UGA Cotton Team Newsletter

May 5, 2020

Articles in this month's issue include:

Germination and Emergence in Cotton (John Snider, Cotton Physiologist and Gurpreet Virk, Graduate Student, Crop and Soil Sciences): This time of year, growers are ready to plant cotton once the opportunity presents itself. Thus, it's as good a time as any to discuss some of the normal physiological processes that occur between planting and stand establishment and how this influences plant response to early season conditions. Almost immediately after the seed is placed in the soil, assuming the soil is moist, in good contact with the seed, and is well-aerated, the seed begins to take up water (a process called imbibition). Depending on temperature (higher temperatures speed up the process, lower temperatures slow it down), hydration of the cotton embryo inside the seed will be complete around six hours after planting. Soon after this, the embryo starts burning energy reserves in the seed to drive growth, which requires oxygen uptake. Finally, the radicle (embryonic primary root) protrudes beyond the seed coat at one or two days after planting (depending on temperature). This represents the end of the germination process, and the cotton plant has now entered the seedling stage. The primary root grows into the soil profile, and the hypocotyl, the region just below the cotyledons, takes on a hook-like appearance and begins to extend upward. This has the effect of pulling the cotyledons, which are likely still covered by the seed coat, up through the soil. If you were to scratch just below the soil surface a few days after planting, the hypocotyl would be the closest part of the plant to the soil surface (Image 1a). Once the cotyledons have been pulled above the soil surface, emergence is complete (Image 1b).

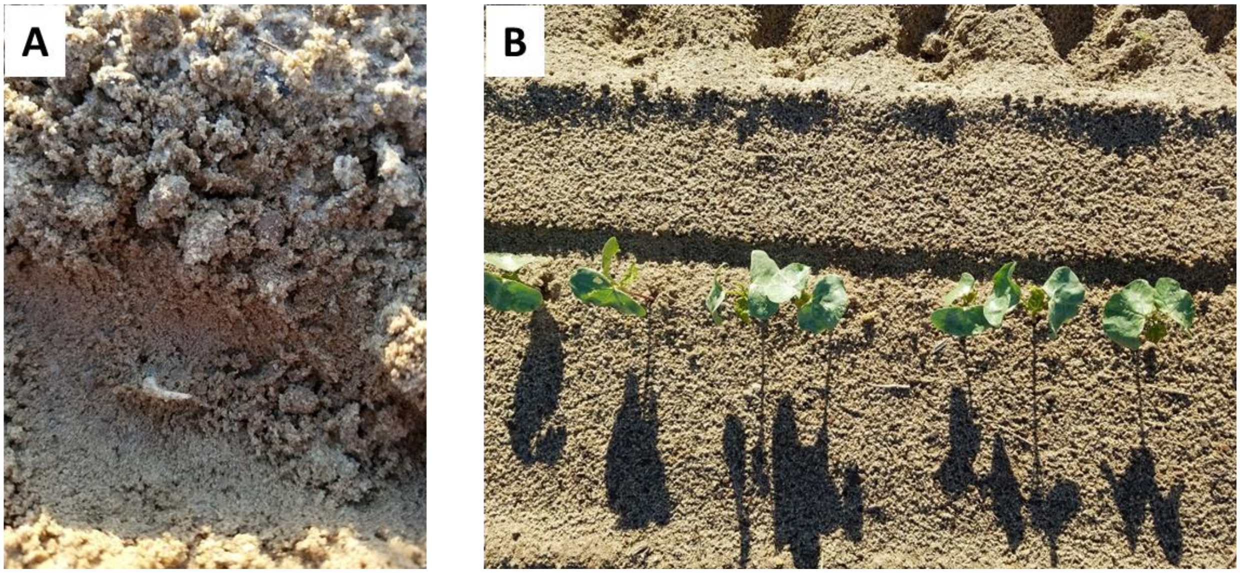

Image 1: The expanding hypocotyl just below the soil surface (A) and newly-emerged seedlings (B).

