ASPECTS OF DRIP IRRIGATION ON SLOPES

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Abstract

Nowadays, water and its supply raise problems of strategic importance, of great complexity, being considered one of the keys to sustainable human development. Drip irrigation consists in the slow and controlled administration of water in the area of the root system of the plants for the purposes of fulfilling their physiological needs and is considered to be one of the variants of localized irrigation. Water is distributed in a uniform and slow manner, drop by drop, in a quantity and with a frequency that depend on the needs of the plant, thanks to the exact regulation of the water flow rate and pressure, as well as to the activation of the irrigation based on the information recorded by the tensiometer with regard to soil humidity. This method enables the exact dosage of the water quantity necessary in the various evolution stages of the plant, thus eliminating losses. By applying the irrigation with 5 liters of water per linear meter, at a 7 days interval, in the month of august, for a vine cultivated on a slope, in layers covered with black film and irrigated via dropping, soil humidity immediately after irrigation reaches its highest level, but within the limits of active humidity, on the line of the irrigation band. Three days later, the water content of the soil in the layer is relatively uniform, and, after this interval, it is higher in the points situated at the basis of the film. This technology of cultivation on slopes favors the accumulation, in the soil, of the water resulted from heavy rains and reduces soil losses as a result of erosion.

Key words: drip irrigation, soil moisture, land slope.

As a limited, vulnerable, renewable, natural resource, the water represents an indispensable element for society, being a decisive factor in maintaining the ecological equilibrium for human existence and for achieving all the human activities.

Although the drip irrigation method is relatively new, this method was rapidly spread in Romania too due to the numerous advantages it has. The drip irrigation is the most efficient solution for irrigating vegetable growing in solariums and in the fields, flowers, grapevine and fruit trees suitable almost for all types of soils, on uneven and sloping lands.

MATERIAL AND METHOD

The field observations on water distribution of drip irrigation were carried out on a cambic faeoziom soil in a grapevine school cultivated in moldboards covered with black film. The grapevine school is located on a sloping land (average slope of 15%), the moldboards being oriented along the contour lines and spaced at 1.10 m (*fig. 1*). In order to determine the water content of soil, soil probes were sampled with a tubular probe in 10 cm steps at 50 cm depth before wetting, soon after wetting, at 6 hours, at 48 hours and 72 hours from wetting application. The water quantity of 5 l/linear meter was applied through the wetting strip with drip holes spaced at 20 cm and at 7 days between wettings.

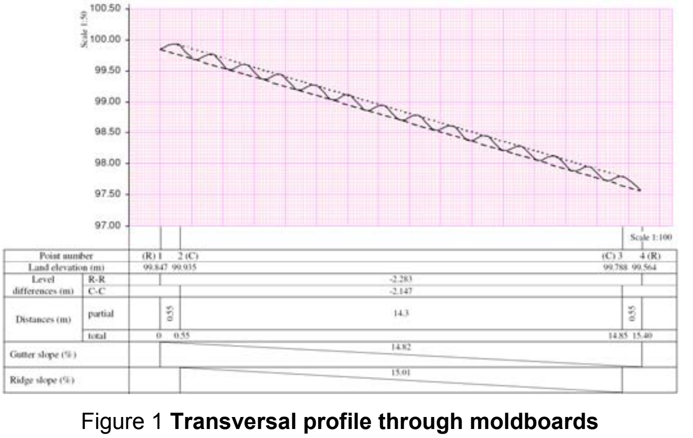
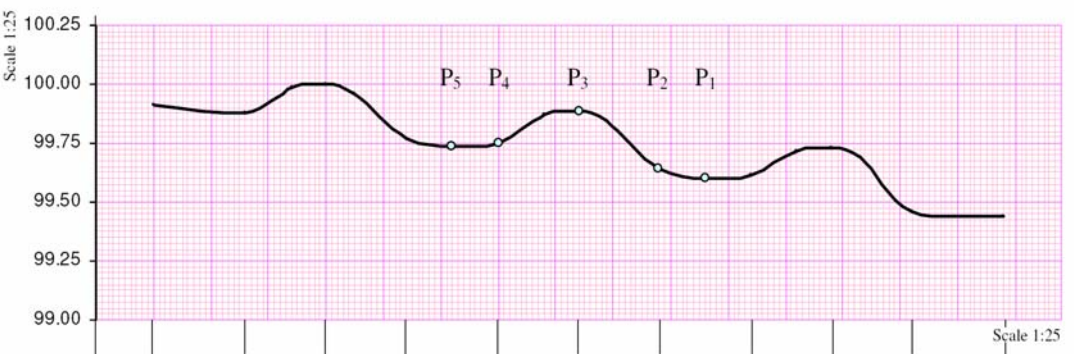


