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THE RELATIONSHIP BETWEEN HEAT UNITS AND YIELD IN ARIZONA COTTON COUNTIES

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Heat units are used to predict emergence of cotton seedlings, appearance of the first flower and the application of certain plant growth regulators. They are also used to predict the emergence of pink bollworms and development of cotton bollworms and boll weevil. They provide a method of studying the relationship of plant and insect development with temperature.

Cotton grows best in a warm climate and requires a relatively long season to produce optimum yields. The highest average upland cotton lint yield for the past 25 years was in Yuma County, 1192 pounds per acre, and the lowest of 719 pounds per acre was in Cochise County. The yields in the remaining counties fell in between these extremes and generally were proportional to the length of the growing season and therefore seasonal total heat units (Figures 1, 2, 3, 4, 5, 6).

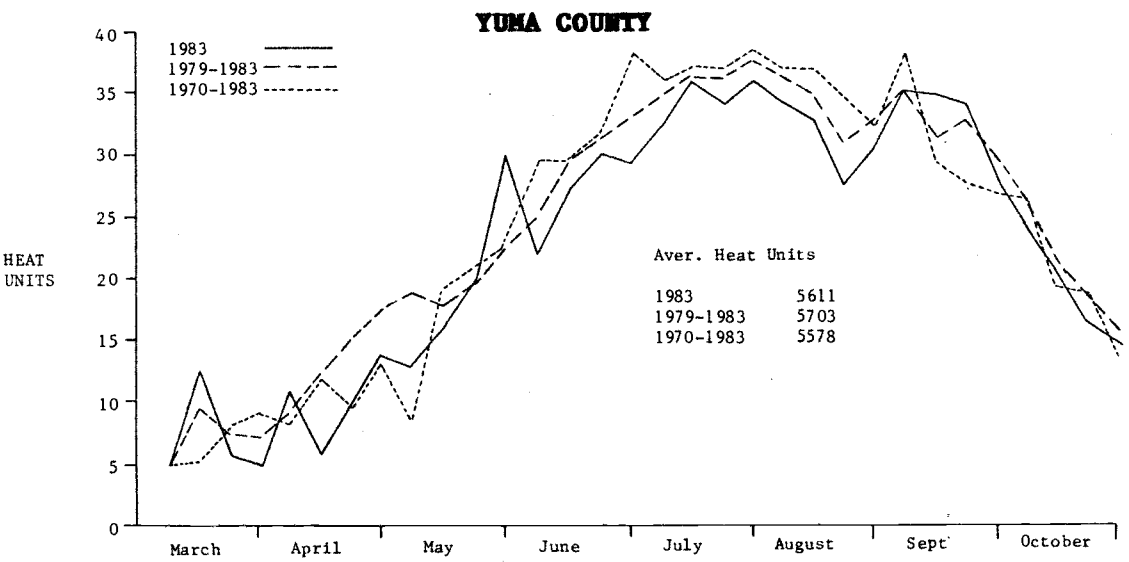


Figure 1. Heat unit accumulation on a daily basis beginning 1970 with a 14-year average, 5-year average, 1983 average with lower and upper threshold temperatures of 55F and 95F, respectively.