As noted previously, temperature is an important factor that can affect germination and emergence in cotton. For example, chilling temperatures (< 50 °F) during imbibition can damage the developing radicle and limit seedling survival. While cotton generally performs best when the daily high is 86 °F and nighttime low is 68 °F, it is not always possible to have optimal temperatures at planting. As a general rule, growers should plant when soil temperatures are 65 °F or higher with 50 DD60s projected to accumulate within the first five days after planting. The Cotton Planting Conditions Calculator developed by North Carolina State University (http://climate.ncsu.edu/cotton_planting) simplifies the five-day temperature forecast (DD60 forecast) information into 6 nominal categories of planting conditions ranging from Poor to Excellent and is a user-friendly resource for cotton growers.

Waterlogging conditions deprive the growing embryo of oxygen, resulting in death of the young seedling. Soil crusting mechanically impedes emergence, and in some instances, the hypocotyl will snap as it attempts to pull the cotyledons through the crust. Where soil crusting is a problem, it may be necessary to run a rotary hoe over the field to facilitate emergence. At the opposite extreme, poor seed-to-soil contact and a lack of mechanical pressure against the seed and developing seedling may not provide enough resistance to remove the seed coat as the seedling moves through the soil profile. As a result, the seed coat may prevent the unfolding of the cotyledons. Image 2a is from a recent growth chamber experiment, where the tight seed cap condition is commonly observed because the potting medium doesn't provide enough resistance during emergence. The same principle applies to the field as well and illustrates the importance of adjusting planter settings for specific field conditions. This topic was discussed in the previous newsletter. In situations where the seed coat stays on longer than it should (poor seed-to-soil contact or low temperatures), the cotyledons will have characteristic yellow spots or streaks (Image 2b). This happens because, the precursor to chlorophyll requires light to form fully functional chlorophyll. As a result, the portions of the cotyledon that remained under the seed coat do not turn green as quickly as the other parts of the cotyledons. This is not a major concern since the entire cotyledon will eventually green up with further exposure to sunlight.

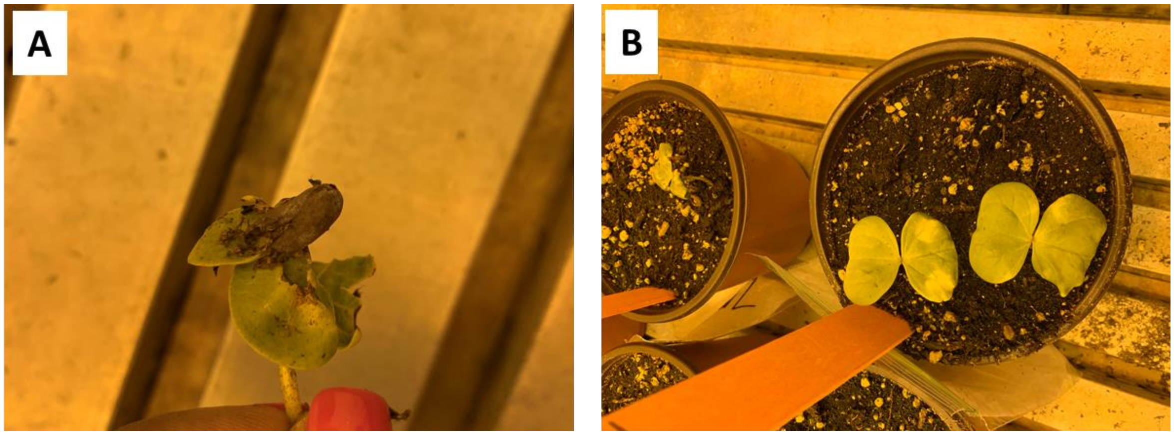

Image 2: Tight seed cap (A) and chlorotic spots (B) on newly-emerged seedlings.

