Agriculture

AGRICULTURAL DROUGHT IN THE MIDSOUTH: 1986

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ABSTRACT

Dry and hot weather was primarily responsible for the reduced production in Midsouth agriculture in 1986. A dry winter, followed by a dry and hot summer, were particularly damaging; soil moisture deficiencies became apparent during the critical reproductive phase of development for cotton and soybeans. Notable losses also occurred in the poultry and aquaculture industries.

1. INTRODUCTION

The 1986 crop year was marked by a long period of crop moisture deficiency across a major portion of the Midsouth's agriculturally productive regions. In addition, an untimely midsummer heat wave exacerbated already deteriorating crop conditions during crucial phases of development.

The United States Department of Agriculture's crop yield estimates (2) for cotton and soybeans bear out these effects (Table 1). Soybean yields averaged near or below normal in all Midsouth States (Arkansas, Louisiana, Mississippi, and Tennessee) while cotton suffered losses in Mississippi, Louisiana, and Arkansas. In Tennessee, alfalfa and other hay production lagged 27% and 31% behind normal, respectively. Abandoned acreage was not accounted for in these estimates, thus real losses were likely lower than indicated. Irrigation had some influence on yields, but only approximately 20% of the soybeans and cotton received supplemental water.

Poultry in Arkansas and Mississippi suffered significant losses owing mainly to high temperatures (3, 4). Extreme heat was also indirectly responsible for losses totaling over four and a half million dollars in the catfish industry in the Mississippi Delta (5).

Low soybean yields compounded by low prices produced a particularly critical situation. As a result of the drought, portions of the Midsouth were declared natural disaster areas by the Secretary of Agriculture (6). Fig. 1 depicts the counties which are eligible for federal assistance programs.

This article will discuss the basic meteorological and agronomic factors which led to decreased production in Midsouth agriculture.

Table 1. Summary of crop yield estimates for 1986 and the five-year average of annual yields.

	Cotton lb lint/ac.		Soybeans bu/ac.	
	1986	5-yr avg.	1986	5-yr avg.
Mississippi	576	729	18	23.4
Arkansas	605	622	21	23.4
Louisiana	573	639	21	24.2
Tennessee	573	508	25	25.2

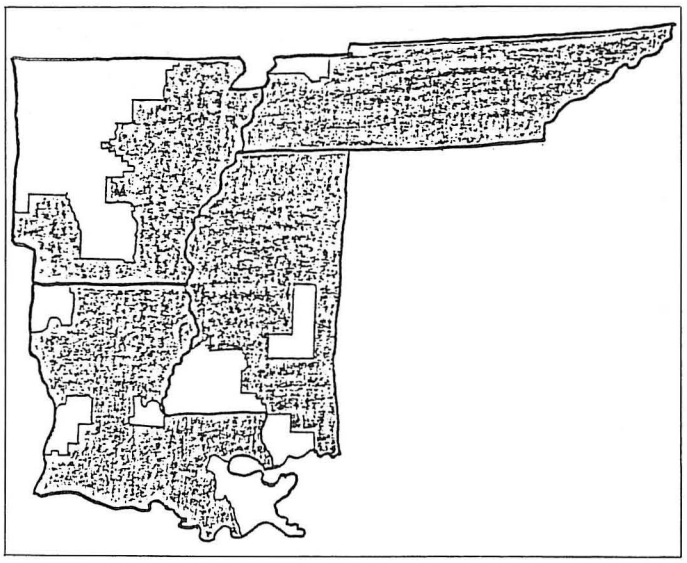


Fig. 1 Portions of the Midsouth (by county) eligible for Federal assistance programs due to drought conditions (shaded).

2. DATA ANALYSIS AND DISCUSSION

Precipitation from December 1985 through March 1986 was substantially below normal across the Midsouth. This is usually a season when rainfall exceeds evaporation and transpiration, and this excess recharges soil moisture supplies. The driest areas extended northeast from the Louisiana Delta through the Mississippi Delta into northeast Mississippi, with a second area of low winter rainfall located in central Tennessee (Fig. 2). Regionwide, rainfall ranged between 28 to 78% of the 30-yr normal (1951–80), which translates into actual amounts of 5 to 13 in. for the 4-month period.

Crop season rainfall (April through September) was more variable but still generally low. The driest areas, which reported less than 70% of normal rainfall, were located in the Arkansas and Mississippi Delta, southeast and Middle Tennessee, and east-central Mississippi for those months (Fig. 3). Portions of West Tennessee and northeast Arkansas generally received near normal rainfall. Note that the large area of greater than 90 percent rainfall in the western Midsouth shown in Fig. 3 is outside the major crop-growing region.

Not only is the total amount of rainfall important for crop development, but so is its distribution in time. Soybeans are most susceptible to a deficiency of soil moisture during the reproductive stages (i.e., flowering through pod fill) (7). Likewise, cotton is most sensitive during flowering and early boll formation (8).

Figs. 4a to 4d show the progress of development by crop stage for soybeans and cotton in each of the fourth Midsouth States. In the Midsouth, soybeans are most sensitive to moisture stress

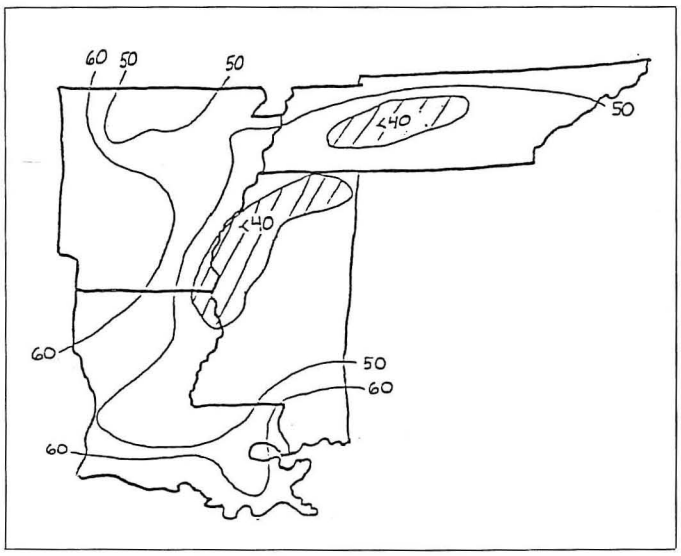


Fig. 2 Percent of normal rainfall in the Midsouth, December 1, 1985 to March 31, 1986. Isopleths are in 10% intervals.

