JULY WEATHER SUMMARY

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The 1999 growing season will no doubt be remembered for unusual weather conditions, and the month of July was certainly no exception. The 1999 crop entered July behind schedule due to a cool planting season which delayed crop establishment, and relatively cool May and June temperatures that slowed crop development. By the end of June, rising dew points signaled the arrival of an early monsoon, which was certainly an unwanted occurrence for the late 1999 crop. A late crop and an early monsoon often combine to produce extended periods of heat stress during the primary fruiting cycle which can significantly reduce fruit retention (shedding of small bolls). Few would argue the monsoon was not an important feature of July weather, however in many cases, the 1999 crop has not suffered the level of weather-related fruit loss observed during recent monsoon seasons. An assessment of July weather conditions provides some insight into this better-than-expected crop performance and is provided below.

The 1999 monsoon reached official status (3 consecutive days of dew points above 54°F) by the end of June or the first few days of July in most locations. Unlike many previous monsoons, the 1999 edition arrived with an early intensity not seen since 1990. Very high dew point temperatures developed in early July and significant rains occurred at most locations by 10 July. These moist conditions remained entrenched over the state for much of the month, leading to record or near record dew point temperatures (Fig. 1) and above normal rates of precipitation (Fig. 2). Dew point temperatures averaged in excess of 10 degrees above normal at most Arizona locations, and rainfall typically exceeded normal by a factor of two or more.

The high July dew points would normally be a prescription for severe heat stress conditions that can result in low levels of fruit retention. High dew points reduce the ability of the crop to cool itself by evaporative cooling during the day and radiative cooling at night. However, the cool daytime temperatures helped minimize the magnitude and duration of heat stress. July maximum temperatures averaged well below normal (Fig. 3) and were the lowest in more than 15 years. Plentiful rainfall, cloudy weather, and mild tropical airflow were the reasons for the cool daytime conditions.

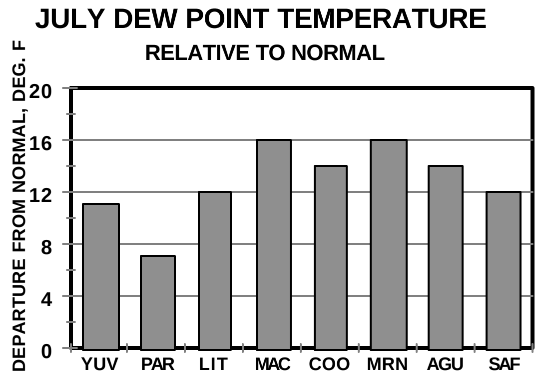

Fig. 1. Departure from normal of July dew point temperatures at Yuma Valley (YUV), Parker (PAR), Litchfield Park (LIT), Maricopa (MAC), Coolidge (COO), Marana (MRN), Aguila (AGU) and Safford (SAF).

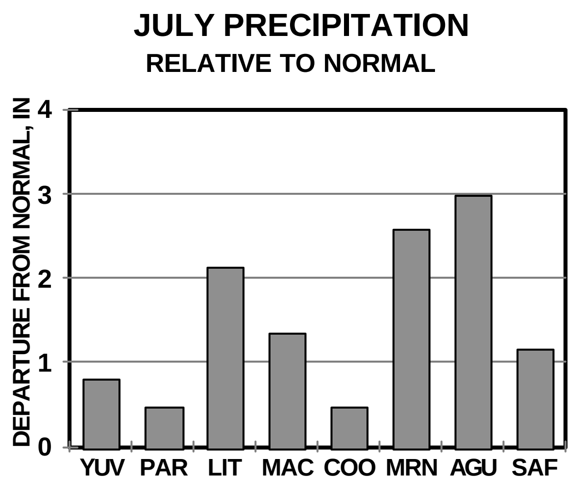

Fig. 2. Departure from normal of July precipitation totals at Yuma Valley (YUV), Parker (PAR), Litchfield Park (LIT), Maricopa (MAC), Coolidge (COO), Marana (MRN), Aguila (AGU) and Safford (SAF).