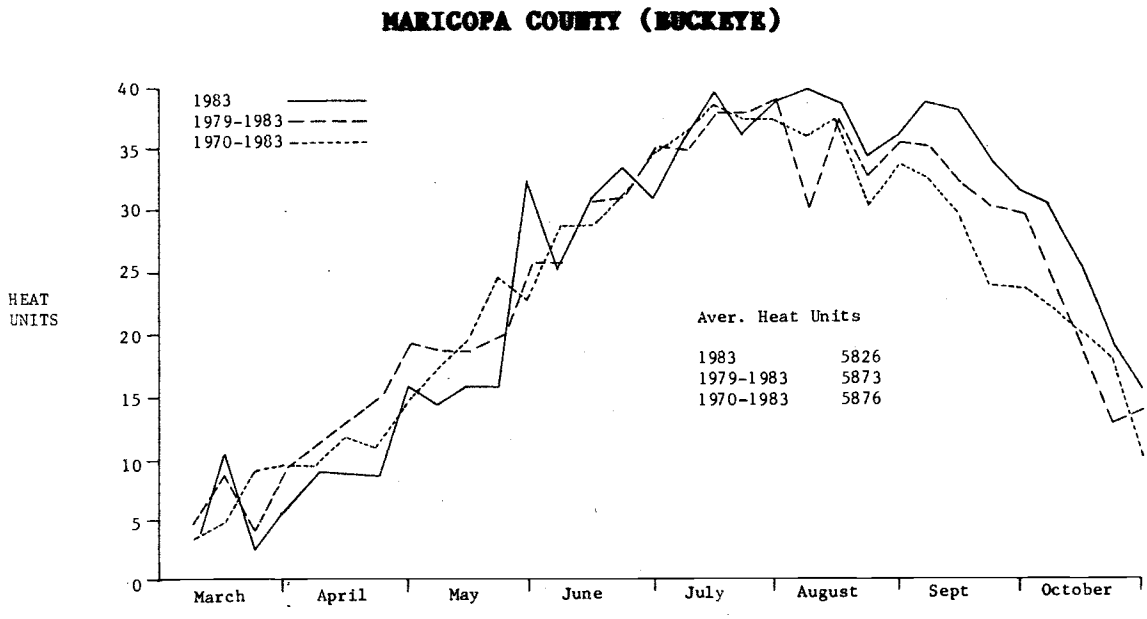


Figure 2. Heat unit accumulation on a daily basis beginning 1970 with a 14-year average, 5-year average, 1983 average with lower and upper threshold temperatures of 55F and 95F, respectively.

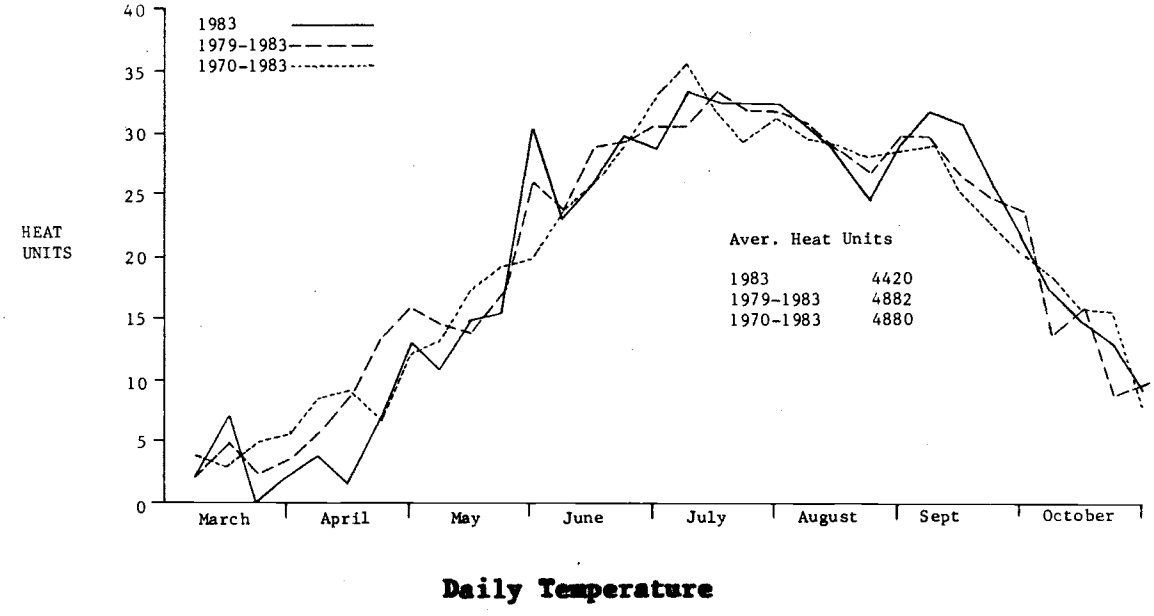
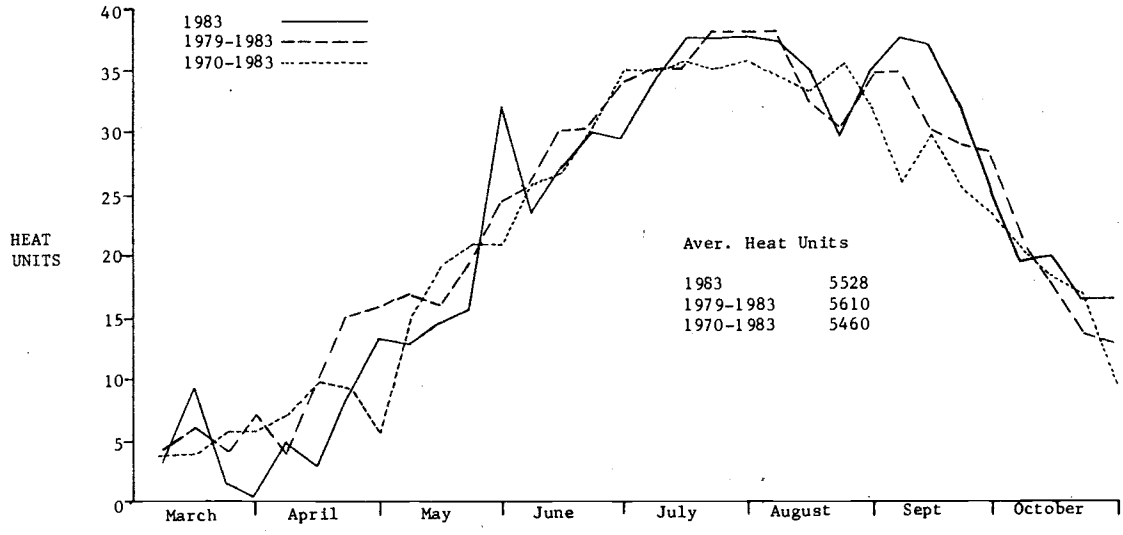