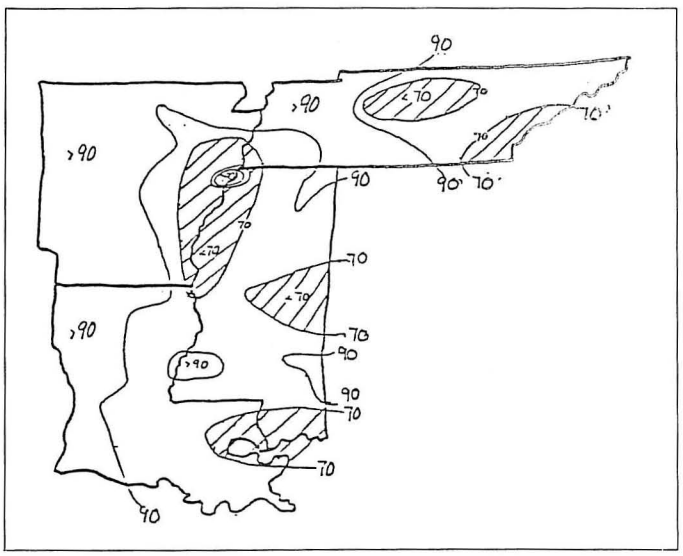
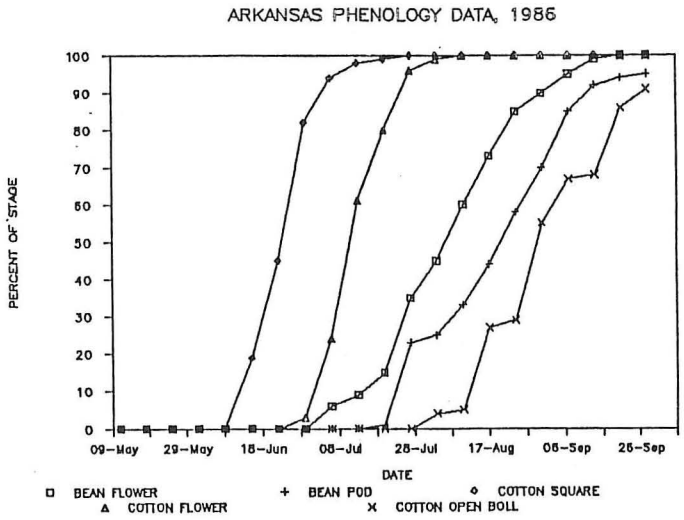
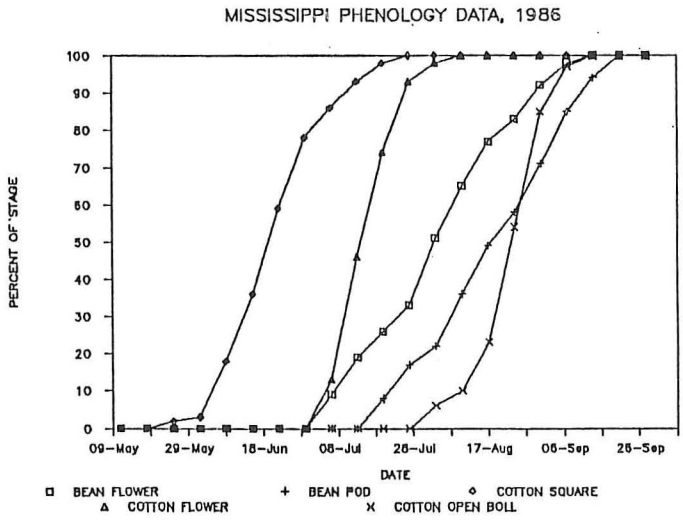
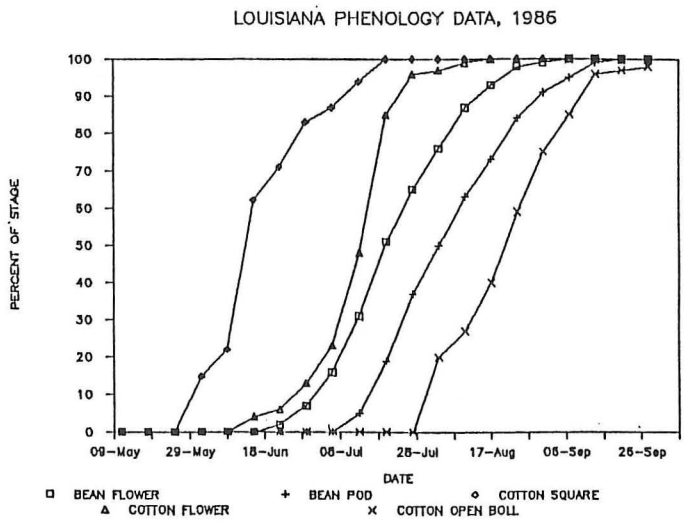


Fig. 3 Percent of normal rainfall in the Midsouth, April 1, 1986 to September 30, 1986. Isopleths are in 20% intervals.







