Responses of four cotton cultivars to irrigation in a Mediterranean environment

Orgaz F., Mateos L., Fereres E.

in

Braud M. (ed.), Campagne P. (ed.).
Le coton en Méditerranée et au Moyen-Orient

Montpellier : CIHEAM
Options Méditerranéennes : Série Etudes; n. 1988-I

1988
pages 201-202

Atelier : "irrigation"

Responses of four cotton cultivars to irrigation in a mediterranean environment

F. ORGAZ, L. MATEOS, E. FERERES

SIA and University of Cordoba, Junta de Andalucia

Four cotton genotypes of diverse origin were evaluated for their responses to irrigation at Cordoba, Spain, using a line source sprinkler system (Hanks et al, 1980). The cultivars evaluated were : Coker 310 which is the variety most commonly used in Spain, Jaen which is a locally developed variety of Greek-Russian origin, and two Acala types recently developed in California (USA).

The experiment was conducted on an alluvial sandy loam soil with rows 75 cm apart at a plant population of 100,000 plants/ha. Individual plots were two rows 8 m long with each genotype replicated four times.

Irrigation timing was determined using a pressure chamber. Water was applied every time midday leaf water potential of plants near the sprinkler line source reached a value of -16 bars (Grimes & Yamada, 1982). On that basis, irrigation interval was 7 to 12 days depending on the evaporative demand.

Results and discussion

Figure 1 presents the water applied and the evapotranspiration (ET) as a function of distance to the line source. The difference between both lines indicates the depths of water extracted by the crop from the soil profile. There were no detectable differences among genotypes.

Figure 2 shows the response of biomass production to increases in ET. Aboveground biomass increased linearly as ET was augmented by the depth of irrigation water applied. The rate of change in biomass appeared to be greater for the Jaen and Acalas as for the Coker variety.

Earliness is an important characteristic of mediterranean cotton which can be manipulated through irrigation. To evaluate the differential response, Figure 3 shows the percentage of total yield which was harvested by October as a function of water use (ET). As can be seen, water deficits increased earliness in all cultivars, althrough Jaen was earlier than all others at any ET level.

Crop yield in cotton is determined by the proportion of biomass that is partitioned to fruiting bodies. Such proportion, defined agronomically as harvest index (HI), has been known to be affected by irrigation management. Figure 4 shows that it is also genotype dependent. Coker HI increased as ET deficits increased to an optimum level corresponding to about 625 mm of seasonal ET. All other three genotypes behaved differently exhibiting only minor changes in HI with variations in ET. Such responses influence the yield responses to water deficits shown in Figure 5. Seed yield decreased linearly as ET deficits were imposed for Jaen and both Acala varieties. Absolute seed yield was higher in Jaen for any ET level. Coker seed yield, however, stayed constant as ET decreased up to 600 mm, then declining with decreases in ET levels.

It is tentatively concluded that irrigation management is an effective tool to manipulate earliness in cotton. Yield responses to water deficits exhibited an optimum yield level at moderate water deficits for the cultivar Coker 310 while it showed a maximum yield for Jaen and Acalas at maximum irrigation applications. Finally, modern Acala genotypes,of determinate growth habit, mature at about the same time as the standard genotype variety (Coker 310) commonly used in Andalucia.

References

Gimes D.W. and Yamada H., 1982.
Relation of cotton growth and yield to minimum leaf water potential. *Crop Sci. 22* : 134-139.

Hanks R.J., Sisson D.V., Hurst R.L. and Hubbard K.G., 1980.
Statistical analysis of results from irrigation experiments using the line-source sprinkler system.
Soil Sci. Soc. Am. J. 44 : 886-888.

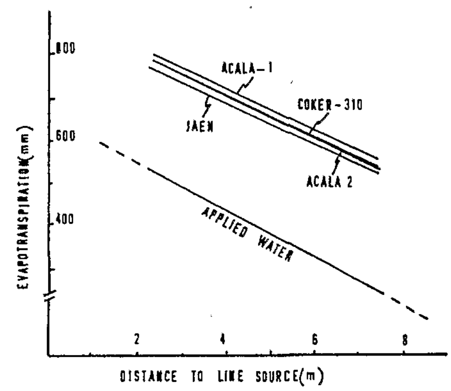

Figure 1 : Applied water and evapotranspiration as a function of distance to the sprinkler line source

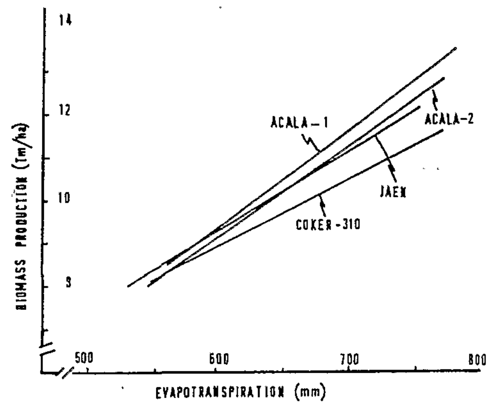

Figure 2 : Response of biomass production to increase in evapotranspiration

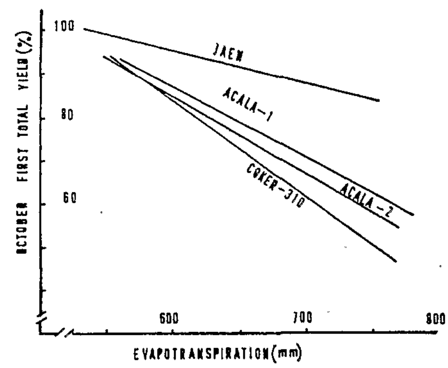

Figure 3 : Percentage of total yield which was harvested by October as a funtion of evapotranspiration

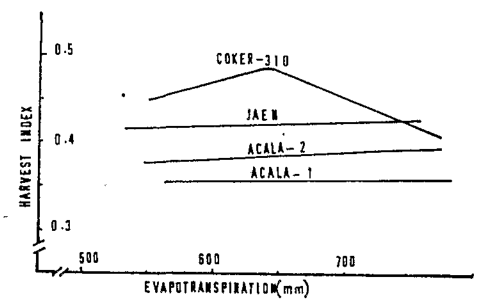

Figure 4 : Harvest index as a function of evapotranspiration

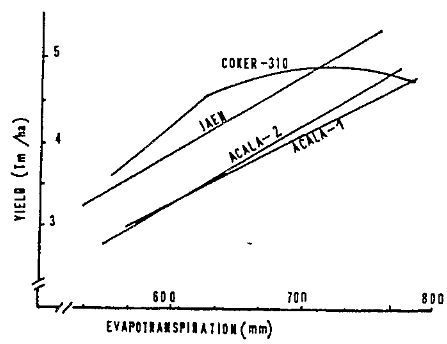

Figure 5 : Yield response to water deficits