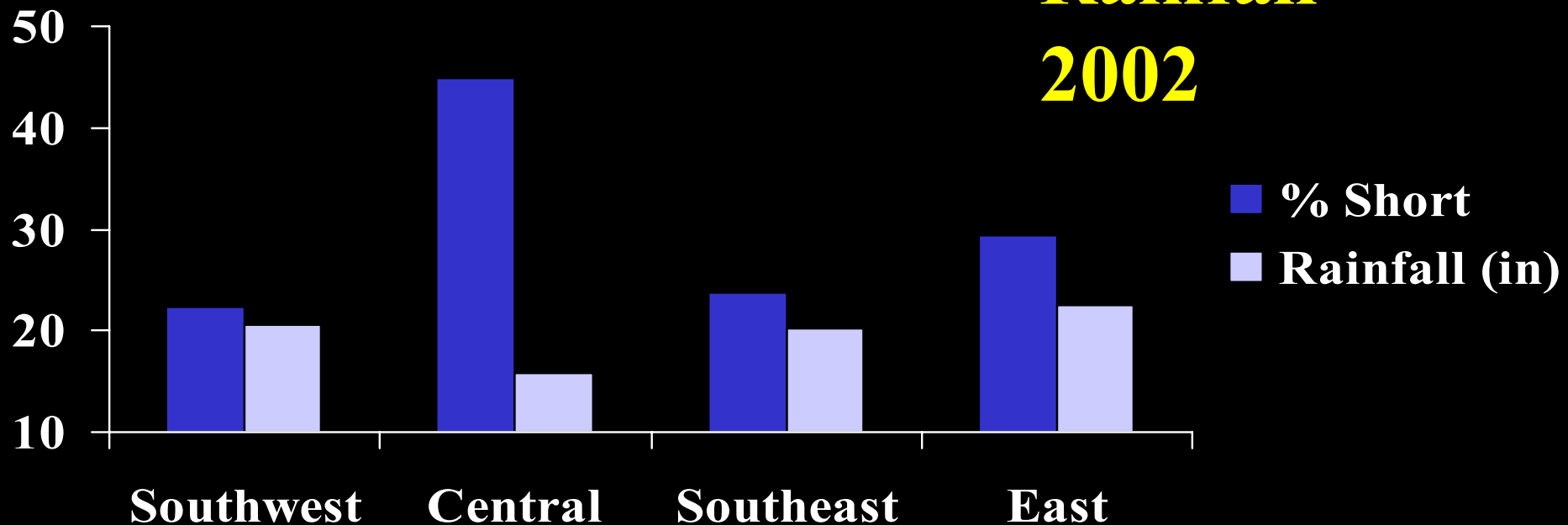
# % Short Staple (1993 - 2003)





