

# **FACTORS INFLUENCING FIBER QUALITY**

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# STAGES OF FIBER DEVELOPMENT



**SECONDARY WALL SYNTHESIS**

**ELONGATION**

**INITIATION**

0 10 20 30 40 50 60

**DAYS POST ANTHESIS**

DATA SOURCE: DR. BARBARA TRIPLETT, SRRC

# FACTORS INFLUENCING FIBER QUALITY

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**I. ENVIRONMENT**

**II. VARIETY**

**III. PROCESSING (GINNING)**

# ENVIRONMENTAL FACTORS INFLUENCING FIBER QUALITY

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## 1. US REGIONS

(CLIMATE, SOILS, PESTS)

## 2. WITHIN US REGIONS

(WEATHER, MANAGEMENT)

# **REGIONAL DIFFERENCES IN FIBER QUALITY**

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**WEST - CALIFORNIA**

**PLAINS – TEXAS**

**MIDSOUTH – MISSISSIPPI**

**SOUTHEAST - GEORGIA**

# REGIONAL DIFFERENCES IN 2007 IN GRADE

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<u>REGION</u>	<u>MID +</u>	<u>SLM</u>
CA	96.4	1.7
TX	64.6	17.4
<b>MS</b>	<b>24.4</b>	<b>56.4</b>
GA	28.5	67.0

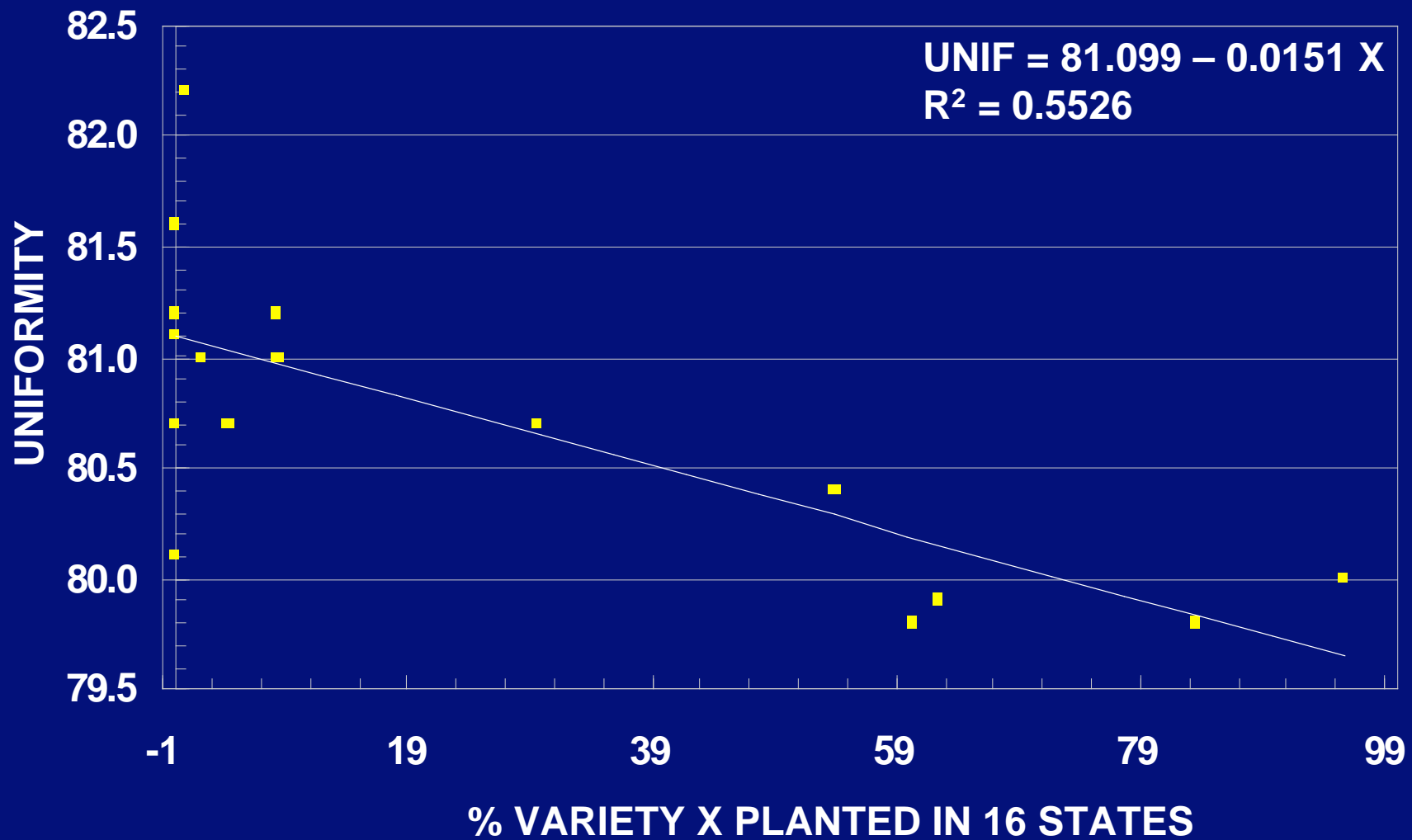
DATA SOURCE: AMS - COTTON

# REGIONAL DIFFERENCES IN 2007 IN LENGTH & UNIFORMITY

<u>REGION</u>	<u>LEN (IN.)</u>	<u>UNIF</u>
CA	37.1 (1.16)	82.2
TX	36.0 (1.13)	81.0
<b>MS</b>	<b>34.6 (1.08)</b>	<b>80.7</b>
GA	34.1 (1.07)	79.8

DATA SOURCE: AMS - COTTON

# AVERAGE UNIFORMITY INDEX FOR 16 STATES AND % VAREITY X PLANTED IN EACH STATE



# REGIONAL DIFFERENCES IN 2007 FOR HVI STRENGTH, LENGTH, AND MICRONAIRE

<u>REGION</u>	<u>HVI STR</u>	<u>LENGTH</u>	<u>MIC</u>
CA	33.5	1.16	4.3
TX	29.4	1.13	4.2
<b>MS</b>	<b>28.6</b>	<b>1.08</b>	<b>4.4</b>
GA	28.2	1.07	4.8

DATA SOURCE: AMS - COTTON

# WHY ARE THERE DIFFERENCES IN REGIONS?

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REGIONAL CLIMATIC ADVANTAGE?  
REGIONAL MANAGEMENT ADVANTAGE?  
VARIETIES?

