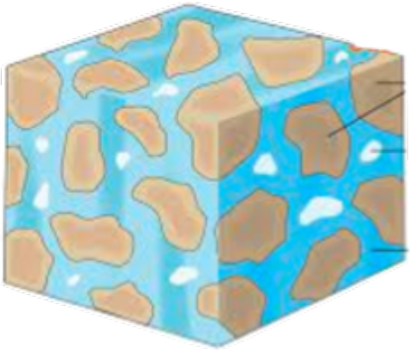
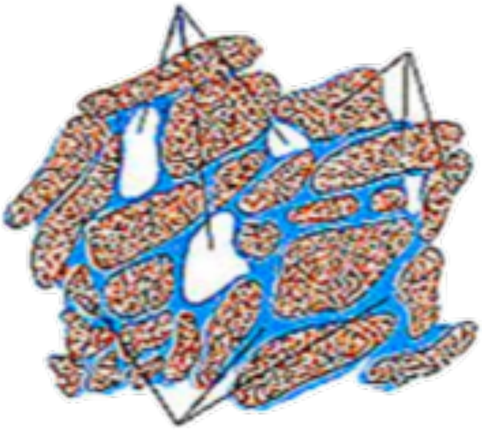
A methodological proposal for a precise irrigation

Watering correctly means supplying water and nutrients at the time the plant asks for it and in a volume that does not exceed the capacity of the soil to retain that water (any reference to the soil is applicable to the substrate).



This figure represents an overwatered soil in which all pores contain water. The soil particles cannot retain this volume of water and therefore this excess drains away. Since the soil is saturated with water, there is no air with all the damage that entails.



In this figure we see a soil in *field capacity* in the sense that the water found in it is retained by its particles and available for the plant. (The retention force is measured in millibars (mB). (The higher the tension, the lower the humidity).

How do we get this information?

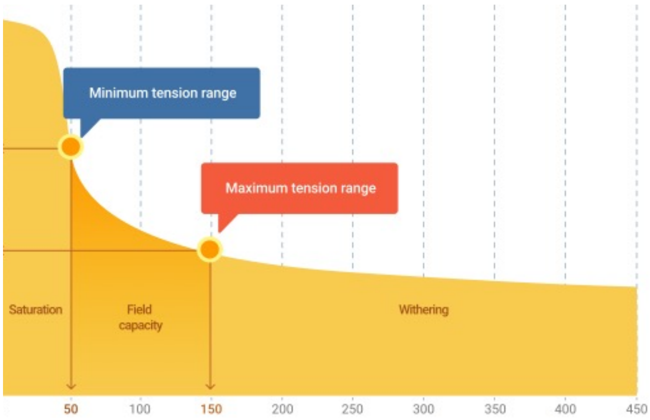
First we have to analyze the soil to know what its retention capacity is, that is, given a volume of soil, what % of it can contain water.

The calculation of the retention curve shows us the functional relationship between the tension and the volumetric humidity of the soil and through an appropriate analysis, we detect:

• Starting what tension, the soil begins to retain water to make it available to the plant.

• Starting what tension, the plant does not have enough strength to remove that water to the soil.

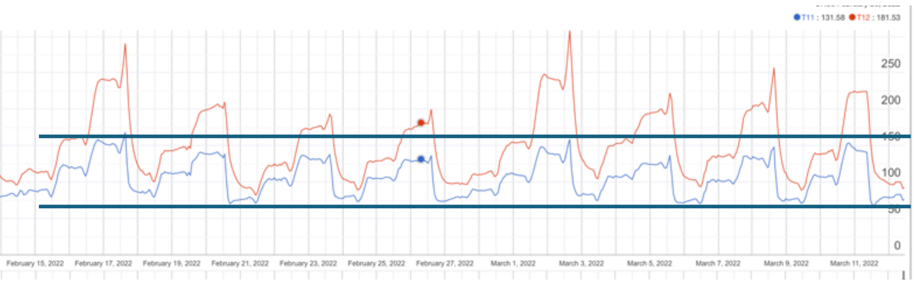
In the figure below, we see the functional relationship between tension and % moisture (volumetric) of the soil.



The analysis of the curve will indicate that below 50 mB (or, 13.5% humidity), the water from the soil drains and therefore will not be available for the plant and above 150 mB (or, 10% humidity) the water is not available due to the force it is held by the soil particles.

(The tensiometer measures the effort that the roots must make to extract moisture from the soil)

Now we have the first part of the appropriate irrigation regime for this soil: *"we are going to water when the tensiometer approaches 150 mB, a time (or volume) such that we do not go below 50 mB."*



By obtaining, in real time, the measurement of water tension in the soil, through the use of electronic tensiometers, we can easily carry out this regime and irrigate between the values of the tension limits.

The second part of the irrigation regime: "how long, or what volume we have to water", we will also obtain from the analysis of the curve, but first we need more information, for which we are going to assume the following:

1. We have a 5-year-old crop of fruit trees.

2. Active roots are located at an average depth of 45 cm in a diameter of 120 cm. and therefore we estimate the volume of soil to be moistened at 188 liters.

3. The irrigation system has 2 drippers of 4 L/H per tree.

Based on this information we can make a first approximation of the irrigation time.

The irrigation volume necessary to moisten 188 liters of soil with a retention capacity of 3.5% (13.5-10%) would be 188*3.5%=6.58 liters.
This means that we water when the tensiometer reaches 150 mB to return to 50 mB, but if we want to position ourselves at a tension less than 150 and/or a tension greater than 50 mb, we will have to adjust the volume or irrigation time.
Therefore, if the drippers supply 8 liters per hour, we need to water 49 minutes plus the network filling time (60*6.58/8=49 minutes).

In summary, the irrigation regime in our case will be:

Water for around 49 minutes between 50 to 150 mB, every time the crop requires it, that is, every time the tensiometer approaches 150 mB

Other considerations to take into account

- It is very important to have an irrigation network capable of distributing water and nutrients in a uniform way.
- It is also necessary to review environmental variability to sectorize irrigation sectors, not only according to soil and varieties, but also according to climate.

I am going to end this article with a proposal to change the existing irrigation paradigm:

Generally is a custom to irrigate by shifts, regardless if the sector need water or not

When the information of the irrigation protocol is available, (when and how much) then we can irrigate by demand i.e when the sector needs instead arbitrarily by periodical shifts

In that way, we can really irrigate efficiently