The University of Georgia
Cooperative Extension
College of Agricultural and Environmental Sciences

Georgia Cotton

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Early Bloom Growth Management Decisions (*Collins and Whitaker*)

Nearly ¼th of Georgia cotton is now blooming, which is a vital time for making critical growth management decisions. First bloom marks the point where reproductive growth demands become greater, and should begin to take precedence for carbohydrates over vegetative structures, which typically slows terminal growth from this point forward. Therefore, the rate of terminal growth should gradually decrease between first bloom and cutout. However, several environmental factors (primarily soil moisture) prior to first bloom can influence the crop's growth potential and "horsepower" going into the bloom period, and can drastically change the growth rate or overall progression of fruit development during this time. With a few exceptions, most of Georgia has experienced adequate rainfall during square development and leading into the bloom period. Additionally, most cotton should have also been side- or top-dressed with nitrogen by now, which can further stimulate growth in the presence of adequate soil moisture.

Most growers have probably already made their first PGR applications at 8- to 10-leaves, especially those that received adequate rainfall early on, resulting in vigorous growth during squaring. Now that some cotton is beginning to bloom, and the rest is rapidly approaching first bloom with vigorous growth potential, it is time to make critical PGR decisions in order to position the crop for optimal yield potential while preventing excessive growth. Below are a few helpful tips to consider when making these decisions; however it is important to realize that there is no one-size-fits-all approach to growth management, especially now that Georgia cotton producers are planting a wide array of varieties with variable growth potential and maturity.

Even within similar environments (irrigated or dryland) it is difficult to generalize PGR recommendations for newer varieties, as substantial research efforts addressing this issue are currently underway. Therefore each field should be treated on an individual basis, and we need to rely on past experience. In any case, it is important to monitor growth closely and frequently, and to only treat fields that exhibit potential for excessive growth…..not prophylactically when plants are not growing vigorously, especially in dryland fields.

Plant height prior to, or at, first bloom: When we make PGR decisions, remember that we are trying to achieve a final plant height that can support adequate fruiting sites in order to maximize yield potential, without excessive height which could result in several adversities including: poor retention of earlier-set fruit or delayed maturity, dense canopies that impede other over-the-top applications, promote boll rot diseases, reduced harvest efficiency, lodging of plants, and potentially yield loss. For most situations (but definitely not always), some observations indicate that a very general optimal final plant height is usually within 10 percent of the row width (36 to 40 inches tall). Although much of the crop has likely been treated prior to bloom, an additional or first-time PGR application could be justified when plant height reaches 25 to 30 inches during the first week of bloom (the onset of the bloom period occurs when one bloom every 5 to 6 feet of row is visible) and when plants exhibit signs of continued vigorous growth. However, growers should consider the other signs of potentially excessive growth, before treating cotton just based on plant height.

Nodes above white flower and fruit load throughout the bloom period: The number of nodes above a first position white flower (NAWF) should be around 9 to 10 at first bloom (14 to 16 total plant nodes) in healthy, vigorously growing cotton and 7 to 8 at peak bloom (2 to 3 weeks after first bloom). This number should gradually decrease throughout the bloom period until the cessation of fruiting. Usually, terminal growth slows as this number decreases and a boll load accumulates. If NAWF is significantly less than 9 or 10 at 1st bloom (7 or less), then this could be an indicator of some sort of stress (primarily drought) which occurred prior to bloom. This could also be a result of prior PGR treatments, thus a PGR application may not be necessary, especially in dryland fields. If NAWF is 9 to 10 or greater at first bloom, a PGR application may be justified if soil moisture is sufficient and there are no signs of current drought stress.

Several cotton fields have recently experienced varying levels of plant bug infestation resulting in some level of square loss. This square loss could result in more aggressive terminal growth, as the photosynthetic demands of these lost fruit may now be available for terminal growth. It will be critical to monitor fruit retention as the crop progresses towards the bloom period, and a PGR application may be necessary to prevent excessive growth if retention is poor in these situations. Additionally, the loss of the earliest-set fruit may fool some growers into thinking that their crop has not yet reached what would be first bloom, whereas the crop should physiologically be blooming but no flowers are visible leaving a poor indication of crop development. In these situations, growers should look for the first reproductive branch, note how many fruiting sites have been aborted, and be sure to examine undamaged plants for early set fruit that may be blooming. PGR applications may be justified to prevent excessive growth; however, it is important that adequate fruiting sites are produced from this point forward. Overly aggressive PGR treatments, especially if applied too early or utilizing high rates, may prevent further fruiting sites from forming, which may be essential for optimizing yield.

