Managing Late-Planted or Late-Emerging Cotton
Extension Cotton Team, Auburn University

There are many reasons why cotton might emerge later than the desired time window. In Alabama this primarily occurs in years with early season droughts, and cotton seed are dusted in, waiting for a rain. Replanting cotton can also produce the same need for an extended growing period. As a result of late planting and emergence, the timeliness of all management operations becomes even more critical. Compressing the growing season into a shorter time frame can affect growth and development and reduces the likelihood that the plant can compensate for in-season damage. Protecting early squares and small bolls becomes even more important under these circumstances.

Up-to-date and long-term rainfall information for specific sites can be obtained at the following URLs: http://www.awis.com/mesonet/index.html; and http://www.ag.auburn.edu/xfer/alabamacotton/ddinformation.html. In addition, soil moisture status for the nation can be viewed at: http://www.cpc.ncep.noaa.gov/soilmst/. Drought status for the nation can be viewed as it has developed over the past 12 weeks at the following URL: http://www.drought.unl.edu/dm/monitor.html. The following areas of concern are not intended to be exhaustive but are considerations for producers when managing a late-planted or late-emerging crop.

Effect of late emergence on plant growth and development. C. Dale Monks, Extension Cotton Agronomist

Cotton planting in Alabama begins in early April in the northern Tennessee Valley counties and proceeds through mid-May. Central and South Alabama cotton producers will generally be planting cotton later in April and proceed throughout May. When seedlings emerge under cool wet, conditions, development is slow and the incidence of seedling disease sometimes higher. However, when warmer soil temperatures are present, emergence and plant development occurs at a faster rate. Often this will allow cotton plants to grow quickly and overcome disease, insect, and other stresses.

When cotton is planted and/or emerges later than the “normal” production window, warmer temperatures coupled with soil moisture will allow it to develop rapidly. The basics of plant development still hold true with the general growth stages and DD60 accumulation (Table 1). However, the rate at which DD60 accumulates is faster as the season progresses through the summer months compared to the early spring. High temperature extremes do not automatically translate into faster development, especially when night-time temperatures remain elevated.
Table 1. Accumulated heat units required for a normal cotton crop to reach a specific growth stage*.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Requirement*</th>
<th>Cumulative*</th>
<th>Georgia**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergence</td>
<td>45-130</td>
<td>45-130</td>
<td>50</td>
</tr>
<tr>
<td>First square</td>
<td>350-450</td>
<td>480-530</td>
<td>550</td>
</tr>
<tr>
<td>First flower</td>
<td>740-1150</td>
<td>950</td>
<td></td>
</tr>
<tr>
<td>Peak bloom</td>
<td>200-800</td>
<td>850-1625</td>
<td></td>
</tr>
<tr>
<td>First open boll</td>
<td>1690-2050</td>
<td>2150</td>
<td></td>
</tr>
<tr>
<td>Defoliation/harvest</td>
<td>2550-4600</td>
<td>2600</td>
<td></td>
</tr>
</tbody>
</table>

*Adapted from Mauney, J.R., 1986.

**Adapted from Ritchie, et al., 2007.

Note: these totals may vary according to location, variety, and production area.

Cotton bolls set during the normal peak bloom period will generally mature in approximately 50 days (Ritchie et al. 2007). For late emerging cotton, heat unit accumulation and corresponding boll development will begin to slow down as the temperatures drop in the late summer and early fall. As a result, bolls set can be higher on the plant (Nuti et al. 2006) and take longer to mature and open. Thus, it is critical to protect the fruit and avoid untimely damage to the plant (i.e. late glyphosate applications, uncontrolled insects, etc.).

There is likely some merit to utilizing plant growth regulators (i.e., mepiquat chloride) for promoting earliness in an effort to encourage fruiting. However, premature or aggressive application on late-emerging cotton that needs to grow and establish a vegetative structure can also be detrimental. Plant growth regulators should be managed very carefully and on a field by field basis, especially when drought conditions threaten to completely shut plant development down.

Fiber and boll development in late-emerging cotton can also be directly affected by later planting dates and emergence (Bauer et al. 2000). Late emerging cotton is forced to set fruit and develop bolls during the summer when temperatures are higher and soil moisture is often limited (Figure 1). These adverse conditions can result in higher micaire and shorter staple lint, as well as a higher incidence of motes (Bauer et al. 2000; Davidonis et al. 2004). As was stated earlier, compressing the season into a shorter time frame means that producers must put an even higher priority on protecting the fruit.
There are other problems associated with late-emerging fields of cotton that involve late-fall conditions. These would include yield and fiber quality losses due to increased weathering, decreased daily harvest efficiency due to adverse weather conditions, and the increase in the likelihood of frost or freeze damage (Lange and Hake 1991). As pointed out by Dr. Steve Brown, Ext. Cotton Agronomist at the University of Georgia (http://commodities.caes.uga.edu/fieldcrops/cotton/HowLateTooLateMay302007.pdf), “late planting…necessitates that there be no delays or interruptions in emergence, growth, fruiting, or maturity”.