- Southwest
- Central
- Southeast
- East

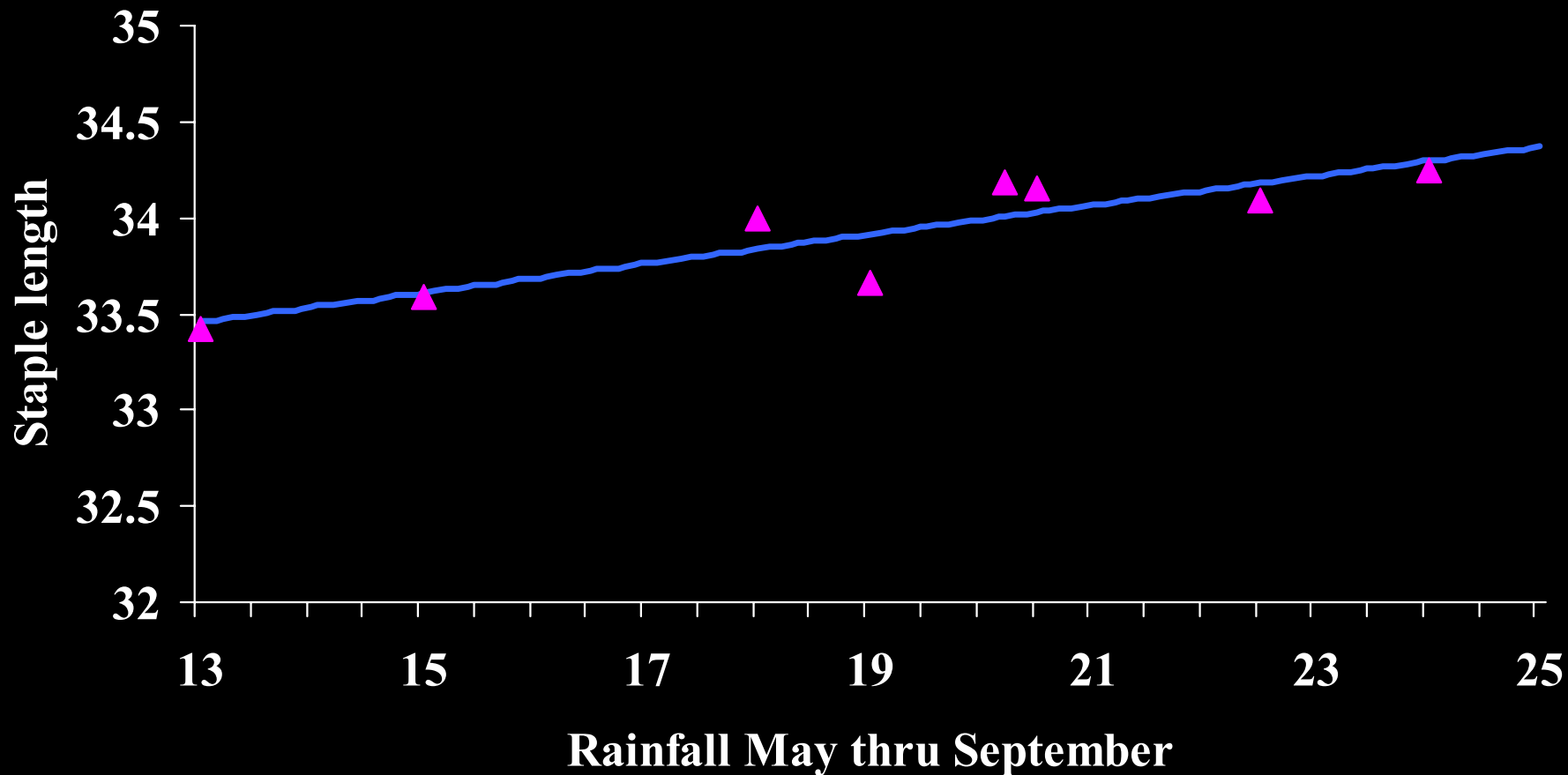
## %Short vs Rainfall 2002





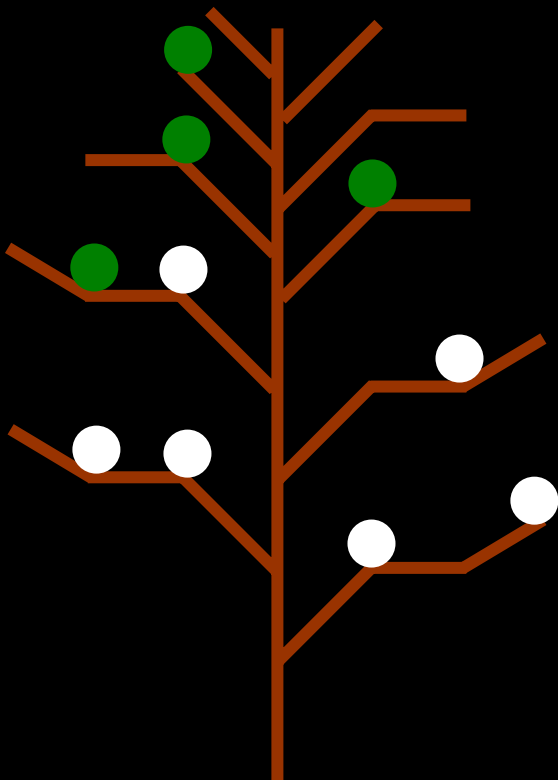
# Rainfall vs Staple

*2001 and 2002*

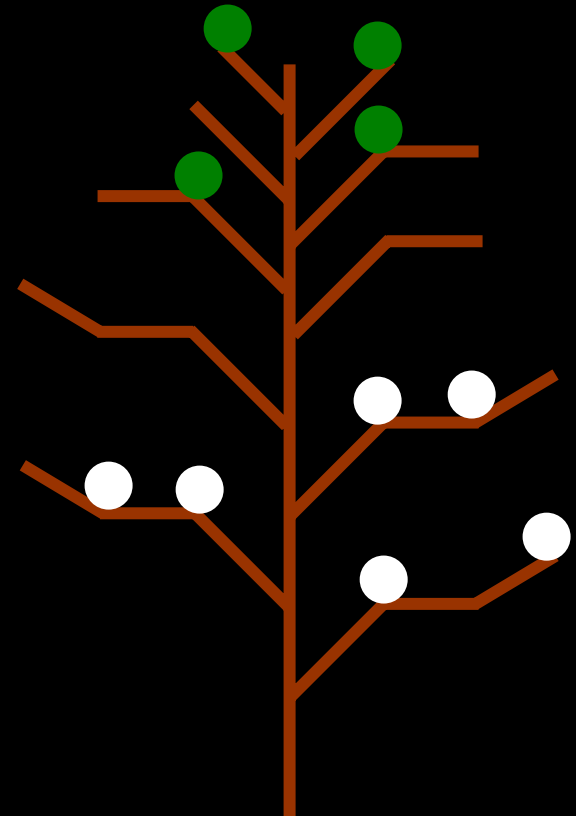


# Timing of Defoliation

4 NACB

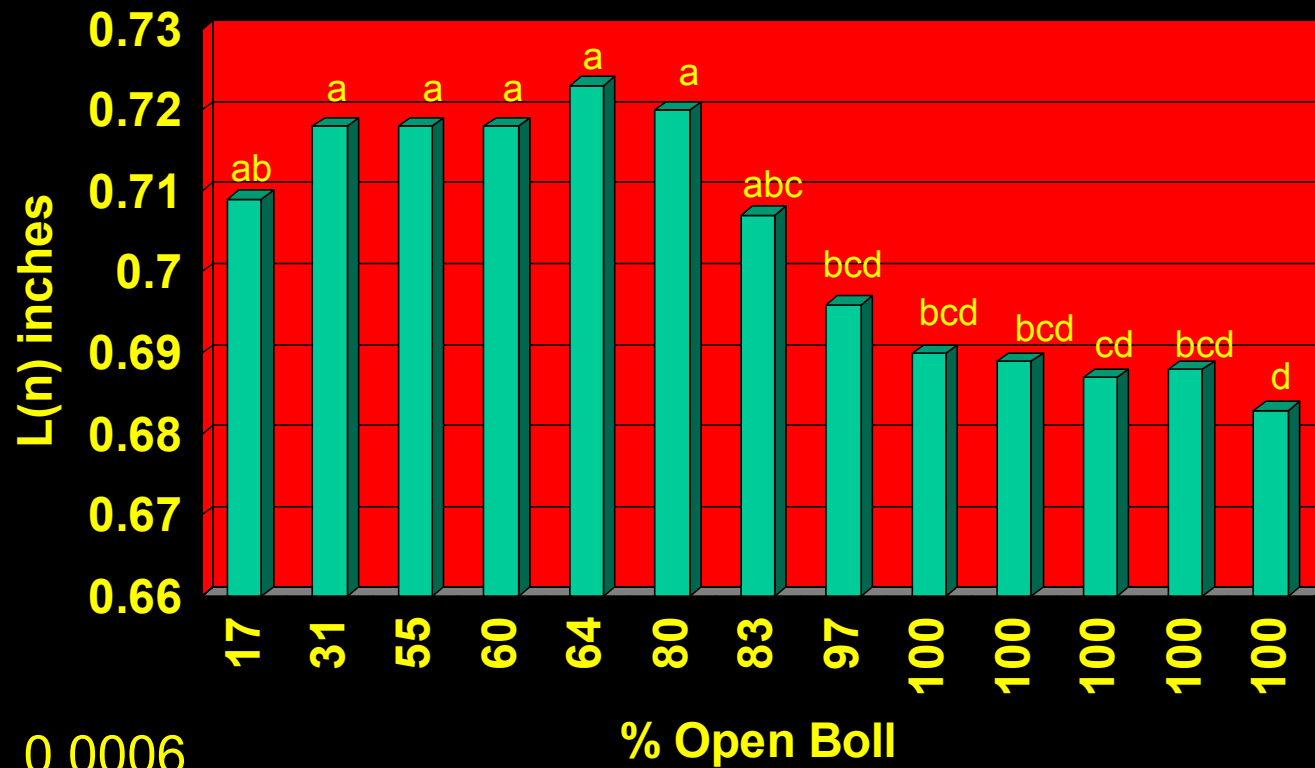


7 NACB

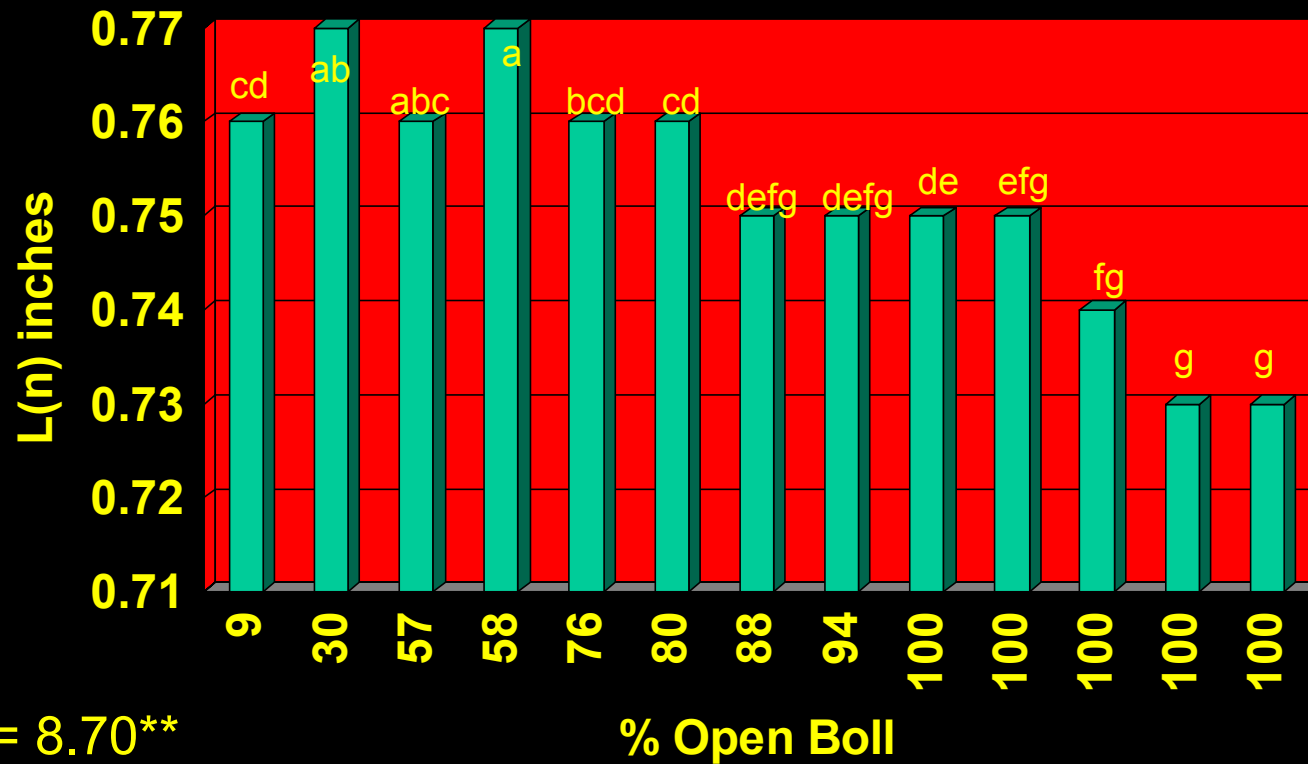


Both 60% open

# AFIS-Length(n) 1999



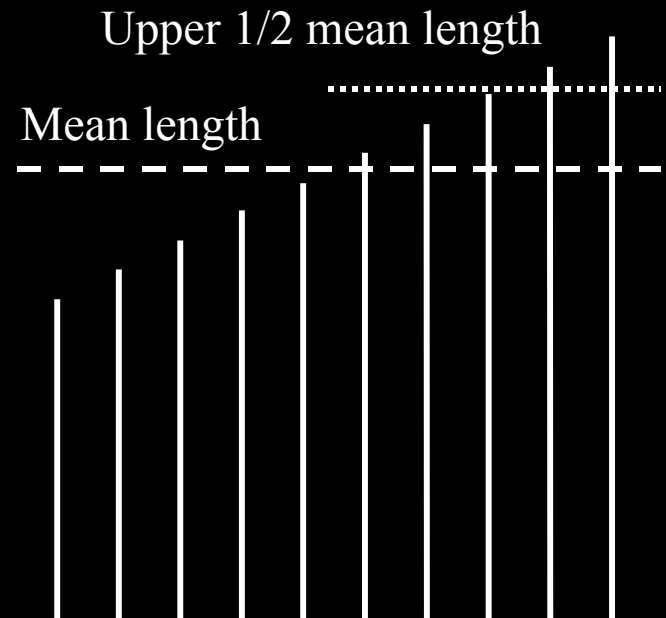
# AFIS-Length(n) 2000



# Fiber Quality

## *Length Uniformity*

- Reported as a ratio of mean length to upper  $\frac{1}{2}$  mean length.
- Base is 81
- Indirect measure of short fibers.
- How bad can it hurt?
  - 79 = -.35 cents
  - Mill problems – short fibers