Internode distances: A very strong, and one of the best indicators of vigorous growth is the distance between adjacent plant nodes, between the 4th and 5th leaf from the terminal, which is generally the uppermost internode that has fully expanded. Longer distances between these nodes is an indicator of greater terminal "horsepower" or growth potential. This is often a much better indicator of growth potential than height-to-node ratio, because height-to-node ratio may sometimes fail to account for the current growth rate. If internode distances between the 4th and 5th leaf from the terminal are around 3 to 5 inches, then the plants are growing vigorously, possibly requiring a PGR application. If internode distances are much less than 3 inches, then the plants may be encountering some sort of stress (primarily drought) and terminal growth has slowed, therefore a PGR application may not be necessary.

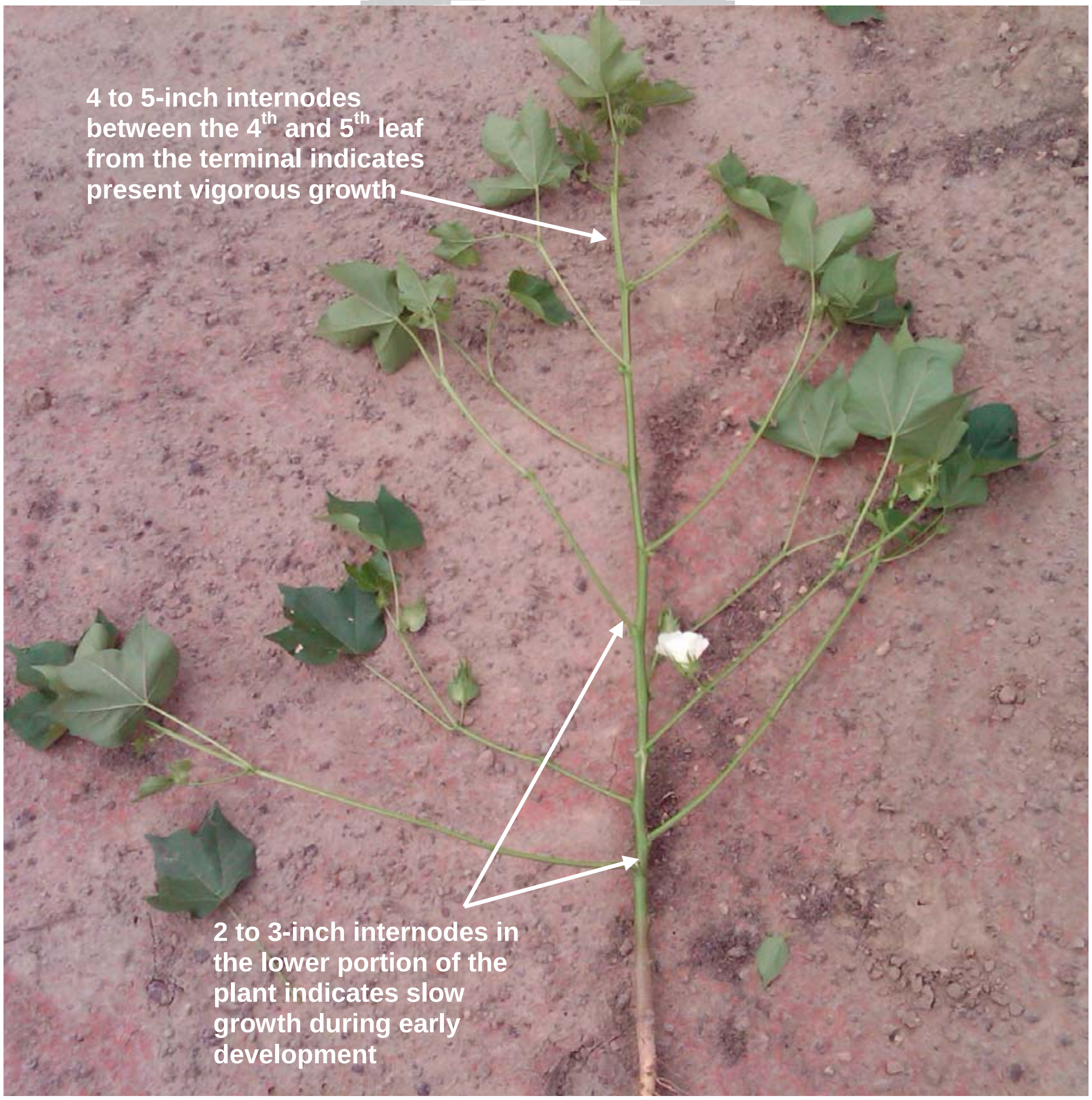


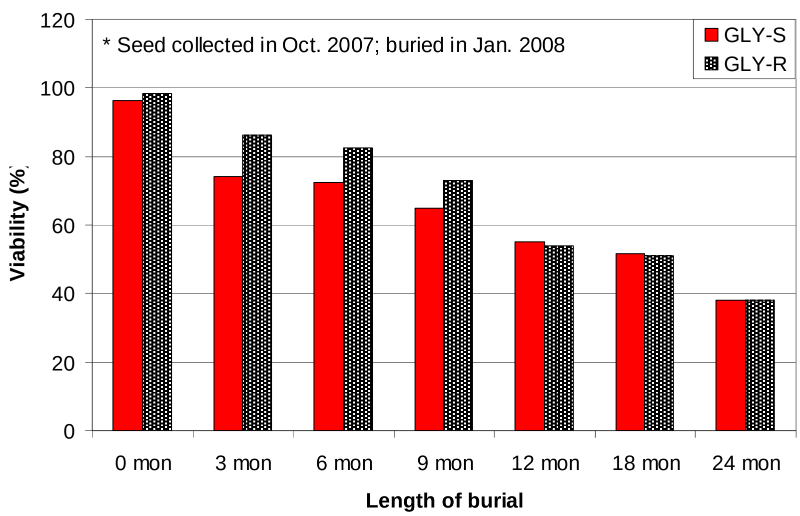
Figure 1. Internode distances as an indicator of terminal growth potential. Note the square loss cause by plant bugs in the upper nodes.

These are just a few of several general guidelines that are useful in determining the need for PGRs for cotton that is approaching the bloom period. The most accurate assessments are made when evaluating the "big picture" or utilizing several of these guidelines in concert. No single approach can determine the optimal PGR rate or timing without predicting the future, nor is a single approach accurate enough to account for all the variation in crop development and environments. Again, it is critical to make these decisions on a case by case basis, and to monitor growth frequently to determine the necessity of additional mid-bloom PGR applications. Remember that environment tends to play a very strong role in the necessity of PGR applications…..just because you grow cotton in a dryland field, does not mean that excessive growth can't occur, and vice versa for irrigated fields. The same idea applies to variety maturity. PGRs should only be applied on an as-needed basis, when there are signs of current and expected vigorous growth. PGRs should not be applied when there is insufficient soil moisture, especially in dryland fields. There has been little rainfall during the past week in several places across Georgia, and some cotton is beginning to wilt. Waiting until rainfall returns before making PGR applications will likely result in a more positive outcome. The attached bulletin entitled "Use of Plant Growth Regulators as a Management Tool in Cotton" contains additional valuable information regarding the use of PGRs, and was developed by our agronomists here in Georgia.

Palmer amaranth Management for 2011 Begins NOW! (*Culpepper and Sosnoskie*).