**WHAT WOULD HAPPEN IF YOU  
GREW THE SAME VARIETIES IN  
EACH REGION AND COMPARED  
REGIONAL DIFFERENCES FOR  
24 YEARS?**

**AVERAGE FIBER LENGTH, YARN  
STRENGTH, & MICRONAIRE FOR FOUR  
VARIETIES GROWN IN THREE US COTTON  
REGIONS (1961 – 1984)**

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<b>REGION</b>	<b>LEN</b>	<b>STR</b>	<b>MIC</b>
<b>CALIFORNIA</b>	<b>1.12</b>	<b>131</b>	<b>4.02</b>
<b>PLAINS</b>	<b>1.10</b>	<b>133</b>	<b>4.43</b>
<b>DELTA</b>	<b>1.14</b>	<b>136</b>	<b>4.57</b>

**DATA SOURCE: NATIONAL COTTON VARIETY TEST, 1961-1984.**

# REGIONAL DIFFERENCES IN 2007 FOR HVI STRENGTH, LENGTH, AND MICRONAIRE

<u>REGION</u>	<u>LENGTH</u>	<u>HVI STR</u>	<u>MIC</u>
CA	1.16	33.5	4.3
TX	1.13	29.4	4.2
<b>MS</b>	<b>1.08</b>	<b>28.6</b>	<b>4.4</b>
GA	1.07	28.2	4.8

DATA SOURCE: AMS - COTTON

# **AVERAGE PROPORTION (%) OF TOTAL VARIATION ASSOCIATED WITH ENVIRONMENTS (E), VARIETIES (V), AND THEIR VE INTERACTION**

<b>CHARACTERISTIC</b>	<b>E</b>	<b>V</b>	<b>VE</b>
<b>YIELD (36)</b>	<b>80</b>	<b>7</b>	<b>13</b>
<b>LINT % (36)</b>	<b>57</b>	<b>26</b>	<b>17</b>
<b>BOLL WT (36)</b>	<b>55</b>	<b>27</b>	<b>19</b>
<b>SEED WT (36)</b>	<b>47</b>	<b>35</b>	<b>18</b>

**( ) INDICATES NO OF YEARS**

# **AVERAGE PROPORTION (%) OF TOTAL VARIATION ASSOCIATED WITH ENVIRONMENTS (E), VARIETIES (V), AND THEIR VE INTERACTION**

<b>CHARACTERISTIC</b>	<b>E</b>	<b>V</b>	<b>VE</b>
<b>COLOR Rd (35)</b>	<b>81</b>	<b>6</b>	<b>13</b>
<b>COLOR +b (35)</b>	<b>74</b>	<b>9</b>	<b>17</b>

**( ) INDICATES NO OF YEARS**

# **AVERAGE PROPORTION (%) OF TOTAL VARIATION ASSOCIATED WITH ENVIRONMENTS (E), VARIETIES (V), AND THEIR VE INTERACTION**

<b>CHARACTERISTIC</b>	<b>E</b>	<b>V</b>	<b>VE</b>
<b>LENGTH (36)</b>	<b>51</b>	<b>29</b>	<b>20</b>
<b>UNIFORMITY (23)</b>	<b>56</b>	<b>12</b>	<b>32</b>

**( ) INDICATES NO OF YEARS**

# **AVERAGE PROPORTION (%) OF TOTAL VARIATION ASSOCIATED WITH ENVIRONMENTS (E), VARIETIES (V), AND THEIR VE INTERACTION**

<b>CHARACTERISTIC</b>	<b>E</b>	<b>V</b>	<b>VE</b>
<b>STRENGTH (20)</b>	<b>34</b>	<b>44</b>	<b>22</b>
<b>MICRONAIRE (36)</b>	<b>61</b>	<b>21</b>	<b>18</b>

**( ) INDICATES NO OF YEARS**

# **PRIMARY REASON FOR REGIONAL AND WITHIN REGIONAL VARIABILITY IS DUE TO:**

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**GRADE:**

**DIFFERENCES ARE RELATED TO WEATHER**

**STRENGTH/LENGTH/UNIFORMITY:  
DETERMINED BY VARIETY**

**MICRONAIRE\* IS VARIABLE;  
BOTH WEATHER AND VARIETY**

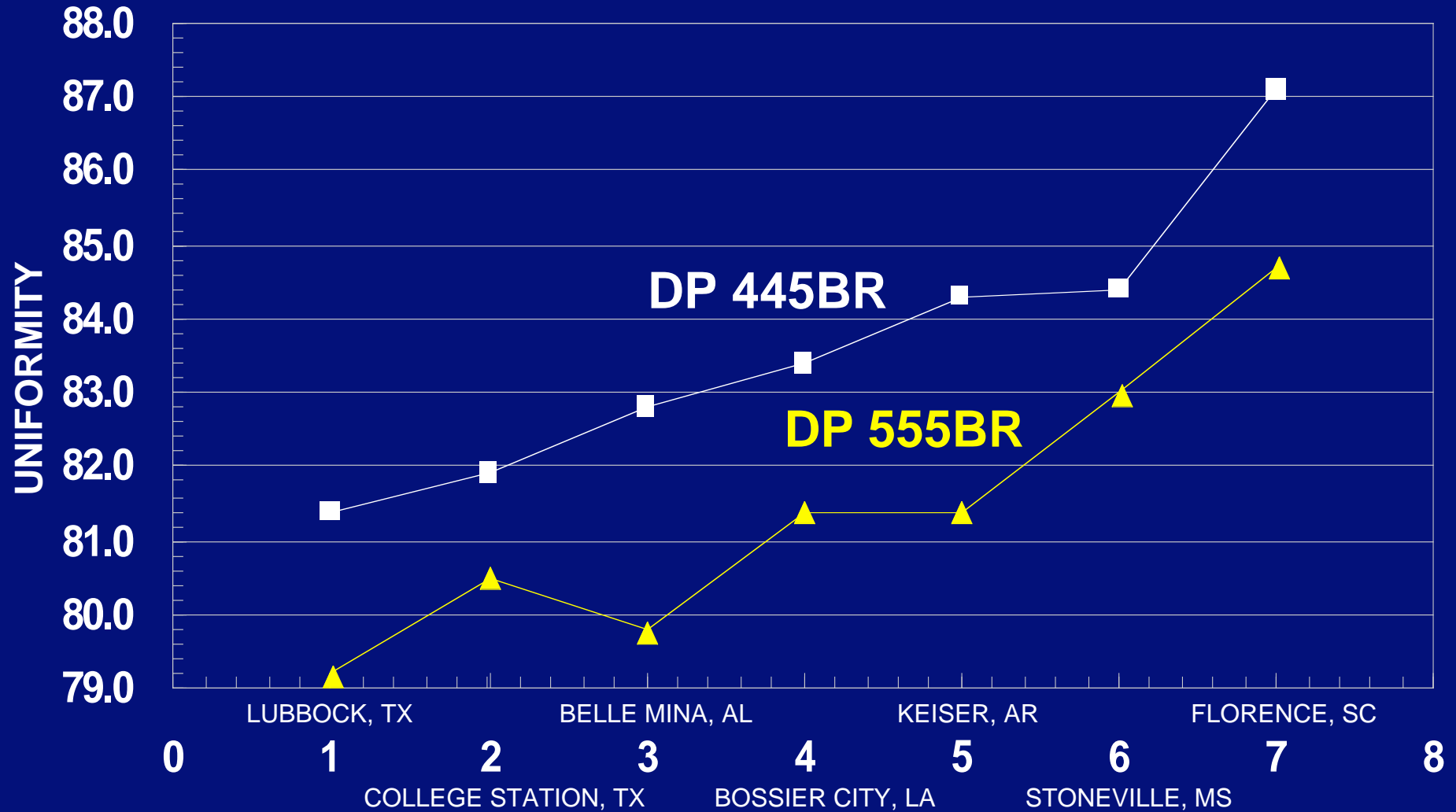
**\* MICRONAIRE IS AN ESTIMATE OF TWO FIBER PROPERTIES;  
MATURITY AND FINENESS**

