UNIVERSITY OF GEORGIA EXTENSION

UGA Cotton Team Newsletter
May 2021

Articles in this month's issue include:

Temperature and early-season crop growth (*John Snider, Gurpreet Virk, and Camp Hand*): In the previous newsletter, we described the germination and emergence stage of cotton development and some of the environmental factors that influence it. In the current newsletter we turn our attention to the effect of temperature on post-emergence seedling growth. Most growers would agree that vigorous early season growth is desirable because it increases competitiveness with weeds, lessens the negative impacts of early season pathogens and insects, and minimizes the risks of stand loss. This is particularly important in cotton, a crop known to have poor seedling vigor compared with other major row crops. Seedling growth can be influenced by cultivar, management, and environmental conditions. Cultivar differences in seedling vigor are commonly associated with differences in seed characteristics such as seed mass and density, with larger, more dense seeds typically producing more vigorous seedlings. Management practices that are conducive to early season growth include planting into good soil moisture and into a well-aerated, weed-free seed bed. Beyond these factors, temperature is one of the most important factors governing seedling development.

Chilling temperatures (temperatures less than 50°F) experienced soon after planting can cause the primary root tip to die off. This prevents normal taproot development and may even cause the primary root to curl upwards rather than growing down into the soil profile. Even for plants that survive chilling injury, there can be a lasting stunting affect that causes subsequent growth and development to lag relative to normal developmental trends. Low, non-chilling temperatures between 50 and 77°F do not directly injure plant tissues, but they do substantially slow root and shoot growth, with attainment of key developmental stages being directly tied to growing degree day accumulation. The crop requires approximately 50 DD60s for emergence and another 50 to produce its first true leaf. DD60 accumulation is a function of daily average temperature ([(Tmax + Tmin) / 2] minus a standard base temperature, which is 60 °F for cotton). With increases in daily average temperature, DD60s accumulate more rapidly which can accelerate the addition of new leaf nodes, driving further increases in growth. However, it is also

important to utilize an upper temperature limit for DD60 calculations since there is a point above which higher temperature do not appreciably contribute to growth and can even be inhibitory.
Figure 1 shows the results of a recently-conducted, controlled-environment experiment at the University of Georgia. Seeds were sown under four different day/night temperature treatments, and plants were allowed to grow for two weeks prior to growth measurements. Two main observations are worth noting here. First, the cotton plant responds positively to increases in growth temperature up to a day/night temperature regime of 95/77 °F. This supports the popular perception that cotton does well under high temperature conditions, at least in the early seedling stage evaluated here. This agrees with commonly utilized DD60 accumulation models that illustrate a positive relationship between rate of development and cumulative DD60s. The second observation worth noting is that there is a limit above which further increases in temperature significantly hinder growth rather than promote it. For example, as temperatures increased from 35/77 °F to 104/86 °F, plant height decreased 20%, and leaf area/total dry weight decreased more than 40%. This is likely because high day temperatures in excess of 95 °F are known to limit photosynthesis and high day and night temperatures increase respiration rates, which burns a higher percentage of the carbohydrates produced by the plant.

So, what are the takeaways? 1) Cotton is a plant of tropical origin and needs warm temperatures for growth and development. Follow extension recommendations and plant when the weather forecast predicts sufficiently warm temperatures to maximize early season growth (minimum temperatures above 65 °F and 50 DD60s accumulated within the first five days after planting). 2) Recognize when high temperature may be a limiting factor in seedling development. For example, afternoon temperatures in the low 100s along with night temperatures in the 80s will substantially limit seedling growth. If heat wave events corresponding to these temperatures occur soon after planting, understand that seedling vigor may be negatively impacted.