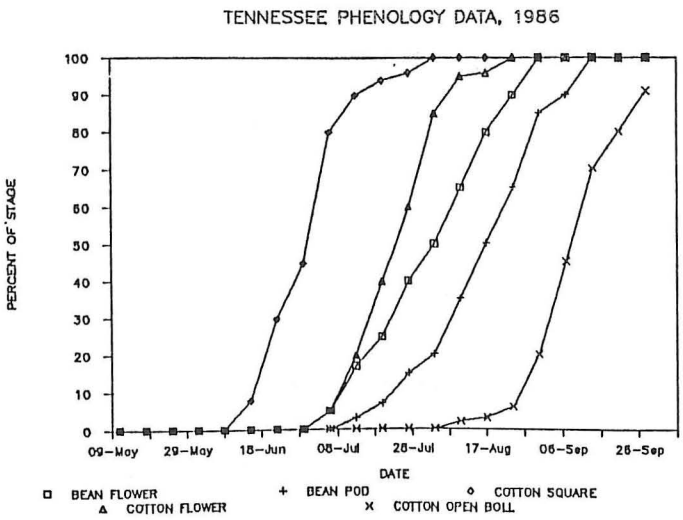


Fig. 4a–d. Percent of cotton and soybeans at the respective stage of reproduction (phenology) for Arkansas (a), Louisiana (b), Mississippi (c) and Tennessee (d).

from mid-July through August while cotton is most sensitive from the beginning of July to mid-August.

The weekly cumulative actual and normal rainfall for the crop season is plotted for four Midsouth stations in Figs. 5a to 5d. Most of the Delta, which includes Stoneville, MS and Stuttgart, AR (Figs. 5a and 5b), showed a distinct cumulative deficiency of rainfall, as compared to normal, which widened through the summer. A similar rainfall pattern was found for Knoxville, TN (Fig. 5c) in the eastern part of that State. Figs. 6a and 6b depict even more clearly the short-fall of precipitation during the period critical to agriculture in the Delta during July and August. This was especially crucial since even in normal years, rainfall does not meet crop water demand in July and August.

Dyersburg, TN was indicative of a small portion of the north-central Midsouth including West Tennessee and extreme north-east Arkansas that was not as dry (Fig. 5d). Rainfall during July and August proved to be near or above normal. Approximately 75% of the soybeans and almost all of the cotton in Tennessee is grown within this area, which probably explains why yields in that State were at or above the 5-year average.

The Crop Moisture Index (CMI) (9), an indication of water availability compared to crop need, began showing abnormally dry conditions across parts of the Midsouth in mid-July with excessively dry conditions in East Tennessee. Soil moisture continued to be short through the month and into August, and much of the Midsouth was rated excessively dry with pockets that were severely dry (Fig. 7). According to the CMI, areas rated excessively dry or worse have reduced yield prospects. A few showers benefitted some farms during August in the north-central Midsouth, but amounts elsewhere were too light and scattered or too late to improve production.

Above-normal temperatures from July 15 to August 2 further worsened the situation. Average daily temperatures during the 19-day period ranged from 3 to 7 degrees above normal at almost all Midsouth locations. More critically, average daily maximum temperatures for the same period ran 4° to 10°F above normal. Temperatures above 100°F were common, and maximum temperatures in most areas averaged in the mid-90s or above. The hot weather increased the crop demand for water when soil moisture supplies were already limited. The timeliness of the

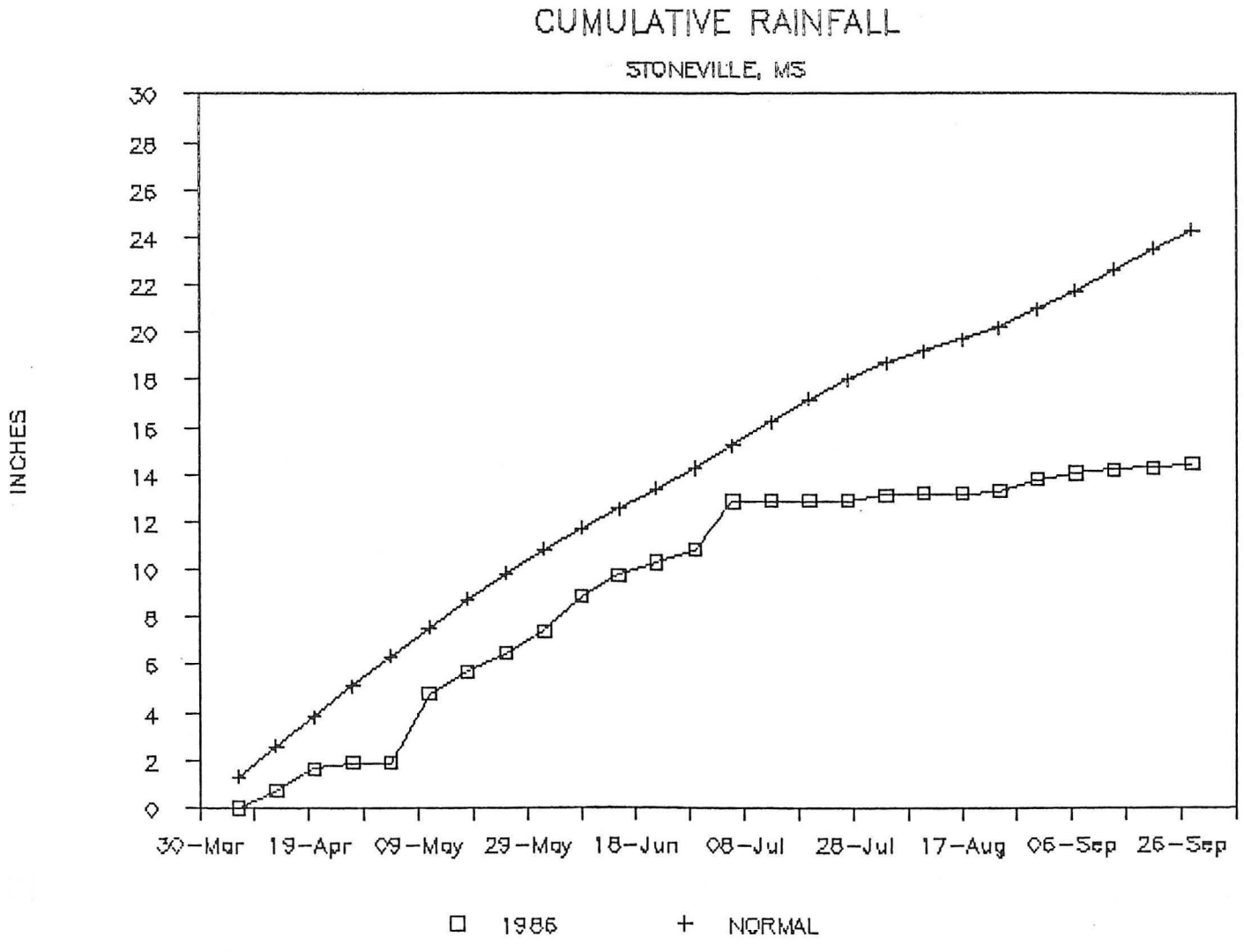


Fig. 5a. Cumulative actual and normal rainfall for Stoneville, MS.

