Weather Conditions During the 1992 Growing Season

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Abstract

Abundant rainfall was the most prominent feature of the 1992 growing season. Monthly precipitation totaled above normal during the first five months of the year, and during August and December. Warm temperatures accompanied the wet weather during the spring planting season and helped boost growing season heat unit totals to near record levels in central and western Arizona. Early fall weather was warm and dry which provided excellent conditions for both finishing the crop and preparing the crop for harvest.

Introduction

Entomological and meteorological conditions combined to make 1992 a difficult year for Arizona cotton producers. While the extensive problems caused by sweet potato whitefly will be the most remembered attribute of 1992, weather conditions, particularly heavy rainfall and hail also affected cotton producers. In this report we reexamine weather conditions during the 1992 growing season using information obtained from the Arizona Meteorological Network (AZMET).

Methods

Weather information collected from six AZMET stations -- Coolidge, Litchfield Park, Marana, Parker, Safford and Yuma Valley -- were selected for evaluation in this review. The selected stations range in elevation from 120' (Yuma Valley) to 2955' above sea level (Safford) and provide a broad geographical representation of the cotton production regions of Arizona. Monthly totals and/or means of heat unit (HU) accumulation (85F/55F, upper and lower temperature thresholds, respectively), precipitation, maximum temperatures and minimum temperatures were summarized for each location and compared against weather records observed in recent years (HU only) and long-term normals (30 year means). Since long-term normals are not available for AZMET stations, normals for the nearest NOAA Cooperative Observer Station were used for comparisons against normal.

1992 Heat Unit Accumulation: Comparison With Recent Years

The number of days between the last spring frost and the first fall frost is often used to determine the length of a growing season. Such an approach often poorly represents the length of the growing season because temperature conditions are not taken into consideration. A more representative means of assessing growing season length is to examine the total HU accumulation between selected dates. Silvertooth et al. (1991) have shown that cotton growth and development can be predicted using HUs; thus, years when HU accumulation is high provide more thermal time for cotton development while years with low HU accumulation provide less time. Figure 1 shows the total growing season HU accumulation (from legal first planting date to 30 September) for Yuma Valley, Coolidge and Safford for each of the past...
6 years. The 1992 growing season produced the highest HU accumulation at Yuma Valley and Coolidge since 1989 -- one of the hottest years in recent memory. As will be discussed later, this high HU accumulation was the result of a warm spring and a warm September, not due to a hot summer. HU accumulation at Safford was also high but did not surpass either 1989 or 1990.

Another factor clearly evident in Figure 1 is that HU accumulation during the 1992 growing season rebounded nicely in central and southwest Arizona from the cool and troublesome 1991 growing season. The difference in HU accumulation between 1992 and 1991 when converted back to days by diving by the normal daily HU accumulation for the season represents a difference of 17 and 21 days for Coolidge and Yuma Valley, respectively.

The 1992 Growing Season: Comparison To Normal

The dynamics of a particular growing season can be examined by comparing weather variables with long-term normals. In this section, monthly totals (precipitation and heat units) or monthly means (maximum and minimum temperatures) are compared against long-term normals for 6 locations -- Coolidge, Litchfield Park, Marana, Parker, Safford and Yuma Valley. The four figures referenced in this discussion depict the deviation of a particular weather variable from normal. Data points located above the zero line (normal) represent above normal conditions; data below the line, a below normal condition.

Seasonal Precipitation

All cotton production areas received above normal precipitation in 1992. Rainfall was particularly heavy in the first five months of the year and during December (Figure 2). Precipitation levels were normal or above for all locations from January to May. The months of February, March and May produced extremely high rates of rainfall which slowed seedbed preparation and planting. The rare May rains came in the form of thunderstorms which produced damaging hail in several regions.

Rainfall diminished in June and fell at below normal levels in July. The exception to low July rainfall was Litchfield Park where rainfall totaled about 0.5" above normal. August brought the return of wet conditions to all areas except Yuma Valley. Rainfall associated with tropical storm Lester (21-24 August) was responsible for the above normal August rainfall in many locations, particularly at Safford where Lester dropped about 3".

Rainfall diminished to below normal levels for a three month period starting in September. With the lone exception of Parker, all locations reported below normal precipitation for the months of September, October and November. Precipitation at Parker was below normal in September and November, but totaled slightly above normal for October.