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Checking In-Field Planter Performance during Planting (Simerjeet Virk, Research Engineer, Precision Ag & Machinery Systems, and Wesley Porter, Extension Precision Ag and Irrigation Specialist, Crop and Soil Sciences): Last time, we emphasized and talked about correct planter setup and maintenance procedures to ensure that the planter is ready to operate at a peak performance when it’s time to plant. This time, we will cover how to check planter performance in the field and make any required adjustments to obtain a high in-field planter performance. Before we discuss planter performance, it is important to mention that the main function of a row-crop planter is to **meter seeds at the target seeding rate, place metered seeds at a desired seeding depth and cover seeds with soil to provide adequate seed-to-soil contact** for rapid germination and uniform emergence throughout the field. Keeping that in mind, when we talk about planter performance, we are checking if the planter is successfully performing the abovementioned operations with a certain precision and accuracy. These four key variables are most commonly used to evaluate planter performance in terms of seed metering and seed placement accuracy:

Seeding Rate: On most ground-driven planters, seeding rate is achieved by using correct sprocket/gear ratio for the drive and driven shaft that rotates the seed meter. Technologically advanced planters have either a hydraulically driven main shaft that drive seed meters on all row-units or an electric motor driving each seed meter on every individual row-unit. A planter's ability to accurately meter seeds is dependent on seed meter setup and performance. Seeding rate accuracy is checked by counting number of seeds within a certain distance or by using a seed monitor which displays planted seeding rate separately for each row. The term 'Seed Singulation' is typically used to describe seed meter performance and is defined as 100 minus any skips or multiples. A seed singulation of 100% means target seeding rate is achieved with 100% accuracy with no skips or multiples. A seed singulation of 98-100% is considered acceptable during planting and anything less than that means reduced plant population in the field. Growers with seed monitors should monitor singulation constantly during planting and make any necessary adjustments to stay as close to acceptable singulation throughout each field. Growers with no seed monitoring technology should perform field checks regularly during planting season or anytime seeding rate is changed on the planter.

Seed Spacing: Seed spacing depends on the target seeding rate (at a given row-spacing) and is typically provided in the planter operator's manual for different combinations of seeding rates and row-spacings. There are some useful online tools and mobile apps that can used for calculating target seed spacing if you know the target seeding rate and row-spacing. Here is a link to one of the online resources: http://www.dickey-john.com/seed-spacing-conversion/. Seed spacing can be checked by digging up at least 4-5 seeds within a row and using a tape measure to determine seed-to-seed spacing. Seed spacing should be checked for accuracy and uniformity across all planter row-units. Among many factors that can affect seed spacing uniformity, poor seed meter singulation, cracked seed tubes, excessive row-unit vibration and high planter speeds are the most common ones. Growers should consider these factors when trying to address non-uniform seed spacing. New seed monitoring systems on planters also display seed spacing information along with seeding rate during planting. Growers with these advanced seed monitoring features should also consider performing field checks to verify in-field seed spacing accuracy and uniformity during planting.

Seed Depth: Seed depth is controlled by vertical movement of gauge-wheels in relation to double-disc openers. Seed depth on most row-crop planters is set by adjusting the t-handle or a knob that positions the gauge-wheel stop at a set location required to attain the target seeding depth. Prior to planting, seed depth setting should be checked on each row-unit by raising the gauge-wheel and observing (preferably measuring) the height of double-disc openers under the row-unit. In the field, seed depth is checked by digging up individual seeds in the row and using a depth gauge (https://www.ideastage.com/Seed-Depth-Tool-Indicator-944284143) to measure depth of the seed in the furrow relative to the ground surface. Seed depth should be checked across all row-units as depth variations between the rows is pretty common and depth setting on some row-units may need to be adjusted more than others. Seed depth is mostly influenced by field conditions (tillage, soil type or texture, soil moisture), inadequate depth or downforce, and planting speed. Planter adjustments, if needed, usually require either adjusting depth or downforce to achieve the desired planting depth.

Seed-to-Soil Contact: While there is no standard procedure to check seed-to-soil contact, this can be performed while digging up seeds to measure seed spacing or seed depth. An adequate seed-to-soil contact looks like firmly placed seed in the soil with no air pockets, crop residue, or soil compaction around the seed. Improper seed-to-soil contact is mostly caused by poor performance of closing wheels – either due to lack of sufficient pressure or too much pressure on the soil in the furrow. Row-cleaners, if not adjusted properly, can also cause crop residue to get in the furrow before the seed which create issues for proper seed placement. Excessive downforce in some cases leads to compacted soil around the seed which hinders seed germination and timely emergence. Appropriate planter adjustments should be made to ensure accurate seed-to-soil contact in each row before proceeding with planting in rest of the field.

