Notes

A FIELD TEST OF THE CONTROL OF COTTON IRRIGATION PRACTICE FROM CLASS A PAN DATA

By

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A simple field test was made at three sites to compare the yield, water application and evapotranspiration of cotton crops irrigated according to the measured water loss from nearby Class A evaporation pans and from conventional gravimetric soil moisture determinations. Both methods gave similar results but the equipment and labor required to determine the water requirement by the meteorological method was approximately one eighth of that needed for the standard soil moisture sampling method.

In an earlier paper (1) the results were given of an investigation into the relationship between the water loss from commercial crops of cotton receiving near-optimum irrigation treatments and Class A evaporation pans sited upwind of the irrigated fields.

It was concluded from the results obtained that, during the season of irrigation application, the two water losses were linearly related and that the slope of the relationship was reasonably constant throughout the wide range of climatic, soil and irrigation and plant factors examined. It was suggested that, in the period following the first irrigation, this relationship could be exploited for the control of field irrigation practice and should give results as accurate as present conventional methods of soil moisture assessment, with considerably less expenditure of time and labor.

The results of a simple field experiment to test these suppositions are given in this paper.

When comparing methods of irrigation control designed for large-scale field applications, it is necessary to work with plots of similar size to avoid edge or oasis effects which can give values of evapotranspiration very different from those measured in conventional-size experimental plots. For this reason it was not possible to use the normal experimental layout with replicated, randomly situated plots, and to establish the statistical significance of the results.

The method adopted in this experiment was to select a long narrow strip approximately 24 dunams*** in area within a large commercial field of cotton receiving its recommended irrigation treatment. The experimental plot was of the same length as the irrigation line (500 m) and was the width covered by three irrigation lines (48 m). It was situated within the central part of the field, and irrigated according to the amount of evaporation from a screened Class A pan sited upwind of the field, using the relationship found previously between the two water losses. More specifically, the amount of water to be applied at each irrigation after the first (which was approximately 60 days after sowing) was obtained by multiplying the amount of evaporation (measured from the date of the previous irrigation) by 0.69, and adding 20% to the product to allow for irrigation efficiency.

The remaining part of the field was irrigated in accordance with the results of gravimetric soil moisture sampling carried out by, and following the standard practice of, the Agricultural Extension Service.

Yields and water application were measured in the strip irrigated according to the Class A pan data, and also in a similar adjacent strip irrigated according to standard practice; both plots were irrigated at the same time.

Within the standard treatment area very intensive soil moisture sampling (10 replicate cores extracted to the full depth of soil moisture extraction, at 5-day intervals) enabled the evapotranspiration of this plot to be determined accurately ($\pm$ 8%) and to be compared with the water loss from the adjacent Class A pan.

The tests were carried out at the settlements

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*** 1 dunam = 1000 m² = approx. 1/4 acre.

of Lavi, Sarid and Nahal Oz, representative of the three main climatic regions in which cotton is grown in Israel. Lavi is in the hot and dry Jordan Rift Valley; Sarid is representative of the inland valleys with their intermediate climate; and Nahal Oz is typical of the cooler and more humid climate of the coastal plain. The results obtained at these sites are given in Table 1.

TABLE 1

A COMPARISON OF COTTON YIELDS AND WATER APPLICATIONS FOR TWO METHODS OF IRRIGATION CONTROL

Site	Lavi		Sarid		Nahal Oz	
	35° 30′ E 32° 45′ N	−70m MSL	35° 16′ E 32° 39′ N	65m MSL	34° 29′ E 31° 28′ N	80m MSL
Control method	Class A pan	Soil sampling	Class A pan	Soil sampling	Class A pan	Soil sampling
Irrigation	*Water applied* (mm)					
1st	100	100	78	79	68	67
2nd	120	110	115	119	117	83
3rd	120	120	92	85	107	108
4th	150	130	74	60	82	95
5th	130	110	—	—	—	—
6th	80	80	—	—	—	—
Total	700	650	359	343	374	353
Yield (kg/du)	435	385	462	430	385	362

The general pattern of the results at the three sites shows that the plots irrigated according to the Class A pan data gave somewhat higher yields and also consumed somewhat higher amounts of water than those irrigated according to the sampling method. This is an illustration of the point that the 0.69 ratio, used to determine the near-optimum treatment, can be regarded only as an approximate, mean value. The variation of the crop: pan ratio found in Israel was discussed in (1).

No seasonal trend was apparent in the differences between the amounts of water applied at each irrigation for the two treatments.

Data on evapotranspiration as measured by changes in soil moisture content, and on its relationship to Class A pan evaporation losses for the plots receiving the standard near-optimum irrigation treatment, are given in Table 2.

TABLE 2

SEASONAL EVAPOTRANSPIRATION FROM COTTON PLOTS RECEIVING STANDARD IRRIGATION TREATMENT, AND THE EVAPOTRANSPIRATION-TO-EVAPORATION RATIO DURING THE IRRIGATION SEASON

Site		Lavi	Sarid	Nahal Oz	*Mean*
Seasonal evapotranspiration	Average (mm)	840	750	597	—
	Coefficient of variation (%)	11.9	8.0	4.5	8.1
Evapotranspiration-to-evaporation ratio	Average	0.71	0.74	0.63	0.69
	Coefficient of variation (%)	9.5	10.3	7.6	9.1

The mean of the evapotranspiration-to-evaporation ratio is the same as that obtained during previous years' work (1). Also, the absolute values of the water requirements at the three sites are in excellent agreement with the respective long-term average values obtained from the previously

published map of seasonal water requirements for cotton (1), which was based on Class A evaporation data.

The gravimetric soil moisture sampling required approximately eight times the labor needed for the maintenance of the Class A evaporation pan; the cost of the necessary equipment for the two methods was in approximately the same ratio (2).

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