IRRIGATING COTTON WITH A LIMITED WATER SUPPLY

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Because water allotments have been dramatically reduced this year, we will review principles of water management with limited supply. The same topic is reviewed in California Cotton Review, Vol. 9, March 1989. For additional information see "Late Season Irrigation Management Recommendations" in Vol. 60, Aug 2001 available at http://cottoninfo.ucdavis.edu

STRETCHING THE WATER SUPPLY!

Variety Selection. A more determinant type of cotton plant will require less water than an indeterminate type. A general observation is that determinate Acala varieties experienced the most sensitivity to the timing of water stress with yields severely declining when sustained water stress levels below –22 bars occurred shortly after crop cutout. Moderately indeterminate to indeterminate varieties were affected least by exposure to late season water stress imposed during the period between cutout and last mature boll. Limited information is available on how a specific newer variety responds to water stress conditions.

Irrigation Timing. During seasons with water shortages, production can be better sustained by consistent management allowing only moderate stress through boll maturity and avoiding periods of severe stress. Crop growth from emergence to peak bloom (mid July) is most sensitive to water stress. Consequently, timing of the first and for some soils, the second crop irrigations are most important. Irrigate to protect the early season fruit from water stress and dropping. This will avoid delayed crop maturity and increased late season water usage.

A valuable tool to assist is controlling water stress is the pressure chamber. The pressure chamber provides a direct measurement of plant water stress and can be used in several fields to prioritize the need for irrigations in each field. If you have access to a pressure chamber, it is recommended for SJ-2 during drought conditions that irrigation be applied when the pressure chamber reading is 18 bars. This practice should be continued through July. Measurements of 20 bars can be tolerated in August and still fully mature the fiber.

Applying Water Efficiently. A key to successfully managing a water-short season is controlling the amount and uniformity of applied water by the furrow irrigation system. Candidates for poor uniformity, and thus substantial water losses past the root zone include fields with sandy or loamy soils, one-half mile run lengths, and large advance times (time required for water to reach the end of the field). Under these conditions, much water can infiltrate below the root zone, which is undesirable, particularly when the water supply is limited.

The uniformity of furrow systems can be improved by getting the water to the end of the field faster. Particular emphasis should be placed on preirrigations and first crop irrigations, where soil intake rates are the highest. Measures to improve the uniformity of a furrow irrigated field, and thus stretch a limited water supply by reducing deep percolation losses, include the following:

- Reduce the run length and the set time by one-half. Under adequate irrigation conditions, this measure can reduce the deep percolation by at least 50 percent. Do not reduce furrow flowrates to less than that normally used.
- Convert to surge irrigation. This has the potential of reducing deep percolation by 30 to 40 percent.
- Improve slope uniformity. Flat spots in the field can greatly increase the time required for water to reach the end of the field. An evaluation of a furrow irrigated field with flat areas revealed that about three hours were required for the water to flow about 150 feet in the flat areas compared to about 45 minutes in the sloped areas.
- Reuse the tailwater. The above measures can increase the amount of tailwater. Thus, stretching a limited water supply will require recovery of the tailwater for use elsewhere.

A measure commonly recommended for improving uniformity of furrow systems is to increase the furrow inflow rate. Studies, however, have shown that this is not very effective for furrow irrigation. Increasing the inflow rate does advance the water faster across the field, but at the same time, higher infiltration rates occur because more surface area of the furrow is wetted. These higher infiltration rates offset the effect of the faster advance on the irrigation uniformity.