SUMMARY

Due to climate change in recent decades, there is a warming trend, which has repercussions on both the need and water consumption of trees.

The total consumption of soil water also includes, besides the plants consumption in various physiological processes, the consumption of water that evaporates through plant transpiration, as well as the consumption of water that is lost through evaporation of water from the soil.

This paper proposes a model of good practice in implementing a drip irrigation system for a newly established apple orchard in Bacău County.

Drip irrigation technology distributes water and nutrients precisely and evenly directly at the root. This distribution is carried out with a small amount of water and at a low pressure level.

This ensures the optimal need for plant development. The configured irrigation program depends on the crop, its water needs, soil type and climatic conditions.

The drip irrigation system can ensure high yields using small volumes of water and nutrients.

Under irrigation conditions, the productivity of fruit trees, especially apple, increases, given the peculiarities of cultivated varieties (size, average weight of a fruit, moisture content, content in reserve substances).

The expenses generated by the acquisition, installation and operation of the irrigation system are much lower than the income that can be obtained from operating a superintensive apple orchard.

Although expensive, the investment in such a drip irrigation system is recovered in 6 years of production, due to the high productivity of the apple compared to other fruit species. In addition, the service life of the superintensive orchard is 32-35 years.

The paper is structured on 7 chapters, conclusions, bibliography and annexes.

The introductory part includes the first three chapters, and the Personal contributions part, the next 4 chapters.

In the first chapter, entitled ***The current state of knowledge in the field of drip irrigation***, research conducted at international and national level in the field of drip irrigation of orchards is presented, as well as the impact of this technology on the quality of the harvest and the monetary benefit obtained from the exploitation of this irrigation system.

International studies in the field have shown that local drip irrigation technology at low pressure is the most efficient irrigation method, thus saving 45% of the amount of water administered by other irrigation methods and also obtaining the best yield for apple crops, with 19.8 t/ha.

Studies conducted in our country have shown that the return on investment is lower in the case of the superintensive culture system, being calculated at 8.8 years, while in the classical culture system, the return on investment can take up to 11.7 years.

The constructive and functional elements of an irrigation system are:

1. The front assembly, which mainly includes the antenna connection, pressure regulator, filters, fertilizer container and water meter (Savu P și colab., 2005);

2. Main and secondary pipelines - the adduction and distribution pipeline network consists of adduction (main) and distribution pipelines, of different sizes, depending on the sector served. The front transport pipes have a diameter of 30-90 mm, are made of PVC, and the row watering pipes have a maximum diameter of 20 mm, are made of plasticized PVC and are provided with drip devices;

3. Fertilization tank - The pumping stations consist of a tank where solutions with chemical fertilizers or different treatments applied to the root of the tree are prepared. These tanks are located on a bypass of the pipeline network, have different capacities and are equipped with a tap to regulate the flow to the distribution pipes;

4. Drip lines - Their role is to ensure a uniform distribution of irrigation water, in the most optimal points for plants, slowly, to be more easily taken over by absorbent roots;

5. Filtration equipment - It has the role of retaining particles that could reach and obstruct the droppers. These particles may be organic or inorganic in nature, originating from the precipitation of salts or the growth of algae and bacteria in the collection tank.

The filters are mesh grates or passage sections, and the filtering dimensions are positioned in decreasing terms on the direction of the flowing water. Thus, for a pre-cleaning, filter elements with sections of 50-100 mm are used, for an average 10-25 mm filtration, and, for a fine filtration, filters with porosity of 3-10 mm are used.

For calculating water consumption in the orchard, evapotranspiration is of interest, i.e. both water lost through perspiration by trees and water lost through evaporation.

The average daily water consumption varies, depending on the vegetation phenophases: growth, maturation, etc., but also depending on climatic conditions: temperature, humidity and wind speed. The increase in wind speed in the summer months accentuates the pluviometric deficit by increasing the values of potential evapotranspiration and plant transpiration.

The high consumption of moisture, in the case of trees, goes from flowering to fruit ripening, and then water consumption decreases, with evapotranspiration remaining predominant.

Chapter 2, entitled ***The natural setting of the area where the research was conducted***, describes the geographical, hydrographic and geomorphic situation of the study area, climatic peculiarities (temperatures, humidity, precipitation, wind regime) of the area where the orchard is located. The conclusions showed that the pedoclimatic favorability for apple cultivation is medium (natural favorability note = 2.73); and in enhanced mode, it is good (= 3.43). The moisture deficit on the 2 ground-terrain units (UST) is moderate. The land quality class (for the orchard) is III (medium grade).

Chapter 3**, *Presentation of the unit where the research was conducted*** describes the unit S.C. Livada Mere de Iteşti S.R.L, from an administrative - territorial point of view, as well as the facilities it has in order to carry out the activity. The structure of the orchard, by varieties, as well as the location of the irrigation tank, are described in this chapter. At the same time, a brief economic analysis of the company was carried out, showing that with the receipt of revenues from the sale of fruits from the young orchard, the net profit began to increase, the recovery of the investment being close to completion. Due to the high degree of mechanization and automation of installations, the average number of employees has gradually decreased in recent years, with the entry of the young orchard into fruition.