**How to evaluate late emerging cotton in Alabama.** *C. H. Burmester, Ext. Agronomist, Auburn University*

The growing season for cotton in Alabama is quite different as you journey from North to South Alabama. Not only do soils change but the length of the growing season dictates many of the farming practices farmers use and the cotton varieties they plant. I have been asked on many occasions; “Do I still have time to grow and mature a cotton crop”? The answer is never simple, but I have found it is best to start counting backward from the last effective bloom date for an answer.

What I mean by last effective bloom is the calendar date you normally always expect a bloom to have time to fully mature into a boll in Alabama. This date will vary depending on where you farm in Alabama. The estimate for four locations in Alabama is located in Table 2.
Table 2. Estimate of last effective bloom date and first frost for four AL locations.

<table>
<thead>
<tr>
<th>Location</th>
<th>Average Frost Date</th>
<th>Last Effective Bloom *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belle Mina</td>
<td>October 25</td>
<td>August 20</td>
</tr>
<tr>
<td>Prattville</td>
<td>November 5</td>
<td>September 5</td>
</tr>
<tr>
<td>Headland</td>
<td>November 10</td>
<td>September 7</td>
</tr>
<tr>
<td>Fairhope</td>
<td>November 20</td>
<td>September 10</td>
</tr>
</tbody>
</table>


Normally I would like cotton to have at least four weeks of bloom. Using the Belle Mina last bloom date would mean that blooming should begin at least by July 24. Knowing it normally takes about 21 days to go from a pinhead square to a bloom indicates a pinhead square needs to be visible by July 3 in northern Alabama. Weather will still dictate the final outcome, but I feel comfortable in telling a North Alabama farmer the odds are against him making a good cotton crop if you do not have a square by the first week in July.

The same calculations can be done for the other areas of the state (Table 3.) One can clearly see the longer growing season possible in Central and South Alabama. Cotton has a tremendous ability to overcome adversity and produce a crop as seen by the 2006 season in South Alabama and South Georgia. Farmers know each growing season is different and fall temperatures can speed up or slow down cotton maturity. However, using the last effective bloom date can provide needed information on the risk and potential of a cotton crop.

Table 3. Estimated critical date of first pinhead square and first bloom for four Alabama locations.

<table>
<thead>
<tr>
<th>Location</th>
<th>Pinhead Square</th>
<th>First Bloom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belle Mina</td>
<td>July 3</td>
<td>July 24</td>
</tr>
<tr>
<td>Prattville</td>
<td>July 18</td>
<td>August 9</td>
</tr>
<tr>
<td>Headland</td>
<td>July 20</td>
<td>August 11</td>
</tr>
<tr>
<td>Fairhope</td>
<td>July 23</td>
<td>August 14</td>
</tr>
</tbody>
</table>

Side-dress N for drought-stressed or late-emerging cotton: Liebig’s Law Rules.  
*C. Mitchell, Extension Agronomist- Soils*

Justus von Liebig was a 19th Century German chemist who pioneered modern theories of plant nutrition. He is most famous for his “Law of the Minimum” which basically states that plant growth will be limited by whatever factor is in short supply. In 2006 and 2007 in most of Alabama cotton fields, that factor is water. You can put all the fertilizer you dare on a crop but if growth and yield is limited by water, it won’t do any good. In other words, don’t waste money side-dressing a crop that is late planted or late emerging or severely drought stressed.
We have nitrogen rate studies on cotton every year around Alabama. Last year at Prattville, Black Belt and Tennessee Valley, crop yields were severely reduced by drought. There was absolutely no response to added N fertilizer at these locations. The zero N treatments made just as much as the standard or higher N rate. Lint yields ranged from about 350 pounds per acre to 600 pounds per acre because of the drought. This was because water, not N, was limiting yields. I have seen many good cotton fields produce 1 ½ bales per acre with no additional N fertilizer in a good year. Yields above this value is where you would expect N to be a limiting factor in keeping with Liebig’s Law of the Minimum.

Long-term trends also support this approach. We summarized cotton response to N at several Alabama locations. In a very good year when conditions were suitable for high yields, we got the expected response to additional N fertilizer. This response held up in an average year. However, in a year where some other factor severely reduced cotton yield, presumably drought, applying no N at all was just as good as applying the highest N rate and it did not cost nearly as much (see attached figure for Prattville).