Georgia growers have waged an effective war on Palmer amaranth during 2010 with management, for the most part, being better than in previous years. Although many growers have been battling Palmer amaranth quite successfully this year, this pest continues to destroy our economic ability to produce cotton. Thus, it is essential that we focus on seed production by those escaped Palmer amaranth female plants. Our initial research suggests the seed will be short lived in Georgia (Figure 1) and that it may be possible to turn the tide on this pest in as few as 3 or 4 years. However, this effort will only be effective if we negate seed production of escaped female Palmer amaranth plants. Palmer amaranth that emerged in early planting cotton (April/May) will be setting seed in the very near future and should be removed in the next couple weeks!!!!!!!!!

Figure 1. GLY-R and GLY-S Palmer amaranth seed* viability after 24 months burial



<u>I Really Don't Want to Hand Weed…..But Should I??????</u> (*Culpepper*)

Although many growers are having an effective (albeit not economical) year in controlling Palmer amaranth, there are escapes in nearly every field. A great sign of our aggressiveness was evident this past week with numerous hand weeding crews in full force across the state. Growers utilizing these hand weeding crews will benefit greatly as we try to get the upper hand……however those who question the value of hand weeding should consider the massive seed production of your enemy as noted below.

Example of what has been occurring in Georgia fields since 2004 (figure 1):

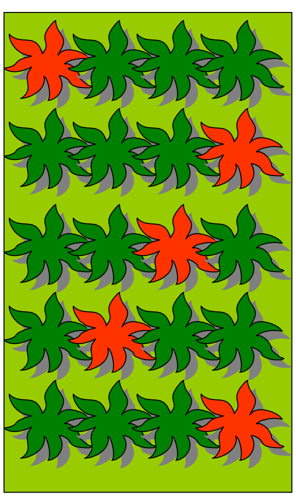
Year 1: If we have a one acre farm and we allow five FEMALE plants to escape, these five female plants will produce at least 400,000 seed each with a total of 2,000,000 seeds returned to the seed bank on our acre farm.

Year 2: We select an extremely effective weed management program which controls 99.9% of the Palmer amaranth that emerges (lets assume 50% germination). Even with 99.9% control and relatively low germ, we still have 1000 Palmer plants at season's end with approximately 400 of these plants being females. These 400 female plants will then produce 160,000,000 seeds now being returned to our one acre seed bank.

Year 3: If 50% of the 160,000,000 seed produced in year 2 germinate during season 3, and we continue to utilize extremely effective herbicide systems (99.9%) then there will be 80,000 escaped plants with approximately 32,000 being female……….as far as seed produced.....need a bigger calculator!!!!!!

Integrated management programs using herbicides, tillage, cover crops, hand weeding and rotation are crucial for our economical survival!!!!

Figure 1. Palmer amaranth seedbank – it is the key!



YEAR 1: 5 Palmer females escape

Produce 2,000,000 seeds in cotton (50% germ)

YEAR 2:

Weed program = 99.9% control

1,000 plants per acre left at harvest

400 female plants/A

160,000,000 seeds produced in cotton (50%)

YEAR 3:

Weed program 99.9% control

80,000 plants per acre left at harvest

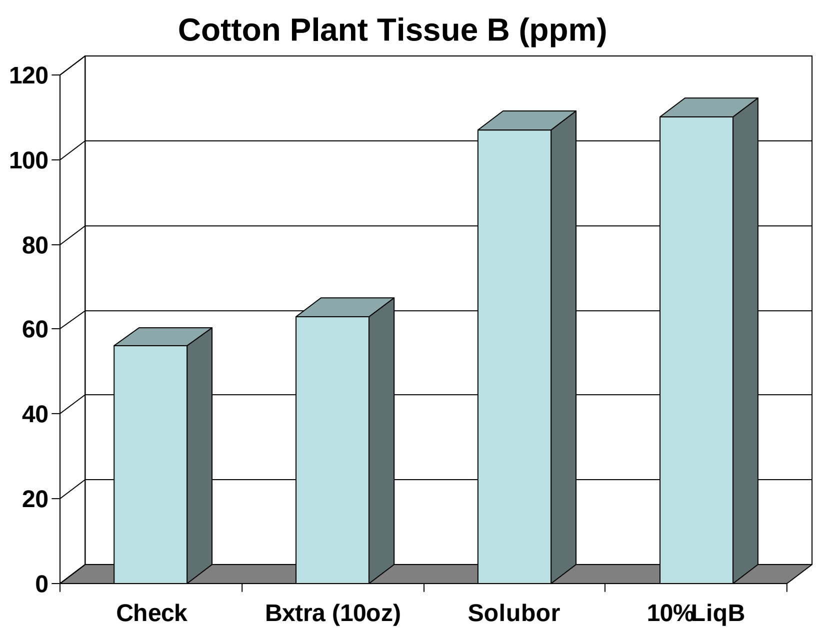
32,000 female plants/A = 1.28 X 10^{10} seed/A