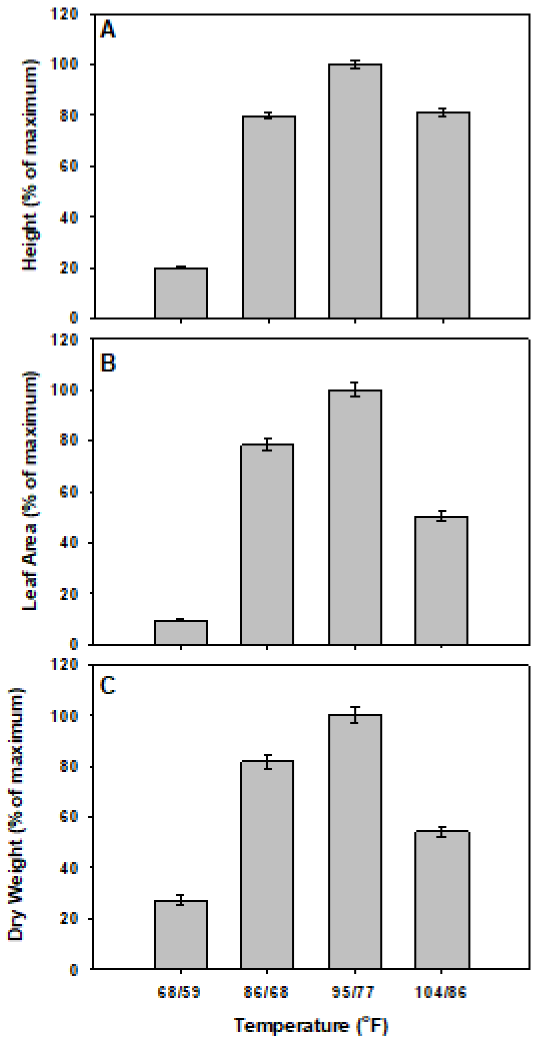

Figure 1. Growth of two-week old cotton seedlings in response to different day/night growth temperature treatments. Parameters measured include plant height (A), leaf area (B) and dry weight (C).

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Protecting cotton from early-season diseases and nematodes – not quite the same as in your peanut crop (*Bob Kemerait*): Many cotton farmers are also peanut farmers. These growers recognize that cotton and peanut crops each need to be protected at planting from seedling diseases and nematodes. They may also recognize that a number of the same products can be used for each crop. Azoxystrobin (e.g. Quadris and Abound), fluopyram (Velum), aldicarb (AgLogic), oxamyl (Vydate C-LV and Return XL), and 1,3-dichloropropene (Telone II) are important tools in the forever battle against diseases and nematodes affecting both crops. Propulse (fluopyram + prothioconazole) can also be used on both crops. These products are appropriate for a couple of reasons. First, disease caused by the fungus *Rhizoctonia solani* is our most important seedling disease on cotton in Georgia and is also a threat to peanuts. In-furrow applications of azoxystrobin products are effective in the management of *Rhizoctonia*. Early-season management of nematodes is critical for both crops and the products listed earlier (Telone II, AgLogic, Velum, Vydate C-LV, and Return XL) can be used to effectively reduce damage and protect yield. The "best" product depends in large part on the size of the nematode population and the susceptibility of the variety that is planted.

While there is a shared need for seedling disease and nematode management in both cotton and peanuts, there are significant differences between the crops as well. First, though Rhizoctonia solani is an important pathogen on both crops, the fungus *Aspergillus niger* (Aspergillus crown rot) is not a problem on cotton but is a significant problem on peanuts. As resistance to azoxystrobin is developing in populations of *Aspergillus niger*, this fungicide is less effective in protecting peanut seedlings than it is in protecting cotton seedlings which are not affected by this pathogen. Products such as Velum and Propulse have additional value to peanut growers because the fluopyram they contain is effective against not only nematodes, but Aspergillus crown rot as well. The fluopyram offers some early-season protection from leaf spot diseases. Peanuts are also affected by Cylindrocladium black rot (CBR), a disease that is most obvious later in the season but treatments are best applied in-furrow at planting time. The fungicide prothioconazole (Proline) is an important management tool for this disease, a disease not affecting cotton. Propulse (fluopyram + prothioconazole) is a useful product on both cotton and peanuts, but for different reasons. The combination of fluopyram + prothioconazole, especially if "spiked" with additional Velum (fluopyram) for increased nematode protection, is tool that can be used to fight Fusarium wilt of cotton (a disease of cotton that is often in association with a root-knot of sting nematodes). The same Propulse, again, often spiked with additional Velum, is an effective tool against CBR which is also often in association with a nematode problem.