# EXAMPLE OF A VARIETY X MANAGEMENT INTERACTION



DIFFERENCE IN YIELD BETWEEN VARIETIES INDICATED IN GREEN  
DATA SOURCE: GORE, ET AL. (2007) T. PLANT BUG MANAGEMENT

# UNIFORMITY INDEX OF TWO VARIETIES FROM SEVEN 2005 RHQ TESTS



DATA SOURCE: REGIONAL HIGH QUALITY TESTS, 2005

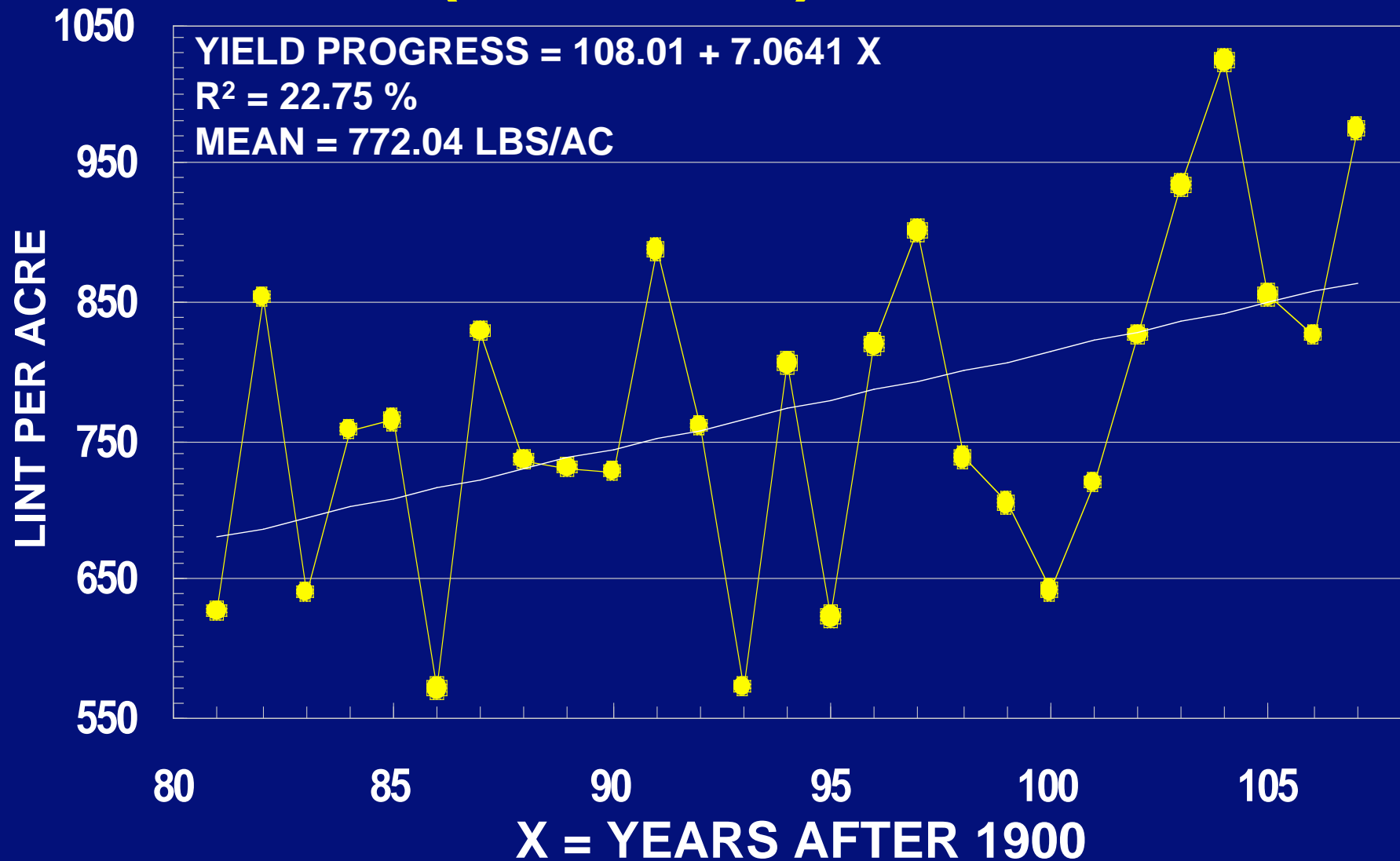
**THE PRIMARY FACTOR CAUSING  
VARIETY X ENVIRONMENT  
INTERACTIONS IS DIFFERENCES IN  
VARIETY MATURITY**

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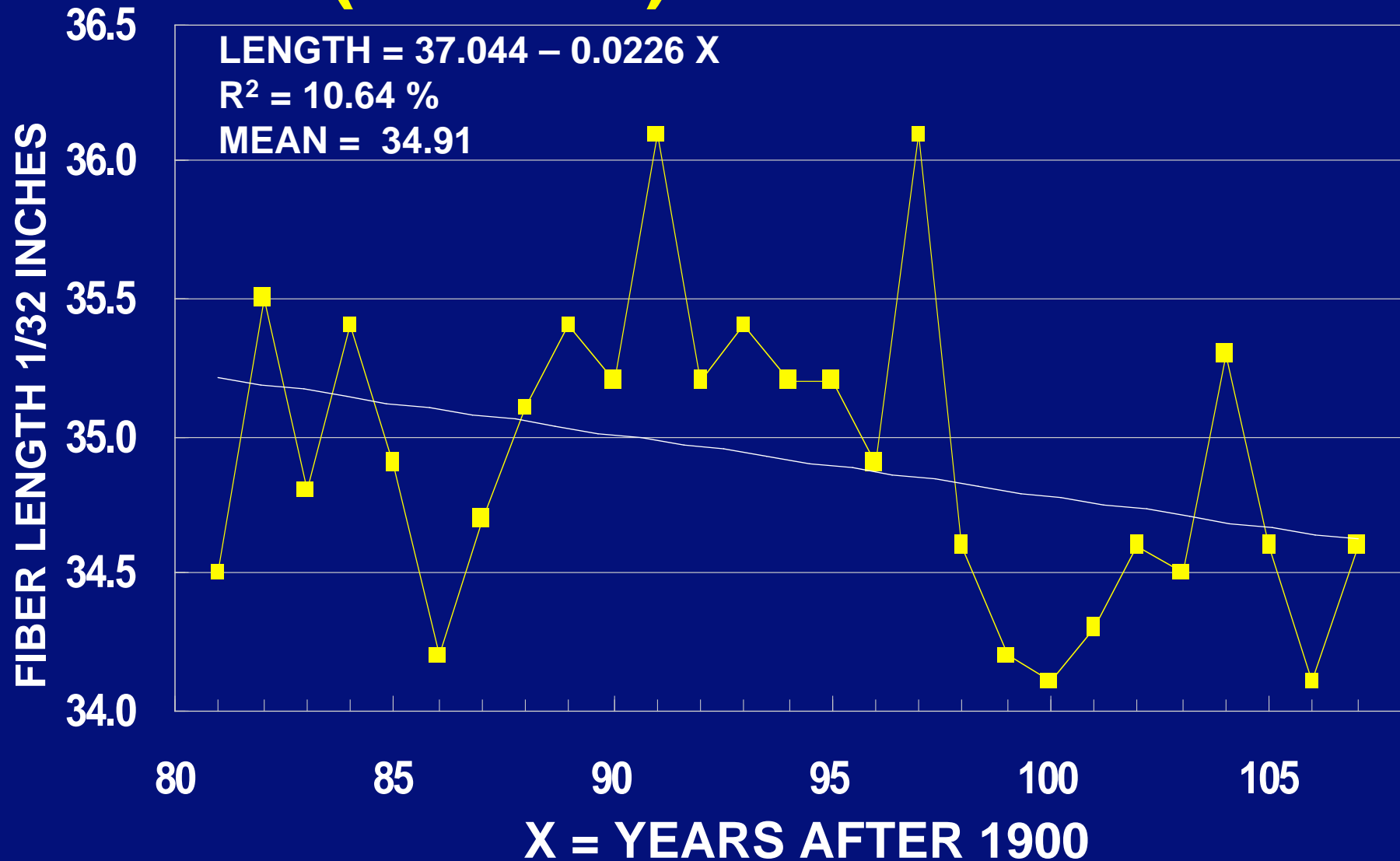
**EXAMPLES:**