Foliar Feeding Guidelines for 2010: Featuring "Six Ounces of Boron is Not Enough !" ***(Harris)***

Foliar feeding cotton can be used as a supplement to a good soil based program (as in the case of N and K), as part of a standard recommendation (for example the UGA recommendation for 0.5 lb B/a), or as a "rescue" treatment for deficiencies (such as Mn and Zn). Some nutrients do not foliar feed well (such as P, Ca and S) and need to be soil applied. There are numerous fertilizer materials available designed for foliar feeding. Price of the nutrient you need and burn potential also need to be considered.

Boron – The UGA recommendation for boron on cotton is 0.5 lb B/a. The most common and economical way of meeting this recommendation in the past has been to use 2.5 lb of sodium borate wettable powder (20 % B) i.e. Solubor or 2 quarts of 10 % liquid boron derived from boric acid. An even better strategy is to apply 1.25 lb/a Solubor or 1 qt/a of a 10 % liquid boron twice in two separate application, about 2 weeks apart starting around first bloom.

Unfortunately, there are some boron products currently being recommended at very low rates. For example, Boron Xtra is a liquid containing 5% B. The label says to apply 4-20 oz/a "depending on level of deficiency". The problem here is that 6 ounces per acre of this material supplies 0.025 lb B. That is 10 times less than half of our UGA recommendation ! Now this would be fine if this product was 10 times better than the Solubor and the 10 % liquid borons – but it is not ! I conducted a field trials with this product on cotton in 2005 where I applied it at 10 ounces per acre and then at the full rate of 0.5 lb B/a. I also included Solubor and 10 % liquid boron ("Borosol 10") at the 0.5 lb B/a. Tissue sampling results from this replicated research trial can be found in the graph below.



Note that the Boron Xtra at 10 ounces did not raise the level of B in the cotton leaves much above the untreated check. Since the sufficiency range for B in cotton tissue at this growth stage is 20-60 ppm there was already sufficient boron even in the untreated check, therefore no yield response was seen for any of the treatments.

Which brings up another point, if there is no B deficiency than 10 ounces is enough…or for that matter 6 ounces is enough …or when you think about it 0 ounces is enough ! Boron deficiency is cotton is not easy to detect without tissue sampling. And if a grower has been spraying the recommended 0.5 lb B/a on cotton and peanuts there is probably enough residual in soil to meet the sufficiency requirement. That is why, quite frankly, yield response to boron applications are rare and are seen as "cheap insurance". So if this is like insurance, are you better of with " liability only" (e.g. 6 oz of Boron Xtra) or "full coverage" (e.g. 0.5 lb B/a as Solubor or 10 % liquid B) ? I would say full coverage ! Especially since, according to my price checking, 0.5 lb B/a as Solubor or 10 % liquid B is not that much more expensive than 6 oz of Boron Xtra (remember that only provides 0.025 lb B).

Potassium – Now let's talk about a nutrient that is commonly deficient in cotton, especially in the last few years. The combination of high K fertilizer price, abundant rainfall and new shorter season varieties has led to increased K deficiency in Georgia cotton. Unlike with boron, K deficiency symptoms on cotton are easy to detect. The trick is to catch them early, i.e. light yellowing between the veins of upper leaves around first bloom. Once you get dark yellowing between the veins and certain leafspots around 4th week of bloom it is probably too late to recover with foliar feeding.

