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COTTON TEMPERATURE AND REFLECTANCE AS RELATED TO DRIP IRRIGATION MANAGEMENT

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A field study was performed to determine the effects of drip irrigation management on the temperature and reflectance characteristics of cotton. The study was performed on an approximately five-acre commercial field owned by D. Nowlin near Stanfield, Arizona. Five irrigation schedules were used to deliver differential irrigation treatments to field subplots (four subplots/treatments) during an interval from 22 July to about 25 August, 1983. Four of these schedules were based upon a percentage of the required consumptive use (CU) for drip irrigated cotton as estimated from Matthias et al. (1983). These were 100% x CU, 85% x CU, and 70% x CU applied daily; and 100% x CU applied on alternate days. The fifth schedule was the growers estimate of CU applied daily.

Measurements of mid-day canopy temperature were taken manually using an Everest Interscience Model 110 infrared thermometer (IRT). Measurements of mid-morning canopy reflectance were also taken manually using an Exotech 100AX hand-

held radiometer equipped with four thematic mapper channels. Radiometer and IRT data were both collected at about 10m intervals along one cotton row of each subplot. Data were logged with an Omnidata Polycorder. Pressure chamber measurements of leaf water potential were made August 6 and August 20 on the fourth leaf of selected plants.

Canopy temperature was found, on average, to be highest in the 70% x CU treatment. This is shown in Table 1, which shows average temperatures for the five treatments on four dates. Differences in temperature among treatments were generally small. This was consistent with the relatively uniform leaf water potentials measured on August 6 (Table 3), which indicated only mild drought stress in the cotton on that date.

Table 1. Mid-day average cotton canopy temperatures for five irrigation treatments and four dates in 1983.

	Canopy temperature* Irrigation treatment				
Date	100% CU	85% CU	70% CU	Alternate-day 100% CU	Grower CU
			°C		
26 July	30.88	31.93	33.35	31.51	31.39
29 July	30.74	31.14	31.31	30.94	30.21
2 Aug	31.97	32.65	32.24	32.47	31.73
6 Aug	32.33	32.84	33.18	32.59	31.73
Average	31.48	32.14	32.33	31.88	31.28

*Each value is an average of about 80 readings.

Table 2. Average infrared/red ratios using ratiant exitance values from cotton canopy.

	Infrared/red ratio* Irrigation treatment				
Date	100% CU	85% CU	70% CU	Alternate-day 100% CU	Grower CU
26 July	21.957	20.666	20.487	22.497	20.597
29 July	20.781	19.689	21.323	22.646	20.884
2 Aug	20.448	19.828	20.981	22.518	21.745
6 Aug	21.710	23.124	21.814	20.143	24.589
20 Aug	16.192	16.604	14.480	15.756	17.152
Average	20.218	19.982	19.817	20.711	20.993

*Each ratio is an average of about 80 individual ratios.

Table 3. Average leaf water potentials at mid-day on 6 August and 20 August 1983.

Date	Leaf water potential* Irrigation treatment				
	100% CU	85% CU	70% CU	Alternate-day 100% CU	Grower CU
	Bars				
6 Aug	-16.6	-16.6	-16.2	-15.2	-16.1
20 Aug	-17.1	-20.1	-23.4	-19.9	-21.4

*Each value is an average of four readings.

The spectral reflectance data were processed by ratioing the radiant exitance (Wcm^{-2}) of channel 4 (760 - 900 nm) to the radiant exitance of channel 3 (630 - 690 mm). Ratioing of these two channels (4:3, or infrared:red) was selected because of much previous research indicating this ratio to be sensitive to stress symptoms in plants. Generally, the lower the ratio the greater the stress symptoms. This is shown in Table 2, which shows average infrared/red ratios for the five treatments on five dates. It is interesting to note the generally low ratios on 20 August. This corresponds well with the lower water potentials observed on that date (Table 3), which indicated stress symptoms in the cotton.

Further detailed analysis is needed to adequately characterize the spatial and temporal variations of temperature and reflectance observed within the treatments. However, preliminary analysis does indicate that these types of measurements do hold promise for aiding in drip irrigation management in cotton.

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TRICKLE AND LEVEL BASIN IRRIGATION FOR 1983 COTTON AT THE MARICOPA AGRICULTURAL CENTER

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The objective of the 1983 study was to determine the effects of irrigation water placement and frequency on cotton production for trickle and level-basin irrigation methods under optimum moisture conditions.