- 1. INSECT CONTROL**
- 2. PLANTING DATE**
- 3. IRRIGATION**
- 4. DEFOLIATION**
- 5. WEATHER**

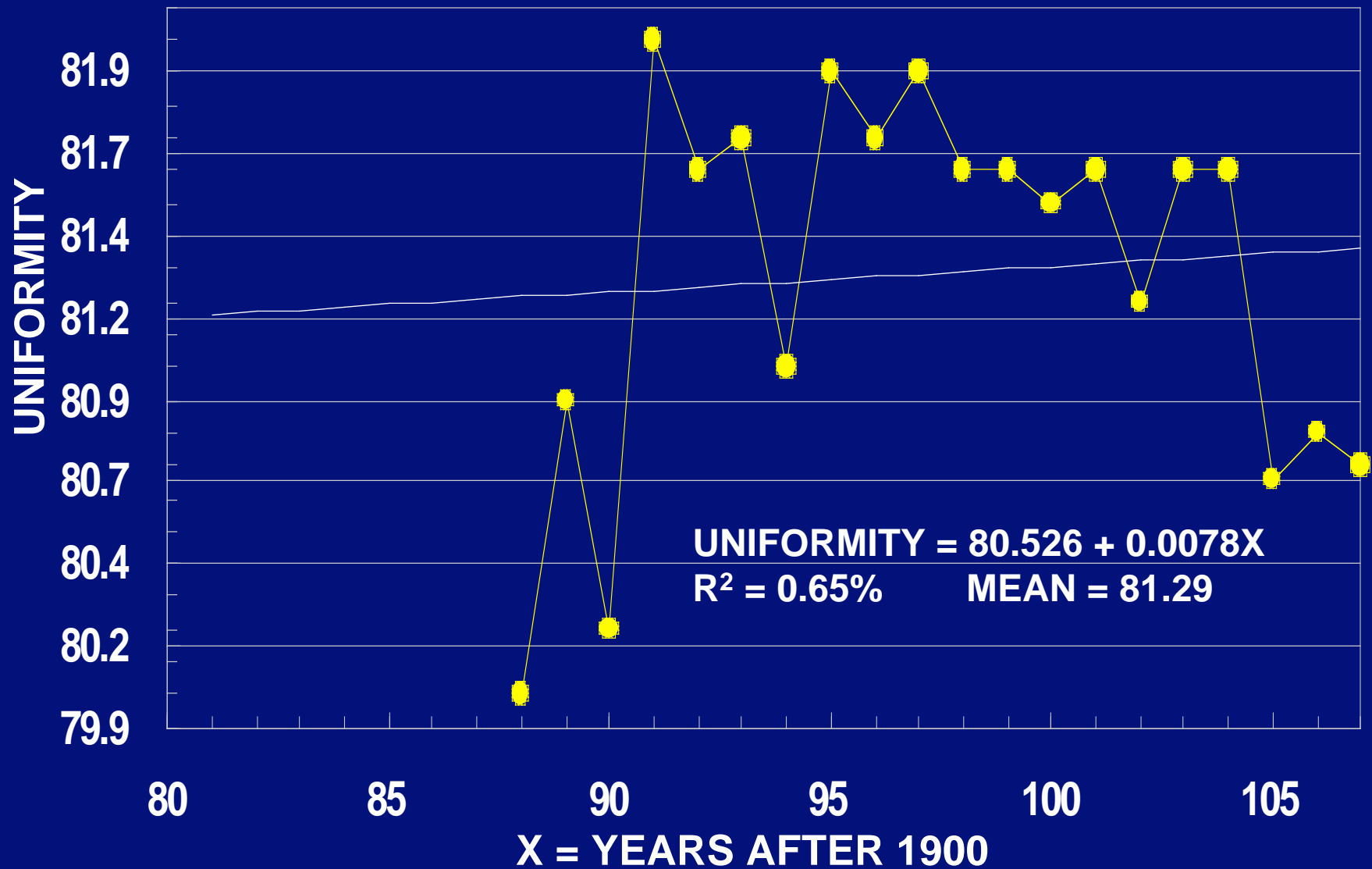
# AVERAGE MISSISSIPPI LINT YIELD (LBS./AC) 1981 - 2007