Figure 1 **Transversal profile through moldboards**



Point number	1	2	3	4	5	6	7	8	9	10	11
Land elevation (m)	99.909	99.880	100.000	99.711	99.753	99.888	99.639	99.613	99.732	99.458	99.441
Level differences (m)		-0.029	0.120	-0.229	-0.018	0.135	-0.249	-0.026	0.119	-0.274	-0.017
Distances (m) partial		0.40	0.35	0.35	0.40	0.35	0.35	0.40	0.35	0.35	0.40
Distances (m) total	0	0.40	0.75	1.10	1.50	1.85	2.20	2.60	2.75	3.30	3.70
Slope (%)		7.25	34.29	65.43	4.50	38.57	71.14	6.50	34.00	78.29	4.25

Figure 2 **Sampling points of soil probes**

In order to determine the level of the land surface in the area under survey, there were carried out topographic measurements of accurate geometrical leveling by inverting method and by traversing combined with inverting based on which the transversal profiles were carried out. The level related observations were carried out with an average accuracy leveling indicator of Zeiss Ni-030 type and with centimeter topographic rod gauge, the level differences being determined based on two horizons of the level instrument.

RESULTS AND DISCUSSIONS

Analyzing the average water content values of the soil on control points recorded before the application of drip wetting (*fig. 3*), we found out the highest soil humidity in the points located at the moldboard base (P_2 and P_4 points) and the lowest one in the points located on drain ditches (P_1 and P_5).

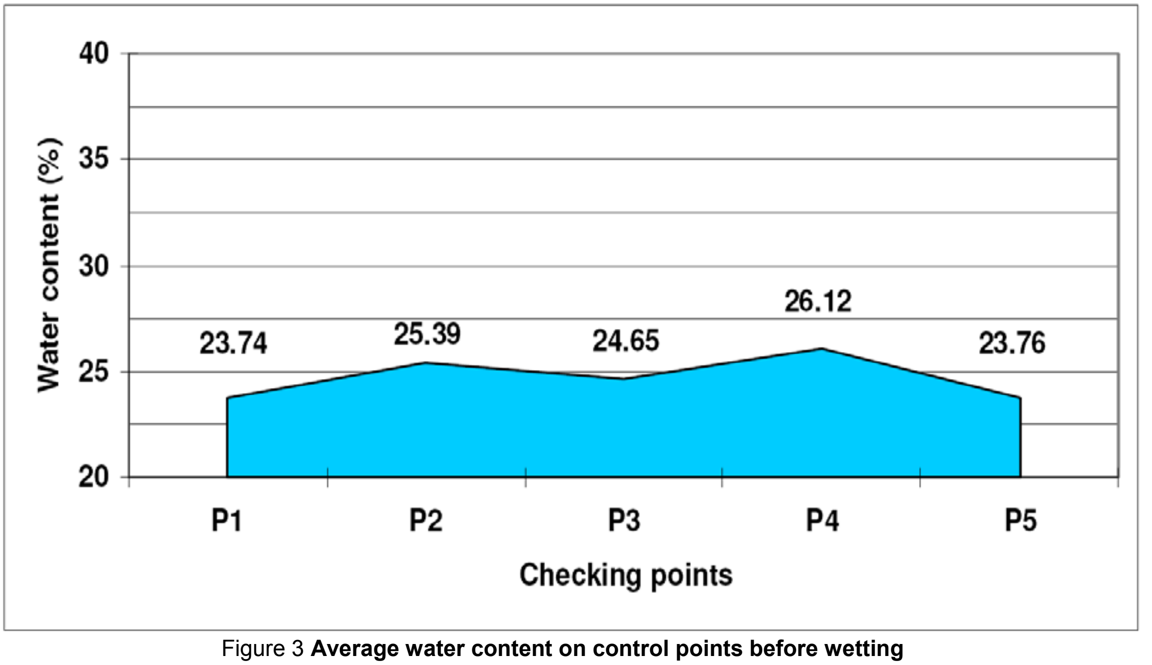


Figure 3 **Average water content on control points before wetting**

In the P_3 control point, located on the moldboard ridge, a lower value was recorded than the ones recorded at the base of the moldboard downstream and upstream due to the root system consumption, this system being highly developed in this area.

On the points located on drain ditches (P_1 and P_5) the same water content of the soil was recorded, its value was the lowest due to fact that the drain ditches are not covered with black film and the evapotranspiration is high.

