Improvement of Irrigation Water Management in Lebanon and Jordan
IRWA PROJECT

JORDAN

Demo Plot

Tomatoes Water Consumption and Crop Coefficient under Different Irrigation Levels

Introduction

Precise determination of water requirements for different crops is considered as one of the most important tool and a key factor that help in rational and proper management of this resource. Evapotranspiration (ET) is a necessary parameter for proper irrigation scheduling and for establishing the duties and the dimension of the irrigation system. It allows better water management, by adjusting the volume and frequency of irrigation to meet crop requirements depending on the soil characteristics. Furthermore, it is a crucial factor on which irrigation management decisions are based. Managing limited water supplies as well as designing and evaluating irrigation systems, are all dependent on ET data.

Tomato is considered as the most important crop whether grown inside plastic houses or in open field. The Jordanian farmers always select the horizontal breeding in the open fields and they haven't any idea about the vertical breeding regarding the production and water requirements. Therefore, the objectives of this work are coming due to this issue.

Objectives

1. Determination of water consumption and crop coefficients of tomato crop.
2. Develop irrigation practices that optimize water application and increase crop productivity.
3. Comparison between crop water requirements and yield under two different agricultural practices (horizontal and vertical breeding)

Methodology and Theory

The experiment will be implemented at Deir-Alla Research Station, located in the Central Jordan Valley, at latitude of 32^{o} N, 35^{o}:30 East-longitude with an elevation of 224 meters below the sea level. A Split plot design will be used. Two tomato breeding methods (Horizontal and Vertical) as main treatments and four irrigation levels (50, 75, 100, and 125% of potential evapotranspiration estimating by Penmen-Monteith method from a nearby metrological station) as sub main treatments, each treatment will be replicated five times. Each plot will have nine lateral GR lines with 13.5 m length.

Oskar tomato (*Lycopersicon esculentum*) seedlings will be transplanted end of Nov. in order to be planted in the field during the first week of January 2007, at a spacing of 40 cm between plants and 150 cm between rows. One row of plants will be planted per each trickle irrigation lateral. The tomato variety was widely used by farmers in Jordan Valley due to its high yield potential. Estimation of plant shaded area will be performed at regular intervals (weekly) by measuring the shaded area under the plant canopy at the mid noon time. Plant height and plant yield of tomato will be also recorded.

Tomato crop will be irrigated frequently (every 3 to 7 days depending on the average readings of two tensiometers installed in the 100% ETr at 15 and 30 cm soil depths). Fertilizers will be applied using *Dosatron* injector. The spacing between drippers will be 40 cm and 150 cm between laterals. Inline drippers (GR) with 4 l/hr discharge will be used; the flow rate for the four treatments will be measured by flow meters. The amount of water applied for each irrigation event will be measured using the following equations (Ayers and Westcot, 1985):

$$AW = \frac{ET}{(1 - LR) * E_a} \qquad LR = \frac{EC_w}{5EC_e - EC_w}$$

where;
AW = depth of applied water (mm)
ET = depth of crop water demand (mm)
LR = leaching requirement
E_a = Irrigation application efficiency (assumed 90%)
EC_w = salinity of the applied irrigation water (dS/m),
EC_e = salinity of soil saturation extract. (dS/m)

- Evapotranspiration measurements (Depletion method)
The CPN neutron probe will used for measurement of soil moisture content through two meter depth of aluminum access tubes at 15, 30, 45, 60, 75, 90, 120,150, and 180 cm. One access tube will be installed for each irrigation treatment. Soil moisture measurements will be taken directly before and after 24 hours of each irrigation at the nine depths of each access tube. Evapotranspiration rate will be calculated according to the method developed by Claude (1959), and FAO (1977) using the following formula:

$$ET = \frac{\left| \sum_{i=1}^{n} (Pv_{1i} - Pv_{2i}) S_i \right|}{\Delta t}$$

Where,
ET = evapotranspiration (mm day^{-1}),
n = number of soil layers sampled in the effective root zone,
Pv_{1i} and Pv_{2i} = volumetric moisture content after the first and before the second irrigation in the *i*-th layer, respectively,
S_i = the thickness of i-th layer (mm),
Δt = the time interval between irrigation (days).
i = 1, 2, 3 ….6.

Evapotranspiration during the 24 hours after irrigation was considered as the average of ET values of before and after the 24 hours. Six aluminum access tubes will be distillated for prediction of the calibration curves for the neutron probe.

- Data and Measurements Collection

Beside the data and measurements required for the crop water requirements which include the amount of irrigation and evaporation, soil moisture data, and crop yield, measurements will be taken to determine the irrigation system efficiency and performance and the efficiency of water distribution. The performance data will be collected on monthly basis.

- Expected Output

Scientific paper will be published internationally for the Tomato water requirements.
Leaflets to the farmers about the water requirement and irrigation scheduling
Reports to Irwa Project activities

Tel/Fax: +962 6 5627 606. P.O.Box 183. 11821 Amman-Jordan. Email: Jordan@irwaproject.com. Website: www.irwaproject.com