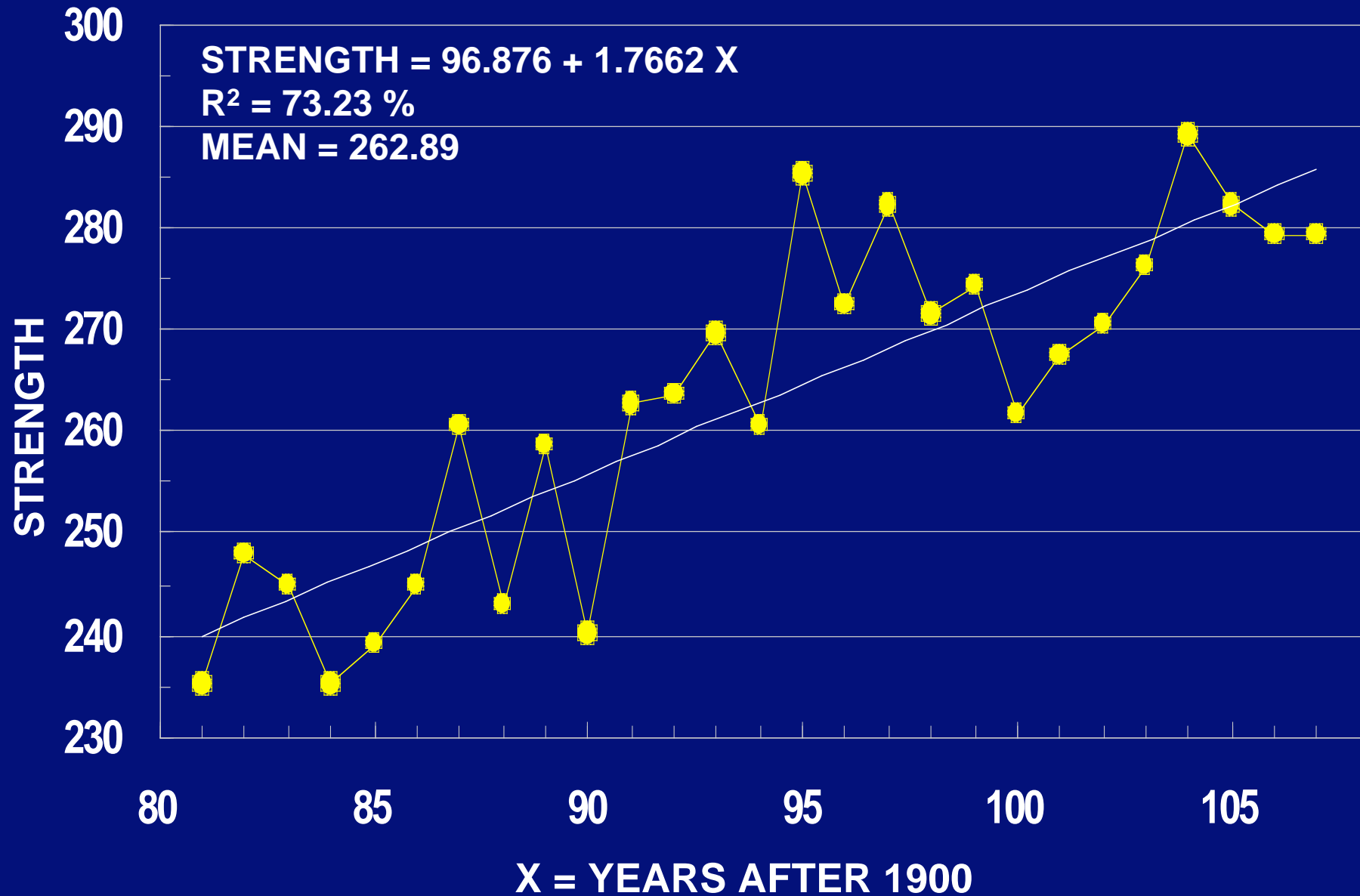
# AVERAGE MISSISSIPPI LENGTH (1/32 IN.) 1981 - 2007