Therefore, the bottom line is, if you have late planted or drought stressed cotton with a high risk of limited production as described by Monks and Burmester above, don’t waste precious dollars on side-dress N.
The drought of ’07 in central Alabama – a look at three experiments. C. Mitchell, Ext. Agronomist-Soils, Auburn University

The Drought of ’07 is on everyone’s mind right now (late-June). This week, I traveled across Central Alabama to work on three contrasting experiments involving cotton. I found them interesting because they are on three vastly different soils with different types of management. All have been devastated by the drought. Pictures are attached at bottom of this article.

The Old Rotation Experiment at Auburn. Since 2003, half of this experiment has been under irrigation and the other half is rain-fed. In the past 4 years, irrigation has had absolutely no effect on cotton yields with yields averaging 1690 pounds lint per acre on the best plots – that’s over 3 bales per acre! Corn plots in rotation with cotton had a 23% yield increase from irrigation with the non-irrigated plots averaging 134 bushels per acre while the irrigated plots averaged 165 bushels per acre on the best treatments. In 2007, the attached photo taken June 22 tells the entire story. There is not one single cotton plant in the non-irrigated half while the irrigated half has the potential for a very good yield. Corn is about 2 feet tall and dying without irrigation.

Yield potential for cotton: non-irrigated = 0; irrigated = 3 bales per acre
Yield potential for corn: non-irrigated = 0; irrigated = 160+ bushels per acre

Sources of N Experiment at Prattville. There is no irrigation at Prattville and no potential yield for either cotton or corn. Superintendent Don Moore was able to get a near perfect stand of corn in early April, but there has been no significant rainfall since cotton was planted and very few plants emerged.

Yield potential for cotton = 0
Yield potential for corn = 10 bushels per acre

Rates of N-P-K for cotton at Black Belt. In spite of an almost total lack of rainfall since April, Superintendent Jimmy Holliman managed to get about an 80% stand of cotton planted into raised beds on this Vaiden clay. Huge cracks in the soil proclaim a severe drought just like last year, but the potential is there to make a modest crop of cotton provided significant rain comes during July and August.

Cotton yield potential = 600 pounds lint/acre

Weed management under adverse growing conditions. M. Patterson, Ext. Weed Sci.

Delayed crop emergence and growth in Roundup Ready cotton as well as RR soybean and corn can result in glyphosate applications made under dry, dusty conditions. Recent research conducted by scientists at North Dakota State University shows that dust, generated by tractor (sprayer) wheels, landing on the leaves of weeds prior to glyphosate spray hitting the leaves could reduce the level of weed control by 27% in some species. We have all noticed that weeds in the sprayer wheel tracks are sometimes not controlled as well as those weeds in the middles. This research sheds some light on why this happens. Glyphosate is locked up tightly onto soil particles and is not readily available for uptake by the leaves once this happens. Although this work was done with glyphosate, the dust may influence the effectiveness of other foliar herbicides, but probably not to the same degree as glyphosate. What can be done to compensate
for this? Possibly spraying early in the morning before the wind gets up may help. Using the highest labeled rate of glyphosate would also help.

Additional research from the mid-west shows that the quality of water used in applying glyphosate can influence weed control significantly. When using hard water (water containing antagonistic cations like iron) the effectiveness of glyphosate on velvetleaf was significantly reduced. Adding ammonium sulfate (AMS) at 1% to the spray tank improved weed control by overcoming the negative effects of the antagonistic minerals in hard water. Several water conditioners were tried and some were as effective as AMS, but all the conditioners contained AMS as a primary active ingredient.

Roundup Ready cotton that emerged several weeks ago may be past the four-leaf stage allowed for over the top applications of glyphosate. RR cotton that is beginning to square can be injured by over the top glyphosate treatments. The resulting loss of fruit is especially detrimental in late-planted or late-emerging cotton stands. In these situations, using drop nozzles is better than spraying directly over the top, but the best application would be with hooded sprayers. Roundup Ready Flex cotton will, of course, tolerate over-the-top applications of glyphosate at essentially any growth stage.

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**Insect control on late-planted or late-maturing cotton. R. Smith, Ext. Entomologist, Auburn University (Emeritus)**

During times of late planting or late emerging seedlings, cotton maturity can vary widely from field-to-field and region to region within the state. During this season (2007), cotton planted in early April is approximately on schedule (maturity-wise) but has not made its usual vegetative growth. Other fields that were late planted or late emerging are up to six weeks or more behind schedule. Cotton in the latter category has a much shorter window or season to produce harvestable yields.

