UGA Cotton Team Newsletter

June 4, 2020

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Temperature and Early-Season Growth (John Snider, Cotton Physiologist and Gurpreet Virk, Graduate Student, Crop and Soil Sciences):

Seedling root and shoot growth: In the previous newsletter, we provided an overview of the processes occurring during germination and emergence and left off at the point that the cotyledons were pulled above the soil surface. It is generally well-known that the shoot of the cotton seedling grows less vigorously than it does in other row crops like peanuts, corn, or soybean. This is partly because cotton seeds are smaller and have fewer energy reserves in a single seed than the previously mentioned crops. However, another reason cotton seems to be growing slowly is because the plant invests most of its effort into the root system. For example, by the time the cotyledons have unfolded, the tap root may be up to 10 inches deep, and root growth will continue rapidly until flowering. Once flowering occurs, the plant redirects more of its resources to boll production, which has the effect of drastically slowing or even halting root growth altogether. Therefore, it is important to minimize stress in the early season to maximize root growth and promote vigorous canopy development. The relationship between root and shoot growth can be readily visualized when we consider the impact of low, early-season growing temperatures. Figure 1 shows how low day/night temperatures can cause reductions in root growth along with substantial inhibition of leaf area development.

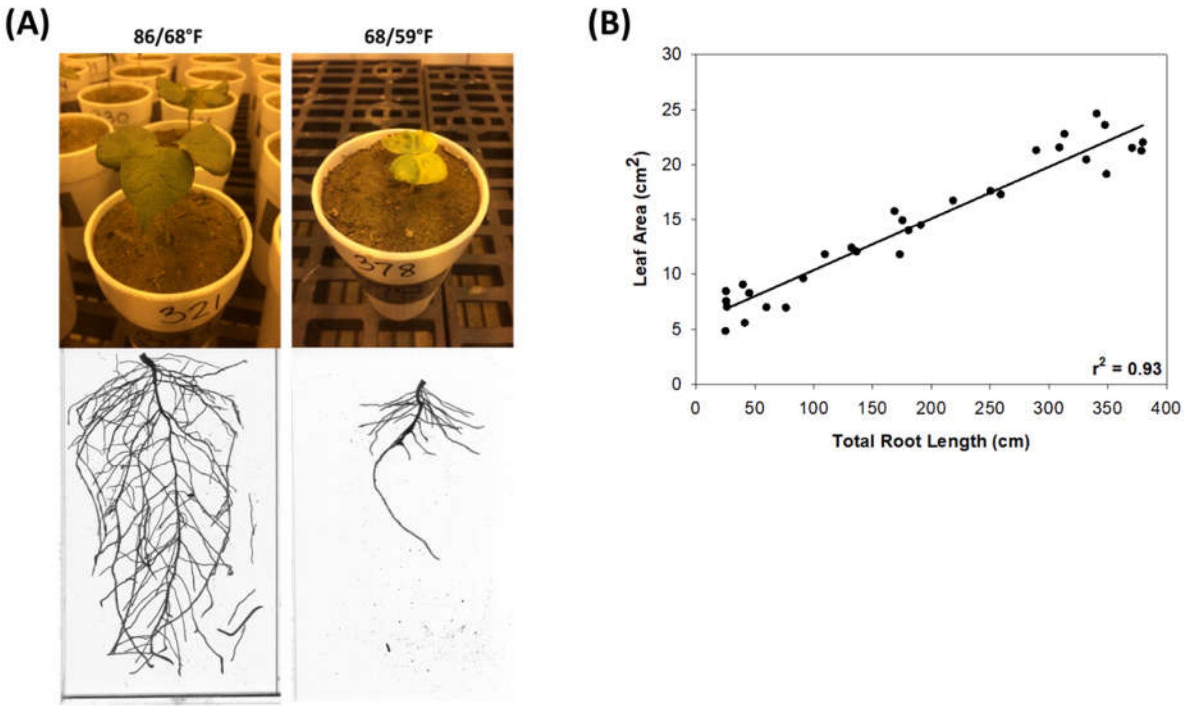

Figure 1. Effect of growth temperature on root and shoot growth in cotton seedlings. (A) provides images showing two-week-old roots and shoots under optimal (86/68 °F) or suboptimal (68/59 °F) temperature conditions, and (B) shows the relationship between average leaf area per plant and total root length per plant at two weeks after planting.