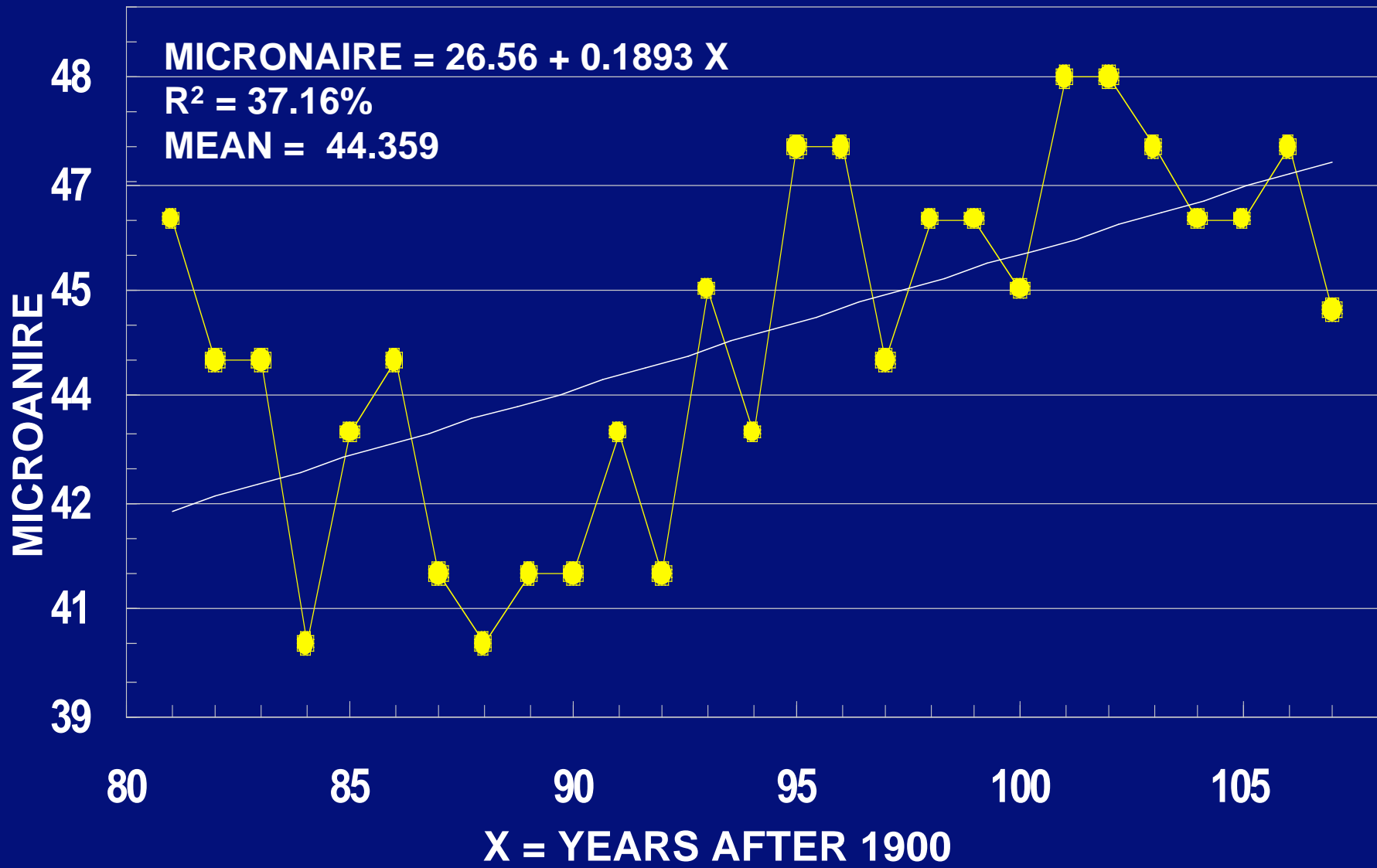
# AVERAGE MISSISSIPPI HVI UNIFORMITY INDEX 1981 – 2007



# AVERAGE MISSISSIPPI STRENGTH 1981 – 2007

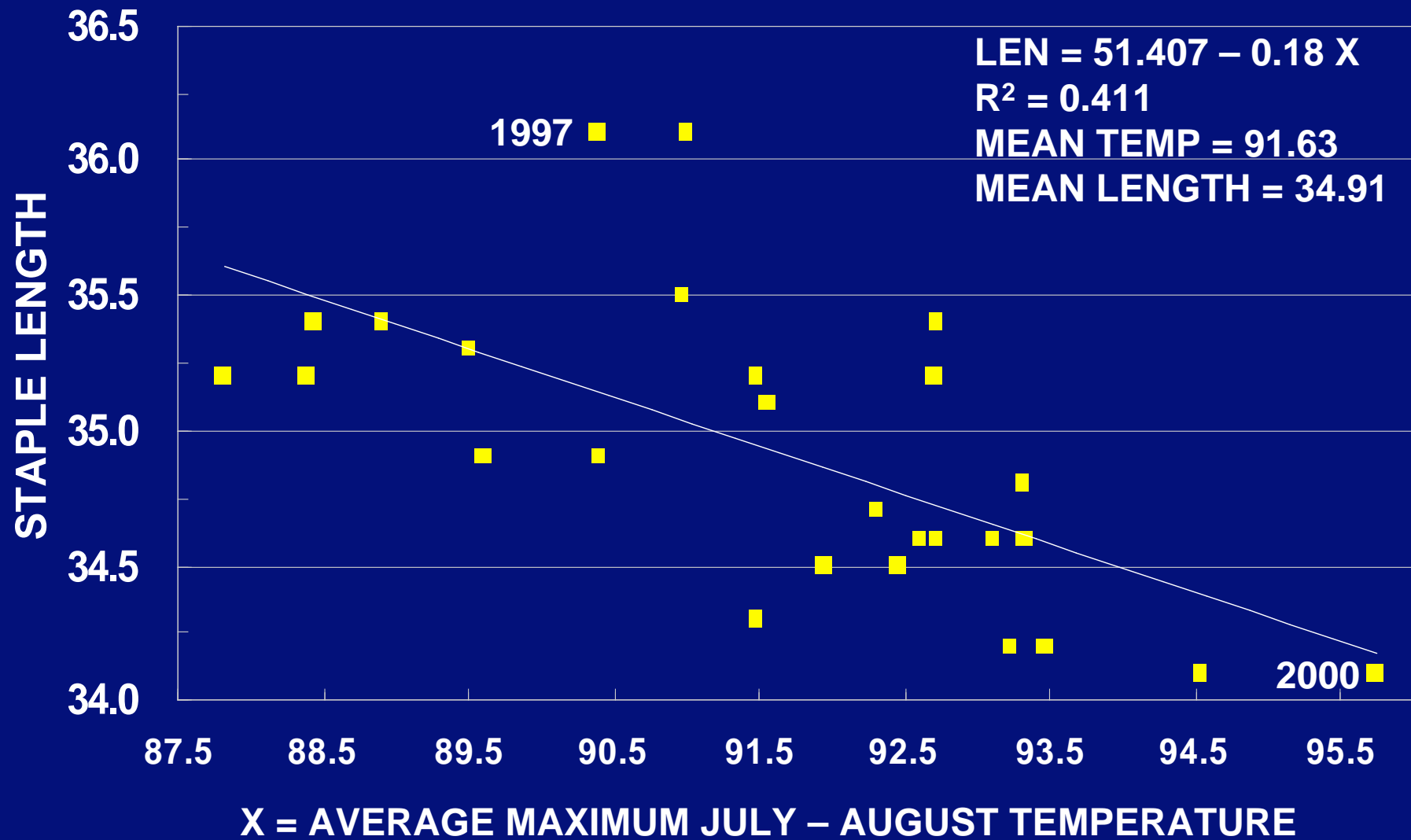


# AVERAGE MISSISSIPPI MICRONAIRE 1981 – 2007

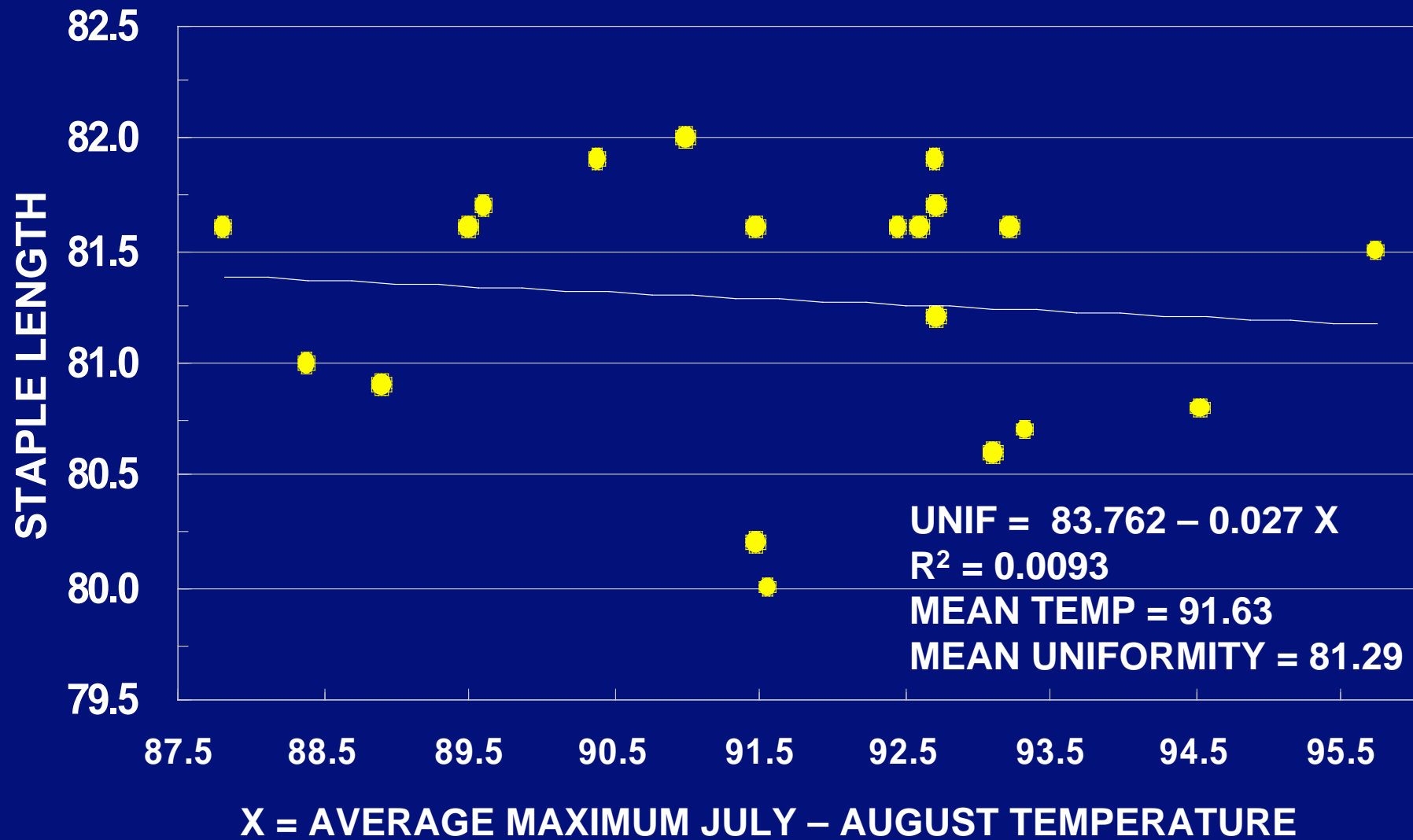