The product of choice for years for foliar feeding cotton with K has been potassium nitrate. This is a 46 % K2O soluble powder. If using a ground rig, you can dissolve 10 lbs of potassium nitrate in 12 or 15 gallons of water thus supplying 4.6 lb K2O per acre with minimum burn. Applications by plane are more challenging since it is hard to get more than 1 pound of potassium nitrate to dissolve in 1 gallon of water.

There are other potassium fertilizers available designed for foliar feeding. For example, there is a "5-0-20" made with potassium thiosulfate. One of the issues with this product is that it is hard to get as much K compared to potassium nitrate without getting burn. There are also different formulations of "10-0-10" where some are made with potassium nitrate but at least one other is made with a slow release urea. Like boron, beware of "low rate" recommendations with some of these formulations, especially considering the cost. If it claims to be 10 times better than potassium nitrate that should be a red flag.

Manganese – Foliar manganese should be used when a deficiency has been confirmed by tissue testing. The likely scenario where you would see manganese deficiency would be where you have low levels of Mn in the soil coupled with high soil ph (7 or above). The product of choice in this situation would be manganese sulfate, for example the product "ManGro" which has 31 % Mn.

There has been a lot of talk about the interaction of glyphosate and manganese. Apparently, tank mixing glyphosate and manganese sulfate can decrease the effectiveness of the glyphosate. This is not suppose to be an issue if you use a chelated form of manganese such as those that contain EDTA. There has also been talk of the glyphosate in this tank mix interfering with the Mn uptake by plants. The way I understand it, this has been studied in soybean in the Midwest, but as far as I know, no one has proven that this is an issue with cotton in the Southeast. I plan to spray some foliar manganese on cotton plots that have received glyphosate applications and see if I get a yield response.

Nitrogen – Finally, foliar nitrogen can increase yields in situations where your total N rate comes up short either from being too low to begin with or for example where you lose significant N from leaching rains. Soil applied N is not recommended after the 3rd week of bloom due to the unlikelihood of response. Foliar feeding N during peak bloom (the first 4 weeks) can be beneficial, again, especially if you are pushing the sufficiency range. Petiole testing is a great way to confirm the need for foliar N. As far as the product of choice, feed grade urea (46& N microprills) is hard to beat. Liquid urea (23%N) is fine also. Again, there are numerous other fertilizer formulations designed for foliar feeding that contain N (e.g.10-010). Again, beware of "low rate" recommendations and be sure to calculate the price per pound of N and compare it to "foliar urea". Like K, 10 lbs of feed grade urea will provide 4.6 pounds of N and is a standard rate to shoot for. For more guidance on foliar feeding N and other nutrients, you can also refer to the UGA 2010 Cotton Production Guide (online or hard copy).

Measuring Single Cotton Fibers Using Laser Technology (*Changying "Charlie" Li*)

Cotton fineness and maturity are important fiber quality properties. The two properties are usually determined by cutting fibers into small pieces and measuring their cross sectional perimeter and area, which is an extremely tedious and challenging task. Cotton engineers on UGA Tifton campus developed an alternative nondestructive method using the laser diffraction method to measure the diameter of single cotton fibers and predict fiber maturity and fineness. They designed the laser optical system, developed a software program, and tested the system on a uniform iron wire and individual cotton fibers from ten different varieties.

The construction of the optical system is relatively simple. The system consists of six major components: a light source (laser with 632 nm), polarizing lenses, an iris, a single cotton fiber sample holder, a collecting lens and a linear CCD camera which is connected to a computer to collect and process the data. A software program was developed to normalize data, de-noise the signal, and compute fiber widths in a batch mode.

Since the true fiber width values from cotton are almost impossible to obtain, a uniform iron wire with known diameter (25.4 micron meter) was used to test the accuracy and precision of the optical system. Figure 1 (a) presents a histogram which shows the distribution of the ribbon-width values of iron wires measured by the optical system. Total 900 diffraction patterns were obtained from the 10 iron wires along their longitudinal direction. The overall shape of this histogram follows a normal distribution pattern. The mean value of the iron wire diameter in this histogram is 25.43 µm which is only 0.1% higher than the nominal diameter value (25.4 µm) provided by the manufacturer. Other statistics such as the standard deviation (0.30 µm) and coefficient of variation (1.18%) proved the good repeatability of the optical system.