Nematodes are an important problem on both cotton and peanuts; however, there are significant differences. First, cotton is affected by the southern root-knot, reniform, sting, and Columbia lance nematodes, while peanuts are affected primarily by the peanut root-knot nematode and, to a much lesser extent, the lesion nematode and, occasionally, the sting nematode. Nematodes affecting both crops are managed using resistant varieties are available (southern root-knot and reniform resistance in cotton and peanut root-knot resistance in peanut) and the same nematicides are labeled on each crop. Nematodes tend to be a more widespread problem on cotton than on peanuts, but must be effectively managed on both crops.

Early season disease management considerations are also tremendously important for peanut growers because of the threat from the Tomato spotted wilt virus. Thrips must be managed on both crops; however the threat from Tomato spotted wilt leads to many growers choosing to use Thimet (phorate) on peanuts, a product not labeled for use on cotton. Because we now recognize that the Cotton leafroll dwarf virus can affect cotton (though we are unclear on the magnitude of the threat), in the future growers may adopt early-season management strategies (planting date, variety selection, etc.) as they have for Tomato spotted wilt on peanut.

Both cotton and peanuts are affected by diseases and nematodes best controlled with early-season management decisions. A number of the management options are the same, or similar, for both crops. However, understanding the differences, and the REASONS for the differences, can help growers to more effectively protect each crop and to protect their yield and profit.

Benghal dayflower aka Tropical spiderwort is already up! (*Stanley Culpepper*): Over the past few seasons, tropical spiderwort has regained its status of being a major pest for many Georgia cotton farmers. To control this weed, one must understand the importance of placing residual herbicides strategically throughout the growing season beginning at planting. However, the most important herbicide application may be the last one where an effective residual product must be applied in a manner where it contacts the soil… yes, the best approach by far is to use a layby rig or hooded sprayer applying the herbicide where it needs to go which is not overtop of the crop. Remember this weed can grow in the dark, so the approach of shading it out with the cotton crop is not as effective as it is on many other weeds.

Activity of the more commonly used cotton herbicides on spiderwort is discussed below; contact your local county Extension agent for a season-long program approach depending on your choice of technology being grown.

Consider the following when building a program:

1. Residual activity from Warrant and Dual Magnum are critical to success; limited data suggests Outlook is also effective.
2. Gramoxone and 2,4-D are very effective controlling emerged plants with timely applications.
3. Dicamba is not overly effective but when mixed with glyphosate and applied sequentially, control of emerged plants is often acceptable depending on the weeds size when the first application is made.

Following sequential dicamba applications with a directed layby application, including an effective residual herbicide, will be important for long-term success with this system.

4. Roundup + Staple remains quite effective on emerged plants if they are small.
5. Liberty is not very effective.
6. Layby materials such as diuron + MSMA, glyphosate + diuron, or any mixture with Aim can be quite effective. Remember to include a residual herbicide with the layby application and follow all application requirements.

Early season irrigation requirements for cotton production (*Wes Porter and David Hall*): On the weekend of April 24th 2021, parts of South Georgia experienced torrential downpours totaling of up to or more than six inches within a twenty-four-hour period. A producer commented that "he could not believe that he was able to be back in the field three to four days later." This comment brings up a perfect opportunity as we begin another cotton growing season to be mindful of the basic principals of soil holding capacities. Most soils in South Georgia can only hold 0.75 to 0.8 inches of water per foot of soil depth total. Additional water beyond this point either becomes runoff or deep percolates. It depends on how the rainfall is received, an event such as we received on April 24th typically becomes runoff as it comes very fast in a short time frame, if the rainfall comes slowly over multiple days there is a risk of it percolating. It is vital that you remember this during the growing season. Yes, it is important to track and keep a record of rainfall to aid in irrigation scheduling, but be realistic on how much actual water is available in the soil profile while scheduling your irrigation events. This is most important if your method of irrigation scheduling is the UGA Checkbook method. It is also important to note that only 50% of the soil water holding capacity is available to row crops. On another note regarding this topic, if you are using soil moisture sensors with a crop stage demanding water and receive a three-inch downpour in less than an hour, don't be surprised if your sensors call for irrigation relatively quick after the heavy rain.