Figure 3. Heat unit accumulation on a daily basis beginning 1970 with a 14-year average, 5-year average, 1983 average with lower and upper threshold temperatures of 55F and 95F, respectively.

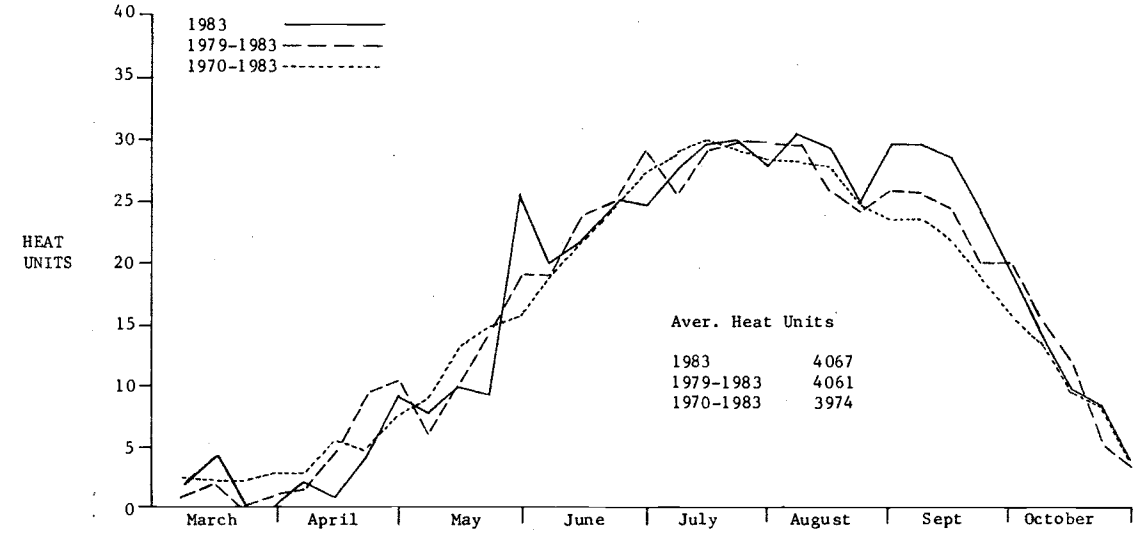
PINAL COUNTY



Daily Temperature

Figure 4. Heat unit accumulation on a daily basis beginning 1970 with a 14-year average, 5-year average, 1983 average with lower and upper threshold temperatures of 55F and 95F, respectively.

GRAHAM COUNTY



Daily Temperature

Figure 5. Heat unit accumulation on a daily basis beginning 1970 with a 14-year average, 5-year average, 1983 average with lower and upper threshold temperatures of 55F and 95F, respectively.