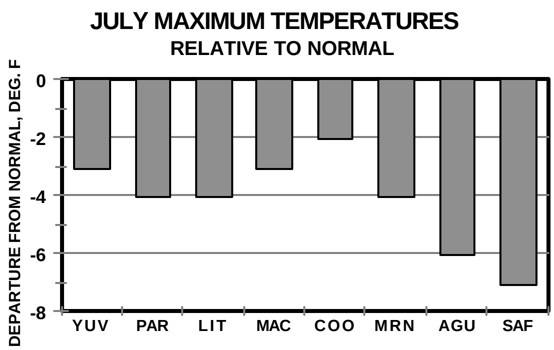

Fig. 3. Departure from normal of July maximum temperatures at Yuma Valley (YUV), Parker (PAR), Litchfield Park (LIT), Maricopa (MAC), Coolidge (COO), Marana (MRN), Aguila (AGU) and Safford (SAF).

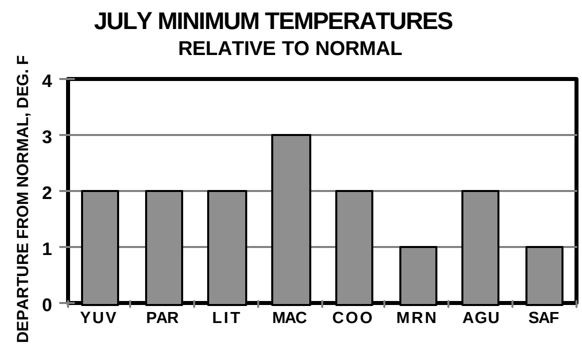

Fig. 4. Departure from normal of July minimum temperatures at Yuma Valley (YUV), Parker (PAR), Litchfield Park (LIT), Maricopa (MAC), Coolidge (COO), Marana (MRN), Aguila (AGU) and Safford (SAF).

Night temperatures, in contrast, averaged above normal at all locations -- a result of higher humidity and cloudiness lowering radiative cooling at night (Fig. 4). High night temperatures are generally a good indicator of heat stress conditions since they are correlated with high levels of humidity. However, the very cool days helped offset the impact of warmer nights and limited the level of crop heat stress. In general, the number of days with high night temperatures (minimums of 77°F and above) were near normal for July. Exceptions to this generalization were observed at Yuma and Maricopa where the number of hot nights exceeded normal by six.

Crop temperature models designed to assess the potential for weather-induced heat stress suggest heat stress has been less severe in comparison to the past two July's. We believe there are two levels of heat stress which we define as Level 1 and Level 2. Level 1 heat stress occurs in most years and results in low to moderate rates of fruit loss(primarily small bolls). Extended periods of Level 1 stress can also reduce the size of retained bolls. Level 2 stress is the more intense and damaging condition that produces higher rates of fruit loss and also damages squares that are ~ 14 days pre-bloom. These damaged squares continue to develop and flower, but most of the bolls abort shortly after bloom, producing a secondary or delayed period of low fruit retention.

Figure 5 provides the June and July crop temperature assessment for Parker and Mohave Valleys. Heat stress conditions developed in late June, about 7-10 days ahead of normal. This period of early stress was reasonably short and registered at the less damaging Level 1 category. Level 1 heat stress was again evident on a number of days in July. Fortunately, cooler and/or drier weather helped minimize any extended periods of heat stress. Level 2 stress has been limited at both locations with Parker reporting only one day on 6 July and Mohave three days on 6,7, and 11 July. The brief outbreak of Level 2 stress in early July likely produced some loss of fruit; however, the generally lower July stress levels and the frequent breaks in stress should result in better fruit retention than has been observed in recent July's.

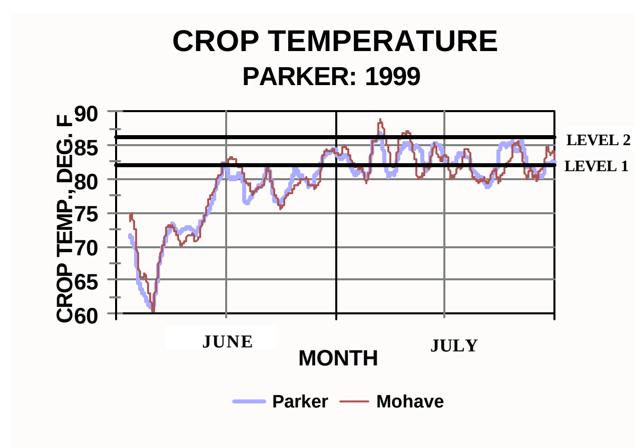

Fig. 5. Crop temperature estimates for Yuma Valley cotton for the months of June and July. Temperature levels marking the beginning of Level 1 and Level 2 heat stress are indicated.