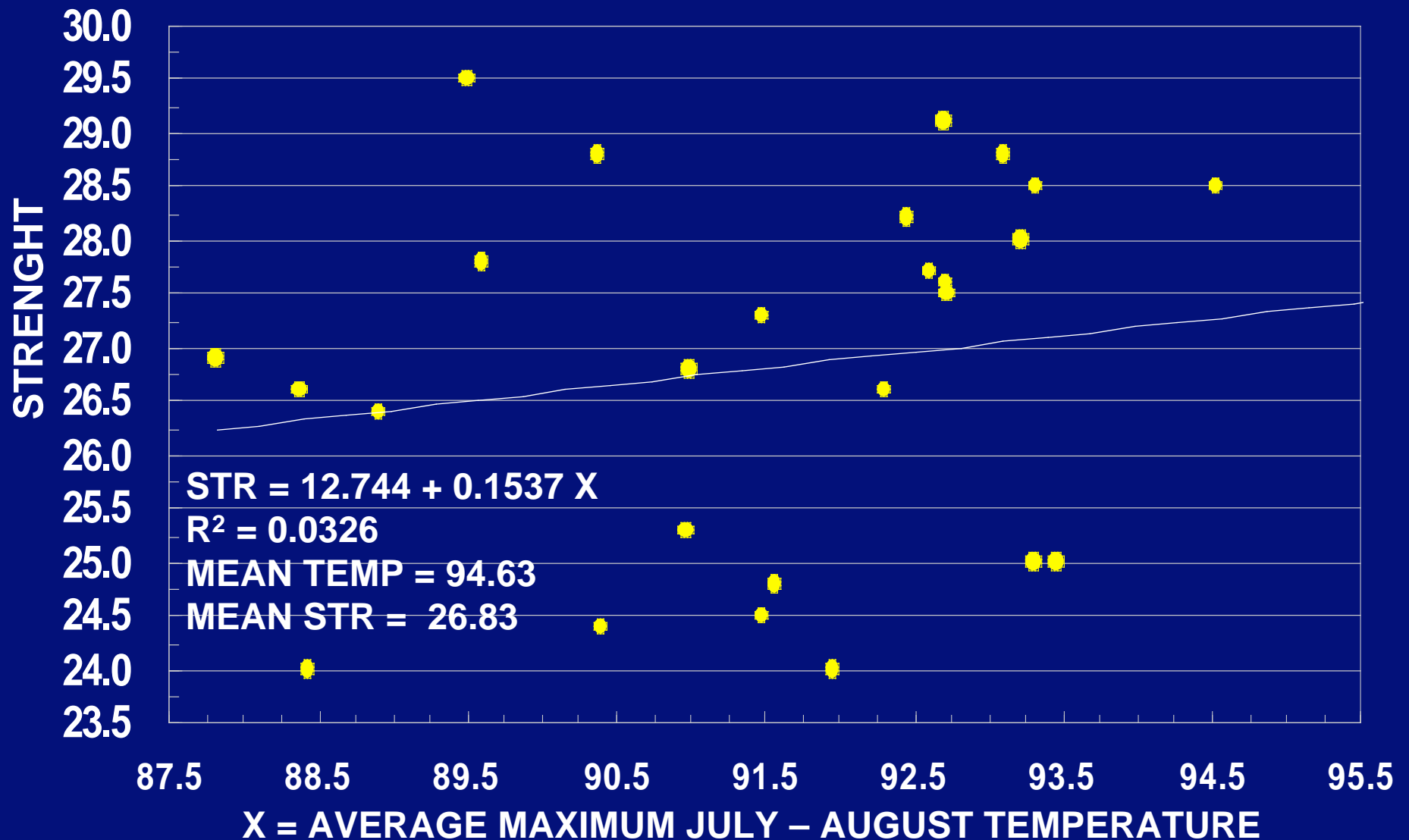
# INFLUENCE OF AVERAGE JULY – AUGUST MAXIMUM TEMPERATURE ON AVERAGE MISSISSIPPI STAPLE LENGTH 1981 - 2007



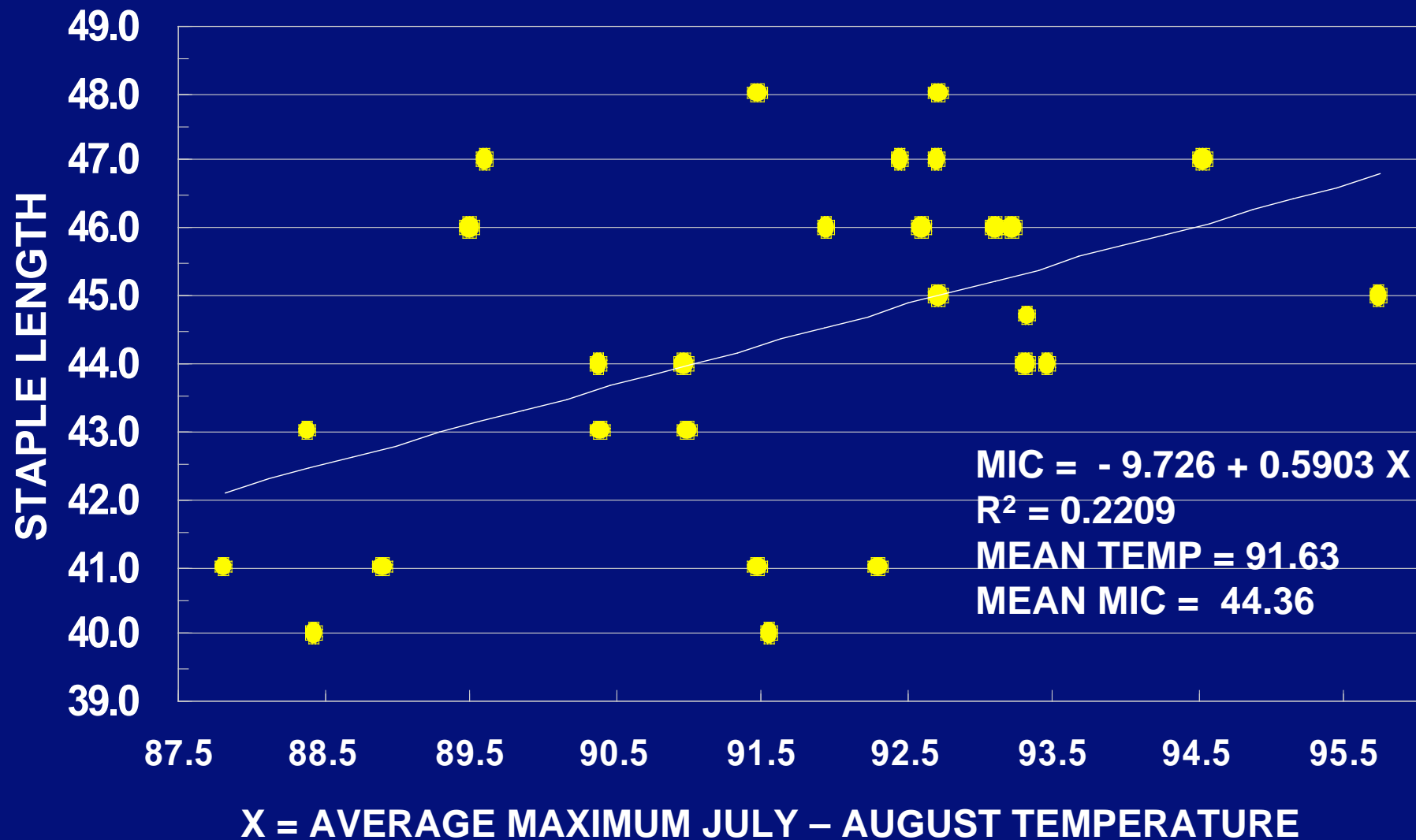
# INFLUENCE OF AVERAGE JULY – AUGUST MAXIMUM TEMPERATURE ON AVERAGE MISSISSIPPI UNIFORMITY 1981 - 2007



