CLIMATIC FACTORS INVOLVED IN EARLY PLANTING OF COTTON

Where the growing season for cotton is short, it is important that the crop be planted as soon as good germination can be assured.

Under laboratory conditions, Arndt (1945) showed that the minimum temperature at which cotton germinated was 64°F, while optimum early growth occurred at temperatures between 91°F and 97°F. Under field conditions, considerable fluctuations in soil temperature occur, so arbitrary standards are set up which help determine temperature conditions necessary for good germination. Several criteria are available. Thurmond, Box, and Elliott (1958) suggested that for best results the minimum soil temperature at a depth of 8 in. should not be lower than 60°F during any 24-hr period for 10 days preceding planting. A less exacting requirement was suggested by Cardozier (1957), who recommended that minimum daily soil temperature at the 6 in. level should be at least 65°F for 4 or 5 days. The minimum for the day at that depth occurs at about 7 a.m.

Bygott (1961) has shown that early planting of cotton on the southern Darling Downs in south-eastern Queensland is necessary to ensure good yields, but that even if adequate soil moisture is present very early plantings are excluded because of low soil temperatures.

Work is now proceeding at the Hermitage Research Station to determine soil temperatures necessary to give adequate germination and emergence of cotton for the southern Darling Downs area. Soil temperatures are being taken in 2 in. increments to the 12 in. level at 7.45 a.m. and 9 a.m.

In anticipation of recommendations in this regard, a study has been made of other climatic data available for Hermitage. It seems desirable to try to relate soil temperature data to some factor more readily available from most weather recording stations.

Weekly means of daily 4-in. earth temperatures recorded at 9 a.m. and of daily mean screen temperatures were examined for the 7-year period 1954-1960. An extremely close relationship was found to exist between the two factors over the 7-year period (see Figure 1). A correlation coefficient of $r=0\cdot998$ was obtained between the 4 in. soil temperature at 9 a.m. and daily mean screen temperature.

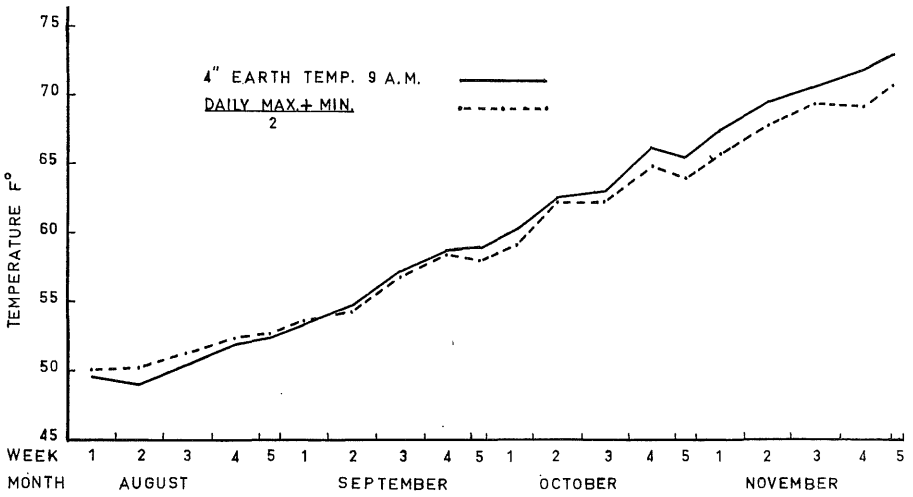

Fig. 1.—Relation between soil temperature and daily mean screen temperature at Hermitage Research Station.

Weekly differences from year to year between the two factors are set out in Table 1.

It is obvious that if 4-in. soil temperature read at 9 a.m. can be used to forecast the planting date for cotton at Hermitage, then the mean of screen maximum and minimum temperatures will be equally effective.

To see if the relationships held true for the main cotton-growing centre in Queensland, data from Biloela Research Station in Central Queensland were examined. A positive relationship was found to exist but it was necessary to apply corrections depending on the time of year under consideration. In early August, 4-in. soil temperature at 9 a.m. was identical with the mean of screen maximum and minimum temperatures. By late November the mean temperature difference between the two factors was 10°F.

Acknowledgement is made to the Biometrics Branch for assistance in examining the data presented.

TABLE 1

COMPARISON OF 9 A.M. EARTH TEMPERATURE AT 4 IN. AND DAILY MEAN SCREEN TEMPERATURE, HERMITAGE RESEARCH STATION

(Number of Degrees (F) by which Earth Temperature Exceeds $\frac{\text{screen maximum} + \text{screen minimum}}{2}$)

Year	Month and Week																			
	August					September					October					November				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1954	2	0	−2	−4	0	1	1	1	0	−1	0	−2	2	3	4	1	2	0	4	0
1955	−1	−3	−2	0	0	−1	−1	−1	−1	−4	0	0	−1	0	2	3	1	−2	4	2
1956	−1	−2	−1	1	−2	−1	0	−1	1	1	1	−1	1	0	4	2	1	0	−2	3
1957	−2	−2	−4	−1	−2	0	0	2	−2	3	4	0	−3	1	2	−2	5	2	2	2
1958	−1	−1	0	0	0	0	1	3	2	1	−1	2	4	4	1	2	0	7	3	1
1959	0	−2	3	1	2	0	0	−1	1	5	1	2	2	2	−2	2	2	1	6	4
1960	1	2	−1	1	1	0	2	0	1	1	2	−1	1	2	0	5	0	1	2	3
Mean	0·3	−1·3	−1·0	−0·3	−0·1	−0·1	+0·4	+0·4	0·3	0·9	1·0	0·1	0·9	1·7	1·6	1·9	1·6	1·3	2·7	2·1
S.D.	1·28	1·58	2·00	1·67	1·36	0·64	0·91	1·54	1·29	2·75	1·78	1·25	2·24	2·25	2·49	2·65	2·18	2·87	3·51	2·42

REFERENCES

ARNDT, C. H. (1945).—Temperature-growth relations of the roots and hypocotyls of cotton seedlings. *Plant Physiol.* 20: 200-25.

BYGOTT, R. B. (1961).—Brighter prospects for southern Downs cotton. *Qd Agric. J.* 87:743-8.

CARDOZIER, V. R. (1957).—"Growing Cotton". (McGraw Hill: New York).

THURMOND, R. V., BOX J., and ELLIOTT, E. C. (1958).—Texas guide for growing irrigated cotton. Bull. Texas Agric. Exp. Sta. No. 896.

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