

# WHEN TO PLANT COTTON



## Background:

In Louisiana, cotton is generally planted from mid-April to mid-May. However, the optimal time to plant cotton is determined by soil temperature and not by the calendar. If planted too early, the cotton crop may suffer stand loss, and the remaining plants are less vigorous, which reduces yield potential.

Cotton is a tropical plant. During the critical germination period, soil temperatures below 50 degrees Fahrenheit can cause chilling injury to germinating plants. The crop is most susceptible to chilling injury when the seed is initiating water uptake (imbibition) and in the first couple of days after planting. Imbibition is a sensitive period because moisture content can increase from 10 to 12 percent to 40 to 80 percent in fewer than 12 hours after planting. Therefore, the minimum temperature at seed depth during this time interval is especially important.

The first two to four days after planting is when the radicle (tiny root) begins to emerge from the seed,

with warm temperatures leading to a more rapid emergence. The adverse effect of cool temperatures during this period is cumulative, and yield reduction can be related to chilling hours below 50 degrees Fahrenheit. Injury at this stage affects the emerging seedlings' capacity to manufacture proteins, which can ultimately limit yield.

Chilling injury can result in malformed seedlings, loss of the taproot, reduced vigor, a less-than-acceptable stand and the increased likelihood of seedling disease problems (Figures 1 and 2). The severity of injury increases the longer seeds are exposed to the cold. Therefore, chilling within the first five days after planting often results in weak plants with delayed maturity and reduced yield. The graph on the following page depicts the relative sensitivity of cotton to chilling injury. Dry seeds are highly tolerant to chilling, but as soon they are placed in moist soil, they begin to imbibe water and enter their most sensitive stage.

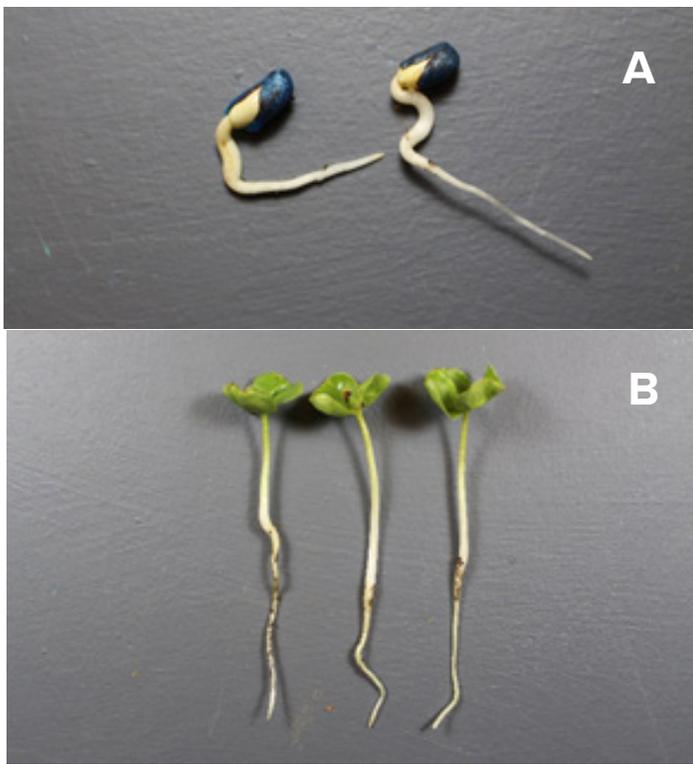
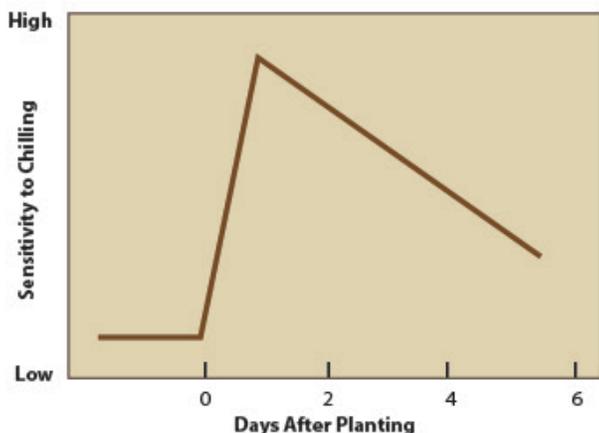


Figure 1. Cotton seedlings subjected to chilling temperature (A) compared to seedlings not chilled (B) during imbibition. Seedlings in A and B were exposed to the same temperature (90 degrees Fahrenheit) with the exception of the first six hours of imbibition, in which they were exposed to chilling temperatures of 40 degrees Fahrenheit.



Figure 2. Chilling injury can increase the likelihood of seedling disease problems.

