

A GOOD COTTON PLANTING FORECAST: SAFFORD

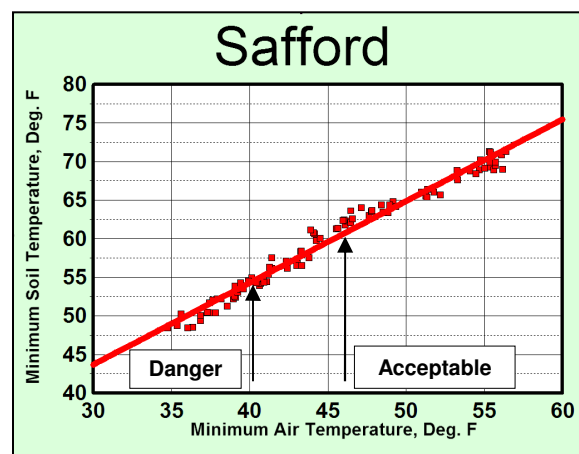
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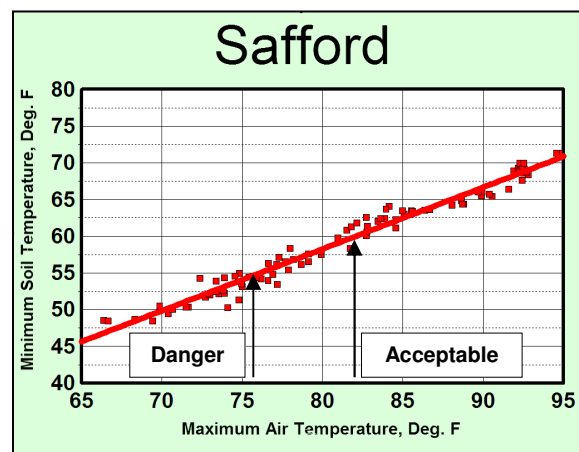
Low soil temperature can adversely impact germination of cotton. Research examining the effect of cold temperatures on germination and stand establishment reveals that chill injury slows germination, alters normal root development and causes cell damage that can render seedlings more susceptible to disease. Additional studies have shown that chill damage is more severe when cold temperatures occur early (first 24 hrs) in the germination process. Cold soils begin to impact germination when soil temperatures at seed depth decrease into the upper 50s°F, and severe damage can result when temperatures decline below 55°F. Given these research findings, growers are encouraged not to plant cotton until soil temperatures at seeding depth remain above 60°F throughout the entire 24-hour day.

Soil temperatures at planting depth are heavily influenced by current weather conditions because the seed zone rests in close proximity to the atmosphere and the thin layer of overlying soil has a limited capacity to retain heat. Changes in weather conditions can therefore have a rapid and pronounced impact on soil temperatures at seeding depth. The Arizona Meteorological Network (AZMET) has been collecting air and soil temperature data at the University of Arizona Safford Agricultural Center for 25 years. This data set reveals that minimum soil temperatures at seeding depth do not approach the recommended planting temperature of 60°F until minimum air temperatures remain in the upper 40s°F or higher (Fig. 1a). Similarly, minimum soil temperatures approach 60°F only after maximum air temperatures rise into the low 80°F range (Fig. 1b).

The relationships presented in Figures 1a & 1b provide clear guidance on what constitutes a good and bad weather forecast for planting cotton in the Safford area. **A good forecast would be clear skies with highs in the low 80s and lows in the upper 40s (~48°F) or higher. This optimal forecast should produce minimum soil temperatures of 60°F or higher.** *A forecast that could foretell trouble with germination and stand establishment would be highs below 75°F and lows in the lower 40s or colder. Such conditions could produce dangerously low soil temperatures (< 55°F).*



a



b

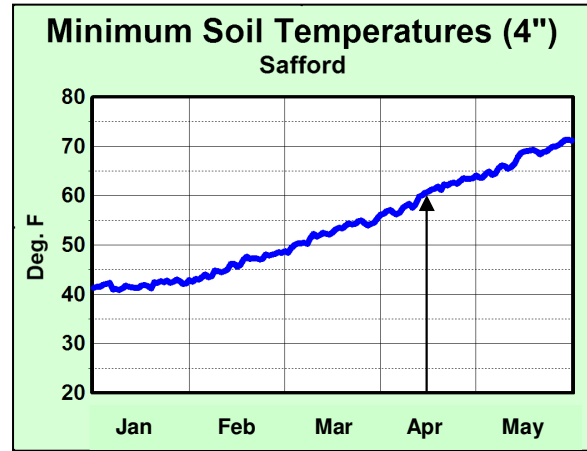
Figure 1. Relationships between minimum soil temperature and minimum air temperature (a) and maximum air temperature (b) during the spring in Safford. Ranges of minimum and maximum air temperatures that lead to acceptable and dangerously low soil temperatures are indicated.

Cloudy daytime conditions make any forecast less desirable since lower levels of solar radiation reduce daytime heating of the soil. Likewise, a forecast calling for any precipitation is a poor forecast due to concerns related to soil crusting and increased surface evaporation which can reduce soil temperatures.

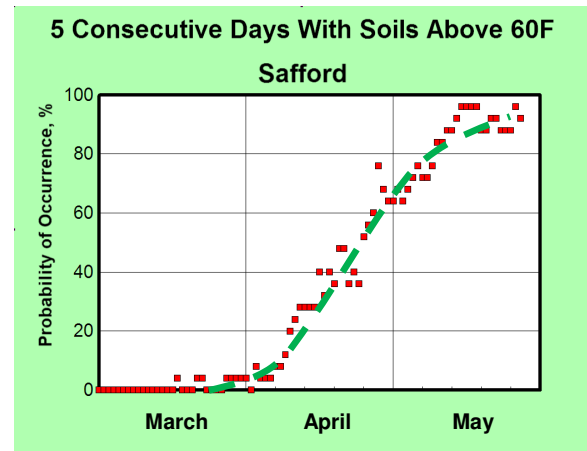
Soil temperatures increase steadily during the spring in Safford and typically approach acceptable levels for planting by mid-April (Fig. 2a). Figure 2b provides the probability of having five consecutive days with minimum soil temperatures above 60°F in Safford during the spring. The probability of occurrence increases from ~5% at the beginning of April to ~70% by the end of the month. The University of Arizona has long recommended using heat unit (HU) based planting windows to target the planting of various cotton maturity groups. These planting windows are provided in Table 1 along with the calendar dates associated with these HU ranges. All windows open when the annual accumulation of HUs totals 400 which is typically the earliest growers would consider planting. The terminal HU values for the planting windows are more important than the opening values as they represent the latest dates growers should consider planting a given maturity class. Planting later than the recommended ending date could delay crop maturity to the point where cold temperatures and/or frost in the fall could negatively impact the crop.

Table 1. Recommended heat unit (HU) based planting windows for early, medium and full season cotton varieties in Arizona. Average opening and closing calendar dates for Safford are included.

Maturity	HUs After 1 January	Calendar Dates
Full	400-700	Apr 5 – May 2
Medium	400-800	Apr 5 – May 10
Short	400-1000	Apr 5 – May 21



a



b

Figure 2. Long term average values of minimum soil temperature measured at a 4" depth for Safford (a). Arrow indicates average date when minimum soil temperatures reach acceptable levels for planting. Probability of having five consecutive days with minimum 4" soil temperatures above 60°F during the spring at Safford (b).