$$\text{Uniformity} = \frac{\text{Mean}}{\text{Upper 1/2}}$$



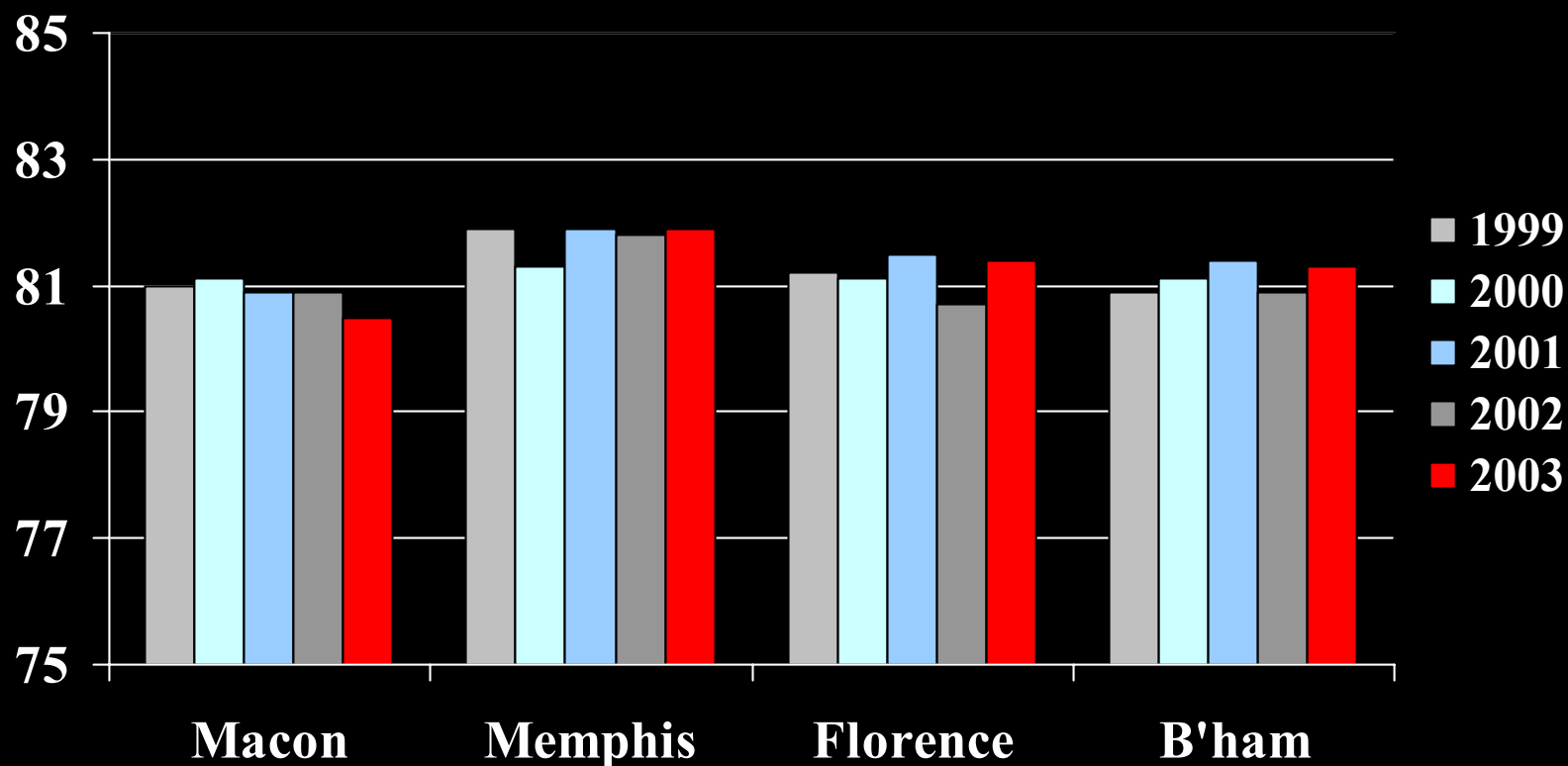
# Fiber Quality

## *Short-fiber content*

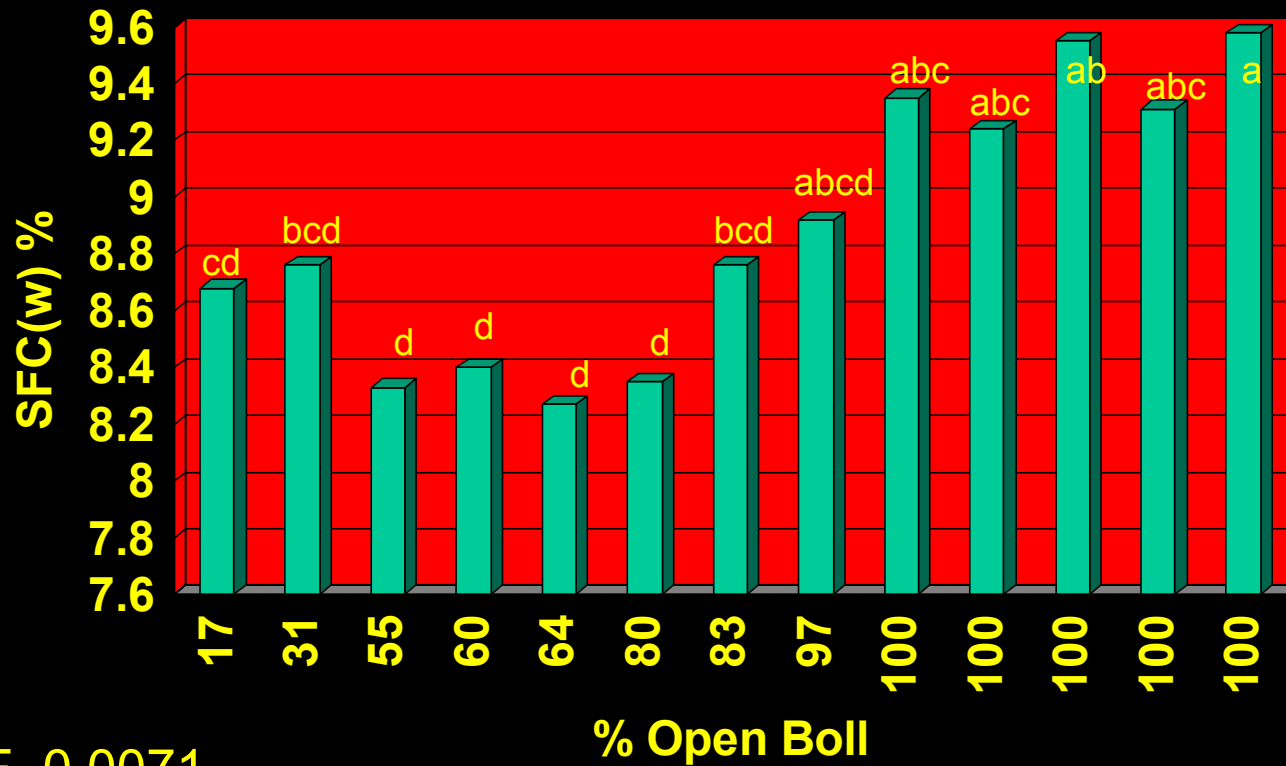
- Problems
  - Lower yarn strength
  - Reduce spinning efficiency
  - Limit the use of the yarn
  - Increase imperfections in the yarn
- Causes
  - Weathering
  - Ginning