Regular field checks of these planting variables would not only help to assess your current planter performance but would also provide opportunities to improve planter performance in the areas that may be limiting your maximum crop emergence and yield potential.

Early Season Irrigation Requirements for Cotton Production (Wesley Porter, Extension Precision Ag and Irrigation Specialist, Cale Cloud, Extension Water Agent, and David Hall, Extension Water Educator): Most people have been delayed in their cotton planting due to excessively wet conditions from the heavy rainfalls we have been receiving during the month of April. Most of the cotton 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 a quick and easy irrigation scheduling guide that is laminated and contains the four major row crops grown in Georgia. The guide can be downloaded at https://extension.uga.edu/publications/detail.html?number=C1189. However, if it gets hot and dry again like it did during late March and May of 2019 you may need to apply a small irrigation application 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 of 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.

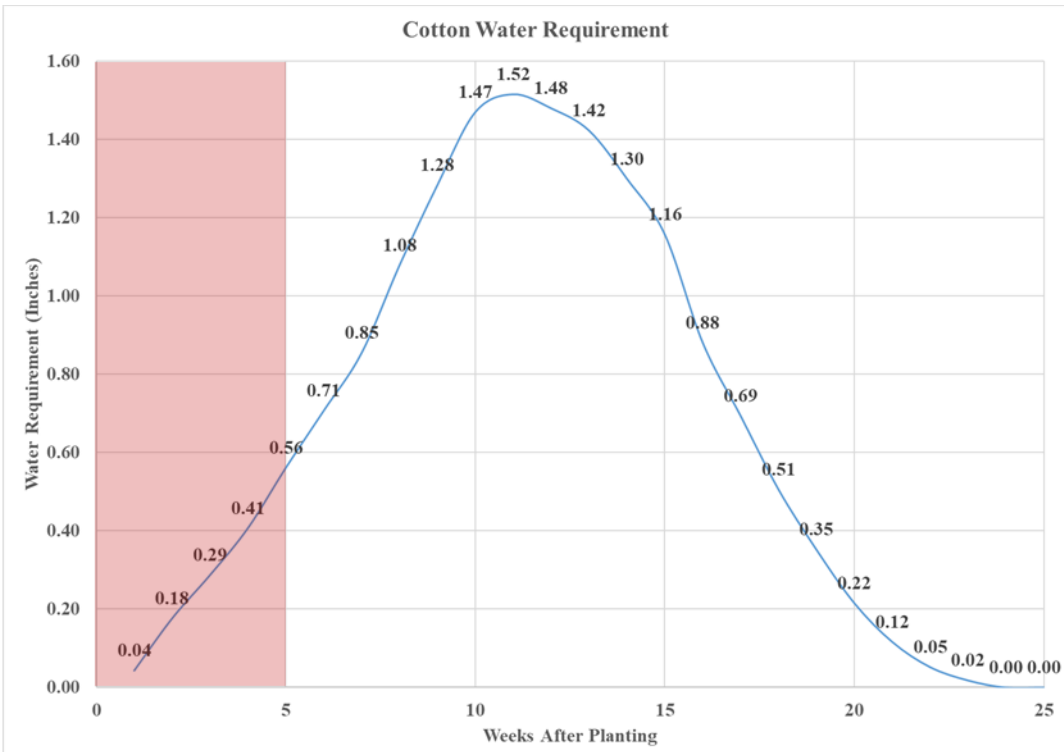

Figure 1. Seasonal Cotton Water Requirement.

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.