<u>DD60s:</u> In the absence of other confounding stresses, canopy development in cotton follows a predictable response to temperature. Specifically, the timing of key developmental stages can be predicted using the accumulation of DD60s. DD60s accumulated in a given day are calculated as the average daily temperature [(Tmax + Tmin) / 2] minus a standard base temperature, which is 60 °F for cotton. Figure 2 shows the average daily temperature from March 23 until May 24 for Tifton, GA along with the base temperature. Since April 1, there have been multiple days in which DD60 accumulation was at or less than zero, but as of May 31, heat unit accumulation has been positive for the last three weeks (Since May 8th).

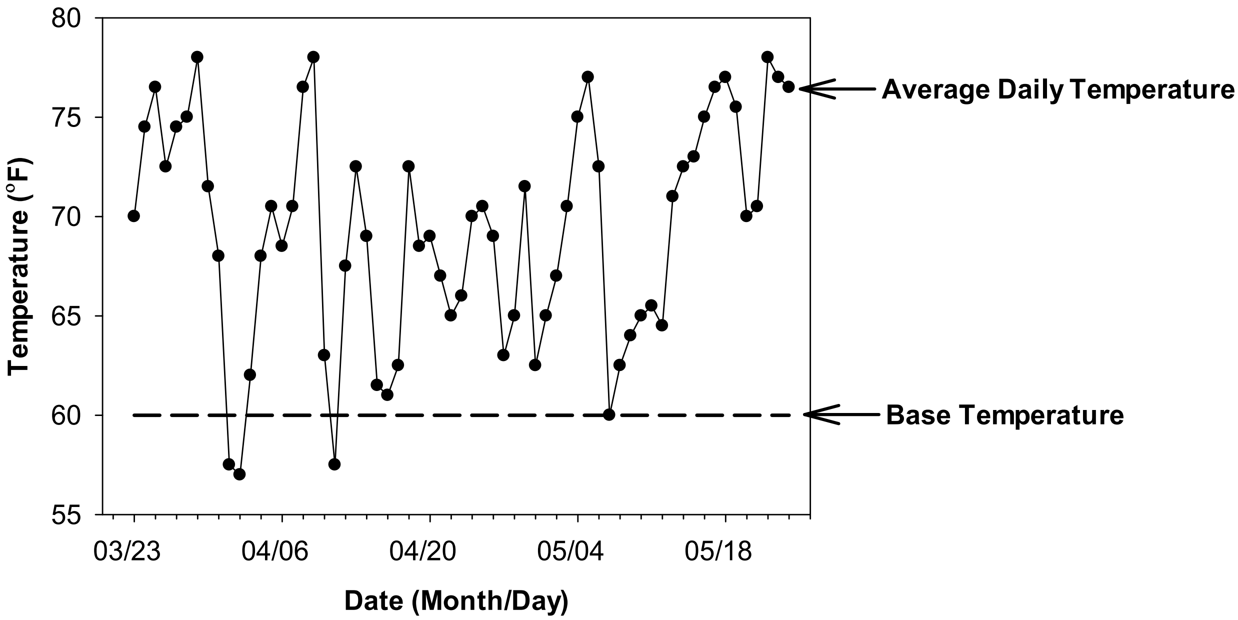

Figure 2. Average daily temperature (line and scatter plot) and a base temperature of 60 °F (dashed line) for Tifton, GA during the 2020 season.

Canopy Development: The crop requires approximately 50 DD60s for emergence and another 50 to produce its first true leaf and each mainstem leaf thereafter. Figure 3 shows images of cotton plants at the Lang-Rigdon UGA research farm in Tifton, GA during the 2020 season. Plants range from the early stages of emergence to the two/three leaf stage, and the number of DD60s (http://www.georgiaweather.net/) accumulated from planting until the time that each image was taken is provided in the upper right corner of the image. Although the numbers do not match up exactly as noted above (i.e. one new node for every 50 DD60s), they are fairly close and illustrate how temperature drives the development of new leaf nodes. The cotton plant will produce one new leaf in an alternating pattern up the mainstem. At approximately the sixth mainstem node (plus or minus one), the plant will produce its first fruiting branch (usually after having produced one or more vegetative branches), and the first square will be visible on the first fruiting branch at approximately 35 days after planting, but even the timing of squaring depends on the initial rate of node development, which (as we've noted previously) is temperature dependent. Each fruiting branch will add additional fruiting sites at positions further away from the mainstem and new fruiting branches will continue to be produced at newly generated nodes above the first fruiting branch. Furthermore, each fruiting site on a fruiting branch will have a subtending leaf associated with it.

Figure 3. Cotton seedlings at the Lang-Rigdon UGA research farm in Tifton, GA during the 2020 growing season. Images represent different stages of development and DD60 accumulation (due to different planting dates) from planting until the image was taken.