# Fiber Uniformity in the S.E.

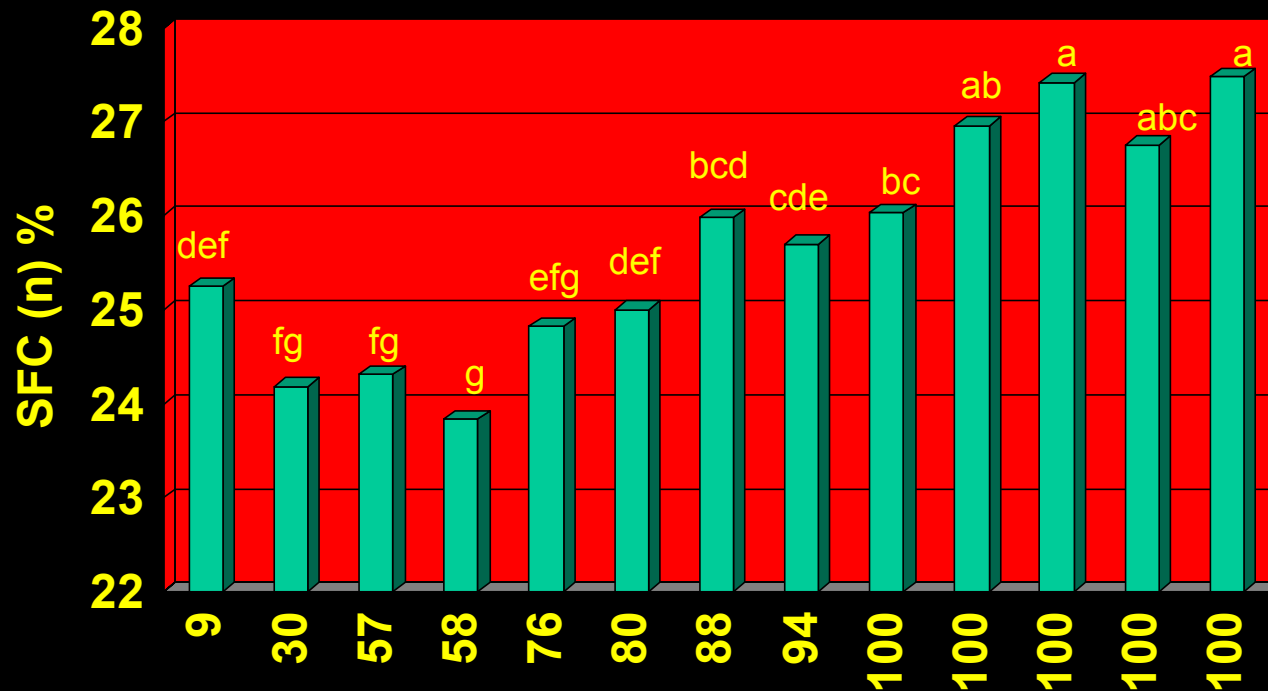
## *1999-2003*



# AFIS-SFC(w) 1999



# AFIS-SFC(n) 2000



$F = 9.24^{**}$

% Open Boll

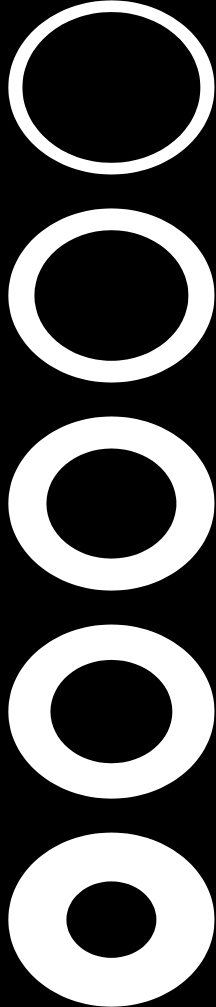
# FIBER THICKENING

Stage 2



# Fiber Thickening

## *Stage 2*

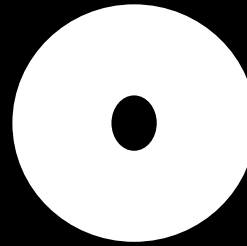


- Secondary wall thickening occurs from 17 to 53 days after pollination.
  - Cellulose is deposited inside the elongated cell.
  - The cellulose is deposited at slightly differing angles.
- Fiber thickening will determine fiber fineness, or micronaire.

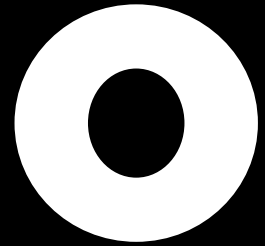
# Fiber Quality

## *Micronaire*

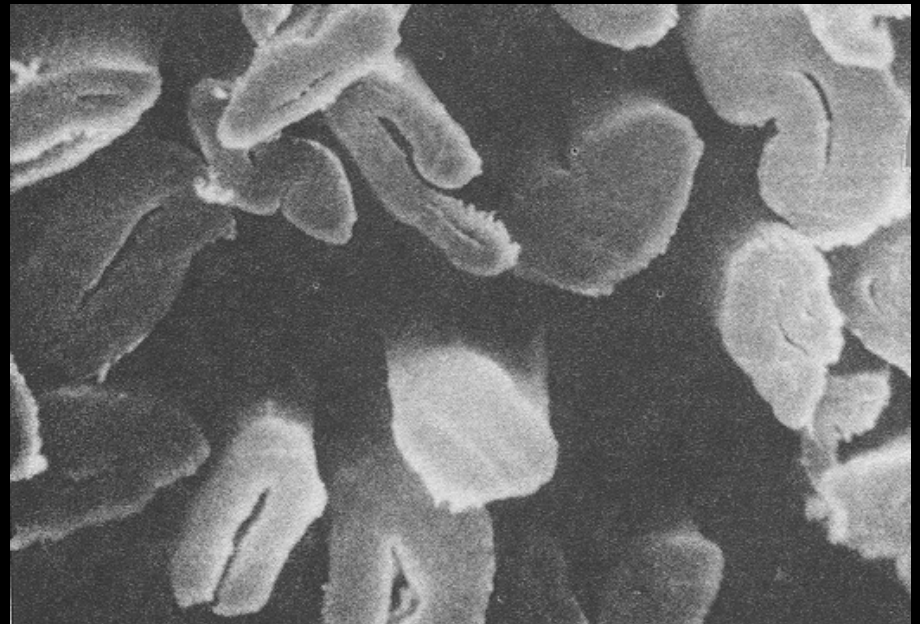
- Indirect measure of fiber fineness and maturity.
- The air-permeability of a specimen enclosed in a container of fixed dimensions.



HIGH

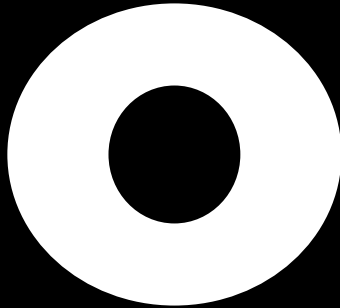


LOW



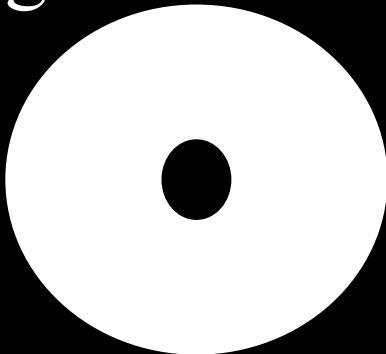
# Fiber Thickening

- Low micronaire cotton – thin fibers



- Insufficient carbohydrate supply.
  - Nutrient deficiency
  - Excessive vegetative growth
  - Heavy boll set