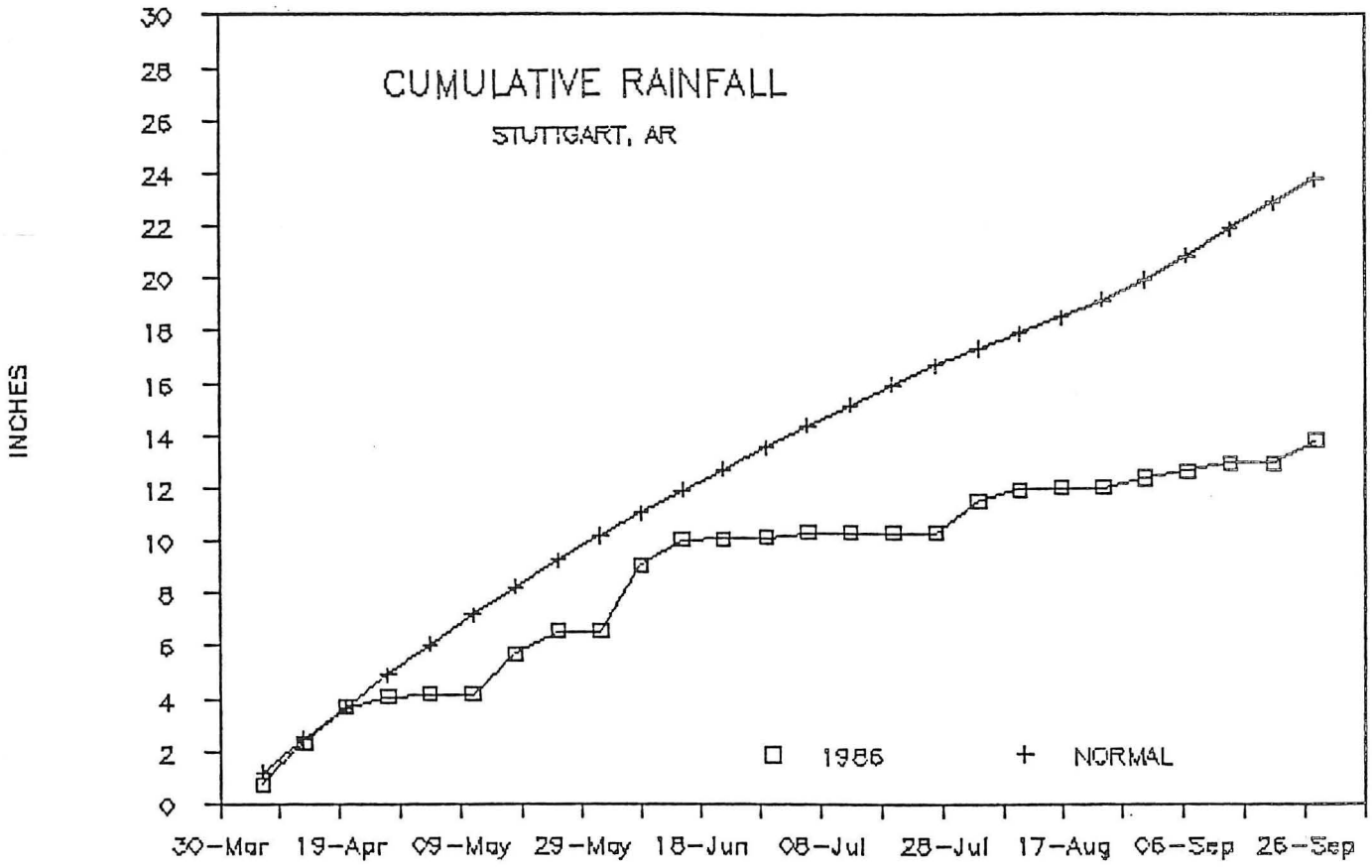


Fig. 5b. Cumulative actual and normal rainfall for Stuttgart, AR.

