KINGS RIVER CONSERVATION DISTRICT

IRRIGATION NEWS

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Dealing With Infiltration Woes

Poor infiltration causes multiple problems, including standing water, increased runoff, and poor irrigation uniformity. A soil with infiltration problems can be reclaimed. The key is to understand what caused the problem in the first place and apply the appropriate corrective action.

How soil aggregates (large, tightly bound collections of soil particles) react to irrigation water depends upon the chemistry of the water itself. Dan Munk, the Water/Soil and Cotton Specialist at the University of California Cooperative Extension's Fresno office, says, "Soils have an inherent stability to them. The first few millimeters of the soil are the key. How the aggregates at the surface react to the chemistry of the water determines whether infiltration problems will occur. With the exception of very low clay content soils (less than 5 %), most soils have the opportunity to have infiltration problems depending upon the soil and water quality," says Munk.

Dan Munk UCCE Water, Soil, and Cotton Specialist, Fresno County

All naturally occurring water contains dissolved minerals. It is these minerals that allow water to conduct electricity, which when measured by specialized equipment returns a value called electrical conductivity (EC). The EC increases as the concentration of dissolved minerals increases. The most common minerals in irrigation water include calcium, magnesium, and, to a lesser degree, sodium in the form of dissolved salts. The use of water that has low EC or high sodium content will lead to infiltration problems.

Very pure water (low EC values) destabilizes soils by disrupting the electrical balance between the soil particles. Once the bridging properties of calcium and magnesium are restricted, the inherent negative charges in the soil particles cause them to separate and move with the water into the soil pore spaces, where they eventually clog the pore space and reduce infiltration. This condition is common to soils that use surface water supplies on the valley's east side.

Waters with high EC values have a stabilizing influence on soil structure, unless the water contains sodium-based salts or bicarbonates (common to well water on the westside). These materials destabilize soil aggregates by displacing and tying up the available calcium and magnesium within the soil, allowing the particles to disperse.

So what can a grower do? In low EC conditions, the addition of gypsum to the water supply slowly raises the EC and reduces the onset of soil crusting. "Gypsum is better applied in the spring and summer months, rather than the fall to reduce crust formation during the growing season," says Munk. Cover crops also stabilize the soil structure, thus improving infiltration.

Where bicarbonates are present, acidic materials are recommended to neutralize them before the naturally available calcium/magnesium is locked up. These chemicals also release available calcium from the soil, allowing for the displacement of any sodium within the root zone. Sodium is easily leached from the root zone, how to best do this is discussed on the back page.

Pump Test, Repair Money Available

The Center for Irrigation Technology, through a grant program from the California PUC, is offering money to cover the cost of pump testing and approved well repairs. All owners or users of agricultural electric accounts that pay the Public Goods Charge on their bill are eligible. The program is handled on a first come-first serve basis and available funds are limited.

Pump tests are performed by CIT approved testers, who handle all the necessary program paperwork. Tests are available for electric and natural gas powered pumping plants. Those with diesel powered pumps need to contact CIT to determine eligibility.

Incentives are available for repairs and retrofits for working electric and natural gas motors. Projects not covered under this program include fuel and system type conversions.

For a complete list of covered repairs and other conditions,
call CIT at (800) 845-6038 or visit www.pumpefficiency.org.

Washing Out The Salt

Leaching is often required to maintain or reduce the salt load within the root zone. It is the process of controlled over-irrigation (applied water in excess of ET) to wash out the salts. A successful leaching program exists if the salinity of the soil increases with depth, and the zone of low salinity expands over time.

Determining the correct amount of water to apply for proper leaching comes one of two ways. The first is by determining the Leaching Fraction (LF). LF is used when salinity is not a serious problem, and maintenance of current conditions is desired. The formula for LF is:

$$LF = \frac{(\text{Amount of Water Applied - ET for Season})}{\text{Amount of Water Applied}}$$

If this number is zero or negative, then no salt movement within the soil has occurred.

The second method is based on laboratory analysis of the water used and the actual salinity of the soil. The Leaching Requirement (LR) takes into account the water quality used to do the leaching.

LR is based on the electrical conductivity of the irrigation water (ECw) and the electrical conductivity of water extracted from a saturated soil paste (ECe). Since the ECe value is the water that the roots encounter within the soil profile, and it has the greatest impact on crop growth. The formula for the Leaching Requirement is:

$$LR = (ECw / (5 \times ECe - ECw)) \times 100$$

Poor quality water, if not applied in greater quantities, will increase the salinity of the soil over time. The number returned indicates what percentage of Seasonal ET needs to be added to the annual total irrigation.

When the water is best applied is a subject of debate. Many advocate the application leaching water late in the season (after harvest), while others desire to leach in the spring prior to planting. Both methods are correct when taking cultural practices into account. If ECe is greater than 50 percent of the crop tolerance, then it may be desirable to add a portion of the leaching requirement with each irrigation. Rainfall can also be effective for leaching if it occurs in sufficient quantities and at appropriate times.

Leaching is most effective when the water is applied at a rate near the maximum infiltration rate of the soil. Keeping the soil between field capacity (moisture content where gravity drainage occurs) and total saturation will maximize salt movement. Use amendments as necessary to adjust the soil chemistry to favor soil stability.

Salt tolerance varies by crop. Many crops can tolerate substantial levels of salinity and thus can use lower quality water or be cultivated in reclamation situations. A list of common crops within KRCD's boundaries and their tolerances to salinity is shown below.

	No Yield Reductions Until Values Reach		Yield Reduced to Zero When Values Exceed	
Crop	ECe	ECw	ECe	ECw
Barley	8.0	5.3	28.0	19.0
Cotton	7.7	5.1	27.0	18.0
Sugar beets	7.0	4.7	24.0	16.0
Wheat	6.0	4.0	20.0	13.0
Corn	1.7	1.1	10.0	6.7
Strawberries	1.0	0.7	4.0	2.7
Alfalfa	2.0	1.3	16.0	10.0
Tomatoes	2.5	1.7	13.0	8.4
Lettuce	1.3	0.9	9.0	6.0
Onions	1.2	0.8	7.4	5.0
Orange	1.7	1.1	8.0	5.3
Peaches	1.7	1.1	6.5	4.3
Apricots*	1.6	1.1	5.8	3.8
Grapes*	1.5	1.0	12.0	7.9
Almonds*	1.5	1.0	6.8	4.5
Plums*	1.5	1.0	7.1	4.7

*Tolerance value based on tree growth, not yield. Source: Water Quality for Agriculture, FAO Irrigation and Drainage Paper 29 by Ayers and Westcot, 1989

Leaching, when done properly and patiently, can reclaim problem soils without causing future groundwater problems or degradation of existing groundwater supplies. Because the purpose of leaching is to remove water-soluble compounds from the root zone, care must be taken to minimize the movement of fertilizers (nitrates) and pesticides.

Contact the KRCD Irrigation Specialist at 237-5567 should you have any questions regarding this topic or any other irrigation related issue.

It's Pump and Irrigation System Test Time !!!

Spring is a good time to find out how well your pump and irrigation systems are performing.
A properly functioning system can save you both time and money,
and minimize the risk of yield loss due to lack of water.
Call Irrigation Specialist, Eric Athorp, today at (559) 237-5567 extension 117, to schedule an
On-Farm Evaluation at NO COST to You.

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For more information contact
Eric Athorp at
(559) 237-5567 ext 117
www.krcd.org

Kings River Conservation District
4886 E. Jensen Avenue
Fresno, CA 93725-1899

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