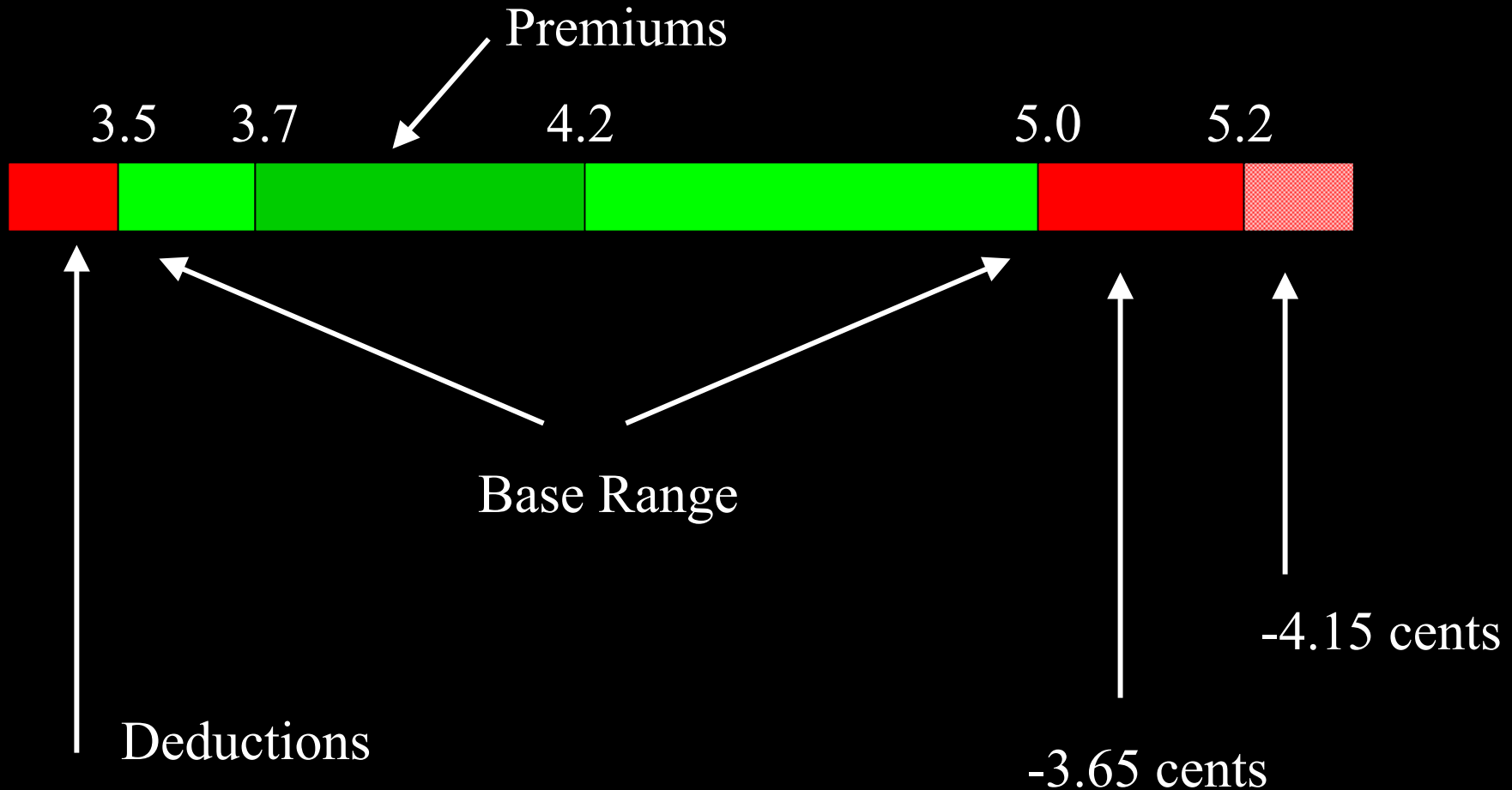
- High micronaire cotton – thick fibers



- Ample carbohydrate supply.
  - Poor boll set
  - Short fibers

# Fiber Quality

## *Micronaire*



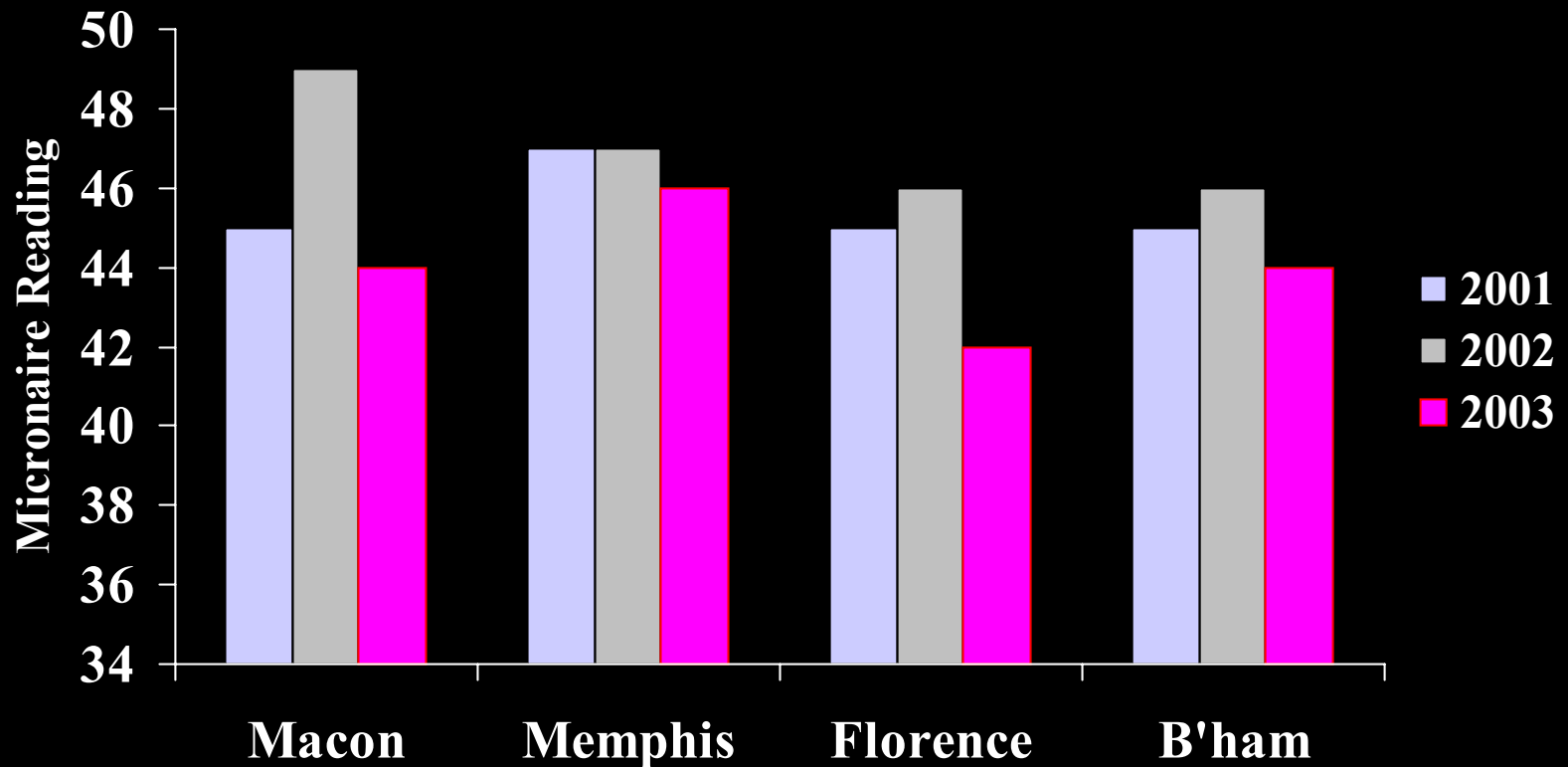
# Fiber Quality

## *Micronaire*

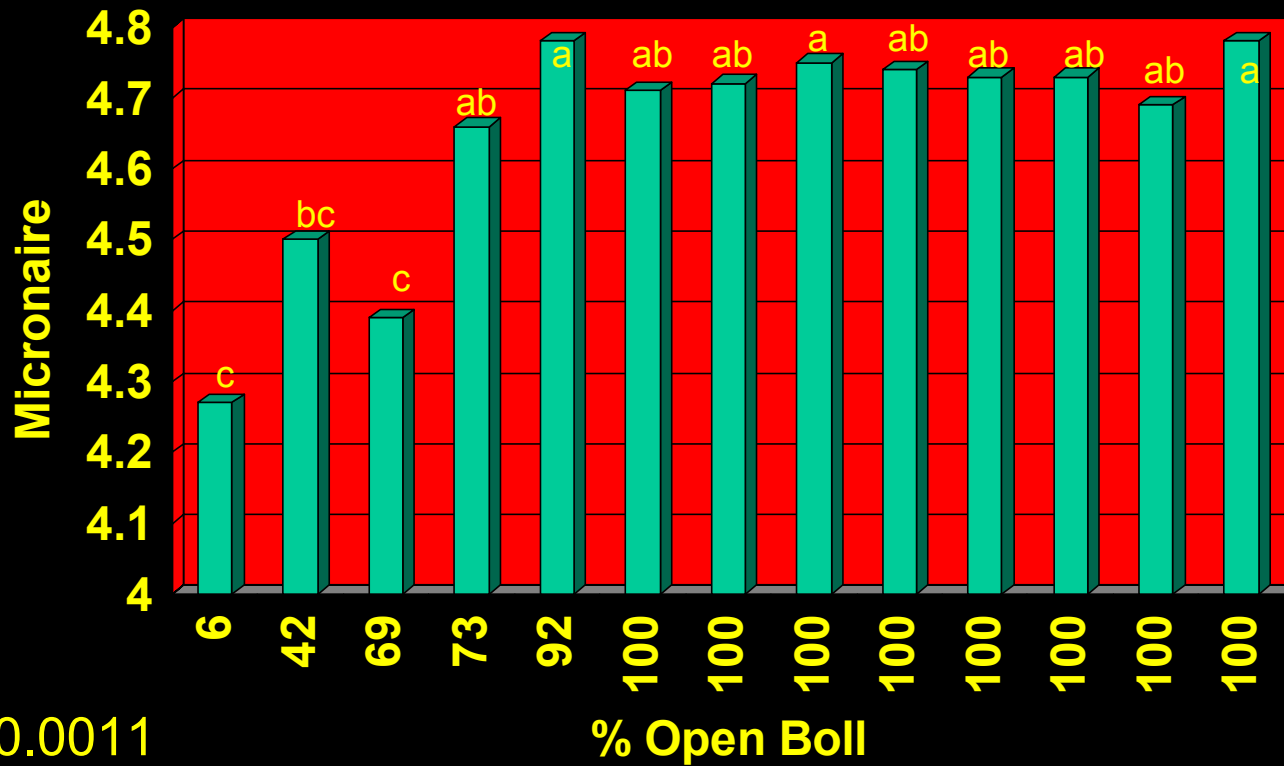
- How to manage a crop for micronaire.
  - Variety selection
  - Irrigation where possible
  - Insect control
  - Harvest preparation
  - Once-over harvesting



