

Feb. 2000
Marana

A GOOD PLANTING FORECAST

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Low soil temperature can adversely impact germination of cotton. Research examining the effect of cold soil on germination and stand establishment shows that chill injury slows germination, alters normal root development and causes cell damage that can render seedlings more susceptible to seedling diseases. Cold soils begin to impact germination when temperatures decrease into the upper 50°F range, and severe damage can result when soil temperatures drop below 55°F. These research findings provide the justification for recommending that cotton be planted only when seed zone-soil temperatures remain at or above 60°F.

Soil temperature at planting depth is heavily influenced by current weather conditions because 1) the seed zone is in close proximity to the atmosphere and 2) the thin layer of seed-zone soil (~2") 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 soil temperature data at seeding depth (2"-4") for approximately 10 years. Analyses of AZMET air and soil temperature data reveal consistent relationships between soil and above ground temperatures for all areas involved in cotton production. A linear relationship exists between minimum soil temperature and minimum air temperature for the day (Fig. 1). Minimum soil temperatures do not approach the recommended planting temperature of 60°F until minimum air temperatures rise into the upper 40s or higher. A second linear relationship exists between minimum soil temperature and maximum air temperature (Fig. 2). Minimum soil temperatures approach 60°F when maximum air temperatures rise into the low 80°F range.

The relationships presented in Figs. 1 & 2 provide clear guidance on what constitutes a good and bad weather planting forecast for cotton. A good forecast would be clear skies with highs in the low 80s and lows above 48°F. In terms of heat units (HUs; 86°F/55°F), such a forecast will generate 12+HUs/day, or about 84 HUs/week. A forecast that could foretell trouble with germination and stand establishment would be highs below 75°F and lows in the low 40s or colder. Such a forecast would produce less than 7 HUs/day or less than 50 HUs/week. 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 over crusting and evaporative cooling of wet soils.

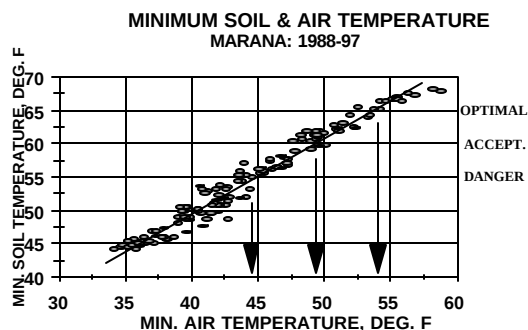


Fig. 1. Minimum soil vs. minimum air temperature for Marana. Arrows indicate minimum temperatures associated with critical temperature thresholds for germination.

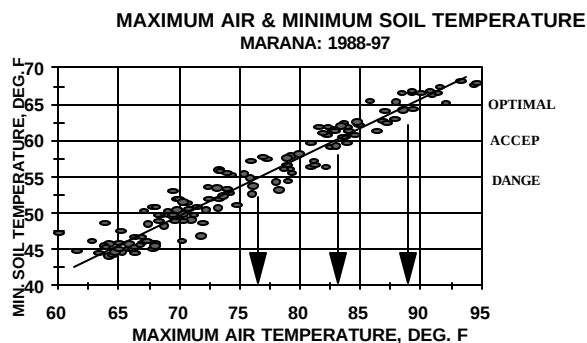


Fig. 2. Minimum soil vs. maximum air temperature for Marana. Arrows indicate maximum temperatures associated with critical temperature thresholds for germination.