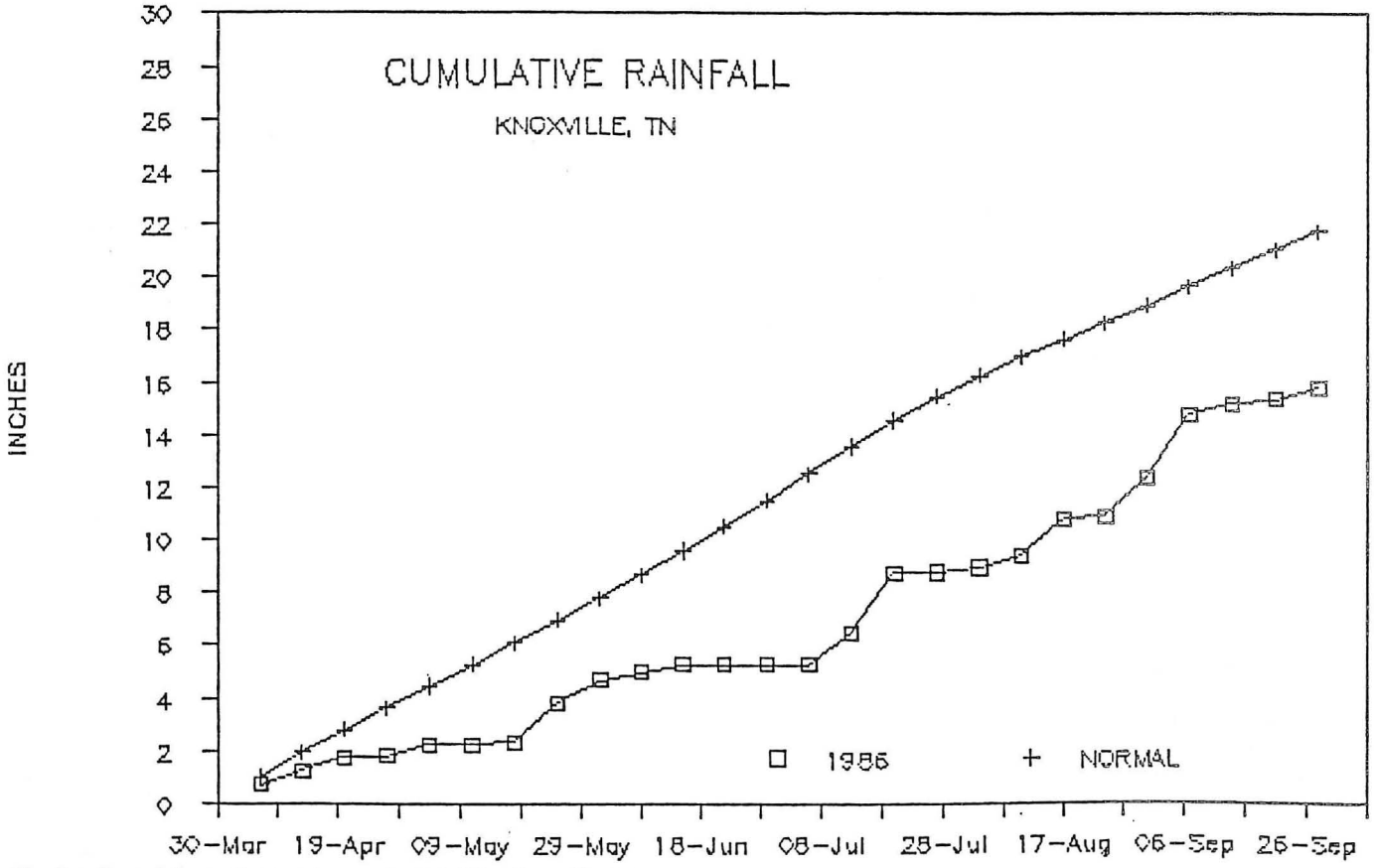


Fig. 5c. Cumulative actual and normal rainfall for Knoxville, TN.

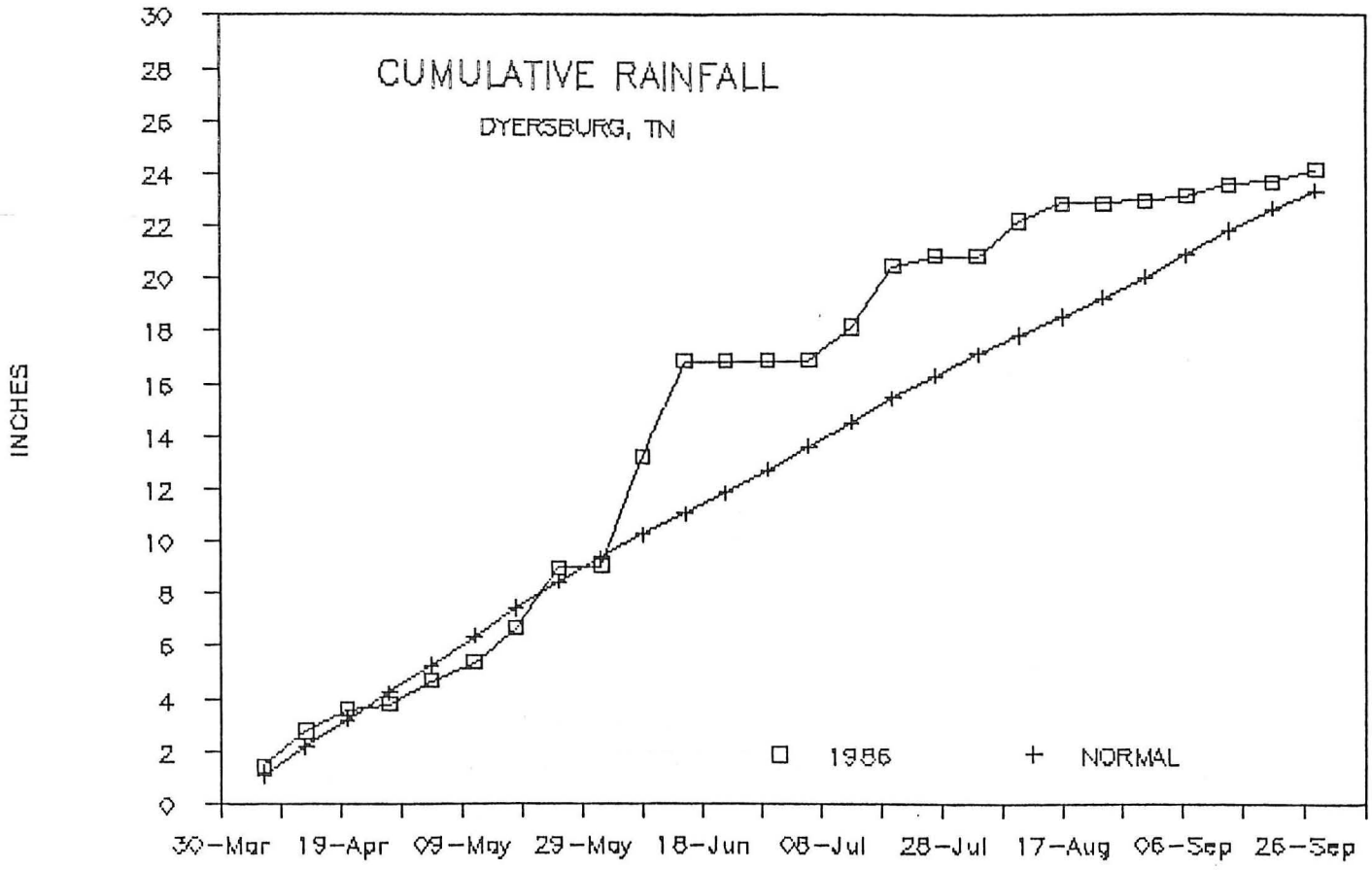


Fig. 5d. Cumulative actual and normal rainfall for Dyersburg, TN.

hot and dry weather proved critical since cotton and soybeans were most susceptible to drought conditions when these conditions actually occurred. This resulted in a small pod set for soybeans and square and boll droppage, reduced boll size, and a lower than normal percent lint for cotton.