Most of the cotton across Georgia should be planted during early- to mid- May. Similar to peanut, cotton does not require very much irrigation during the first month or so of growth and in some cases if adequate rainfall is received cotton can go up to squaring and even bloom without additional irrigation applications as exhibited by the red box and water use curve below in Figure 1. UGA Extension has developed an Irrigation Reference Guide for Corn, Cotton, Peanuts, and Soybeans | UGA Cooperative Extension, a quick and easy irrigation scheduling guide that is laminated and contains the four major row crops grown in Georgia. However, if it gets hot and dry again like it did during late March and May of 2019 you may need to apply a few small irrigation applications either weekly or potentially a few times per week. The red box below represents cotton water requirements the first five weeks after planting. Keep a track of rainfall and temperature, your irrigation efficiency (typically around 65-70% for high pressure systems and 80-90% for low pressure systems), and make irrigation applications accordingly. Keep in mind that the water requirement below is irrigation plus rainfall, and the weekly water requirement recommendation was developed based on a historical average evapotranspiration. So your actual water/irrigation requirement may vary slightly based on weather conditions and rainfall during the growing season. For a more in-depth irrigation recommendation it is suggested that you look into implementing either a computer scheduling model either online or via a Smartphone App, or soil moisture sensors.

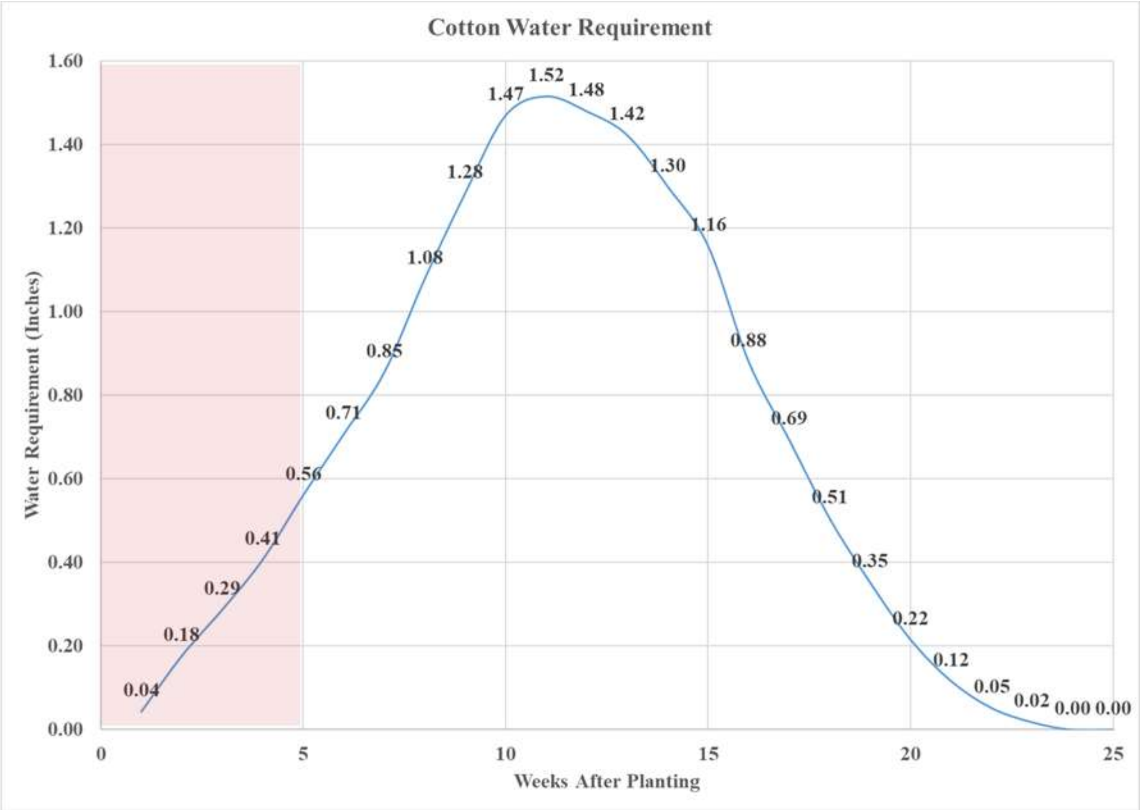


Figure 1. Seasonal Cotton Water Requirement.