<u>Why it matters:</u> Delayed node development in the early season can also delay the start of squaring, flowering, and boll production. Vigorous vegetative growth prior to flowering will increase the number of fruiting sites available to set bolls, and because each fruiting site has a leaf associated with it, the rate of new fruiting branch development can partially determine the timing of canopy closure which is important for maximizing light interception for photosynthesis. So, how many mainstem squaring nodes should a plant have at first flower? Values ranging from 9 to 12 squaring nodes above a first position white flower are indicative of ideal to vigorous vegetative growth. While fewer squaring nodes could potentially be indicative of stress (water, nutrients, etc.), yield is a function of the number of fruiting sites produced and the rate of fruit retention, so acceptable yields can also be achieved with fewer nodes, provided fruit retention is high. Thus, utilizing crop monitoring and management after flowering is an important component of any cotton production system and will be discussed in the next newsletter.

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Sprayer Considerations To Improve Application (Simerjeet Virk, Research Engineer, Wesley Porter, Precision Ag & Machinery Systems, and Eric Prostko, Extension Weed Specialist): (Simerjeet Virk, Wesley Porter, and Eric Prostko): As growers across the State wrap up planting operations in the next couple of weeks, their efforts from here onwards will be primarily focused on crop management and protection from weeds, insects and diseases which can cause significant yield and quality losses. Boom sprayers are commonly used for spraying pesticides to control weeds, insects and diseases in row-crops. Achieving desired spray coverage and efficacy while keeping off-target movement of pesticides to a minimum continues to be a challenging task that every grower undertakes every year. Inaccurate spray applications resulting in too little or too much pesticide or ineffective coverage can have serious consequences. Below are several things to consider for growers to achieve greater application accuracy and reduced drift with boom-type sprayers:

Nozzle Selection: Correct nozzle selection is one of the most important decisions made related to pesticide applications as nozzle type affects product rate, uniformity, coverage and drift. Make sure to check pesticide labels for recommended application rate and conditions needed to safely apply the pesticide. Consult the manufacturer's nozzle catalog for selecting the nozzle that provides the desired output (flow rate and droplet size) specific to the application. Nozzle selection will also depend on the ground speed and pressure required to achieve the rate in gallons per acre. A TeeJet catalog illustrating different nozzle types with their flow output, droplet size, rate at different speeds can be accessed here: https://teejet.it/media/461429/broadcast_nozzles.pdf

Spray Pressure: Spray pattern and droplet size changes with pressure. Lower pressures result in larger droplets whereas higher pressures produce smaller droplets. For most applications, it is recommended to maintain a spray pressure that results in medium to coarse droplets to reduce drift and obtain adequate spray coverage.

Ground Speed: Sprayer speed plays an important role in achieving the desired application rate. A higher travel speed will require a higher nozzle flow rate to achieve the given application rate and vice-versa. Reduce the sprayer speed (less than 10 mph) to obtain a consistent and more uniform coverage. Faster speeds will cause excessive boom bounce and spray inversion sending finer droplets higher in the air and increasing potential for drift.

Boom Height: Boom height influences overlap and uniformity of spray application at a selected nozzle spacing and spray angle. Lower boom height is generally recommended for maintaining a proper spray pattern and overlap. Make sure to use nozzles that have a 110 degree angle to allow spraying at lower boom heights without effecting spray coverage. Follow nozzle manufacturer recommendations for boom height (generally 24” or less for 20-inch nozzle spacing) to achieve satisfactory coverage and reduce drift.

Environment: Weather conditions such as wind speed and temperature also play a role in achieving the desired spray coverage and efficacy. High wind speed affects spray coverage and also results in greater drift. Wind direction should be also considered to avoid spraying towards sensitive crops, homes, etc. Warmer temperatures also increase drift especially at higher boom heights. To minimize off-target movement, avoid pesticide applications when conditions for temperature inversions are favorable. Also, consult labels for optimum time of day applications. For example, current dicamba product labels recommend applications between one hour after sunrise and two hours before sunset to help reduce off-target issues.