Cotton insect thresholds are established to be general guidelines and are not written in concrete. They have been established over the years based on scientific research and expert observations. Therefore, it is felt that all are good guidelines but may be adjusted to fit the season, stage of maturity, and expected yields. In general, late maturing cotton (that still has positive yield potential) has less time to compensate for fruit loss and may be at greater risk to late season insect injury. Less insect damage can be tolerated in this situation. Growers should pay particular attention to pests such as aphids and spider mites. Cotton will not be able to cope with insect stress on top of drought stress or delayed maturity.

In summary, if cotton is going to be farmed for yield, insect thresholds may be adjusted by 5-10% to fit the 2007 situation. However, adjusting them by 25-30% would be unwise. We will know much more about how much input we can put into the 2007 crop after the next 20-30 days (from mid-June).
Replanting and late-planted cotton suggestions for south Alabama. W. Birdsong, Ext. Specialist, Alabama Cooperative Extension System

Stand evaluation. One of the first steps is to assess the stand of cotton have in each field. From research conducted at the Wiregrass Research and Extension Center in Headland, a final plant stand of greater than 2 plants per foot is needed for a workable stand and “normal” yield potential. In poorly emerging fields, there will be areas where the plant stand is adequate and other areas that are sparse to non-existent. In this situation, “spot planting” the poor stand areas to achieve an adequate stand can be done. In southeast Alabama, we suggest that you use an earlier maturing variety this late in the growing season. This has been done before with great success and excellent yields results. Remember the final stand must be adequate to have a chance at a reasonable crop.

Late-planting. Producers in South Alabama have the opportunity to produce cotton planted much later than the rest of the state in most cases (Table 4). ‘DPL 555’, a full season variety from Delta and Pine Land Co., rebounded in 2006 from early- and mid-season drought when the rains came in late July. In mid-June, this variety is not recommended since it is a very full season variety. Planting late will necessitate that an earlier maturing variety be used to ensure that it has time to mature the crop.

In addition, specialists at the Wiregrass REC have observed a “low investment plan” when it comes to late planting and subsequent management. First, consider your soil sample analyses and limit fertilizer where possible. In some cases, nitrogen may be the only requirement and may be reduced below recommended rates in some cases. Second, thrips control using foliar sprays and/or hopper box treatments may be the most economical treatments available. Third, limit the use of varieties that have high fees attached like those associated with the Bollgard technology. Fourth, the use of plant growth regulators to control vegetative growth can also be beneficial.

Late-planted and/or late-emerging cotton planted now will meet peak water demand in approximately 90 days in the amounts of 0.3 inch required per day. In mid-June cotton, this period will occur during the later part of September. Unfortunately, September is historically the second driest rainfall month of the year (average monthly = 3.5 inches) with October being the driest month (average monthly = 2 - 2.5 inches). In south Alabama, the greatest challenge for late cotton may not be heat units, but will likely be water requirement during two months when the reproductive stages for the cotton will be at peak demand.

<table>
<thead>
<tr>
<th>Planting date</th>
<th>Lint cotton yield (lbs/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 28</td>
<td>888</td>
</tr>
<tr>
<td>May 23</td>
<td>828</td>
</tr>
<tr>
<td>June 22</td>
<td>695</td>
</tr>
<tr>
<td>LSD (0.05) (4 reps., RCB)</td>
<td>124</td>
</tr>
</tbody>
</table>

*Conducted at the Wiregrass Research and Extension Center.
References


Edited by: C. Dale Monks, Charles Burmester, and W. Robert Goodman, Auburn University

Use pesticides only according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label.

The pesticide rates in this publication are recommended only if they are registered with the Environmental Protection Agency and the Alabama Department of Agriculture and Industries. If a registration is changed or cancelled, the rate listed here is no longer recommended. Before you apply any pesticide, fungicide or herbicide, check with your county Extension agent for the latest information.

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The Old Rotation at Auburn. Cotton and corn plots on the left have received approximately 2 inches of irrigation per week since the cotton was planted in early May. Plots on the right have received no irrigation. Photo taken 6/22/07.
Sources of N for cotton and corn at Prattville. Cotton plots in the foreground are a complete loss while the corn in the background is tasseling with no significant rain since it was planted. Photo taken 6/21/07.
Rates of N-P-K for Cotton at Black Belt. Rudy Yates applies top-dress N to drought-stressed cotton at the Black Belt R&E Center. In spite of extremely dry weather and no rain since the cotton was planted, the high water-holding capacity of these clayey soils resulted in a partial stand. Photo taken 6/21/07.