For cotton farmers who utilize tools such as moisture sensors in their irrigation scheduling, there are a few quick reminders to keep in mind. We tend to visualize the above ground plant and forget what is growing below the surface. We can sometimes be guilty of placing a sensor in the row of the cotton let it start logging data, making decisions from that data and assuming everything is good to go. Unfortunately, we need to make sure we know what is going on in the field before we blindly start following the sensor. Based on when you planted certain fields cotton may be spread in age by several weeks while some are still in the bag, this is a good time to think about "weighting sensor depths" according to rooting depths.

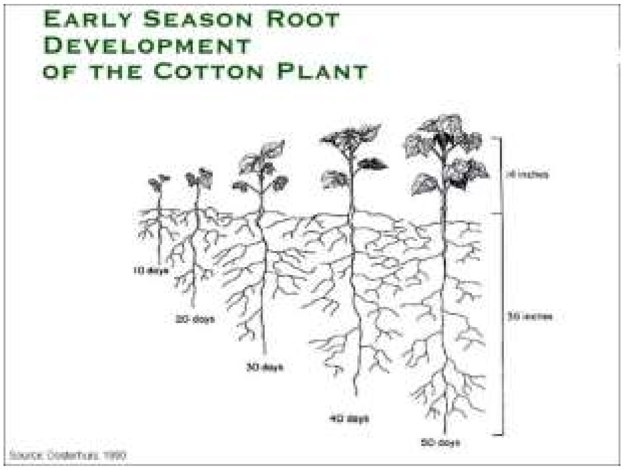


Figure 2. Visual development of root development as the cotton plant progresses in age.

One thing is certain in farming, one year from the next is never the same. Weather and available moisture are constant variables. Adding rooting depths and plant needs in the equation and creates the need for a formula for weighting sensor depths in your irrigation scheduling decision an important factor throughout the growing season. Most sensors come with two or three depths that measure available moisture. Early in the season, cool nights and afternoon temps are “normally” around the low to mid 80s. The evaporation rate is low in comparison to the dry hot summer days and nights. The root profile for the first month develops fairly shallow in the soil. These combinations of events reflect the plant water needs, as shown in our UGA Checkbook method. Moisture sensors generally default to an average of using sensors available on the probe for a trigger decision. This can provide false water needs for young cotton plants. For example, if a 16” depth is showing a dry reading and the 8” sensor is reading adequate moisture, the average will possibly trigger an irrigation event. If a cotton plant has just fully emerged and your root profile is in the 8”-10” range in this scenario, you actually do not need to irrigate. Now, considering the rooting depth let’s weight the 8” sensor by an 80% value and the 16” sensor by 20%. Now since the average is weighted higher on the shallow sensor it can be seen that irrigation may not be needed. You should not begin to fully use deeper sensors for irrigation scheduling decisions until you see what water use is occurring at those depths. Weighting moisture sensors can be very beneficial but can be harmful if adjustments are not made during the growing season. If you are interested in weighting sensors, below are UGA Extension suggestions to consider for weighting sensors during the growing season:

D1 = shallow sensor D2 = middle sensor D3 = deepest sensor

- Early Season: 80% * D1, 20% * D2, 0% * D3
- Early-Mid Season: 60% * D1, 30% * D2, 10% * D3
- Mid Season: 50% * D1, 25% * D2, 25% * D3
- Late Season: 40% * D1, 30% * D2, 30% * D3

Soil moisture sensors provide the most accurate means of monitoring available soil moisture. Monitoring the root zone and available moisture present is a great tool in irrigation scheduling. If you have further questions about irrigation scheduling on your cotton reach out to your local UGA County Extension Agent.