At the end of drip wetting (*fig. 4*), the highest average water content of the soil was recorded in P_3 point located on the moldboard ridge, the value of 34.82%, higher with 10 percentage units compared to the content obtained before wetting. In the control points located on drain ditches, the average water content of the soil remained relatively unchanged and in the points at the base of the moldboard, it increased with about two percentage units.

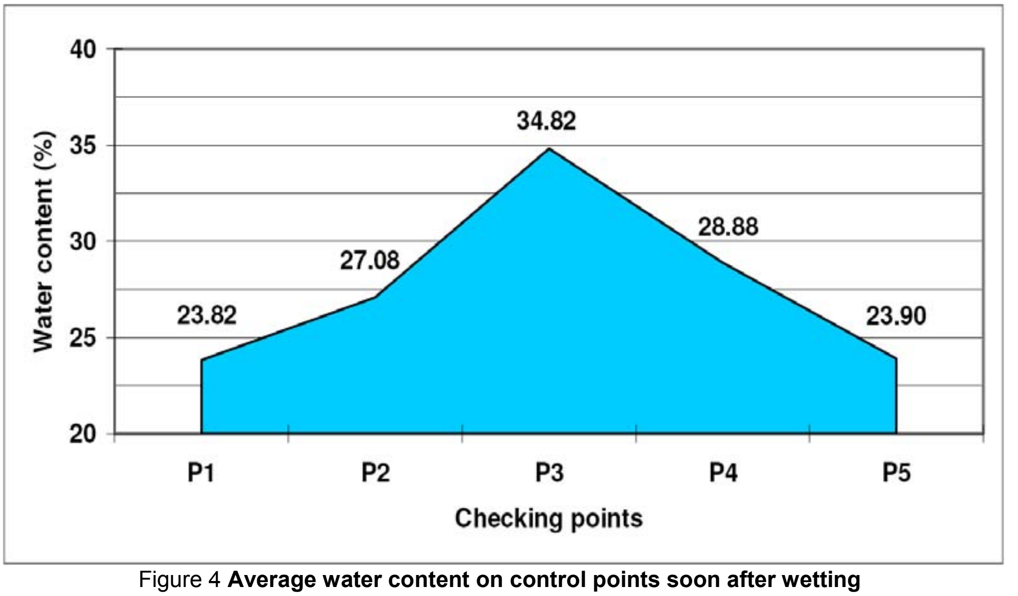


Figure 4 **Average water content on control points soon after wetting**

At 6 hours from the end of wetting (*fig. 5*), we find out a diminution of the average water content in the soil in the P_3 point, located on the moldboard ridge, of about one percentage unit due to the water diffusion in soil and, implicitly, the value increase in the other points. We notice a more significant increase of values in points located at the moldboard base located at a distance of about 0.35 m from the middle of the moldboard and an insignificant increase in the points located on drain ditches.