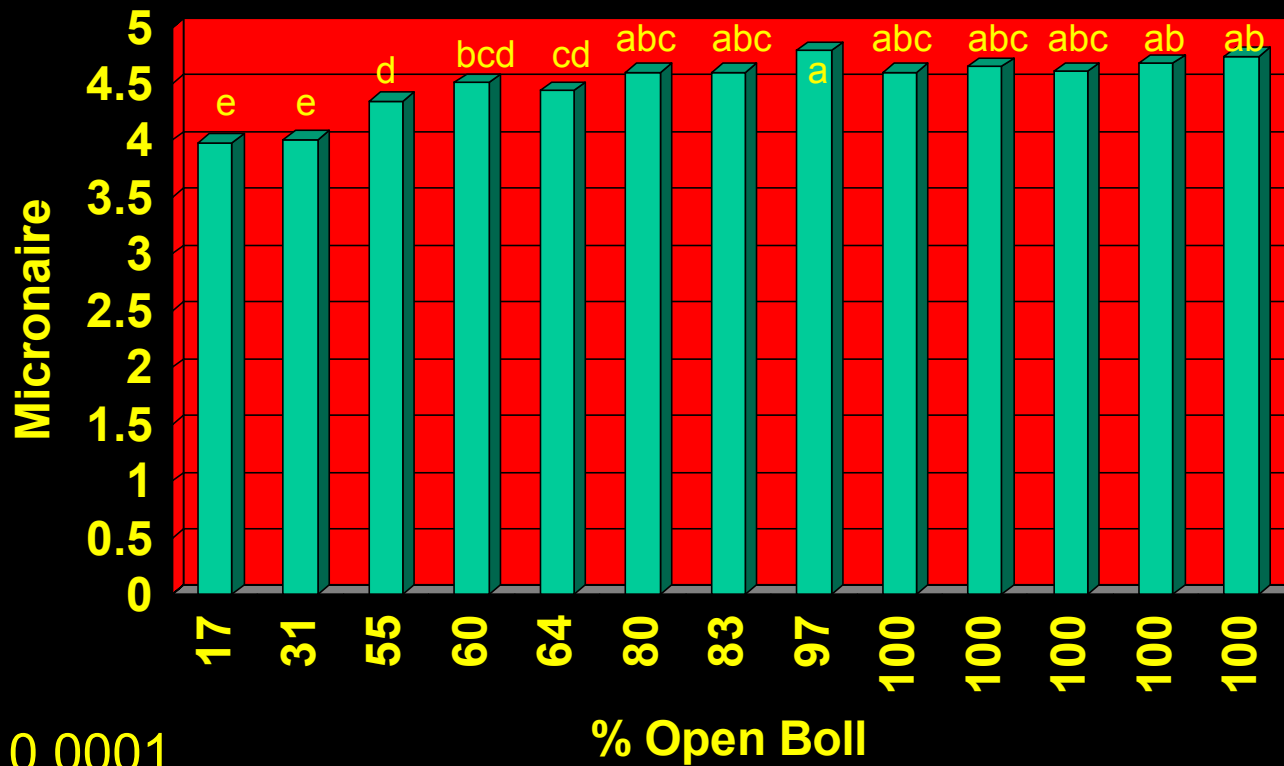
# Micronaire in the South East



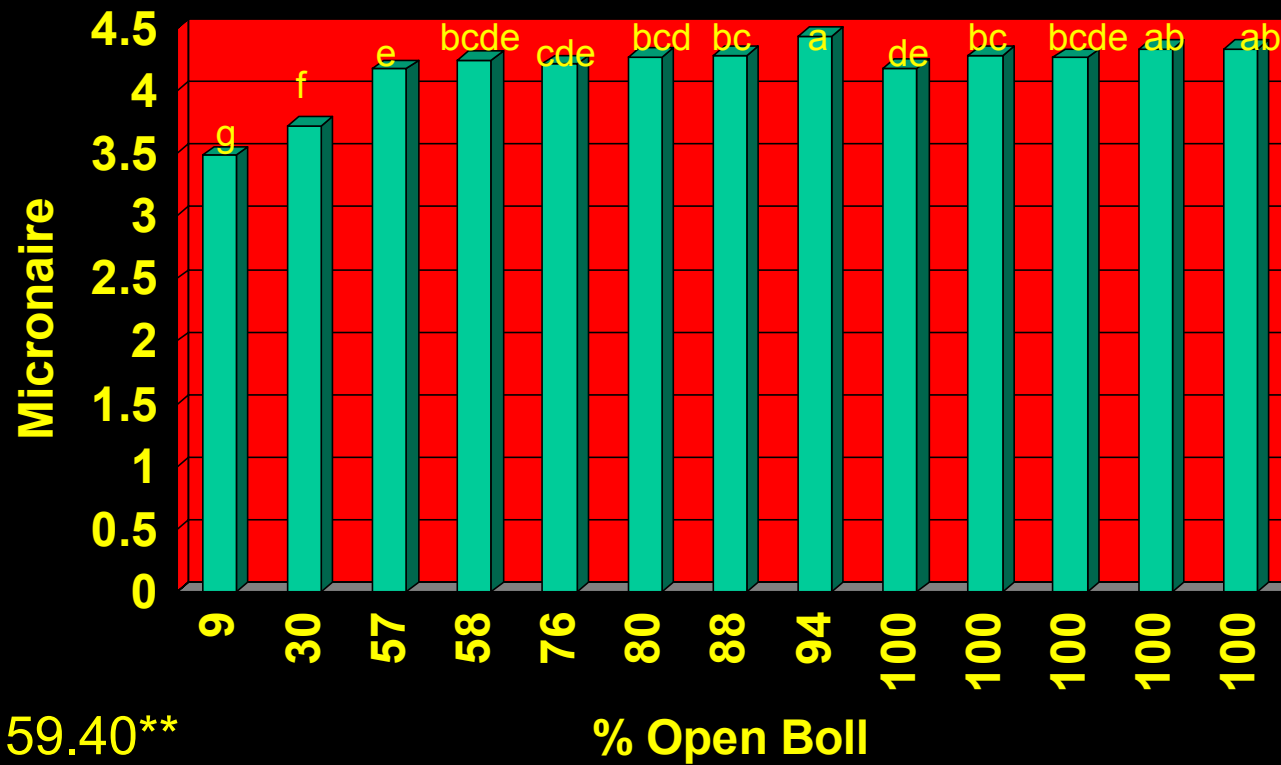
# HVI Micronaire 1998



# HVI Micronaire 1999



# HVI Micronaire 2000



# Fiber Quality

## *Strength*

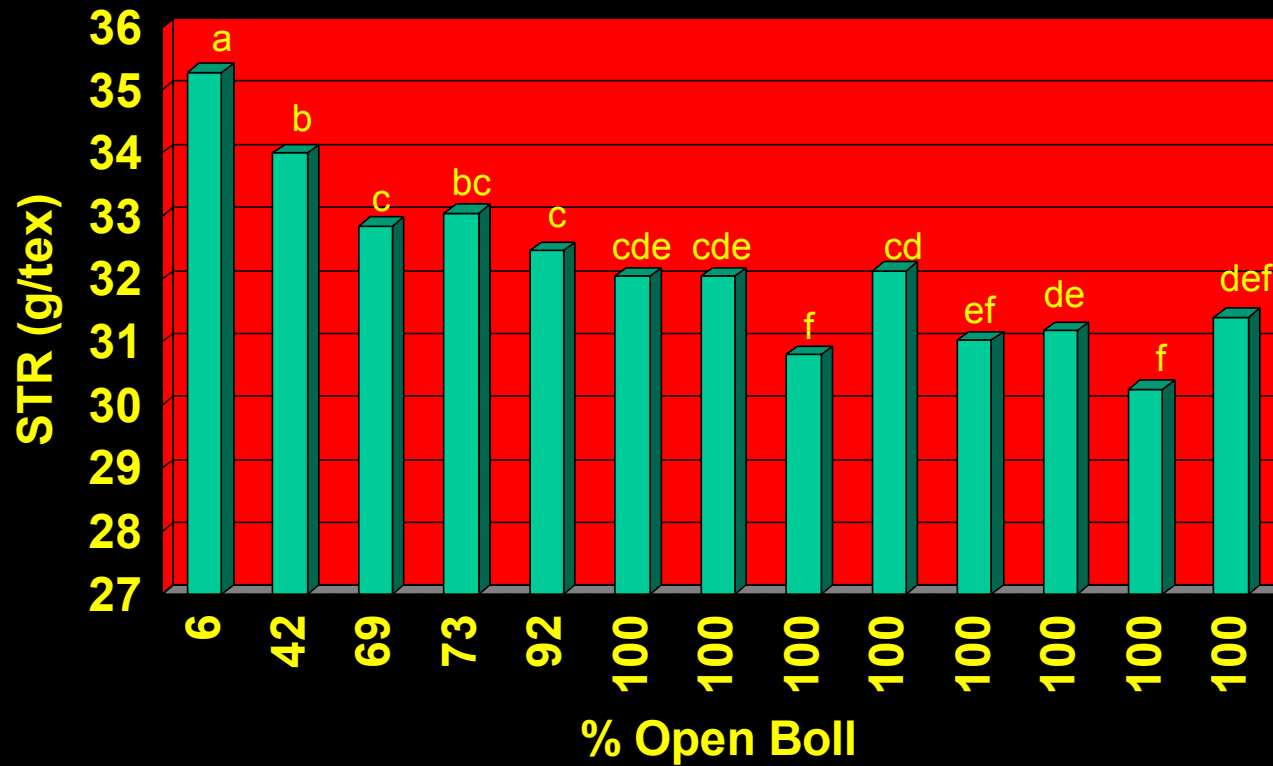
- The breaking strength of the cotton fiber is considered to be the most important factor in determining yarn strength.
- Fiber strength varies along the length of the fiber.
- Reported as grams of breaking load per tex.

