RESEARCH ON LOCALISED DRIP IRRIGATION OF AN APPLE PLANTATION

Kinan Kadir

INTRODUCTION

Increasing water consumption to meet the more and more complex demands of modern society results in a crisis in this natural resource; even though it is renewable, it is ever scarce, due to human-determined pollution. Under these conditions, the use of a lower amount of irrigation water for the same large productions as those resulting from the traditional irrigated technology is extremely important.

MATERIAL AND METHOD

Drip irrigation. It consists in water distribution by means of plastic pipes generally fixed on the soil. Drippers are located on these pipes and water drops out of them, watering the plants. Water penetrates the soil, forming an approximately cone-shaped wet area named moistures bulbs. The size and shape of the moisture bulb depends on the flow of the dripper, water application time length and soil type (1). The moisture bulb is generally larger and somewhat superficially located on the medium and fine textured soils, compared with the sandy soils. These bulbs unite in time, so that they form a moisture strip of approximately 0.8-1.2 m in width along the tree row where most tree roots can be found.

Here are some of the advantages of drip irrigation (2):

- possibility of acurate distribution of the calculated watering standard in plants;
- provision of constant moisture in the root area of the trees;
- partial moisture of soil in the plantations, which determines limited water loss by evaporation, reduced weed growth, and avoids water excess, thus decreasing soil degradation;
- preservation of dryness in leaves;
- possibility to apply irrigation on slightly permeable soils, except for highly permeable (medium and gross sands) or skeletal soils;
- energy conservation, following the lower work pressure of the water supplied by the pumping station;
- possibility to apply fertilisers at the same time with the irrigation water.

The method requires that water should be filtered before being introduced into the pipes. Various filtration types can be used with very good results, depending on the level of water purity (4).

However, drip irrigation has several disadvantages as well:

- high development costs, mainly due to the watering equipment. The equipment used for dripping is about 10 times more expensive thatn the mobile equipment that is manually moved. Also, the energy related to the equipment and materials increases almost three times in the case of this watering method (2).

In order to emphasise the advantages of the drip irrigation method, we organised an experiment that measured the effect of the distance between the dripper and the efficiency of water storage in the soil. Research was carried out on an apple plantation gron on mollic brown-reddish soil at the Moara Domnească centre. Table 1 presents soil characteristics.

Table 1

Main hydrophysical properties of mollic brown-reddish soil

Index	Depth, cm			
	0 – 50	50 - 100	100 - 150	medie 0 – 150
Field capacity, %	23.5	23.5	21.6	22.8
Wilting coefficient, %	14.5	14.2	17.0	15.2
Permeability, mm/hour	2.34	0.79	0.51	0.60

We placed self-regulating drippers at a distance of 1.0 m on the watering ramps, and measured their flows in correlation with the pressured of the water supplied. We calculated the water volume according to the flow of the dripper and the watering time length. Our tests included flows of 2 l/hour and 4 l/hour. We collected soil samples 24 hours after watering, in order to measure soil moisture both along and perpendicular on the watering ramps, between the tree rows. We performed gravimetric analysis on the soil samples, and produced diagrams based on the results on soil moisture (3).

RESULTS

In the drippers operating at a flow of 2l/hours, soil moisture was the highest in the area of the dripper along the watering ramp (Fig. 1), and decreased to 16% towards the limit of the influence interval (wilting coefficient: 14.2% at 100 cm in depth).

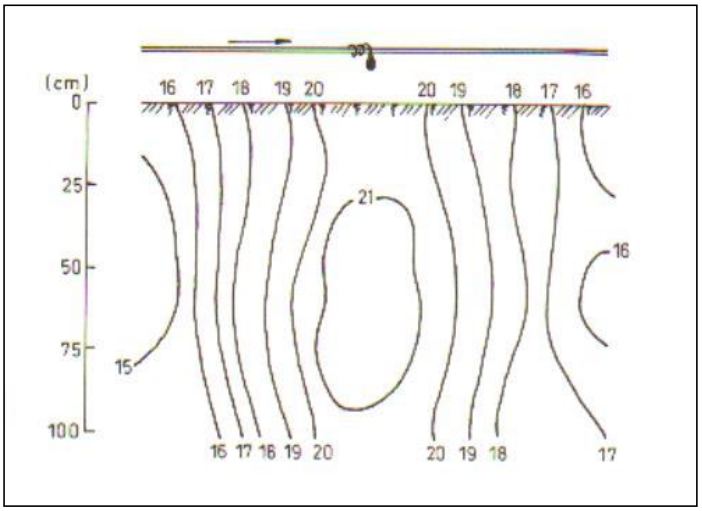

Fig. 1. Soil moisture along the watering ramp (q_p = 2 l/h)

Soil moisture decreased by 2% transverse to the watering ramp, up to the limit of the influence area (Fig. 2) (3).

