THE SITUATION OF PRINCIPLES OF DEVELOPMENT OF IRRIGATION IN THE REPUBLIC OF MOLDOVA

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Abstract: *As result of the theoretical and practical investigations of the 67 irrigation systems and sites, some important proposals were being necessary for the irrigation development in the Republic of Moldova in the actual conditions. It has been established that irrigation ensures an increase in the harvest of 30-80% on the gray soils, typical and levigated chernozems in the North and 180-250% on the ordinary and carbonate chernozems in the South (Andrieș et al., 1998; 2014). They regard at the equipment of the new irrigated lands at the area of 475 thou. hectares and reabilitation of lands equipped with the worst irrigation systems on the area of 125 thou. hectares. Principles are focused for an economic efficiency of the irrigated agricultural territories. The purpose of this paper is to analyze and generalize the situation on the field and determination of proposals to regulate basic principles of the development of irrigation in Republic of Moldova.*

Keywords*: irrigation system, specific capital investments, watering equipment, Republic of Moldova*

INTRODUCTION

Motto: "***Be ready to change your goals, but never change your values***."
The Dalai Lama

In the Republic of Moldova, productivity crop plants is largely determined by the pedologic and climatic conditions. During the vegetation period of plants, especially in the months from June to August, virtually every year there are droughts of soil and air. In such climatic conditions, irrigation is a radical measure to optimize water regime of the soil and of crop plants. It is about ensemble of land improvement works conducted guaranteeing supply with water to crops to increase productivity (Andrieș et al., 1998; 2014).

Peculiarities of natural processes on the territory of the Republic of Moldova are characterized by different hazards - in total 11 main groups of calamities (Mihailescu et al., 2005).

The more complex and dangerous natural phenomena here are considered drought, causing considerable loss of agricultural production, negatively affected the socio - economic development. In the last millennium this natural hazard, within the country, amplified from 35 droughts in the XI century up to 64 droughts in the twentieth century (Mihailescu et al., 2005).

In the years 1945-1996 there were various types of droughts that affected from 7% to 100% of Moldova's territory. In 60 years of this period of 42 years' droughts have affected the territory of between 40-100%. And during the last 20 years, from 1997 to 2016, there are repeated droughts practically once in two years (Mihailescu et al., 2005).

MATERIALS AND METHODS

The purpose of this paper is to analyze and generalize the situation in the field and determination of proposals to regulate basic principles of the development of irrigation in Republic of Moldova.

We performed theoretical and practical investigations in the fields of irrigation in the republic, analysis and generalization of results, examination of techno - functional indices of some systems of irrigation for internal household and management.

There are proposed the solution of regulation of major principles of founding of irrigation systems, taking

into account technical and scientific progress in the field of land improvements.

Restoring previously irrigated areas and new land irrigation planning must be conducted in accordance with some elaborations well argued scientifically and achievable under current conditions.

The aggregate data (Andrieș et al., 1998; 2014) by the Soils Improvement Laboratory of the Institute "Nicolae Dimo" have demonstrated that the efficacy of irrigation heads is different according to the country's agropedoclimatic area (Figure 1).