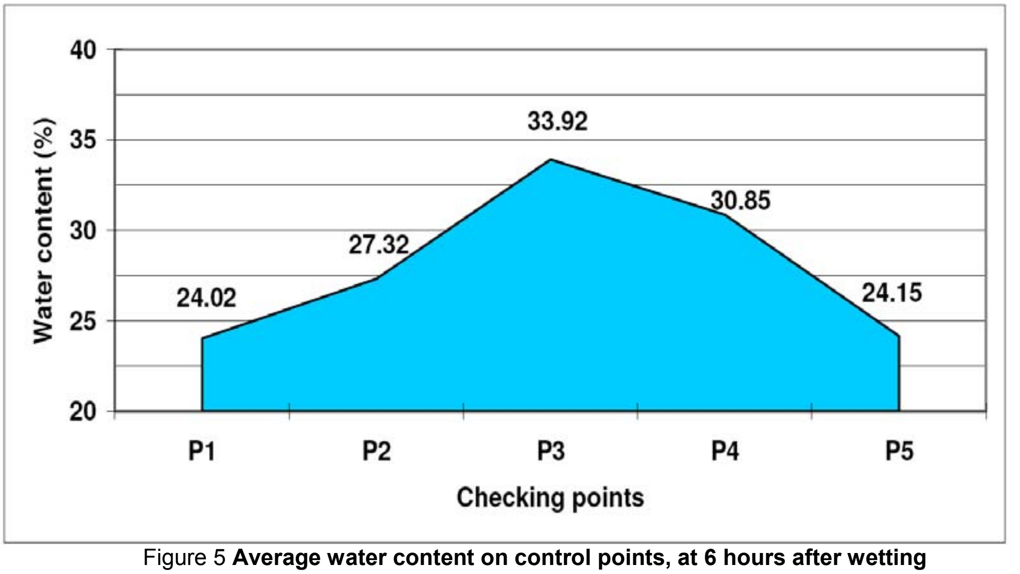


Figure 5 **Average water content on control points, at 6 hours after wetting**

The average water content in the soil at 24 hours from the wetting application increases in the points located on the drain ditches (P_1 and P_5), with about one percentage unit and decreases in other points (*fig. 6*). Compared to the values recorded at 6 hours from wetting application, the average water content of the soil decreases from 33.92% to 30.42% in the P_3 pint, from 30.85% to 28.60% in the P_4 point located at the moldboard base upstream and insignificantly decreases in the P_2 point from the moldboard base downstream.

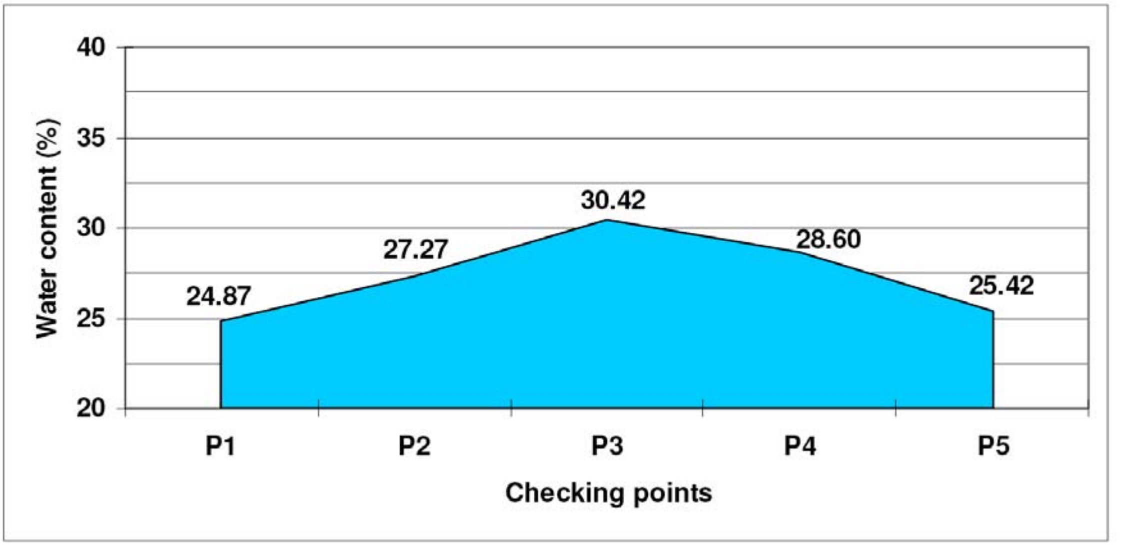


Figure 6 **Average water content on control points, at 24 hours after wetting**

In *figure 7* we may notice, after 72 hours from the drip wetting application with a quantity of 5 water liters on linear meter, a relative evening of the average water content on control points between the range 25.32%-26.13%.