### Cotton Sensitivity to Cold Temperatures During the Germination Period



### Soil Temperature:

Germination can begin when the mean daily temperature is 60 degrees Fahrenheit at the seeding depth, but growth will be inhibited at these temperatures. Optimal conditions for cotton germination and emergence are present when soil temperature at the 4-inch depth is 65 degrees Fahrenheit or greater at 8 a.m. for at least three consecutive days with a favorable five-day forecast following planting. Hourly soil temperatures at the 4-inch depth can be accessed at [weather.isuagcenter.com](http://weather.isuagcenter.com). Utilizing this information to determine when to plant is often not realistic for early planting, but adequate soil temperature for a vigorous plant is critical. A delay in planting of four weeks until optimal conditions exist may only result in a one- to two-week difference in flowering.

The time required for soil to warm depends on several factors. Warm air temperature increases soil temperature by transferring energy by convection. Sunlight or radiant heat on a sunny day is absorbed by the soil, resulting in a warmer soil temperature than by air temperature alone. Consequently, sunny days result in faster soil warming even if air temperature is equal. Moisture at the surface will cool the soil as it evaporates. Therefore, wet soil requires more energy (sunlight or high air temperatures) to warm than drier soils.

Soil texture and color affect how rapidly soil warms. Sandy soil holds less water and warms up faster than clay soil. Dark-colored soil will absorb more sunlight from the sun than light-colored soil; therefore, dark soil will heat faster. Oftentimes a field will not have a uniform soil texture, which can cause a difference in emergence. Also, fields with high levels of crop residue

or trash will warm more slowly than fields in which tillage equipment has reduced surface residue. This is because of the conservation of moisture at the soil's surface.

### Five-Day Weather Forecast

Once optimal soil temperature has been reached, calculate the number of degree days (DD60s) for the next five days to determine if planting conditions are optimal. Depending on the vigor of the seed, emergence will generally occur when 50 to 80 DD60s have been accumulated after planting (Figure 3).



Figure 3. Depending on the vigor of the seed, emergence will generally occur when 50 to 80 DD60s have been accumulated after planting.

Research has shown that when the number of DD60s accumulated is less than 10 during the five days following planting, yield potential of the crop may be reduced. Limited field research suggests that for every day emergence is delayed beyond the first 10 days, yield potential declines by approximately 0.7 percent. The stress caused by unfavorable weather conditions may result in changes in your management program to compensate for uneven stands and weak or diseased plants. Planting should be delayed if the five-day forecast predicts the accumulation of less than 26 DD60s after planting (Table 1). Also, the forecast should call for dry weather, and the low temperature should remain above 50 degrees Fahrenheit.

To determine the five-day outlook for DD60s, go to your preferred weather source and record the daily high and low temperatures for each day. Calculate DD60s by using the following formula:

$$\text{DD60s} = [(\text{Max. Temp.} + \text{Min. Temp.}) \text{ divided by } 2] \text{ minus } 60$$

**Table 1. Five-day outlook for planting.**

Predictive DD60 accumulation for five days following planting	Outlook for planting
<10	Very poor
11-15	Poor
16-25	Marginal
26-50	Good
>51	Very good

## Long-Term Average Temperature

The long-term average temperatures and corresponding DD60s for various dates in March, April and May are listed below for Alexandria and Winnsboro (Tables 2 and 3). When taking into account long-term average temperature, consider delaying planting until after April 9 at Alexandria and after April 17 at Winnsboro. In Alexandria, the result would be an accumulation of at least 7 DD60s per day for a total

of 35 over the next five days. At Winnsboro, at least 8 daily DD60s would result in a total of 40 over the next five days.

While these long-term averages give you a perspective on what has occurred in the past, early spring weather can fluctuate from year to year. Therefore, the direct measurement of soil temperature and having a favorable five-day outlook is the optimal way to determine when to plant.

**Table 2. Long-term average temperatures and corresponding DD60s, Alexandria, Louisiana.**

Day	High	Low	Average	DD60s per day (=average temp - 60)
March 30	74	54	64	4
April 9	78	56	67	7
April 19	79	57	68	8
April 29	83	60	71.5	11.5

**Table 3. Long-term average temperatures and corresponding DD60s, Winnsboro, Louisiana.**

Day	High	Low	Average	DD60s per day (=average temp - 60)
April 9	76	53	65	5
April 17	80	56	68	8
April 25	80	58	69	9
May 2	81	60	70.5	10.5

## Summary:

Using soil temperature in conjunction with the five-day outlook for DD60s to determine when to plant can result in a vigorous plant stand. It can also prevent cotton producers from having to make replant decisions. Delay planting until:

1. Soil temperature at the 4-inch depth is 65 degrees Fahrenheit or greater at 8 a.m. for at least three consecutive days.
2. The five-day outlook forecasts dry weather and a minimum of 26 DD60s.
3. Low temperatures are forecast to remain above 50 degrees Fahrenheit for the following five days.

Utilizing this information to determine when to plant is often not realistic for early planting, but adequate soil temperature for a vigorous plant is critical. A delay in planting of four weeks until optimal conditions exist may only result in a one- to two-week difference in flowering.

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*Cotton bale in the field.*

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