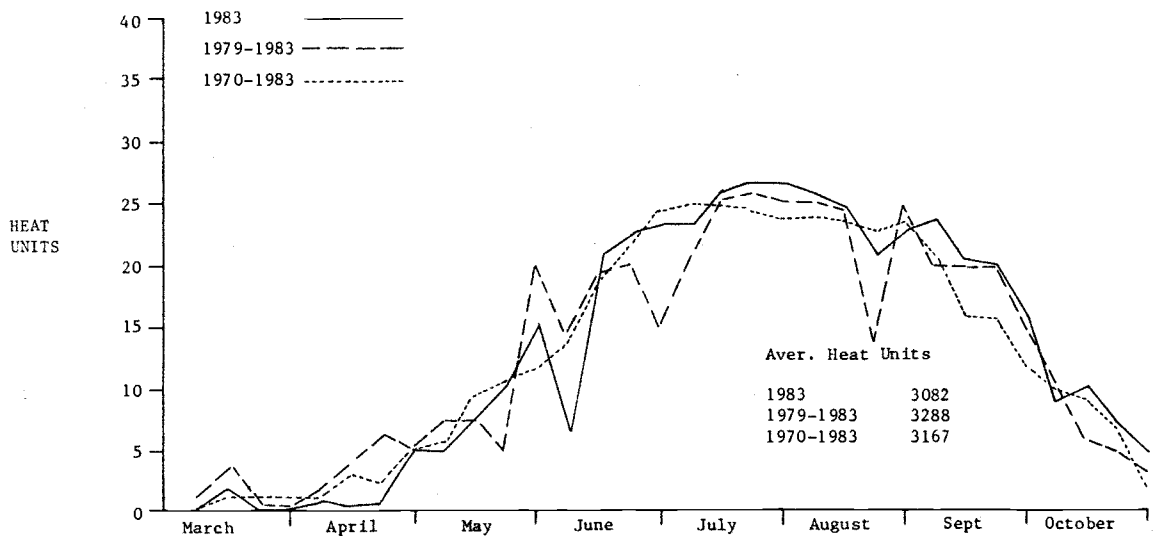


Figure 6. Heat unit accumulation on a daily basis beginning 1970 with a 14-year average, 5-year average, 1983 average with lower and upper threshold temperatures of 55F and 95F, respectively.

We compared the relationship of yield with season length or accumulation of heat units. We defined heat units as the average of the maximum and minimum temperature for each day minus 55. We used an upper threshold of 95 F.

We found very little relationship between cotton yields in each county and accumulation of heat units during the season. Even in Cochise County where temperatures are cool and the season short, the relationship was poor (Table 1).

We equate high yields with a warm, early spring that produces good stands of cotton or with a late fall that allows many top bolls to mature. Thus, a warmer than average spring or fall should result in higher yields.

The seasonal heat unit totals were divided into early, mid and late season and compared with yield. Still little relationship was found.

These comparisons suggest that although warm temperatures promote plant growth and development, the year-to-year variation of heat units within a county has only a minor effect on yield.

Thus, the interaction of temperature and other climatic factors with management practices probably accounts for the greatest variation in yield.

Table 1. Correlation values between heat units and yield during each production season and during March, April and May period; June, July and August period; and September and October period for certain areas of Arizona, 1970-1983.

	Time Period			
City	March, April May	June, July August	September, October	Production Season
Yuma	-.09	-.3	.02	-.03
Buckeye	.36	.03	.09	.26
Casa Grande	.53	.55	.14	.55
Tucson	-.13	-.7	-.13	-.49
Willcox	.35	-.28	-.32	-.23
Safford	.13	.03	.11	.14

THE RELATIONSHIP BETWEEN YIELD, PRICE, PLANTED ACRES AND HEAT UNITS IN COCHISE COUNTY

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The demand for cotton and prices offered remain firm and promise a strong market for next season. The incentive to grow more cotton is blunted, however, by the high cost of production. This is true in Arizona and particularly true in Cochise County. In addition, for unknown reasons, Cochise County has experienced a yield decline during the last 20 years (Figure 1).

In 1956 the average county yield topped 800 pounds per acre and climbed to a peak of 980 pounds per acre in 1958. Since then average yields have slowly declined at a calculated rate of eight pounds per acre each year to the present level.

It is known that cotton requires a relatively long warm production season for optimum yields. Therefore we compared the relationship between yields and heat units in Cochise County during 1970-1983. This comparison suggests that the variation in heat units from year to year has little effect on yields with a correlation value of -.23 (Figure 2). Even when relatively warm or cool spring, summer or fall temperatures are compared