Poultry were also stressed resulting in deaths, decreased weights, and reduced reproductive efficiency. Figs. 8a and 8b presents the actual and normal maximum temperatures for Fayetteville, AR and Stoneville, MS. Fayetteville represents a portion of the poultry areas, although temperatures in other production areas in the Arkansas River Valley commonly averaged 5°F higher than Fayetteville. Stoneville temperatures are indicative of the crop areas in the Delta.

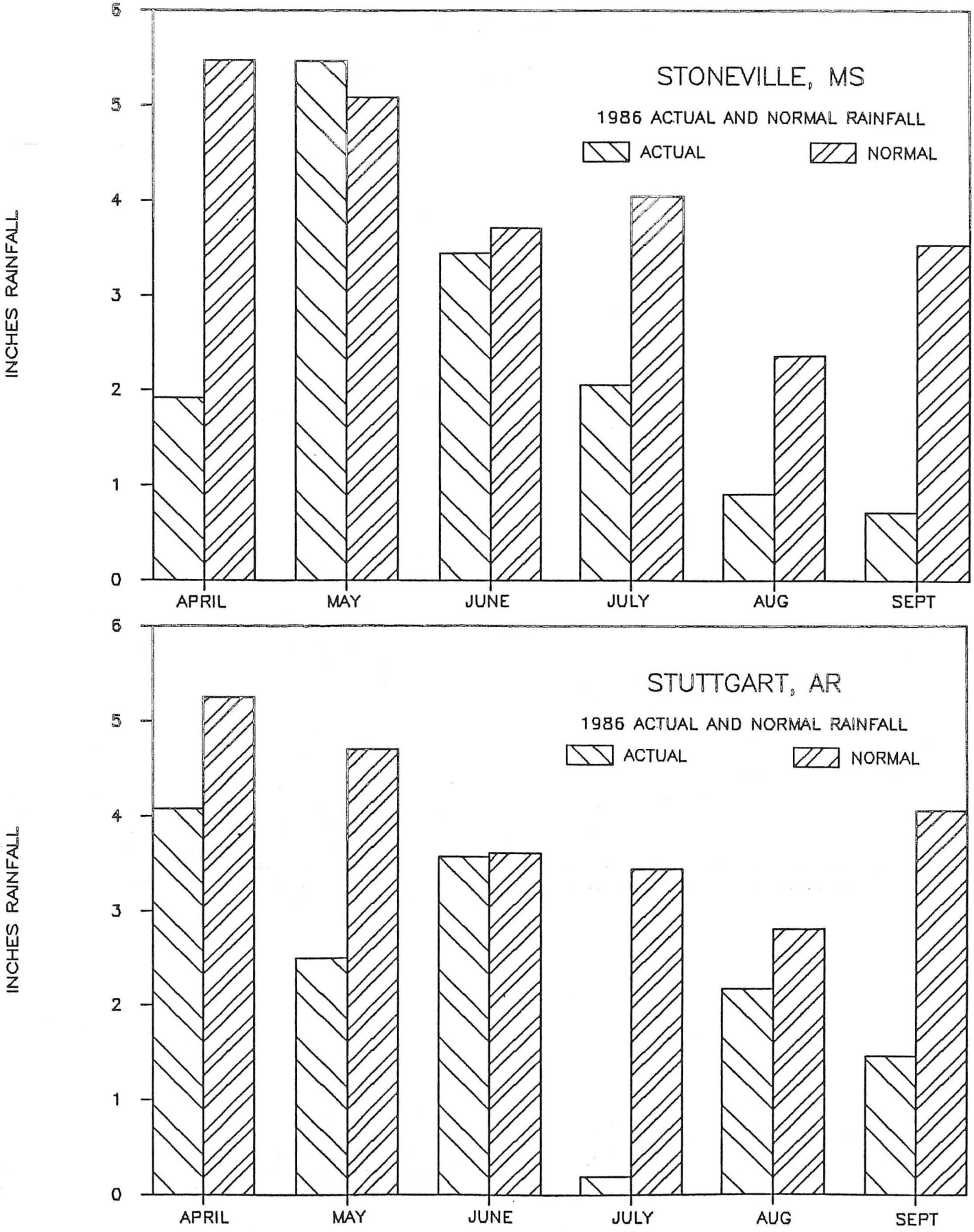
Poultry production is of major economic importance to agriculture in the Midsouth. Arkansas is the leading state in poultry production nationwide, and in 1986 poultry was the leading sector of agricultural income in both Arkansas and Mississippi (3, 4). Although exact dollar value and actual losses would not be released by the poultry industry in Arkansas, poultry losses were estimated to be quite significant based on observations from extension experts (3). In Mississippi, poultry losses totaled a half million broilers and over fifty thousand breeding hens (4).

Meteorological factors leading to the drought are discussed by Bergman et al. (11). They noted that during the late spring and early summer, a long-wave trough persisted in the upper westerlies off the East Coast near 65° W, and an upper level anticyclone developed over the Southeastern United States. This led to an increased tendency for the Bermuda-Azores surface high pressure system to extend farther west than normal, producing an unusually dry and stable weather pattern in the Midsouth.

3. SUMMARY

Decreased agricultural production in the Midsouth in 1986 resulted primarily because of weather. An unusually dry winter failed to fully replenish soil moisture supplies as is typical in most years. Dry weather continued through the summer, especially in July and August. In addition, a mid-summer heat wave acted to further increase the seriousness of the water shortage.

A persistent and strong upper level ridge over the Southeastern United States during July and August was, to a great extent, responsible for producing the agricultural drought in the Midsouth, in association with the vulnerability to water stress of cotton and soybeans during this period and the short-fall of winter precipitation.