Sprayer Calibration: A proper sprayer calibration is the only way to determine the application rate of the sprayed chemical. There are several methods for calibrating boom sprayers; however an ‘ounce’ or ‘1/128 acre’ is the one, most commonly used and recommended for calibrating a boom sprayer. The method is based on spraying 1/128 of an acre per nozzle and collecting the spray output from each nozzle for the time it takes to spray the area. Since there is 128 ounces in one liquid gallon, this convenient relationship results in ounces of liquid collected equal to the application rate in gallons per acre. A detailed step-by-step guide on this calibration method can be found on UGA extension website using the link provided here:
https://extension.uga.edu/publications/detail.html?number=C683&title=Calibration%20Method%20for%20Sprayers%20and%20Other%20Liquid%20Applicators

Spray Technology: Application rate (gallons per acre) is dependent on ground speed, pressure, and nozzle output, any changes in ground speed would require a change in flow rate to meet the desired rate. Rate controllers perform flow rate adjustments based on changes in ground speed during spraying and help maintain application rate and coverage throughout the field. The use of rate controllers also helps improve spray application by minimizing skips and overlaps within a field. Advanced technologies such as PWM (pulse width modulation) nozzle technology and automatic boom height control are also currently available for use on spraying equipment for better application and drift reduction. Spray technology can be utilized to minimize variations in application rate and coverage as well as a record of spray application including product, rate, pressure, nozzle type etc. used in each field.

Plant Pathology Update (Bob Kemerait, Extension Plant Pathologist): The period of time in a cotton season that follows planting and leads up to “first bloom” is one where there seems to be very little a grower can do to fight diseases and nematodes. Upon closure of the furrow, the opportunity to protect the cotton from fungal seedling diseases and to manage plant-parasitic nematodes is largely over. The next opportunity a grower has to consider protecting the crop from disease is around the time of “first bloom”. It is at “first bloom”, when approximately 20% of the cotton plants have at least a single flower, when growers begin to decide if use of a fungicide to protect against target spot and areolate mildew. There are very few management options for diseases and nematodes after planting and prior to first-bloom; however this does not mean that these problems can, or should, be ignored. In my arena, the arena of diseases and plant-parasitic nematodes, there are two opportunities during this time and growers should take advantage of them.

The first opportunity is to assess the effectiveness of whatever management tactics a grower deployed at, or prior to, planting for disease and nematode control. If a good, vigorous stand is achieved with little “Rhizoctonia soreshin” and with little stunting that is associated with nematode damage is observed, then a grower can be comfortable that his plan “worked”. However, where “skippy” stands occur and where plants are dying or are failing to thrive, the grower should take notes to determine what might be done “next time”.

The second opportunity is related to that mentioned above. During the time between planting and first bloom, symptoms of damage from nematodes, from Fusrium wilt, and even from the Cotton leafroll dwarf virus (CLRDV) often develop in a cotton crop. These symptoms include stunted plants, interveinal chlorosis or “tiger striping” on the leaves, wilting, and reddening of the leaves and the petioles. While there is really nothing a grower can do to correct these symptoms in the present season, recognition of the problem and determining the cause of such (e.g. nematodes, the Fusarium fungus, or CLRDV) can lead to improved management decisions in the 2021 season. This may be little consolation to the grower now; however recognizing and diagnosing problems in the field now is essential for next season. Early in the cotton growing season, there are no shortage of tasks for our farmers. However, taking a little bit of time to assess symptoms of diseases and nematodes in the field will pay big dividends in the future.

June Mid-Season Cotton Irrigation Update (David Hall, Extension Water Educator, Cale Cloud, Extension Water Agent, and Wesley Porter, Extension Precision Ag and Irrigation Specialist): The only thing for certain in farming is that there are no two years the same. 2020 is providing its share of weather surprises across the state. So far temperatures have been at or below normal, with low evapotranspiration rates and adequate rainfall across most parts of the state. This is good from an irrigation requirement standpoint but cooler temperatures can mean slower growth for the cotton plant. However, don’t get too comfortable with the cooler wetter weather, as the year progresses, chances are favorable for higher temperatures with periods of dry weather, leading to the need for irrigation.

Cotton planting has been scattered over the past two months. South Georgia started planting early as usual but central Georgia was hindered with cool wet soils. Keeping this in mind, cotton growth stages are varied from near squaring to just emerging, and there are still acres that haven't been planted. Our UGA Extension quick reference irrigation guide shows mainly estimated water needs after days planting, but based on the physiological progression of the crop it may be better to look at the growth stage and not the DAP. Now is a good time to review the cotton irrigation schedule, determine where you currently are and decide what your water requirements are.

