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VERTICAL SUB IRRIGATION

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Abstract. Since millennia, in areas of low rainfall, surface irrigation has been utilized. In 1959 the Israelian inventor Simcha Blass developed a patented very efficient plastic nozzle for dripping the irrigation water from plastic pipes over the crops cultivated soils. In occasion of a FAO project in Libya, this system was utilized for establishing a table grape plantation. In order to support each grape plant, instead of wood poles, plastic pipes of 5 cm diameter, 2.5 mt high were used, dipped into the soil some 50-60 cm, close to each plant. Out of 15 rows, 150 mt long, provided with the normal drip irrigation pipes, in 2 rows a technical modification of "drip irrigation" was used, in which the horizontal water pipe posed on the soil, with holes for dripping the water, was substituted with a normal plastic pipe, without holes, hanged on the plastic vertical poles. In this pipe, close to each grape plant, was made a small hole, in which was inserted a small plastic pipe (like the ones used for blood transfusions). The other side of these mini pipes were inserted into the big vertical plastic pipes used as a support to each plant vegetation, in order to convey the irrigation water deep into the soil. This system has been called "Vertical Sub-irrigation Technology". In the summer of the third year of grape cultivation, the electric pump failed and, after a month, only the 2 rows with the modified system did not show any damage. This system was adopted in other FAO projects in the Near East, also for fertile-irrigation.

Key words: vertical sub irrigation.

Since millennia, in areas of low rainfall, surface irrigation has been utilized, requesting, however, an abundant water supply. Therefore, in many areas where perennial or annual crops are grown there is need of supplemented irrigation for their growth.

Several methods were utilized for water supply since several millennia, but only in 1959 the inventor Simcha Blass developed a patented very efficient and particular nozzle for dripping the irrigation water from plastic pipes over the crops cultivated soils.

He worked in Israel in the kibbutz Hatzerim in the Negev desert. In 1965 he and later on his son Yeshayahu, established the now very famous Metafim Company. This Company has now some 3000 collaborators selling the so called drip (or tricked) irrigation pipes, provided with special nozzles, in more than 150 Countries.

While I was the Crop Production Service Chief of FAO in Roma, from 1975 to 1985, I visited Natzerim and other kibbutz in Israel, to better learn the utilization of this technology. In occasion of a FAO project in Libya, for establishing a table grapes plantation, this system was used in a semi-desertic sandy area dose to Bengasi, with an annual average rainfall of some 300 mm.

Instead of using wood poles, to support each grape plant, plastic pipes of 5 cm diameter, 2.5 mt high were used, dipped into the soil some 50-60 cm, close to each plant. Every 10 pipes and grapes, was located a cement pole 2.5 high in order to strengthen the row and fix the iron wires utilized to support the grapes' vegetation.

Out of 15 rows, 13 rows of about 150 meters long, were provided with the normal drip irrigation pipes laying over the soil, while in two rows a technical modification of "drip irrigation" in which the horizontal water pipe (normally provided with dripping apparatuses, by which water is dropping on soil surface) was substituted with a normal plastic pipe without holes, hanged on the plastic vertical poles. In this pipe, at fixed distance, depending on the crops, are made small holes in which is inserted a very small plastic pipe (like the ones used for blood transfusions). The other side of this mini pipe was inserted into the bigger vertical tubular plastic pipe inserted vertically into the soil down to 50-60 cm, utilized as a support for the plant vegetation, in order to convey the water drops down below into the soil.

This modification has been called "Vertical Sub-Irrigation Technology". Obviously this system is particularly adapted to perennial crops grown in rows and it is very well suited *e.g.* for grape plantations.

This technology is of easy realization, much cheaper for the absence of drips mechanisms (nozzles) in the water adduction pipes, of easy control of its function,

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particularly if transparent connecting mini-pipes are used.

This system is also avoiding some inconveniences of classic dripping pipes, like water stopping caused by limestone or other debris: in fact the connecting transparent mini-pipes are easy to test for percolation. Moreover, the water is provided in depth, 50 cm or more, to the crop root apparatus. Without water in the top soil, weeds are not prospering on the soil surface and the soil superficial evaporation is absent: and only the crop organs above the soil are perspiring. In this way the crop root apparatus is developing in the subsoil and not superficially, as it happens often with drip irrigation and the water utilization by the crop is at a maximum level. If, eventually, fertirrigation is used, the salts are not accumulated in the top soil by the water evaporation.

This system can be adapted also for irrigation of other fruit trees cultivated in rows. Several pipes could be inserted in the soil at X, in the soil stripe between the stems of the trees and the adduction pipe could be sustained in the intersection of each couple of pipes: in this way irrigation water is distributed along the rows in larger stripes.

In Libyan plantation, the 3rd year after table grapes plantation, in August, during the holydays of the technician controlling the vineyard, the pump failed and, for about a month, the irrigation plant did not work. When he was back, several grapes having the normal drip irrigation system were damaged, while the 2 rows with the vertical sub-irrigation were all in very good shape.

This technology was also later used in a coastal area of the Red Sea, close to the border of Saudi Arabia with Yemen, in 4 years old Papaya and Avocado plantations, substituting the normal irrigation system (by soil water submersion of cultivated basins), saving more than 95 of the previously used irrigation water, with a normal fruit production in the following years.

Since the Papaya plants were planted at about 3 mt distance in the rows, 3 double pipes were located at X along the space between each two plants, dipped some 50 cm below. Above the X, the water carrying water pipe was located, fixed and then connected with the rnini-pipes to the pipes inserted into the soil. I was later on told that this technology was utilized in several other areas of Saudi Arabia and Kuwait.

This simplified technology can be used also in gardens and home horticulture, particularly for small fruit trees and shrubs, perennial vegetables (like Asparagus, Artichokes etc.), just inserting small vertical pipes for conveying the water deeper into the soil close to the crop. It can be easily used also for irrigation of gardens and trees in urban areas.