Heavy rains returned to the state in December -- a repeat of 1991. Again, as in 1991, the precipitation interfered with fall tillage operations. All locations reported precipitation totals in excess of 1" above normal. Litchfield Park reported the largest rainfall total for the month -- 3.86" -- which was nearly 3" above normal.

Maximum Temperatures

The 1992 growing season did not produce extremely hot daytime weather (Figure 3). Most of the warm daytime weather was confined to the spring months of April and May, and to the fall months of September and October. Cloudy weather and high rainfall rates kept maximum temperatures mostly below normal during the first 3 months of 1992. Notable exceptions were Parker and Safford where
maximum temperatures averaged above normal for two of the months during January to March period. Maximum temperatures were particularly cool during the cloudy and wet conditions that prevailed during much of March.

The months of April and May produced warm daytime temperatures which were ideal for germinating cotton. April was particularly warm with maximum temperatures averaging 2 - 5 F above normal at most locations. Temperatures were not quite as warm (relative to normal) in May; again, this was due to the unusual rains and cloudiness during this month.

The summer months produced normal to below normal maximum temperatures at all locations. Particularly cool daytime temperatures were observed in Parker, Coolidge and Litchfield Park. Yuma Valley, Safford and Marana all reported near normal temperatures.

The end of the monsoon season brought warm and dry air to the entire region for September and October. All locations except Coolidge reported above normal maximum temperatures during these months; Coolidge temperatures were near normal.

The warm days ended in November when decidedly cooler weather descended upon the entire region. Maximum temperatures averaged well below normal at all locations during November and December. Cool, dry air was responsible for the below normal temperatures in November. The return of cloudy and wet weather was the cause of the cool maximum temperatures in December.

Minimum Temperatures

The wet winter and spring weather produced very warm minimum temperatures during the first five months of the year (Figure 4). With the exception of Parker, all locations reported above normal minimum temperatures for each month. Parker reported below normal minimum temperatures in only one month – January. These warm minimum temperatures were particularly important during April and May and helped to minimize problems with germination and seedling disease during the damp spring weather.

Normal to above normal minimum temperatures continued through October at Yuma Valley and Marana. However, Parker, Safford, Coolidge and Litchfield Park reported normal to below normal minimum temperatures during June and July. Near normal minimum temperatures prevailed in August, September and October for Litchfield Park, Safford and Coolidge, while Parker minimum temperatures remained below normal for the same period.

The cool, dry air that entered Arizona in November produced below normal minimum temperatures at all locations and the first freezing temperatures at most central and upper elevation production areas. December brought an abundance of cloudy and wet weather which produced above normal minimum temperatures at all locations except Parker. Parker minimum temperatures remained slightly below normal during December.

Heat Unit Accumulation

Heat unit accumulation (Figure 5) totaled near normal for most locations during the first three months of 1992. Near normal to slightly below normal HU accumulation in January was followed by above normal HU accumulation in February at all locations except Parker. The cool, damp March weather produced below normal HU accumulation at all locations except Safford.

Warm temperatures in April and May produced above normal HU accumulations at all locations. However, relatively mild temperatures in June, July and August produced normal or below normal
accumulations at all locations except Yuma Valley. Heat unit accumulation remained well above normal at Yuma Valley throughout the summer months.

Warm weather in September and October produced above normal HU accumulation at Yuma Valley, Safford, Marana and Litchfield Park. Heat unit accumulation remained slightly below normal at Coolidge and Parker during the same period. Few growers were able to take advantage of this warm fall weather due to earlier problems with sweet potato whitefly. Whitefly forced many growers to terminate their cotton in August.

Below normal HU accumulation was observed for the final two months of 1992. Cold, dry air produced the reduced HU accumulation in November while cool, wet weather was the culprit in December.
Figure 1. Total heat unit (86F/55F) accumulation for each of the past 6 growing seasons at Yuma Valley, Coolidge and Safford.
Figure 2. Monthly precipitation relative to normal for Coolidge, Parker, Marana, Litchfield Park, Yuma Valley and Safford in 1992.

Figure 3. Monthly maximum temperature relative to normal for Coolidge, Parker, Marana, Litchfield Park, Yuma Valley and Safford for 1992.
Figure 4. Monthly minimum temperature relative to normal for Coolidge, Parker, Marana, Litchfield Park, Yuma Valley and Safford in 1992.

Figure 5. Monthly heat unit (86F/55F) accumulation relative to normal for Coolidge, Parker, Marana, Litchfield Park, Yuma Valley and Safford in 1992.