# Fiber Quality

## *Strength*

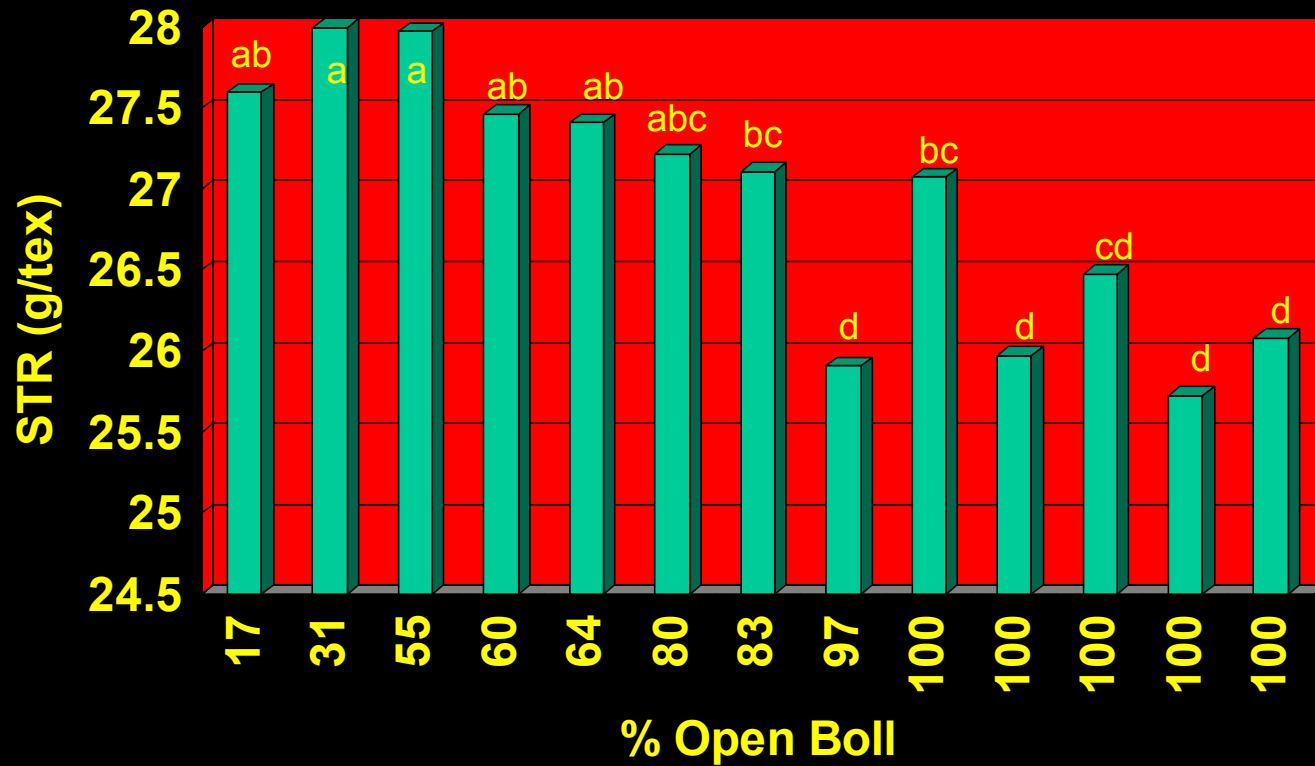
- Reported in grams per tex.
- Base is ~28
  - Below 25.5 = discounts
  - Above 29.4 = premiums

# Strength 1998



P>F 0.0001

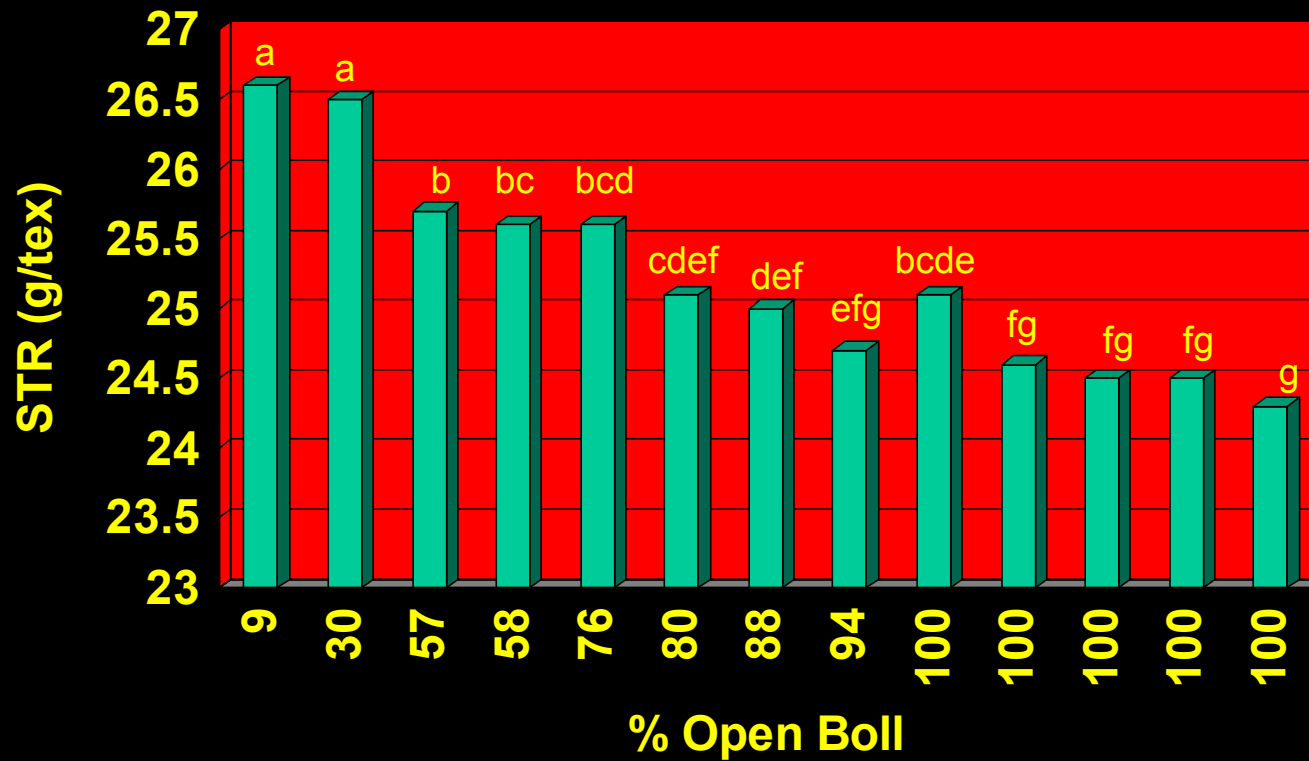
# Strength 1999



P>F 0.0001



# Strength 2000



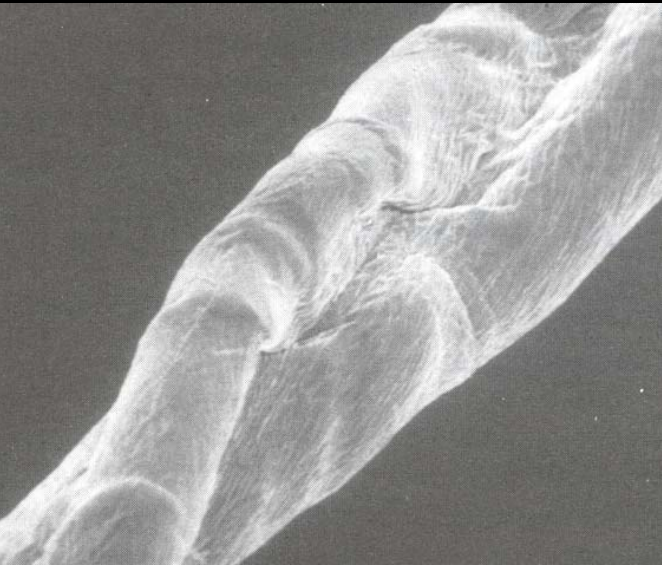
$F = 13.91^{**}$

# FIBER DRYING

Stage 2

# Fiber Drying

## *Stage 3*



- Once mature the fiber dries.
- Fiber shrinks in diameter by approximately one-third.
- Drying causes fibers to twist and crimp.

# Fiber Quality

## *Color*

- Determined by the degree of reflectance (Rd) and yellowness (+b).
- Base is 41-4 (white-strict low middling)
  - First number determines good middling, strict middling etc...
  - Second number determines white(1), light spotted(2), spotted(3), tinged(4) or yellow stained(5)
  - Number after “-” determines leaf grade, roughly a percentage.
  - Premiums and discounts are relative to length.

# Fiber Color

- Most directly linked to growth environment.
  - Weathering leads to fiber to darkening and loss of brightness
- Also correlated with overall fiber quality.

# Color Grades

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<u>Week</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>
0	41	31	42
1	41	31	41
2	41	31	42
3	51	31	41
4	51	31	41
5	52	41	41
6	52	31	41
7	51	41	41
8	51	41	41
9	51	41	51
10	51	41	51
11	61	41	51
12	61	41	51

# Application of Harvest-Aids at 60-80% Open Boll:

- **Maximized**
  - Length Uniformity
  - Fiber Length
  - Lint Yield (1999)
  - Profit (1999)
- **Minimized**
  - Short Fiber Content