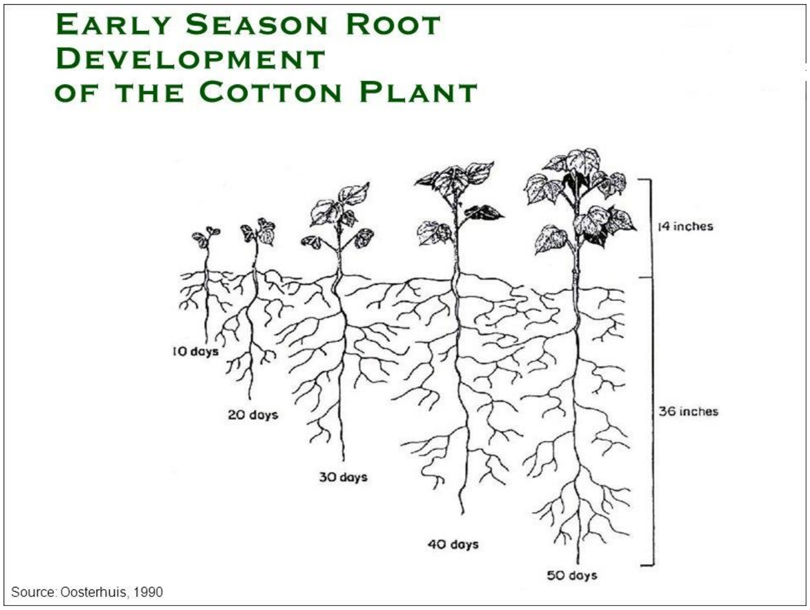

Figure 2. Visual development of root development as the cotton plant progresses in age.

Late April/early May signals planting time for cotton. 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" are 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 use 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.

Scouting Thrips and Supplemental Foliar Sprays (Phillip Roberts, Extension Entomologist): 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.

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.

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

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

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.

Thrips Infestation Predictor for Cotton (Phillip Roberts, Extension Entomologist): The Thrips Infestation Predictor for Cotton (TIPs) tool uses planting date, temperature, precipitation, and knowledge of when and how intense thrips infestations will be to predict risk of thrips injury to cotton for specific geographic locations. Plant injury from thrips is a function of thrips pressure and seedling growth. The TIPs tool can be used to identify planting dates which are at greatest risk for thrips injury. High risk planting dates will require more aggressive thrips management compared with low risk planting dates to achieve acceptable thrips control. Management options for high risk planting dates would include the use of in-furrow liquid insecticides such as acephate or imidacloprid, in-furrow applications of aldicarb, or the use of a neonicotinoid seed treatment plus a supplemental foliar application at the 1-leaf stage. In low thrips risk environments neonicotinoid seed treatments will generally provide acceptable control. The TIPs tool should allow proactive decisions to be made relative to thrips management.

The TIPs tool will give the best predictions within 10-14 days after you use it, so use at multiple times during the planting and thrips management season would be beneficial. A description of the TIPs tool and how to run the tool can be found on the TIPs website. Dr. George Kennedy, NCSU entomologist, has prepared the webinar "Thrips Infestation Predictor for Cotton: An Online Tool for Informed Thrips Management". The webinar includes an overview and how to use the TIPs tool and can be found at: http://www.plantmanagementnetwork.org/edcenter/seminars/cotton/ThripsInfestationPredictor

The TIPs tool is a predictive model based on many years of data from across the southeast and has been validated several years since. However, there will be uncertainty with any forecast model. But we are confident that the TIPs tool, when used as instructed, will accurately forecast thrips risk for cotton. The TIPs tool will not replace scouting and sampling for thrips and thrips injury in cotton, but it does provide information which will improve our thrips management programs. The Thrips Infestation Predictor for Cotton tool found online at: http://climate.ncsu.edu/CottonTIP.

World Cotton Demand Plummeted due to COVID-19 Pandemic (Yangxuan Liu, Extension Economist): Due to the rapid spread of COVID-19, the global cotton supply chain is severely impacted. An unexpected reduction in cotton mill use data is observed across all the major cotton spinning countries, including China, India, Pakistan, Bangladesh, Turkey, and Vietnam. Cotton spinning in China fell by upwards of 90 percent during the height of the pandemic in early March. The spinning industry in China has begun to recover now. However, with the anticipation of a decline in consumers' consumption of apparel, the recovery of the spinning industry is limited for the current marketing year. The virus is spreading fast in Turkey and India and Pakistan right now. Recent travel restrictions in India, Pakistan, and Vietnam are likely to have similar impacts on their spinning industry, like China.