Figs. 6a, b. Actual and normal rainfall by month during the crop season for Stoneville, MS (a) and Stuttgart, AR (b).

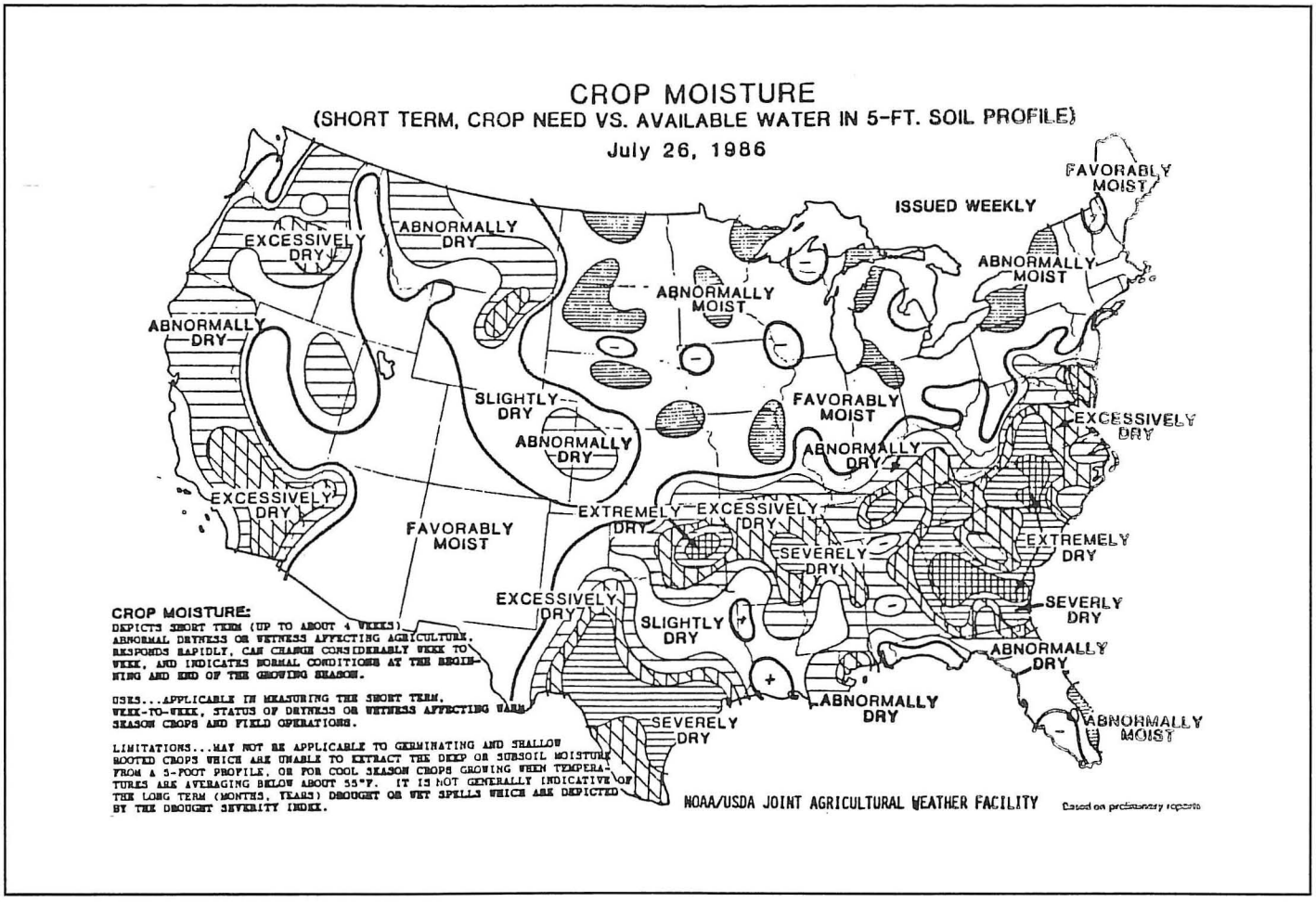


Fig. 7. The Crop Moisture Index for July 26, 1986 (10).

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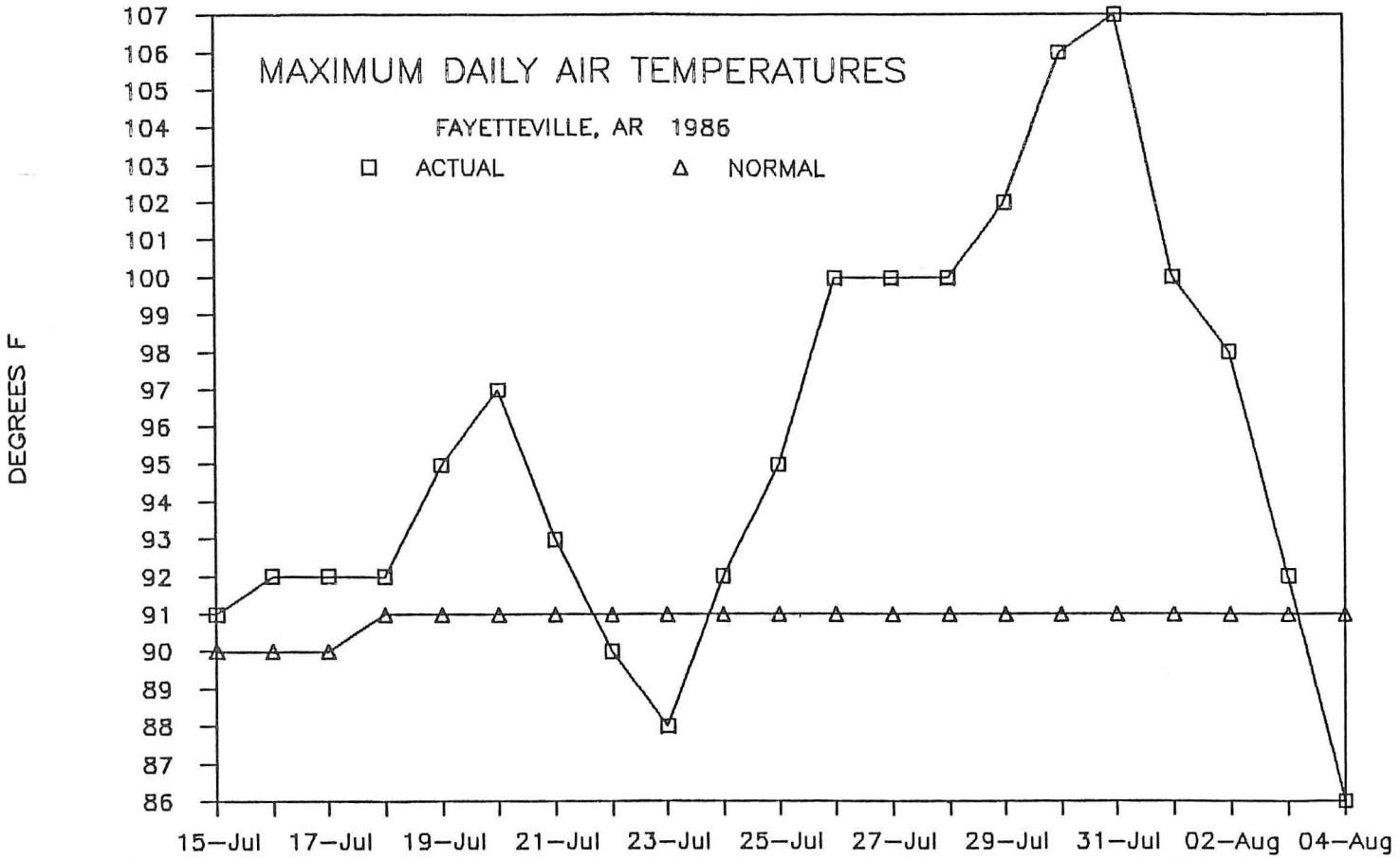