Eight different cotton varieties were measured by the optical system as well. Cotton samples were provided by the Fiber Research Group at the Fiber and Biopolymer Research Institute at Texas Tech University in Lubbock. Cotton fiber quality data (such as AFIS fineness and HVI micronaire) and cross-sectional parameters (perimeter and area) were provided by researchers at Texas Tech with destructive methods and standard instruments such as AFIS and HVI. Similar to iron wire measurement, 900 diffraction patterns were collected for ten fiber samples in each variety. Figure 1 (b) demonstrates the distribution of cotton fiber widths measured by the laser diffraction system for one cotton bale (No. 3177). The mean of the fiber width of this variety is 14.31 µm. The larger range of the fiber width distribution authentically reflects the anisotropic nature of the cotton fiber. The smaller values of fiber width may be attributed to the presence of convolutions along the fiber's axis; the larger values of fiber width may be positions along the fiber that are flat and thicker.

Linear regression analyses showed that the fiber width measured by our laser diffraction system had a strong linear relationship with the cross sectional perimeter and area with r^2=0.81 and 0.77, respectively. Good linear relationships were also observed between the fiber width and AFIS fineness, and between fiber width and HVI micronaire, with r^2=0.79 and 0.73, respectively. This simple, replicable, and relatively inexpensive optical system is capable of scanning multiple points along the longitudinal axis of single cotton fibers and revealing the anisotropic nature of cotton fibers. It could be used to complement current HVI or AFIS system for single fiber longitudinal profile characterization and cotton fineness and maturity estimation.
For more information, please contact Charlie Li at cyli@uga.edu, PI of the Fiber Sensing Lab at Tifton.

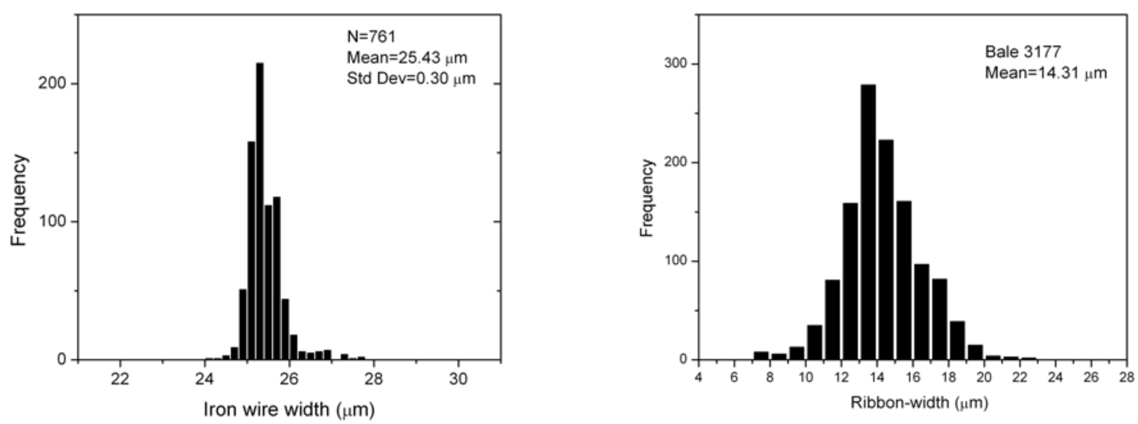


Figure 1. Distribution of ribbon-widths of iron wires (a) and cotton fibers (b).

Upcoming Field Days:
SE GA Research & Education Center in Midville, GA on August 18, 2010
SW GA Research & Education Center in Plains, GA on August 26, 2010
……Details for both to follow

Cotton & Peanut Research Field Day, September 8, 2010 Tifton: Mark your calendars for the 3rd Annual UGA Cotton and Peanut Research Field Day scheduled for September 8, 2010. The tour will begin at 9:00 a.m. and conclude with lunch; a detailed schedule of speakers and registration information will be forthcoming. The field day is being sponsored by the Georgia Cotton Commission and the Georgia Peanut Commission.

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Your local County Extension Agent is a source of more information on these subjects.

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