drought tips

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Furrow Irrigation

Efficient furrow irrigation requires reducing deep percolation and surface runoff losses. Water that percolates below the root zone (deep percolation) is lost to crop production, although deep percolation may be necessary to control salinity. Deep percolation can be reduced by improving the evenness of the applied water and preventing overirrigation. Surface runoff can be captured with a tailwater recovery system and used on lower-lying lands or recirculated on the field being irrigated.

Uniformity of Infiltrated Water
One way to reduce deep percolation losses is to apply water more evenly throughout the field. The greater the evenness or uniformity, the greater the potential for reducing deep percolation. The uniformity of infiltrated water is measured by the distribution uniformity-an index of the evenness of the applied water.

In furrow irrigation systems, uniformity depends on the time required for water to flow across the field (the advance time), the irrigation set time, and the variability of the soil. Because of the advance time, more water infiltrates at the upper end of the field (the beginning of the furrow) than at the lower end (the end of the furrow), resulting in nonuniform infiltration.

Uniformity can be improved by getting the water to the end of the field faster—that is, by decreasing the advance time. The methods recommended for decreasing the advance time are as follows:

1. Reducing the run length by half. This is effective for field lengths of 1,000 feet or longer. The set time must then be reduced by at least half to prevent over irrigation. This can reduce deep percolation by at least 50 percent.

2. Increasing the furrow inflow rate. The set time must be reduced by an amount equal to the difference between the old and new advance times. This measure may not be effective on cracking soils.

3. Improving slope uniformity. Grade reversals and excessive undulation can increase advance times. Laser grading can greatly reduce slope nonuniformity.

4. Using furrow torpedoes to smooth the furrow surface and to compact the soil surface. Torpedoes may have little effect on cracking clay soils.

Since these methods will increase surface runoff, tailwater recovery systems must be used to recirculate the tailwater either onto the field being irrigated or for use elsewhere. If the tailwater is recirculated, additional furrows should be irrigated in order to stretch limited water supplies.

Tailwater can also be reduced through "cutback irrigation," in which the furrow flow rate is decreased once the advance is completed.

Estimating Uniformity
The uniformity of a furrow irrigation system can be quickly estimated by calculating the advance ratio, defined as the irrigation set time minus the on-time divided by the advance time. The following guidelines can be used to estimate the distribution uniformity from the advance ratio:

Sandy Soils/Sandy Loam Soils (Cultivated Prior to Irrigation)

Advance Ratio	Distribution Uniformity
1.0-1.5	less than 60% (poor)
1.5-2.0	at least 75 - 80%
2.5-3.0	at least 80 - 85%
4.0-	at least 90%

Loams/Clay Loam Soil (Cultivated Prior to Irrigation)

Advance Ratio	Distribution Uniformity
1.0-1.25	less than 70% (poor)
1.5-2.0	at least 80 - 85%
2.5-3.0	at least 90%

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Alternate Furrow Irrigation
Alternate furrow irrigation consists of irrigating every other furrow. This may not affect uniformity, but will reduce the average amount of applied water per acre. The furrow flow rate should be at least equal to the normal flow rate to maintain uniformity.

Surge Irrigation
Surge irrigation means cycling water on and off while the water advances. This cycling or surging reduces the soil infiltration rate to less than that which would occur under conventional furrow irrigation. Under surge irrigation, at least 30 percent to 40 percent less water is required for complete advance across the field. A surge valve is used to cycle the irrigation water.

Surge irrigation is particularly effective in coarse soils, but may have little effect in clay soils.

Following are some factors to consider in using surge irrigation:

1. Four to six cycles are recommended during water advance.

2. On-times should equal off-times.

3. The initial on-time can be estimated by dividing the normal advance time by 8 for field lengths of about one-quarter mile, and by 12 for one-half mile field lengths.

4. The furrow flow rate should be at least equal to the normal furrow flow rate.

5. During the runoff stage, on-time must be kept short (10 to 20 minutes) to prevent excessive runoff.

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