COTTON PLANTING GUIDE

The Science Behind the Art

Each season carries a new set of challenges and offers up the age-old dilemma – "when to start planting cotton." Regardless of where we are in the Cotton Belt, the goal is to start the planters rolling as soon as possible and there are plenty of good reasons for starting early. But starting early doesn't mean making an unsound decision. The most important decision on the farm **is** the planting decision. Unfortunately, cotton is a weak seedling and it's simply not possible to "wish it out of the ground", regardless of what the calendar may say. Growers must push the envelope in many areas because the planting window can be very narrow in some years – bracketed on one side by cool soil temperatures and the other side by a calendar date limiting the season. Fortunately, there is good science to assist in making those decisions.

THE WEAK SEEDLING

Cotton is inherently a very weak seedling. Being of tropical nature, cold temperatures represent the germination enemy. The base temperature for cotton growth and development is 60°F. Germination is initiated by the absorption of water. During the first 48 to 72 hours following planting, the seed is very sensitive to cold temperatures, which can result in chilling injury *(Figure 1)*. Cold temperatures along with a cold rain can quickly drop soil temperatures in the seed zone into the 50°F to 55°F range. Chilling injury can result in malformed seedlings, loss of the tap root, reduced vigor and emergence and increased risk of seedling disease *(Figure 2)*. And even temperatures in the upper 50's to 60°F will stall seedling growth. Because of this sensitivity to changing temperature, fields planted within as little as 16 to 24 hours of each other can have very different final plant stands.

Figure 1. Sensitivity to chilling injury in relation to days after planting
(adapted from NCC, 1996)

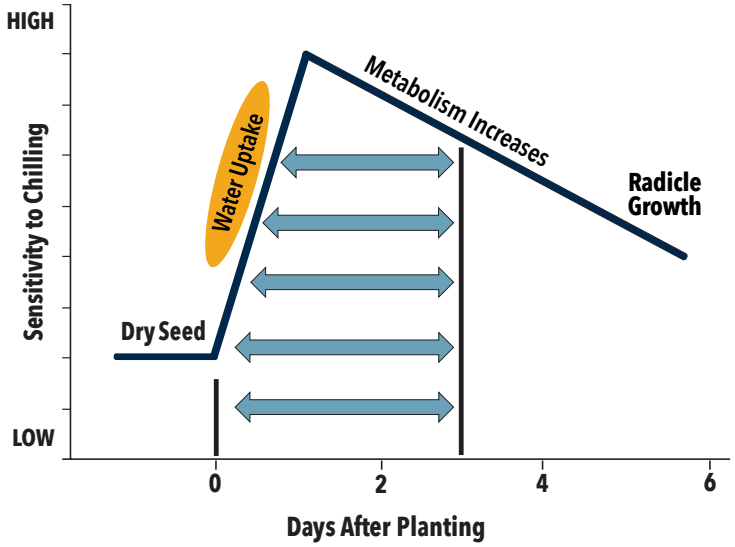
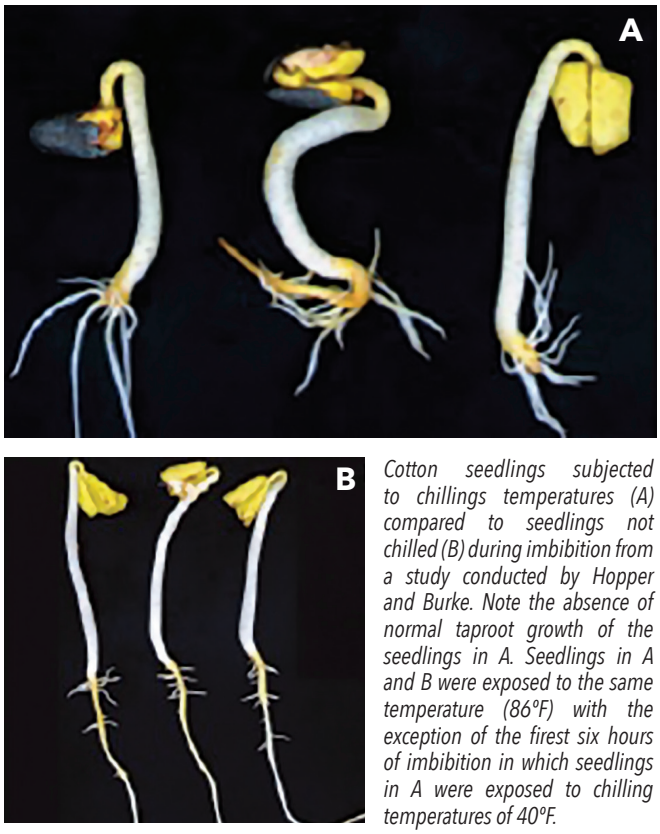