The personal contributions part begins with the fourth chapter, entitled ***Purpose, research goals, material and working methodology.*** Here it is stated that the main purpose of this work was to present in an actual case the influence of drip irrigation on the economic efficiency of apple production, as well as on their quality. A number of 4 stages and goals were proposed to be undertaken, in order to achieve the purpose, namely:

1. Analysis of technical functional characteristics of irrigation arrangement;
2. Observations on the operational behaviour of the irrigation system;
3. Analysis of irrigation regime and technical elements of watering;
4. Analysis of technical and economic efficiency of irrigation system.

The research material consists of the Irrigation Arrangement, briefly describing its components, as well as the biological material under study – the 4 varieties of fruits grown in the orchard: Golden Delicious, Red Delicious, Gala and Granny Smith.

The study and research methodology consists of:

- Analysis of technical functional characteristics of irrigation arrangement;
- Analysis of technical and economic efficiency of irrigation system;
- Analysis of qualitative indices of apple fruits.

In Chapter 5, entitled ***Results regarding the characteristics and functioning of the irrigation system***, the results of observations on the technical functional characteristics of the irrigation arrangement, the behavior in operation of the drip irrigation system: commissioning, maintenance of the installation, malfunctions and their remediation are described. At the same time, conclusions on environmental impact are presented in this chapter.

Chapter 6, entitled ***Technology of cultivation and agrophytotechnical works***, describes in detail the technology of establishing the apple orchard, the maintenance works carried out in the first years after planting, as well as the irrigation regime and the technical

elements of watering. Recommendations on possibilities to improve the current situation were also made.

Chapter 7, ***Results regarding the technical economic efficiency of the irrigation system***, addresses several aspects:

a) General aspects regarding the influence of irrigation on apple production within SC Livada Mere de Iteşti SRL – in which the influence of irrigation on fruit quality was presented, by showing the results obtained from physicochemical analyzes performed during refrigeration storage on apples harvested from irrigated orchard and compared with fruits of the same variety, harvested from non-irrigated orchard.

The results obtained showed that the fruits from the irrigated orchard maintained their sensory properties for a longer time. Even at the end of the storage period, they showed a high firmness, a balanced taste, between sugars and acids, an increased hint of freshness and phytosanitary health.

The fruits that came from non-irrigated orchards, besides the fact that at the end of the storage period they did not show satisfactory organoleptic properties, due to the earlier onset of climacterium – one month earlier than the fruits from the irrigated plantation – the phytosanitary status of the fruits was not good. For this reason, a higher percentage of fruits have been downgraded in quality and cannot be marketed fresh.

At the same time, assessments were made on their yields and quality – from irrigated and non-irrigated orchard. It was observed that the yields obtained in irrigated system are higher than those obtained in non-irrigated system, except for 2020, when 26800 kg/ha were obtained in irrigated system, compared to 27500 kg/ha in non-irrigated system due to the fact that the irrigated orchard was only in the third year of cultivation and the second year of fruiting.

It is known that the maximum fruiting potential of an apple is reached from the 6^{th} year of fruiting. The fruit production in the young orchard increased progressively, with the vegetative growth and the formation of more fruit formations on the tree.

Yields will also increase in the coming years, until production stabilizes at the maximum fruiting potential, which, for varieties grown within SC Livada Mere de Iteşti SRL is 42-48 t/ha;

b) General aspects regarding investment costs and financing sources – starting with the evaluation of the investment regarding the arrangement of the irrigation system within SC Livada mere de Iteşti SRL, by calculating economic efficiency. Thus, the expenses with depreciation of the investment, and the financing sources of the investment were analyzed;

c) The economic and financial analysis of the fruit plantation started with the analysis of the expenses related to the investment with irrigation arrangement, continuing with the analysis of the total operating expenses of the fruit plantation, expenses that include:

1. direct expenses (production costs): tillage, tree work, fertilization, fertilizer, harvesting;
2. irrigation costs, in relation to the irrigation standard;
3. overheads participate in the company's financial year, but do not participate in the production process: loans, depreciation, administrative expenses.

d) The revenues registered by the company were analyzed, by categories of income;

e) The economic efficiency of the irrigation arrangement within the unit of SC Livada mere de Iteşti SRL was analyzed from the perspective of the increase in production obtained after irrigation – expressed quantitatively (kg/ha), but also in the value (lei/ha) of the profit obtained from the sale of irrigated production, but also in the profit rate (%), as a ratio of profit to total expenses.

The rate of profit obtained from operating the irrigated apple orchard is higher than that recorded from operating of the non-irrigated orchard.

It proves once again the major role of irrigation in obtaining superior yields, both quantitatively and qualitatively, compared to non-irrigated farms.