The world retail sales of clothing and textiles have also plummeted. Many "non-essential" businesses, including apparel stores, are closed to slow down the spread of the virus. In addition, with the rising rate of unemployment globally, dispensable income from consumers on apparel is also limited. The forecast for current year's world cotton consumption dropped 6.4 percent (7.6 million bales) in April 2020 compared to March 2020. The current forecast of world cotton demand is at 111 million bales, while the world cotton supply is at a relatively high level of 122 million bales. The world ending stocks are also projected to increase at the third-highest level for the past decade at 91 million bales. With supply outpacing demand and rising global ending stocks, we have seen downward pressure on global cotton prices.

U.S. cotton acreage is projected nearly unchanged at approximately 13.7 million acres in 2020 after a decline in 2019, according to the USDA Prospective Plantings Report. However, the survey was conducted in early March, and may not have captured effects of the full decline in cotton prices since then. U.S. cotton exports are currently forecasted at 15 million bales, down 1.5 million bales from last month's forecast. Since the Sino - U.S. trade dispute, the U.S. lost part of its cotton market share in China. Brazil and Australia have benefited from the loss of market opportunity of U.S. cotton in China. In the global export market, Brazil is becoming the largest competitor for U.S. cotton. The U.S. ending stocks for the 2019-2020 crop year are expected to increase to the highest ending stocks for the past decade at 6.7 million bales.
The decline of global cotton demand, trade uncertainty, increased level of global competition, and economic recession due to Covid-19, all of these factors combined creates continued downward pressure for U.S. cotton prices. July cotton futures for old crops closed at 55.84 cents per pound, and new crop December futures closed at 57.52 cents per pound on May 1st, 2020.

Cotton leafroll dwarf virus Update (Sudeep Bag, Research Plant Virologist):
Does this virus infect cotton? Cotton leafroll dwarf virus (CLRDV) was first reported in late 2018 from AL. This virus has been reported from all the cotton-growing regions in the USA. In 2019, the UGA-cotton team was able to detect the virus from different commercial fields in 16 different counties in GA. The symptoms are highly variables and depend on the plant stage, host genotype, virus titer, geographical locations, time of virus inoculation, soil, and plant health.

What should we look for in the early stage of plant growth? The early symptoms associated with the disease include **reddening of leaves, petiole, and leaves drooping.** As the disease progress, **more severe symptoms were observed including leaves rigidity, crinkling, low retention of squares, and fruits, resulting in yield loss (Fig. 1)**. The symptoms are highly influenced by geographical locations, varieties, and cultural practices. With the improvement in different abiotic factors as cooler temperature and rainfall, these symptoms may diminish and the plant remains symptomless carrier! In the early stages, the plant may show symptoms similar to other soil-borne diseases. The only way to identify the presence of the virus in cotton is TESTING the symptomatic tissues. Fortunately, we have a reliable and precise detection technique to detect the virus. In 2019, CLRDV was also detected from a significant number of asymptomatic plants. The virus has the potential to change the way we grow our cotton!

New Webinar Series on Soil Health (Jason Schmidt, Entomology-Biocontrol): The Soil Health Institute (SHI), through collaboration with cotton growers of the southeast, extension specialists and research specialists developed an online soil health webinar series. SHI has begun releasing the online episodes of this series titled "*Healthy Soils for Sustainable Cotton*" for U.S. cotton growers. Episodes are being released weekly between April and May. The webinar series is on SHI's YouTube Channel and Soil Health Training webpage. If you are looking for more online training, the SHI has developed some online training for soil health, please see Soil Health Training webpage. For more information on this series and on the SHI current project, please contact David Lamm or Camille Hesterberg.

Important Dates:

Georgia Cotton Commission Annual Meeting and UGA Cotton Production Workshop – January 27, 2021