

The Right Water Works

Irrigation water quality can have a direct correlation to soil structure and crop quality.

By Brent Rouppet

IRRIGATION water quality is becoming progressively more important since many growers today are either irrigating with snow-melt runoff from the Sierra Nevada, Cascade, or other mountains, or using poor-quality subsurface water. Therefore, one of the most important current issues with growing crops in the West is water quality and how it relates to soil structure, crop quality, and crop production.

For irrigation water to be effective, it needs to penetrate into the soil, supplying enough water to sustain the crops until the next irrigation. Yet, most irrigation water used in California and the West is harmful to

good soil structure, and eventually to plant growth and crop quality. Because infiltration problems develop slowly they are often overlooked and even go unnoticed. However, in many cases it takes just a few years or less for plants to begin to die or for the soils to become increasingly less productive.

Slow Water Penetration

The most important factor for water penetration is salts (or lack thereof) present in the water and/or soil. While all water used for irrigation contains some dissolved salts, the suitability of water for irrigation depends on the kinds and amounts of salts present. The salts of concern for irrigation and water penetration are

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primarily compounds of positively charged cations (calcium, magnesium, potassium, and sodium), and negatively charged anions (bicarbonate, carbonate, chloride, and sulfate). Many people don't realize that as irrigation water moves down into the soil profile, it is always doing one of two things. It is either depositing salts in the soil, or it is stripping or removing essential elements or constituents from the root zone.

Salinity and sodium content of irrigation water influence to what extent soil particles remain together or separate. The higher the sodium content and lower the total salt content of irrigation water, the more likely soil particles will become separated and disorganized. This is caused by a chemical imbalance between calcium, on one hand, and sodium and magnesium (both villains to good soil structure) on the other. Since both salinity and the amount of sodium and magnesium in irrigation water influences aggregate stability, all must be considered when determining the likelihood that water quality can reduce water infiltration. Snow-melt runoff from the Sierra Nevada, Cascade, and other

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mountains contains very little salts.

Bill Brush of B and B Agriculture Consulting in Modesto, CA, recently told me, "A lack of calcium in the majority of soils due to snow-melt irrigation water, or poor quality sub-surface water, is leading to serious

not physics or mechanics, a chemical solution to the problem using soil amendments containing calcium is usually required. With its addition, calcium's availability is increased in the soil while sodium and magnesium are decreased. The result is increased total salt concentration of the soil water and decreased exchangeable sodium concentration.

Major Benefits Of Calcium

THERE are several benefits to applying calcium to soil and irrigation water.

- Water now penetrates deeper into the soil profile due to a more flocculated or organized soil condition.
- Less water is wasted due to runoff or "ponding" on the soil surface, thus reducing both wet and dry areas and erosion.
- Less irrigation water is required to achieve the same results.
- There is an improvement in water use efficiency.
- There is increased oxygenation in the root zone.
- Calcium is an essential plant nutrient, generally found in deficient quantities in most soils. For example, bitter pit in apples is calcium deficiency related. Calcium deficiency also reduces fruit quality and seed formation and quality in all crops.

problems in California. What we are seeing in the field is, not only are there more and more water penetration problems, but crop quality is also rapidly declining because of a lack of calcium in our irrigation water."

Another major problem with irrigation water that contributes to poor soil structure is the presence of bicarbonate salts. The problem with bicarbonate present in irrigation water is it will combine with any calcium in the water or soil to form lime when the water evaporates. Also, bicarbonate itself is the most toxic anion that exists in relation to plant health. Irrigation water that has bicarbonate present in excessive amounts should be treated with an acid which will eliminate the potential for lime precipitation.

Correcting The Problem

There are several ways to help improve water infiltration problems including:

- Physically breaking surface crusts and compacted soils with use of chisels, rippers, etc.
- The addition and use of organic matter such as composts and manure to improve the stability of soil aggregates.
- The use of wetting agents and related products that can greatly help with soil hydrophobicity.

However, since the problem of water quality and penetration is for the most part one of chemistry and

Poor water penetration is directly caused by a chemical imbalance in the soil and irrigation water between calcium and (sodium + magnesium).

Simply put: Balancing both the soil and irrigation water using additional calcium can correct nearly all water penetration problems. When calcium is applied to the soil and/or irrigation water, the detrimental sodium and magnesium are removed from the soil system. The chemical reaction and positive effect is immediate and dramatic, but not permanent. Therefore, a routine calcium application maintenance program is generally required.

Having worked with problem soils and irrigation water around the world, there cannot be enough said about the occurrence and difficulties associated with water penetration problems. But these problems are easily corrected by well-informed professionals. We have witnessed fields and crops that have not only benefited from precise and accurate water and soil treatment for water penetration problems, but often the crops themselves have been saved from failure. Perhaps the treatment of irrigation water and soils in regard to water penetration should be considered a vital component and necessary "first step" to all successful soil and water management programs in the agriculture industry. ●

Dr. Brent Rouppet is a soils consultant and a former faculty member at Cal Poly, San Luis Obispo and New Mexico State University. E-mail questions or comments about this article to soildoctor@fertile-soil.com.

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