So how does the "big rain" we got in late April change your fertilizer strategy? (*Glen Harris*): Believe it or not, I would argue that the big rain we got on the weekend of April 24th should not change your fertilizer strategy for Georgia cotton all that much. Number one, your preplant fertilizer should only have counted for 1/4 to 1/3 of your total N rate. Then, not all of that N was likely in the "leachable" form of nitrate (versus ammonium or urea). Then on top of that, the rain fell so fast that a lot of it ran off the fields (sideways) instead of soaking down through and taking the nitrate with it. Yes, we may have lost some preplant N. But it is early and we have time to adjust. Simply put, it is probably not economical to make an extra trip over the field right now to replace a little bit of preplant N that was lost. A better strategy would be to sidedress a little earlier (closer to first square than first bloom) and also increase the rate slightly when we do.

But what about potassium? Actually, potassium is even less mobile than nitrogen. The "big rain" may have moved some K down into the profile but the cotton roots should still be able to get deep enough to get it. There are many possible reasons for having potassium problems. For example, nematodes, dry weather, low pH or high pH to name a few. If you have potassium problems this year it could be more from one of these issues.

And you noticed that I did not mention replacing any phosphorous. This is due to the fact that P is basically immobile in our soils and will not leach. It is possible you lost some P that was attached to soil particles that eroded off the field during the big rain. The best way to check on this and actually on N and K also, is to take a plant tissue sample around first square. In fact this is a great way to check on all the status of all the essential plant nutrients while leaving yourself time to correct anything that is deficient.

Don't forget that sulfur and boron are also very mobile in soil, similar to N. Consider putting sulfur in with your sidedress nitrogen. And the standing boron recommendation is 0.5 lb B/a foliar with other sprays such as herbicides or growth regulators. Try to have your boron out by first bloom since it is important to pollination and fruiting.

In-field planter considerations (*Simer Virk and Wes Porter*): Considering the significance of timely and uniform stand establishment, the importance of proper planter setup and operation for planting cotton cannot be over-emphasized so we are talking about planters again. While we covered some details on planter maintenance before planting and setup of different planter components previously, planter issues in the field are common and sometimes unavoidable during planting so here are some additional considerations during cotton planting that growers can utilize to prevent any potential stand establishment or emergence issues that may occur due to planter problems:

1. If you haven't started planting cotton yet, there is still time to PERFORM A THOROUGH PLANTER CHECK using the planter checklist available here Row Crop Planter Checklist: Tips to Achieve Successful Stand Establishment | UGA Cooperative Extension. Remember to take care of any major issues or parts that needs to be replaced before you get out in the field and start planting.

2. If the 2021 cotton planting season has already started for you, don't forget to consistently DIG BEHIND THE PLANTER to ensure that the planter is achieving the target seeding rate, depth, and

seed-to-soil contact in every planter row and maximizing the potential for seed germination and emergence.

3. Changes in planting conditions within a same field or among the fields is common so make sure to ADJUST PLANTER SETTINGS for prevalent field conditions with special consideration to variability in soil texture, moisture, and/or crop residue. A change in cotton variety, specifically seed size, will also require adjustments to vacuum and seed meter settings to ensure high seed singulation with minimum skips or doubles.

4. When you notice any seed singulation, spacing, or depth issues in the field while planting, make sure to PROPERLY IDENTIFY AND FIX PLANTER ISSUES before continuing cotton planting with the same planter. Some useful tips for identifying and troubleshooting some common planter issues (with pictures) are available here https://site.extension.uga.edu/precisionag/2021/04/understanding-and-troubleshooting-common-planter-issues/.