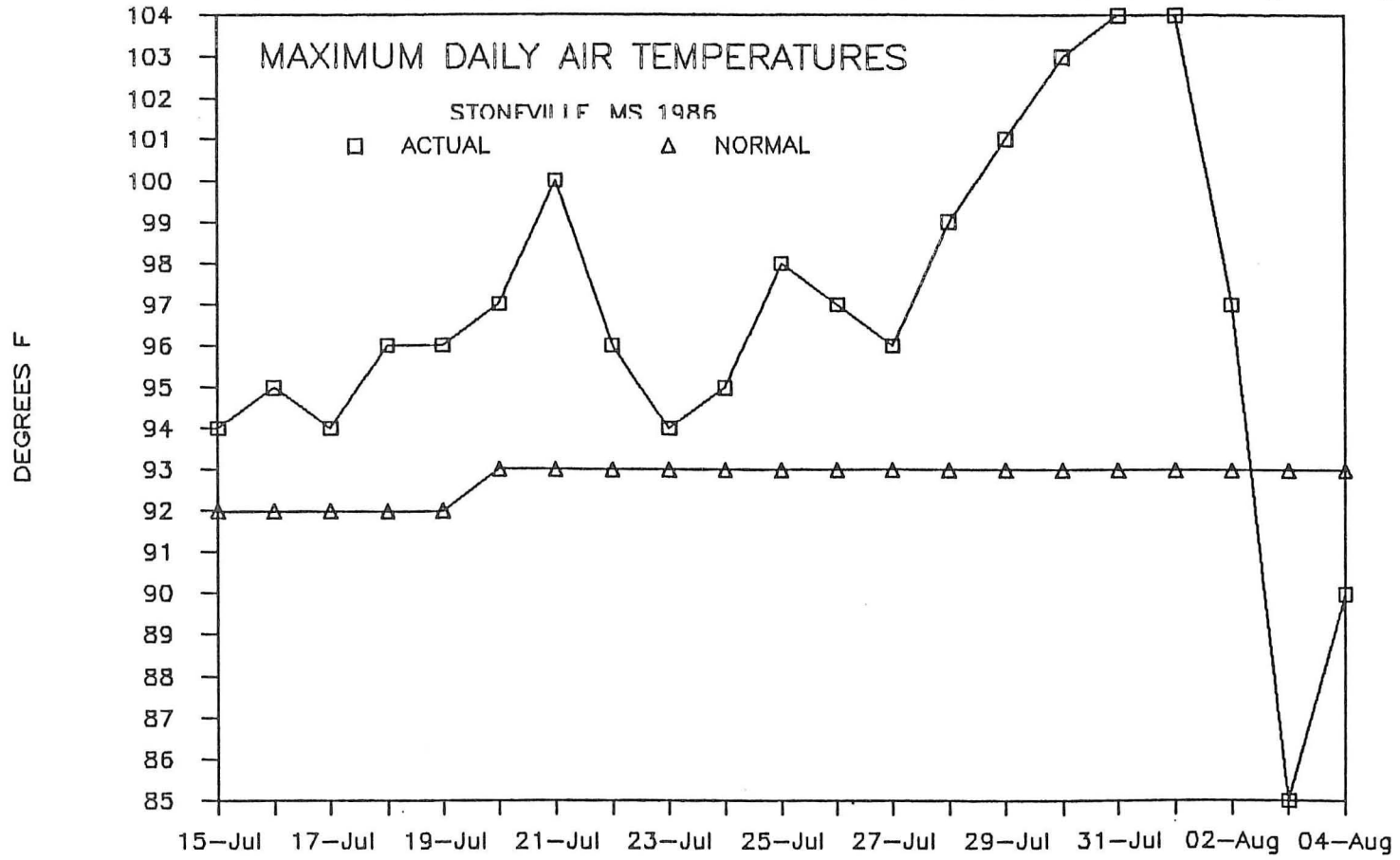

Fig. 8a, b. Maximum average and normal temperatures during mid-July to early August for Fayetteville, AR (a) and Stoneville, MS (b).

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NOTES AND REFERENCES

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2. United States Department of Agriculture, Agricultural Statistics Service for Arkansas, Louisiana, Mississippi and Tennessee. Personal communication.

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