drought tips

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Leaching Under Saline Shallow Water Tables

The historical approach to estimating the leaching fraction and leaching requirement assumes that salt in the irrigation water is the sole contributor to root zone salinity. In areas with saline shallow water tables, however, shallow groundwater may contribute substantially to crop water use. This is particularly true for many field crops, such as cotton, safflower, and alfalfa. Since the salinity of this water is normally much higher than that of the irrigation water, use of the groundwater can cause a significant increase in soil salinity compared to using only irrigation water. The traditional procedures for estimating the leaching fraction and requirement, therefore, may underestimate the leaching fraction. Use of these procedures will underestimate the leaching requirement.

Unfortunately, no method exists for correcting the traditional procedures to adjust for the effect of shallow groundwater on soil salinity; however, a recent study estimated the leaching requirement by determining the amount of irrigation water needed for leaching during preirrigations. This is called the preirrigation reclamation method

Preirrigation Reclamation Method

Along the west side of the San Joaquin Valley, most of the leaching probably occurs during the preirrigation. Later in the irrigation season little or no leaching may occur because of the very low soil infiltration rates. During the cropping season, however, soil salinity increases because of the water table contribution to the crop evapotranspiration. Therefore, leaching during the preirrigation should be sufficient to prevent excessive soil salinity or to at least reduce the soil salinity down to the spring salinilty levels each year.

Where saline shallow water tables are present, it is important that leaching occur during the preirrigation. Little or no leaching is likely to occur during the crop irrigations because of the very low infiltration rates (which will not allow sufficient leaching), yet substantial increases in soil salinity can occur. If leaching does not occur during a preirrigation, soil salinity will continue to increase over time. Figure 1 shows that soil salinity increased in 1981 but, because of leaching during the 1982 preirrigation, 1982 soil salinity levels were similar to those of 1981. Figure 2 shows that soil salinity increased in 1982 because of the upward flow of groundwater; and, because no preirrigation was applied in 1983, soil salinity continued to increase.

An estimate of the amount of leaching water (water applied in excess of the soil moisture depletion) needed to reduce fall salinity levels to that of the spring was made using soil salinity levels from six field studies on groundwater use by crops and from the reclamation curve found in the Cooperative Extension leaflet, "Reclaiming Saline Soils." This reclamation curve shows the amount of leaching water needed per foot of soil leached versus the fraction of initial salinity desired. This analysis assumes that the spring salinity levels allow a maximum yield.

The studies showed that the amount of leaching depended on the amount of groundwater contribution to the crop's water needs. Where the contribution was high (50 to 60 percent), about 2.3 to 2.4 inches of leaching water was needed per foot of soil. Where the contribution was lower (30 to 40 percent), about one inch of leaching water was required per foot of soil leached. It is believed that the latter case is most typical of the San Joaquin Valley.

Conclusion

This analysis indicates that the preirrigation should replenish the soil moisture depletion and that about one inch of leaching water for each foot of soil to be leached should be applied. If the preirrigation soil moisture depletion is six inches and the total depth to be reclaimed is three feet, about nine inches of water should be applied for salinity control. and soil moisture replenishment.

The rule-of-thumb of one inch of leaching water per foot of soil is based on changes in soil salinity from groundwater contributions measured at six locations in the valley. Because site-specific conditions may affect results at other locations, a continuing program to monitor soil salinity is necessary to insure that adequate leaching is taking place.

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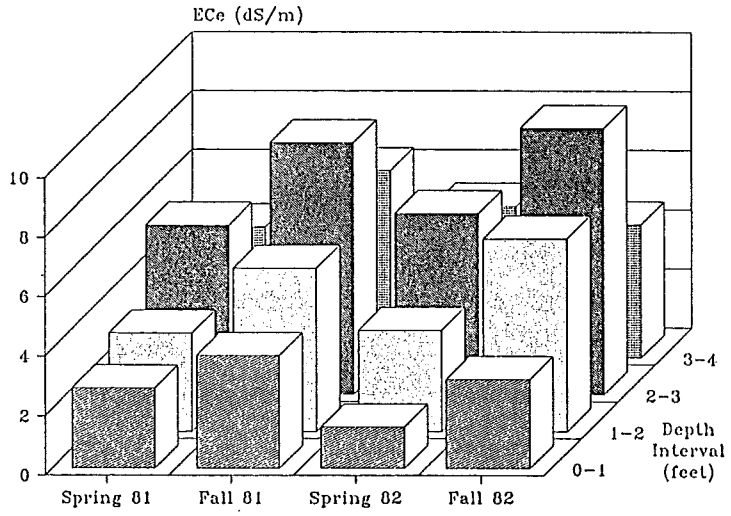

Figure 1. Effect of preirrigation on soil salinity

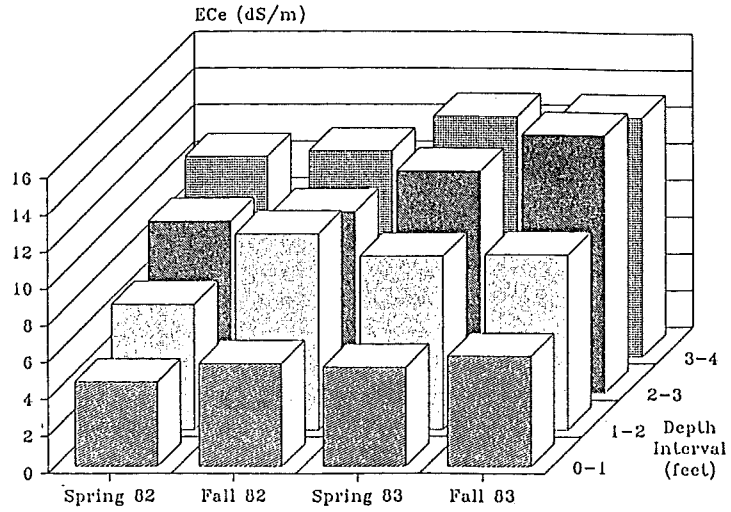

Figure 2. No preirrigation

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