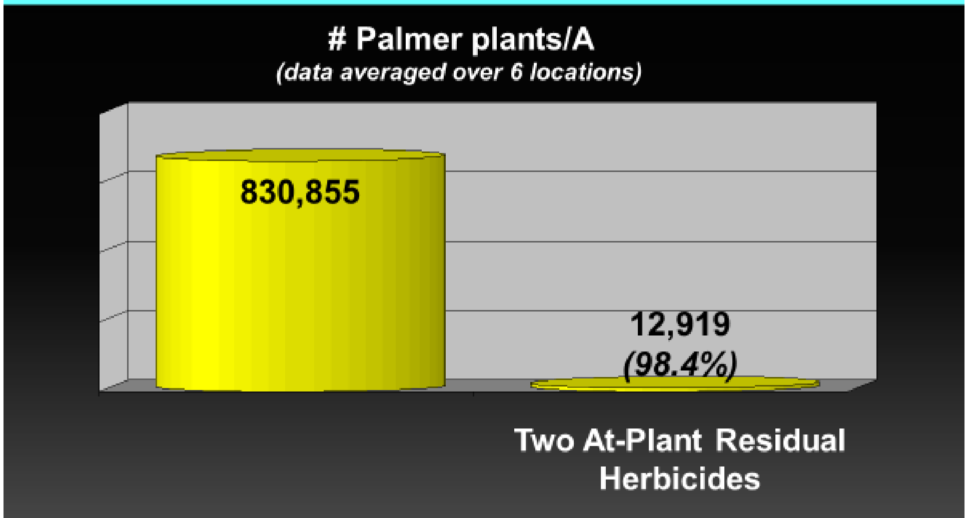
5. Keep a consistent VISUAL CHECK ON IMPORTANT PLANTING PARAMETERS from the tractor cab during planting including vacuum pressure, row-unit bounce, ground speed, operation of row-cleaners, gauge-wheels and closing wheels. Minor planter issues – which can affect seed placement and emergence – during planting are hard to catch and more often go unnoticed when not paying close attention.

6. When using a seed monitor or any other advanced planting technology such as active downforce etc., PAY ATTENTION TO THE PLANTING FEEDBACK FOR EACH ROW instead of looking at the overall population and other averaged planting metrics. Planter issues are usually not consistent across the whole planter but more specific to individual row units so they are easy to capture and fix when viewing by-row feedback.

Value of the at-plant residual herbicide must be understood for family farm sustainability (*Stanley Culpepper*): Research during 2017, 2018, 2019, and 2020 showed preemergence (PRE) herbicides, if activated, reduced the number of Palmer amaranth needing to be controlled by postemergence herbicides during the ENTIRE season by over 98% (*Fig 1*). At-plant applications using two residual herbicides (different chemistries) that are effective on Palmer amaranth are paramount in reducing resistance to topically applied herbicides like Liberty, 2,4-D choline, and dicamba. Additionally, at-plant herbicides should alleviate any potential for early-season weed competition reducing cotton yield. Table 1 defines several preemergence options, but keep in mind that other effective options exist including Cotoran mixtures or preplant incorporated yellow herbicides followed by a PRE herbicide. *Without implementing* *these residual herbicides at planting, the "life" expectancy of topically applied herbicides for some growers is likely less than three years.*

PRE'S	HERBICIDE RATES AND COMMENTS
1) **Brake + Reflex** 2) **Brake + Warrant** 3) **Direx + Warrant** 4) **Reflex + Direx** 5) **Reflex + Warrant**	1) **Brake** at 1 pt/A is an effective rate in mixtures but will require significant rain/irrigation to become fully active. 2) **Warrant** at 32-40 oz/A, for most soils, is in order. Effective on most grasses, pigweeds, and is essential for spiderwort. 3) **Direx** at 10-16 oz/A is needed for most soils; lower rate on sands or under intense irrigation. 4) **Reflex** at 10-12 oz/A is ideal for most soils when used in these mixtures. *NOTE: Add paraquat if Palmer is emerged; jar test to ensure mixing is advised.*

Figure 1. Number of Palmer amaranth to kill with POST herbicides for the entire season. 2017-2020.



Data provided is from conventional till; cover crops reduced the number of Palmer amaranth to be controlled by POST herbicides over 60% (biomass level dependent).