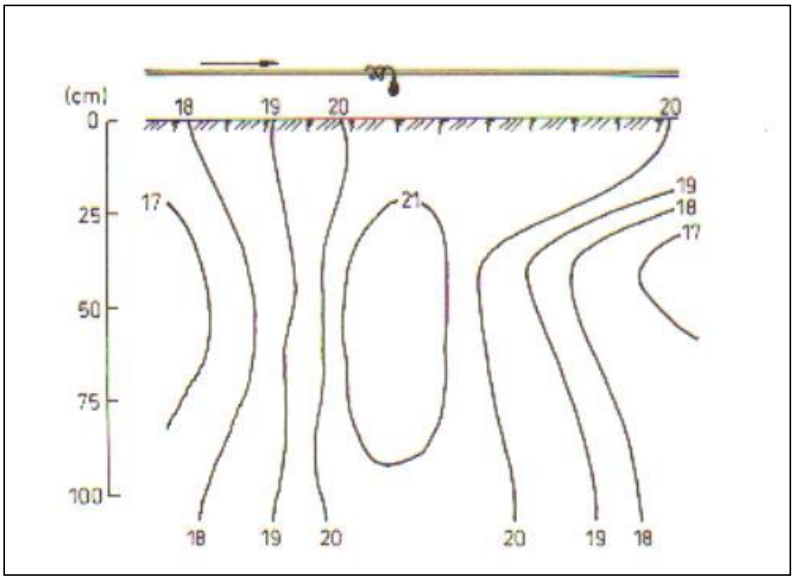

Fig. 2. Soil moisture transverse to watering lamp (q_p = 2 l/h)

For the flow of 4l/hour, soil moisture was somewhat even (20-25%) along the watering ramp and exceeded the lowest watering standard, providing better moisture of the active soil layer (Fig. 3).

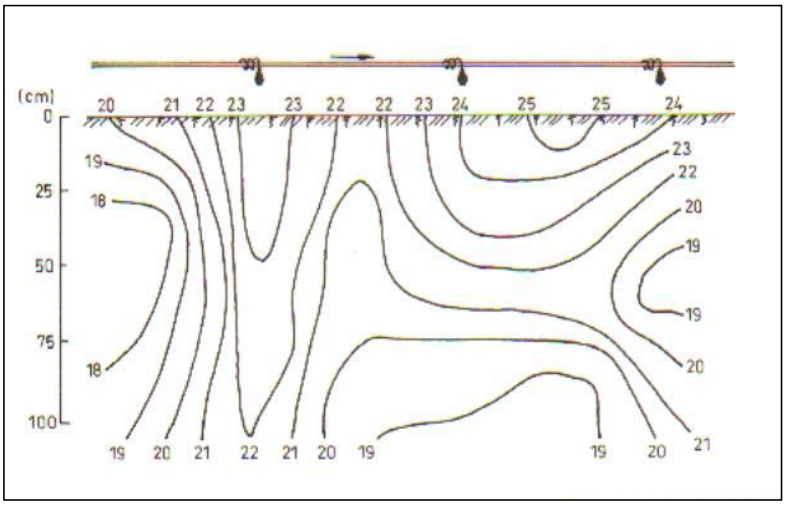

Fig. 3. Soil moisture along the watering ramp (q_p = 4 l/h)

Soil moisture between the tree rows recorded a more favourable distribution than the previous variant (Fig. 4).

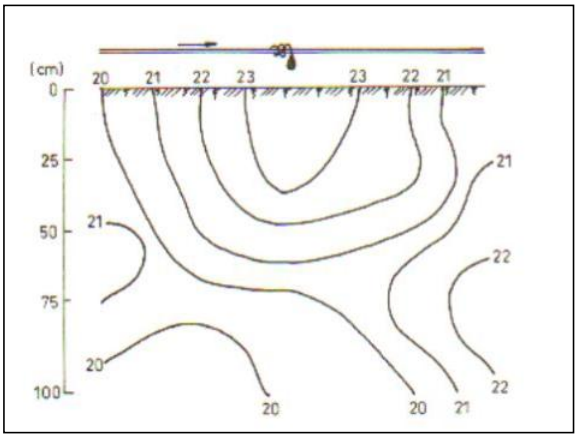

Fig. 4. Soil moisture transverse to the wetting ramp (q_p = 4 l/h)

In flows of 2 l/hour, we recorded an uneven distribution of water in the soil and a limited increase in soil moisture at the middle of the distance between the drippers. The moisture bulb had 1.8 m in diametre and was directed along the ramp. The water volume stored in the coil decreased from the dripper: 515 m^3/ha towards the edge of the moisture bulb and 98 m^3/ha at a distance of 1.50 m from the dripper. The moisture recorded in the area between the tree rows showed better water circulation in the soil transverse to the wetting ramps. Even three days after watering, soil moisture was about 18% at the middle of the distance between the tree rows. The agrotechnical works performed on the areas between the rows increased soil porosity and the water storage capacity of the soil.

CONCLUSIONS

Drip irrigation on the mollic brown-reddish soil of Moara Domnească determined the even watering of the root area of the tree rows. Soil moisture resulted from dripping was also recorded in depth on the interval between the tree rows. It is recommended that fruit-tree irrigation on mollic brown-reddish soil should use drippers with a flow of 4 l/hour, placed at 1 m in distance between them, in order to provide soil moisture ranging within the lowest standards and the water capacity of the field.

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