INTRODUCTION AND OBJECTIVES

The "enarenado" (sand-covering soil) is a technique used in greenhouses located in the southeast of Spain that consists of placing a layer of soil between 20 and 40 cm above the original material, a thin layer of organic matter and above it a layer of sand of about 5 to 10 cm (figure 1).

The objective of this work is to present the methodology of data acquisition and the actions carried out so far to obtain a model that precisely defines the evolution of humidity in wet bulbs generated in "enarenado" soils characteristic of intensive horticultural crops using the Hydrus model.

MATERIAL AND METHODS

The experiments are carried out at the Andalusian Institute for Agricultural Research and Training (IFAPA Center in La Mojonera, Spain (figure 2).

To use the Hydrus model, the texture, root distribution, moisture retention curve, and the saturation hydraulic conductivity and permeability of each proposed material have been characterized.

The expression of the soil moisture retention curve was described via Brooks–Corey model.

\[
\theta_s - \theta_f = \left( \frac{\psi_s}{\psi} \right)^\lambda
\]

Where \( \theta_s \) and \( \theta_f \) are the residual and saturated soil moisture (cm³/cm³), \( \psi \) represents matric potential (kPa) with \( \psi_0 \) the air entry value, and \( \lambda \) is an empirical parameter often referred to as the pore size distribution index.

In this phase of the study it has been considered that the soil is homogeneous in each layer and therefore a quadrant of the drip spacing will be controlled. The crop was pepper in the two selected greenhouses:
- Clay-loam soil (greenhouse B7)
- Sandy-loam soil (greenhouse B8)

Irrigation is automatic, with drippers of nominal flow \( Q_d = 3 l/h \), Self-compensating and Anti-Drainage

It was used Decagon CE5 sensors (capacitance/frequency domain technology).

The soil moisture sensors will be placed at two depths (figure 3):
- just under the sand layer (5 cm depth)
- at the bottom of crop profile (18 cm depth)

RESULTS AND DISCUSSION

Data collection

The average monthly distribution of moisture has been studied (see figure 4). As it can be seen, in cold months a wet bulb is formed, but from February it starts to disappear and from March it is imperceptible.

Soils texture

The variation of each particle size fraction as a function of depth is shown in figure 5. Both soils have differences in the content of the coarse texture.

Moisture retention curve was determined directly from soil samples. The parameters were then adjusted using an optimization scheme based on minimizing the sum of squared errors (Figure 6).

Soil moisture retention curve

Figure 4. Average monthly moisture (%) in the sampled area.

Drips and plants are placed at x=0, y=0. Soil B7

Figure 5. Granulometry and texture of soils

Figure 6. Measured permeability was \( k_s = 2.9 \times 10^{-6} \) cm/s for soil B7 and \( k_s = 6 \times 10^{-6} \) cm/s for soil B8.

Figure 7. Evolution of measured (med) and simulated (sim) soil moisture for a typical day in February. Probes located 5 cm under the added layer (1, 2) and in the original soil (3). Soil B7

CONCLUSIONS

- A procedure has been defined for collecting and processing moisture data in stratified soils.
- The soil curve has been adjusted experimentally for each material and the information has been placed in the Hydrus model.
- The Hydrus model has been used to reproduce the behavioral conditions of a stratified soil and it has been possible to verify that the predictions are appropriate to what has been observed.

REFERENCES


This work is part of the Project RTA2015-00029-C02-02, financed by the National Institute of Agricultural Research (INIA).