

Improved Leaching Practices

SAVE WATER, REDUCE DRAINAGE PROBLEMS

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Soluble salts must be leached from the root zone of crops for irrigation agriculture to thrive. The amount of water required for leaching is determined by the manner in which the water and salt move through any soil. A common misconception is that the quantity of water needed to leach the soluble salts from soil depends primarily upon the amount of soluble salt in the soil. To obtain the desired leaching, it is often recommended that dikes be constructed around the salt infested area and water be ponded for extended periods of time.

Leaching may also be a natural process (by rainfall) or result from irrigation practices. In some cases irrigation water is applied for the specific purpose of leaching. In all cases, for salt to be removed from the root zone (neglecting plant use) water must pass beyond the root zone.

Irrigation water displaces the soil solution in an irregular manner. The applied water passes rapidly through the large pores, flushing out the salt, but the smaller pores, conducting water less rapidly, take much longer to flush clean. As long as water is ponded on the surface, it continues to be lost through the large pores—

Field studies conducted at Tule Lake provide striking evidence that ponding water is not always an efficient method of leaching. In some plots, as much as 6 acre-ft. of water per foot of soil depth was applied, yet the soil salinity was not reduced below one half of the original amount present. Of the six feet of water applied, the first one-half foot was responsible for the leaching obtained.

During the winter months, 4 inches of rainfall was recorded. In this case the soil salinity was reduced by one half again, yet the quantity of water involved was 18 times less. Irrigation techniques can also be used to produce similar results. Reasons for these effects involve consideration of the structure of the soil and the variation in the pore velocity. Similar results have been found in other parts of the world. Reclamation of soils inundated by the sea in the Netherlands flood disaster of 1953 was more efficiently carried out by rainfall than by ponding.

using up irrigation water and placing a greater burden on drainage requirements.

In many soils there are a great number of pores which do not conduct water. To remove salt from these pores, diffusion must take place. This process is time consuming and is not accelerated by the continuous loss of water through pores already flushed clear of salt under ponded conditions. The pore structure of the soil, the variation in the velocity of the water in the different pores and the diffusion of the salt are determining factors affecting the amount of water needed to leach a soil—with the actual amount of soluble salt in the soil being of secondary importance. Ponding water on the surface of the soil for extended periods of time not only results in a waste of water but is generally detrimental to the water-conducting properties of the surface layer—biological slime is formed, the soil structure breaks down and water movement ceases. In contrast, alternate wetting and drying is

beneficial because it helps maintain water intake rates.

Avoidance of ponding when water is applied to the surface of the soil has two obvious advantages. First, the larger pores never become saturated and therefore do not conduct large volumes of water. Water moves through the smaller pores and unsaturated larger pores at about the same rate, making the leaching process more efficient. Second, the soil surface is maintained in a more favorable condition for gaseous exchange and water penetration.

Conditions prevailing during rainfall can provide the same two advantages described above, offering an efficient method which should not be overlooked in a leaching program. Leaching by rainfall should not be compared equally with leaching by ponding, other conditions being equal.

Where ponding is the only available method for leaching, intermittent ponding should prove more efficient. This method provides for better mixing of the applied water and the soil solution by diffusion and reduces water loss through the large pores. Allowing short drying periods between ponding maintains a higher infiltration rate in the surface layer.

The more efficient the leaching process, the less water there will be to create a drainage problem. Pores flushed first will conduct the most water, thereby contributing most to the formation of a water table. Consequently, if leaching methods are improved, less natural or artificial drainage is required for removing salts. This fact makes possible the use of marginal lands which have water table problems and cannot be drained economically. Many soils can be farmed economically today only because they can be leached efficiently.

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