Cotton Irrigation Schedule				
Growth Stage	**DAP**	**Weeks after Planting**	**Inches/Week**	**Inches/Day**
Emergence	1 - 7	1	0.04	0.01
Emergence to First Square	8 - 14	2	0.18	0.03
	15 - 21	3	0.29	0.04
	22 - 28	4	0.41	0.06
	29 - 35	5	0.56	0.08
First Square to First Flower	36 - 42	6	0.71	0.10
	43 - 49	7	0.85	0.12
	50 - 56	8	1.08	0.15
First Flower to First Open Boll	57 - 63	9	1.28	0.18
	64 - 70	10	1.47	0.21
	71 - 77	11	1.52	0.22
	78 - 84	12	1.48	0.21
	85 - 91	13	1.42	0.20
	92 - 98	14	1.30	0.19
	99 - 105	15	1.16	0.17
	106 - 112	16	0.88	0.13
	113 - 119	17	0.69	0.10
First open boll to >60% Open Bolls	120 - 126	18	0.51	0.07
	127 - 133	19	0.35	0.05
	134 - 140	20	0.22	0.03
	141 - 147	21	0.12	0.02
	148 - 154	22	0.05	0.01
	155 - 161	23	0.02	0.00
Harvest	162 - 168	24	0.00	0.00
	169 - 175	25	0.00	0.00

Based on planting observations and where most of the crop is, most farmers should fall within the first square to first flower stage (or the yellow highlighted area) throughout the month of June. If you were unfortunate and did not get your cotton planted until later May or early June then you will fall into the emergence to first square stage (highlighted in red). Crop water requirements increase dramatically from squaring and flowering. From 30 days to 50 days after planting, water consumption almost doubles. Additionally, typically when water use increases is in late-June through July, a time when we usually see very hot and dry weather, keep this in mind and stay on top of your irrigation applications. Conversely, don't over-irrigate the crop as there are yield penalties for doing this too. Please keep in mind, if you have been using water moisture sensors and you have "weighted" your sensors as discussed in the last newsletter, do not forget to change the weighting to reflect current crop water use in the profile. Root growth has dramatically increased downward and we now need to be more balanced with our sensor readings.

One last consideration, top dressing all cotton and our first dose of growth regulator on aggressive irrigated growing cotton will soon or has already taken placed. Don't go into this stage with the mindset of "I'm going to hold back on the water now because I don't want it to take off". If proper growth regulator is applied, it will prevent vegetative growth as it should. If rain chances are low, irrigation will be required to get the fertilizer in the plant by irrigating it in and allowing the plant to uptake the nutrients.

Scout for Tarnished Plant Bugs (Phillip Roberts, Extension Entomologist): Unlike cotton production areas in the Mid-South, tarnished plant bug is an uncommon and sporadic pest of Georgia cotton. However, tarnished plant bug populations must be scouted as economic infestations occur in some fields each and every year. Only treat tarnished plant bugs if threshold levels are exceeded. Tarnished plant bug sprays are disruptive to beneficial insect establishment.

Our primary method for scouting plant bugs is square retention. Our goal is to retain 80 percent of all first positions as we enter bloom. The square retention technique works well in pre-bloom cotton but is not as a reliable technique in blooming cotton as physiological shed confounds counts.

More scouts are using sweep nets to monitor plant bugs. Sweep nets are an excellent tool for monitoring adult plant bug populations, but the drop cloth (especially a black drop cloth) is more effective for monitoring immature plant bugs.

Adult tarnished plant bug (left) and immature tarnished plant bug in bloom (right). Images by Russ Ottens, University of Georgia and Ron Smith, Auburn University, Bugwood.org.

Effective use of the sweep net becomes difficult after bloom due in part to plant size and more emphasis should be placed on use of a drop cloth. Also be observant for both adult and immature plant bugs when making visual plant inspections; examine terminals and inside the bracts of squares, blooms, and small bolls. Also be observant for “dirty blooms”, blooms in which many of the anthers are dried and brown. Dirty blooms are an indication that plant bug (especially nymphs) are feeding on larger squares which the plant did not shed.

“Dirty Blooms”. Images by Ron Smith and Barry Freeman, Auburn University, Bugwood.org.

Clouded plant bug adult (left) and immature (right). Images by Ron Smith, Auburn University, Bugwood.org.

Tarnished plant bug thresholds can be used for clouded plant bugs, but clouded plant bugs should be counted 1.5 times when using a sweep net. Note that the threshold is higher during the third week squaring and bloom compared with the first two weeks of squaring.

Sweep Net and Drop Cloth Thresholds:

> **Third week of squaring through bloom:** Drop Cloth: 3 plant bugs/6 row feet, Sweep Net: 15 plant bugs/100 sweeps
>
> **First 2 weeks of squaring:** Drop Cloth: 1 plant bug/6 row feet, Sweep Net: 8 plant bugs/100 sweeps

<u>Important Dates:</u>
Georgia Cotton Commission Annual Meeting and UGA Cotton Production Workshop – January 2021