Figure 2. Cotton seedling chilling injury
(Cotton Physiology Today Newsletter. 2007. Vol. 13, No. 1.)



Cotton seedlings subjected to chillings temperatures (A) compared to seedlings not chilled (B) during imbibition from a study conducted by Hopper and Burke. Note the absence of normal taproot growth of the seedlings in A. Seedlings in A and B were exposed to the same temperature (86°F) with the exception of the firest six hours of imbibition in which seedlings in A were exposed to chilling temperatures of 40°F.

Photos: N. Hopper and J. Burke

It should also be noted the deeper cotton is planted, the more energy it must expend to reach emergence. In the Southwest we often encounter seasons with limited planting moisture causing us to "chase moisture" with depth. Although stands can be achieved, typically they are less than optimum. A planting depth study demonstrated seed planted shallower resulted in higher yields. **Seed cotton yields were 440 lbs/acre higher for a planting depth interval of 1" to 2" compared to a depth range of 3" to 4".**

TEMPERATURE FACTORS

Temperature regulates both the rate and maximum length the seedling (hypocotyl-shoot/radicle-root) will attain in the soil. Temperatures in the range of 68°F to 86°F are optimum for seedling growth. Moisture also affects seedling growth. Under low moisture conditions, root growth is

cont. on page 2

favored over shoot elongation. While temperature and moisture regulate seedling growth, soil physical restrictions do not. Thus, seedlings that are prevented from elongating due to soil restrictions (deep planting, soil crust, etc.) continue to grow resulting in swollen hypocotyls, commonly known as "thick shank" *(Figure 3)*.

Figure 3. Thick shank

There are several different best management recommendations for cotton planting, and they are all good. However, a tried-and-true approach is to have a soil temperature of 65°F at the 4" depth (taken in the morning) for at least three consecutive days and a five-day forecast indicating the accumulation of at least 25 DD60s *(Table 1)*. **In addition, it's also preferable that the low temperatures during this five-day period remain above 50°F. Table 2 demonstrates the high seedling survival and rapid emergence associated with this approach.**

Table 1. Five-day DD60s outlook for cotton planting

OUTLOOK FOR PLANTING	FIVE-DAY DD60 ACCUMULATION
Excellent	> 45
Very Good	36 to 44
Good	26 to 35
Marginal	16 to 25
Poor	11 to 15
Very Poor	10 or Less

Table 2. Effect of temperature on cotton seedling survival and growth rate *(Constable and Shaw, 1988)*

MINIMUM SOIL TEMP AT 4"	SEEDS EMERGING AND SURVIVAL	DAYS TO COMPLETE EMERGENCE
50° F	56%	29
57° F	73%	17
65° F	90%	5

Cool spring conditions on the High Plains often create planting decision uncertainty. When considering long-term average temperatures for May, the weather data indicate by delaying planting until May 10 would result in the accumulation of about 40 DD60s over the next five days *(Table 3)*. In addition, planting date studies indicate the optimum planting date range is early-May to June 1 *(Table 4)*. Realizing this "optimum" is not always attainable, the information presented in this document can be used as a guide to assist in making informed planting decisions.

Table 3. Long-term temperature factors for Lubbock, TX

DAY	HIGH TEMP	LOW TEMP	AVERAGE TEMP	DD60S ACCUMULATION
May 1	79	51	65	5
May 10	82	54	68	8
May 20	84	57	71	11
May 30	87	60	74	14

Table 4. Yield reduction of irrigated cotton due to delayed planting at Lubbock, TX, 1960-1966

PLANTING DATE	RELATIVE LINT YIELD %	YIELD DECREASE %
May 15	100	---
June 1	93	7
June 10	76	24
June 20	51	49

Selected References:

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