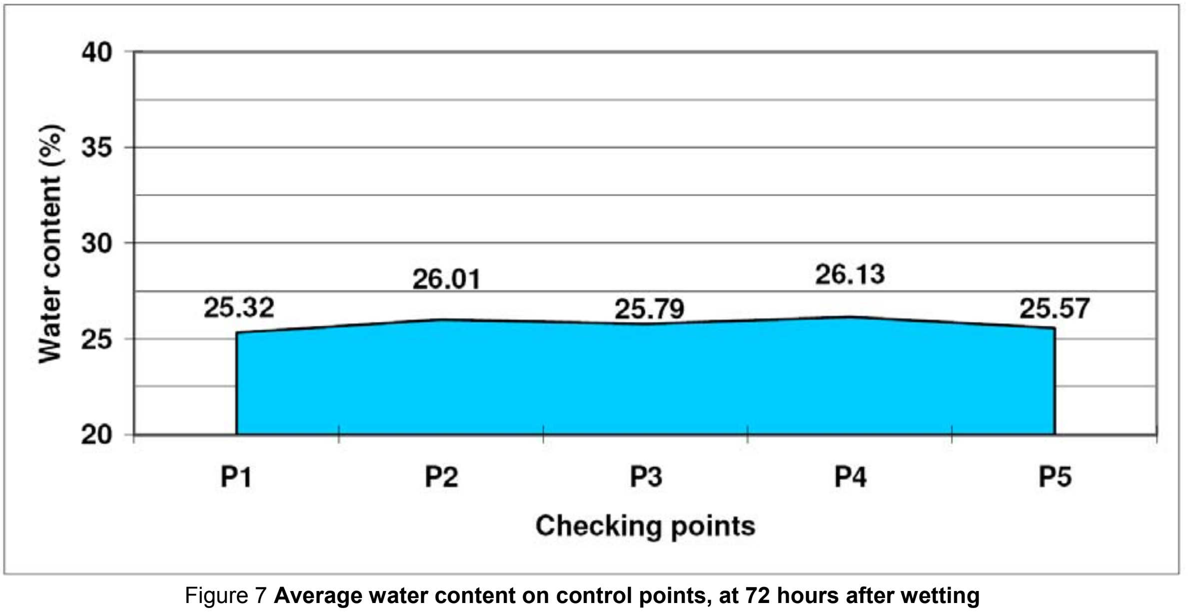


Figure 7 **Average water content on control points, at 72 hours after wetting**

Analyzing *figure 8* it results that, by applying drip wetting with 5l/l.m. a significant increase of the water content of the soil takes place only inside the moldboard in the main mass area of plant roots which reflects the controlled and rational use of irrigation water. Likewise, higher values are found out of the average water content of the soil in the point at the moldboard base upstream from the point located at the moldboard base downstream. This fact is justified by the higher level of the land in the P_4 control point, but also by the influence of water originated from abundant rainfalls which is retained between moldboards (*photo 1*). By this technology of cultivation on sloping lands, it is improved the retaining and accumulation of water in the soil coming from rainfalls and the soil losses determined by surface erosion are diminished.

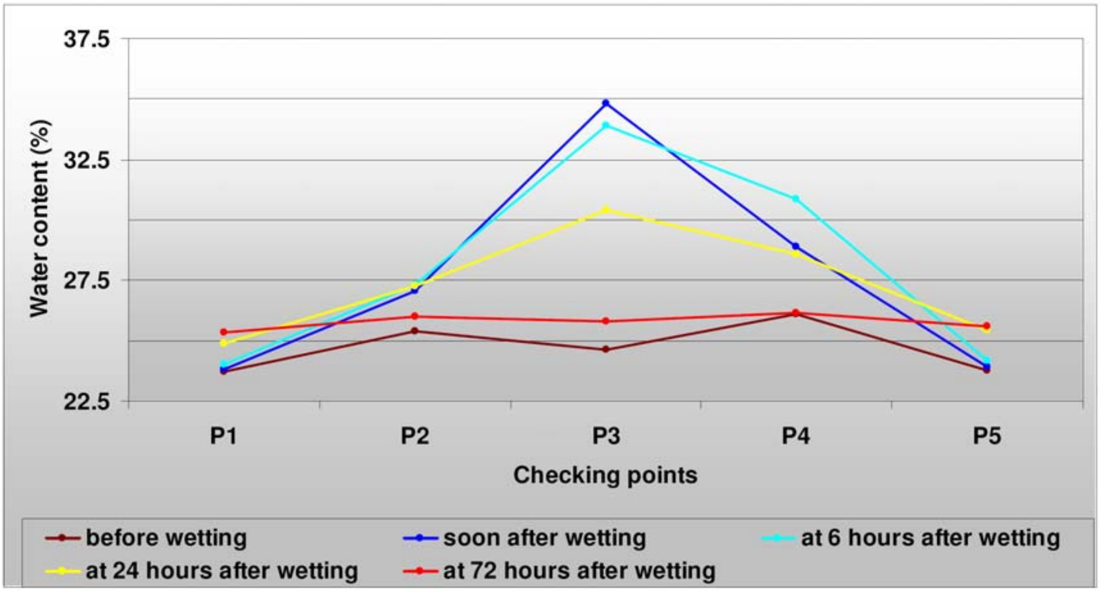


Figure 8 **Evolution of average water content of the soil on control points**

Figure 9 **Water accumulation and stagnation between moldboards**

CONCLUSIONS

The maximum value of the average water content of the soil on control points was recorded soon after drip wetting application on the moldboard ridge, at 6 hours in the points located at the moldboard base and at 72 hours in the control points located on drain ditches.

The drip wetting determines a significant increase of water content in the soil only inside the moldboard in the main mass area of plant roots which reflects the controlled and rational use of water.

The cultivation technology on sloping lands, in moldboard covered with black film, oriented along the contour lines and irrigated by dripping, improves the retaining and accumulation of water in the soil coming from rainfalls and the soil losses determined by surface erosion are diminished.

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