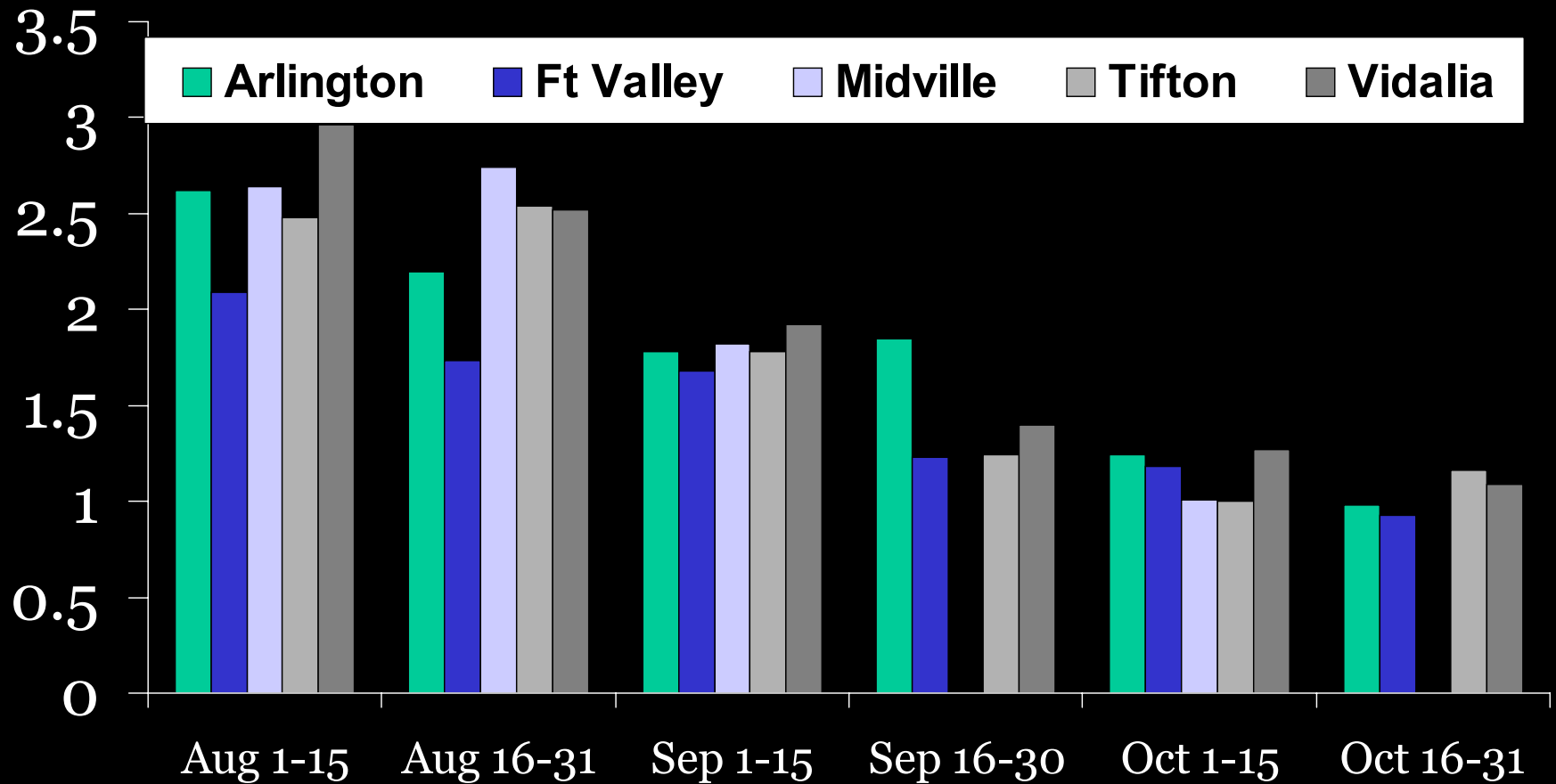




# Early Management System?

- **Why:**
  - TSWV has shifted “prime time” for peanut planting from mid-April to mid to late May,
  - Peanut harvest now in October - traditional cotton harvest time.
  - A range of maturity spreads out harvest.
- **What:** Should we consider planting 10 to 20 percent of acreage for harvest prior to September 20?

# Concerns - Late Summer/Early Fall Rainfall





# What/How Early Management

- Manage for harvest prior to September 20
  - Plant by April 20
  - Use Pix to encourage earliness
  - Avoid excessive N
  - Avoid fruit losses from pest management mistakes (ex. insects, herbicides)
  - Be prepared to apply defoliant/boll opener Aug 20 to Sep 5

# Risks of Early Management

- April plantings may encounter stand problems related to cool temperatures
- Significant potential for rainfall events in late August to early September >> boll rot, hard lock, reduced color grade

# Other Fiber Quality Questions

Misapplications of glyphosate in RR  
Cotton adversely affect fiber quality.

True or False?

Misapplications of glyphosate in RR  
Cotton adversely affect fiber quality.

FALSE



# RR Cotton Response to Glyphosate Systems

	Timing	RDC Pvt, lint lb/A	Ponder Fm, lint lb/A
Conv	PRE, OTT, Prec PDIR	1958 a	1878 a
Roundup	4 lf OTT Prec PDIR	1953 a	1881 a
Roundup	1,4,9 lf OTT Slppy Dir	1974 a	1749 b

*Cotton Fiber Analysis NS*

*NS*

*2002 results, DP 555 BG/RR*

Stinkbug damage in cotton  
can adversely affect fiber  
quality. True or False



Heavy Stink Bugs in 2003



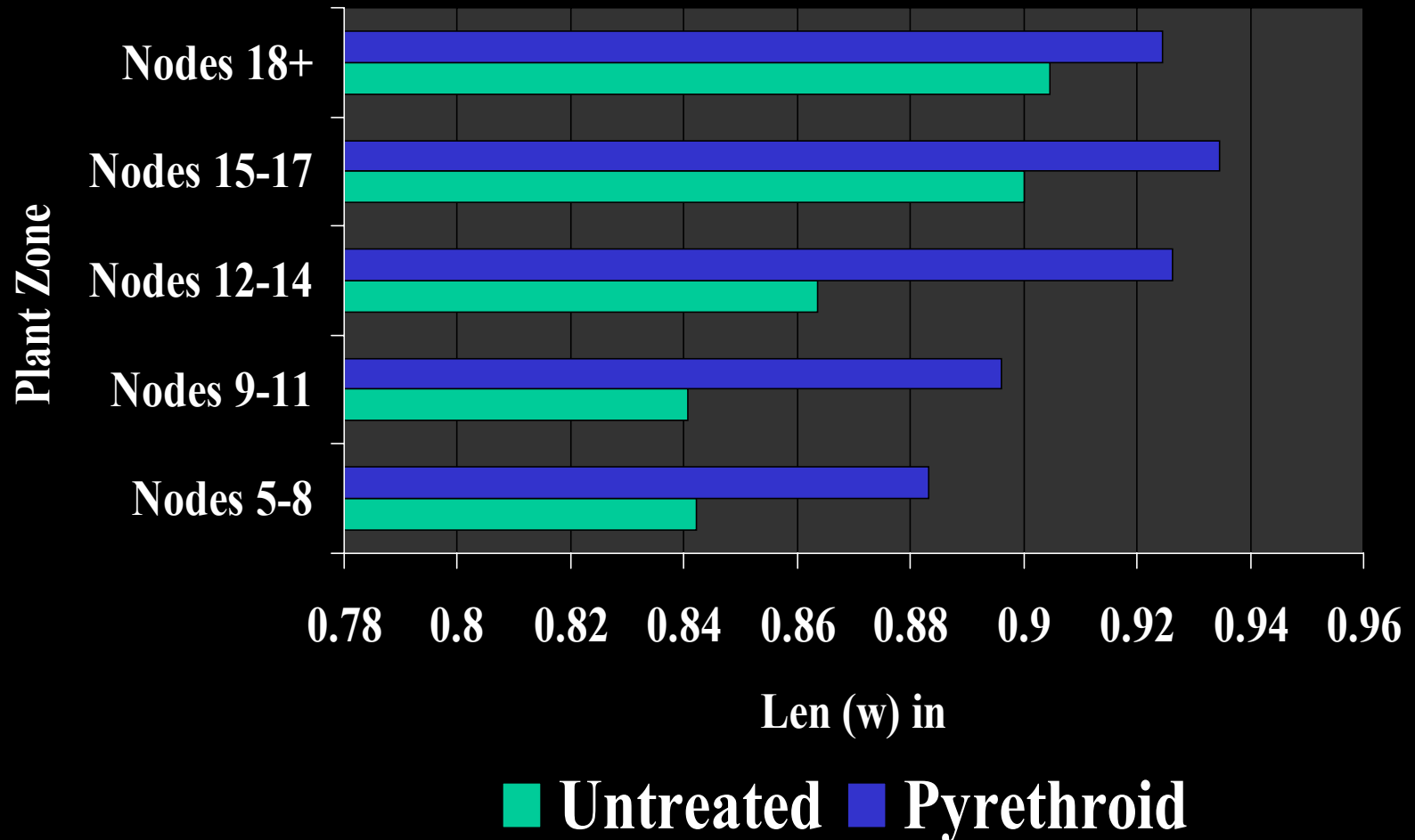
• TRUE !



Severe Stink Bug Damage

S

# Fiber Length as Influenced by Stink Bug Control, Irwin Co. 2000



Aggressive fertilization with N, K, and B  
can eliminate fiber quality problems.

True or False?



Aggressive fertilization with N, K, and B  
can eliminate fiber quality problems.

FALSE

.....but K needs study

Which is the most important in avoiding fiber quality problems – variety selection or environmental conditions?





Which is the most important in avoiding fiber quality problems – variety selection or environmental conditions?

ENVIRONMENTAL CONDITIONS

...temperature, water, harvest conditions, etc.



There are fiber quality differences among varieties. True or False?

There are fiber quality differences among varieties because of the insertion of transgenes? True or False?

There are fiber quality differences among varieties. TRUE

There are fiber quality differences among varieties because of the insertion of transgenes? FALSE but....