

Irrigation Management Series

Irrigation Principles 1

The irrigation industry is changing rapidly with increasing pressure on water resources and the increasing cost of irrigating, focusing irrigators on achieving increased irrigation efficiency. One of the keys to improving your irrigation efficiency is gathering the correct information to assist with your decision making processes. This starts at the time you decide to install an irrigation system. It is critical you choose the correct system for your property. Once a system is chosen the information is then needed to assist you in deciding to when to irrigate and how much to apply.

Information has little value unless you understand what it means and the focus of this article and subsequent articles in coming months is to help explain some of the terms and concepts used in irrigation management. This will allow irrigators to better use information relating to their soils and soil water status to increase the irrigation application efficiency. This month we will be looking at some of the descriptors of soil water status and how they affect your soil's ability to store water.

The amount of water a particular soil can store is not the same amount of water that plants have access to, and understanding some key parameters is the first step in developing some form of management system for you irrigation system. The following terms are critical to this:

1. **Field Capacity** describes the maximum amount of water the soil can hold against the forces of gravity. Water is held in the soil through matric forces which is the sum of adsorptive and capillary forces. Adsorptive forces result because of the attraction between negatively charged clay particles and the positive end of dipole water molecules. Capillary forces are due to adhesion between soil particles and water, and the surface tension of water. Matric forces must be overcome to remove water from the soil. As the voids between soil particles are filled with water and the soil approaches saturation, the matric forces holding water in the soil approach zero. The force of gravity is therefore stronger and water will be forced to drain from the soil until the matric forces are equal the gravitational force. The water that is drained has little economic value as you cannot retain it in the soil. Soil texture is the dominant controller of Field Capacity as the higher the clay or finer particle content the smaller the average void between the particles. The capillary forces are stronger in smaller voids and therefore Field Capacity in what are often termed heavier soils is higher as gravity cannot force as much water to drain.

2. **Permanent Wilting Point** – As the soil dries water becomes held in smaller and smaller voids between the soil particles. As these voids get smaller and smaller the matric forces the plants must overcome to be able to extract the water increase. Eventually the water is bound in pores so tightly that the plant is unable to extract it and at this point Permanent Wilting Point is reached.
3. **Plant Available Water** – This is simply the water held in the soil between Field Capacity and Permanent wilting point. When the soil is above Field Capacity the water will drain and when the soil is below Permanent Wilting Point the plants cannot longer access it.

Soil texture controls the first two terms, and by definition the Plant Available Water, and just because you have a heavy soil with a high Field Capacity does not mean you have a higher Plant Available Water value as much of the water may be held in very small soil pores that the plants can not actually access. We will cover this topic at a later time. The key point I would like people to consider is how do they know if they are going to put on too much irrigation and exceed Field Capacity? Apply too much irrigation and exceed field capacity and some of the water you have paid to apply will be lost. In some circumstances you may in fact reduce production, and there is a high probability of leaching soluble nutrients such as nitrogen which has an economic and environmental impact as well.

Measuring your soil water status provides the key information so you can compare the current water status with the field capacity and determine your application requirements.

AQUAFLEX NZ are available to assist you with developing an irrigation management system for your operation, please feel free to contact them on 03 3848900 or visit www.aquaflex.co.nz

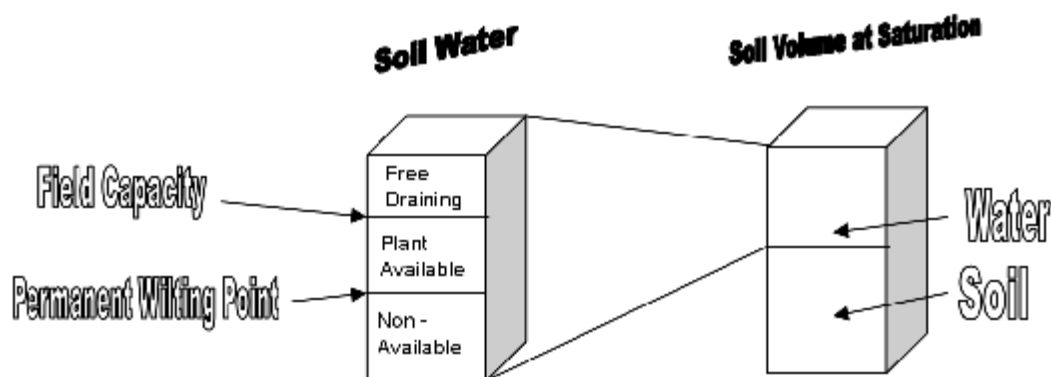


Diagram showing the relationship of Plant Available water to Field Capacity and Permanent Wilting Point. Note as water drains air replaces it in the saturated soil volume.