# EFFECT OF AVERAGE JULY – AUGUST MAXIMUM TEMPERATURE ON AVERAGE STRENGTH FOR MISSISSIPPI 1981 - 2007



# INFLUENCE OF AVERAGE JULY – AUGUST MAXIMUM TEMPERATURE ON AVERAGE MISSISSIPPI MICRONAIRE 1981 - 2007



## AVERAGE OVER 3 YEARS EFFECT OF PLANTING DATE ON FIBER TRAITS

<u>PLANTING DATE</u>	<u>LENGTH</u>	<u>T<sub>1</sub> STRENGTH</u>	<u>MIC</u>
EARLY	1.132	205.0	4.54
MEDIUM	1.142*	200.5	4.44
LATE	1.146*	203.5	4.37
LSD 0.05	.007	NS	0.12

SOURCE: CATHEY AND MEREDITH, 1988.

# **WEATHER FACTORS THAT INFLUENCE FIBER QUALITY**

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**1.TEMPERATURE**

**2.MOISTURE**

# **MANAGEMENT FACTORS THAT INFLUENCE FIBER QUALITY**

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**1.PLANTING DATES**

**2.SEEDING RATES**

**3.FERTILIZER**

**4.IRRIGATION**

**5.DEFOLIATION**

## COTTON FIBER BUNDLE STRENGTH ( $T_1$ ) AND LENGTH AS AFFECTED BY K FERTILIZER

K FERTILIZER	$T_1$ STRENGTH	LENGTH	LENGTH UNIF.
0.0	207	1.11	48.0
100 LBS/AC	203	1.11	48.7
		NS	
LSD 0.005	NS		0.4

SOURCE: PETTIGREW, 1996.

# COTTON FIBER MICRONAIRE, MATURITY, AND FINENESS AS AFFECTED BY K FERTILIZER

<u>K FERTILIZER</u>	<u>MIC</u>	<u>FIBER MATURITY %</u>	<u>PERIMETER <math>\mu\text{m}</math></u>
0.0	3.7	74.1	49.1
100 LBS/AC	4.1	78.3	49.4
LSD 0.005	0.1	1.6	0.1

SOURCE: PETTIGREW, 1996.

# EFFECT OF PLANTING RATE ON FIBER TRAITS

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<u>PLANT POP PER FOOT</u>	<u>T<sub>1</sub> STR</u>	<u>LEN (IN.)</u>	<u>UNIF.</u>
2.1	188	1.12	48.8
2.7	186	1.12	49.0
3.4	187	1.13	47.9
4.0	189	1.12	48.8

SOURCE: PETTIGREW & JOHNSON, 2005.

# EFFECT OF PLANTING RATE ON FIBER TRAITS

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<u>PLANT POP PER FOOT</u>	<u>MIC</u>	<u>MAT %</u>
2.1	4.84	85.8
2.7	4.90	86.6
3.4	4.79	86.4
4.0	4.88	86.7

SOURCE: PETTIGREW & JOHNSON, 2005.

# EFFECT OF PLANT GROWTH REGULATOR (PGR) ON FIBER LENGTH AND STRENGTH

STUDY	LENGTH IN INCHES <sup>f</sup>	
	PGR	NO PGR
CATHEY & MEREDITH (1988)	1.15*	1.13
PETTIGREW & JOHNSON (2005)	1.13*	1.12
JOHNSON & PETTIGREW (2006)	1.15*	1.14
<b>AVERAGE</b>	<b>1.143*</b>	<b>1.130</b>

**f PGR = MEPIQUAT CHOLORIDE OR MEPIQUAT PENTABORATE**

**\* INDICATES STATISTICAL SIGNIFICANCE.**

# EFFECT OF PLANT GROWTH REGULATOR (PGR) ON STRENGTH

STUDY	STRENGTH	
	PGR	NO PGR
CATHEY & MEREDITH (1988) <sup>f</sup>	27.5*	26.7
PETTIGREW & JOHNSON (2005) <sup>f</sup>	25.1	24.9
JOHNSON & PETTIGREW (2006)	30.7*	30.2
AVERAGE	27.8*	27.3

**f CONVERTED T<sub>1</sub> STRENGTH TO HVI VALUES BY T<sub>1</sub> X .133 = HVI**

**\* INDICATES STATISTICAL SIGNIFICANCE.**

# **EFFECT OF PLANT GROWTH REGULATOR (PGR) ON MICRONAIRE**

<b>STUDY</b>	<b>MICRONAIRE</b>	
	<b>PGR</b>	<b>NO PGR</b>
<b>CATHEY &amp; MEREDITH (1988)</b>	<b>4.45</b>	<b>4.45</b>
<b>PETTIGREW &amp; JOHNSON (2005)</b>	<b>4.86</b>	<b>4.84</b>
<b>JOHNSON &amp; PETTIGREW (2006)</b>	<b>4.80</b>	<b>4.80</b>
<b>AVERAGE</b>	<b>4.70</b>	<b>4.70</b>

# CORRELATION OF CROP VALUE PER ACRE AND LOAN VALUE FROM 2001 DELTA VARIETY TESTS

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<u>CHARACTERISTIC</u>	<u>VALUE/ACRE</u>	
	<u>EARLY</u>	<u>MEDIUM</u>
YIELD	0.92**	0.96**
LOAN VALUE	-0.33*	0.41*

# CORRELATION OF CROP VALUE PER ACRE & LENGTH, UNIFORMITY, & MICRONAIRE

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<u>CHARACTERISTIC</u>	<u>VALUE/ACRE</u>	
	<u>EARLY</u>	<u>MEDIUM</u>
UHM LENGTH	0.08	0.51**
UNIFORMITY	0.13	0.72**
MICRONAIRE	0.11	0.13

**WHY SHOULD I FOCUS MORE ON  
FIBER QUALITY WHEN THEY  
WON'T PAY ME FOR IT?**

**ANSWER: SO YOU CAN *SELL* IT!**