<u>Scouting thrips and supplemental foliar sprays (*Phillip Roberts*):</u> Vigor or the rate of seedling growth influences seedling injury from thrips. Thrips initially feed on the underside of cotyledons; damaged cotyledons will appear silvery on the lower surface of cotyledons. The majority of thrips eggs are laid on the cotyledons and it takes about 5-6 days for an egg to hatch. Once a terminal is present thrips will move to and feed on unfurled leaves in the terminal. As the leaves unfurl and expand the characteristic crinkling and malformations become obvious (Figure 1). A rapidly growing seedling may unfurl a true leaf every 3 days where as a seedling which is stressed may take 4-5 days or more to unfurl a new leaf. Again, thrips are feeding on the unfurled leaves so thrips feed for a more extended time on the same unfurled leaf of a slow growing or stressed plant compared with a rapidly growing plant. The same infestation of thrips will create more damage on a slow growing plant.

Figure 1. Crinkling and malformed true leaves are caused by thrips feeding in the terminal bud.

Figure 2. Sample thrips by slapping a seedling on a white piece of paper or box to dislodge thrips.

The decision to use a foliar insecticide to supplement at-plant insecticides for thrips control should be based on **scouting**. Scout thrips by randomly pulling a seedling and "slapping" the seedling against a piece of paper or box to dislodge the thrips (Figure 2). There will likely be sand and other debris on the paper. Thrips will begin to move within a few seconds and will cling to the paper whereas sand and other debris will slide when you tilt the paper. Count the number of thrips per plant after each sample. Be observant for immature thrips when making counts. Immature thrips are wingless and crème colored (Figure 3). Adult thrips are usually brownish or almost black in appearance and have wings (depends on species, tobacco thrips is the most common thrips species infesting cotton and adults will be dark brown or black). Do this on several plants and determine the average number of thrips per plant. The threshold for thrips is 2-3 thrips per plant with immatures present. The presence of numerous immature thrips suggests that the at-plant insecticide is no longer providing acceptable control (i.e. thrips eggs laid on the plant, eggs hatched, and immature thrips are surviving). Foliar insecticide options include the systemic insecticides Orthene, Bidrin, and dimethoate. Note that these products are systemic. Pyrethroids will not provide acceptable control thrips in cotton.

Economic damage from thrips rarely occurs once seedlings reach the 4-leaf stage and are growing rapidly. It is important that we make thrips decisions early in the plant's development. Seedlings become more tolerant to thrips feeding in terms of yield potential with every true leaf it puts on. 1-leaf cotton is much more susceptible to yield loss than 3-leaf cotton.

Figure 3. Immature thrips are crème colored and wingless (bottom). Adults are brownish with wings (top). Image by Jack T. Reed, Mississippi State University, Bugwood.org

Suggestions on planting new varieties and other planting thoughts (*Camp Hand*): Coming off the "rain delay" we had in the southwest part of the state, and the inch or two needed to plant in other parts of Georgia, many people are getting in the field to plant cotton. In this time, I have gotten a couple of questions from county agents that I'm sure more than one person is curious about. Question number 1: "Farmer Joe called me and asked about _____ variety. It wasn't in the on-farm variety trial this past year and I wanted to see if you knew anything about it." Although the on-farm variety trial does a great job of evaluating varieties across a wide range of environments, we are limited to how many we can look at. The twelve that were planted in last year's trial accounted for nearly 75% of the planted acres in Georgia, but there are other varieties out there and new ones coming out every year. A fantastic resource that we have at UGA is our OVT program, which evaluated 76 varieties last year. They get to test varieties as they are released, and do it in both irrigated and dryland environments. To find the yield data from last year's OVTs, please follow this link: https://swvt.uga.edu/content/dam/caes-subsite/statewide-variety-testing/docs/performance-trials/2020/yield-summary-irrigated-cotton-2020.pdf. Varieties that growers aren't familiar with should be tested on a limited number of acres so that growers can gain familiarity with those varieties.

Another question is related to plant population. As we attempt to cut input costs, one of the first questions is on how to stretch our seed out so we can plant more acres on a bag. Cole Moon, an ANR agent in Bleckley and Twiggs counties, sent me some data this past week on a trial he has been conducting. His data showed that a final plant stand of 30,000 plants per acre produced the same yield as higher plant populations, but was economically the best option. This is in an irrigated scenario, and further research will be conducted in dryland environments as well.

As always, your local county agents, myself, and the other specialists are here to help. If you need anything please don't hesitate to reach out. Be safe out there, and happy planting!