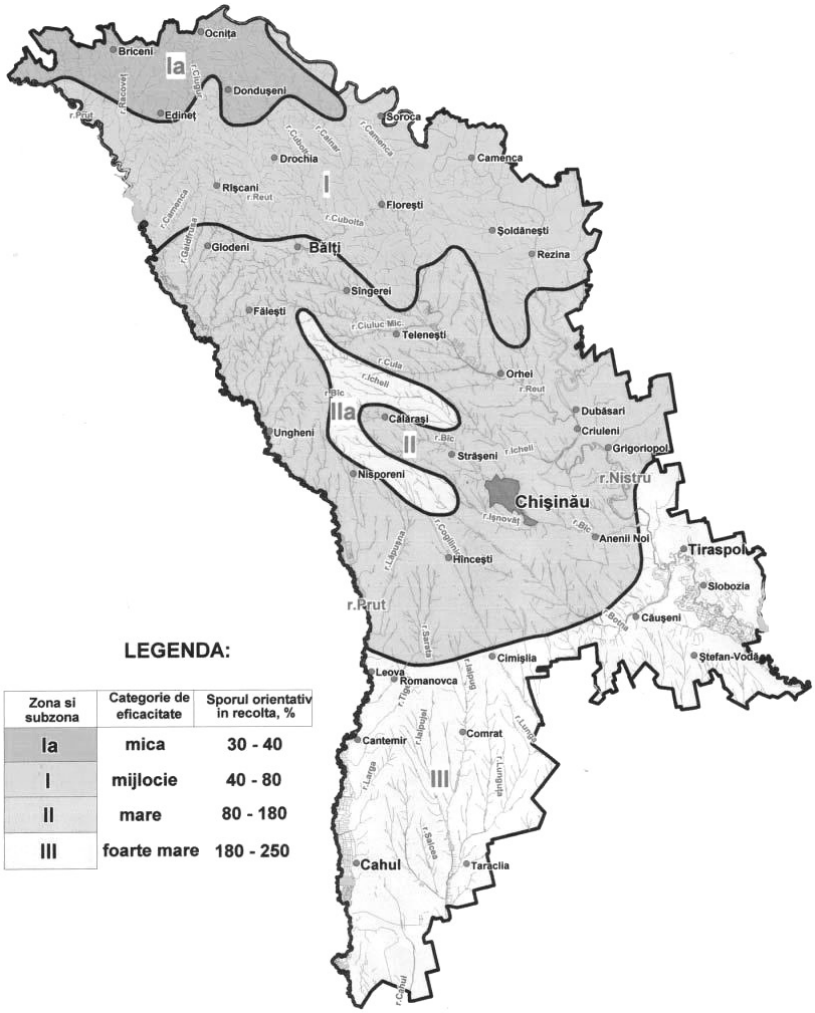

Figure 1. The effectiveness of irrigation in different climatic zones of Republic of Moldova (*dates: Iu. Rozloga, V. Filipciuc*)

RESULTS AND DISCUSSIONS

The Moldovan agriculture will develop with success only with an ample application of irrigation of land. Agricultural production, especially vegetables, fruits, under the conditions of market economy, through its

qualities, can`t be competitive without irrigation. Simultaneously, global harvest depends on irrigation too.

These circumstances have made the basis for the future of the agricultural sector, aiming at obtaining high yields and stable quality. Recently, in the mass media, it was broadcast and published information on the main problems of development of agricultural irrigation in the Republic of Moldova in the nearest future.

This program provides the increase of irrigation areas up to 600 thousand hectares, for which purpose is, needed 4.2 billion lei for capital construction, namely for the arrangement of new irrigation systems and 2.4 billion lei, for the rehabilitation, namely, reconstruction of existing irrigation systems.

Optimization of water regime is accomplished according to moisture reserves in the soil active layer and the critical stages of water used by plants (Andrieș et al., 1998; 2014).

Simultaneously, we mention that according to a strategic plan of action for rehabilitation of irrigation and development in the Republic of Moldova, elaborated in 2000 by the Republican Concern "Moldova's Waters" (***Ministry of Agriculture and Processing Industry, 2000) and approved by the Government Decision published in the Official Monitor of the Republic of Moldova No. 46 of 20 April 2001, were to be rehabilitated irrigation systems on a total area of 125 thousand hectares, which condition the special capital investments 19.200 lei per hectare.

Therefore, examining data from mass media and strategic development plan, in the years 2000 - 2016, we can generalize the following main indices as stated by the development strategies of irrigation in our country of 600 thousand hectares (Table No.1).

Table No. 1.

Main indices of development of irrigation in the Republic of Moldova (in the years 2000 – 2016)

Land development	Landscaping areas, thousand hectares	Total investments, billions MDL	Specific investment, MDL per hectare
The construction of new irrigation systems	475.0	4.2	**8842**
Rehabilitation of existing irrigation systems	125.0	2.4	**19200**
Total	**600.0**	**6.6**	**28.042**

Evidently, in the full developments of this strategic program, there are committed discrepancies and inconsistencies, which eloquently demonstrate the data from Table No.1. Really, specific capital investments to the rehabilitation of irrigation systems can`t be 2.2 times higher than those in the construction of new systems, being smaller in reality.

The analysis of information from the strategic plan of development and rehabilitation of irrigation (*** Ministry of Agriculture and Processing Industry, 2000), the general technical and economic data on 60 small systems and of irrigation sectors ranging in size from 7-100 hectares and the 7 largest irrigation systems ranging in size from 137-650 hectares (situation at 04.10.2002) and also the study on some recommendations for irrigating fruit and vegetables in Moldova (Coșuleanu, 1981; 1998) allow us to concretize to the possible extent that the irrigation situation in our country is characterized by technical-economic indexes (Table No.2).

Mention that capital investment indices generalized in Table No.2, expressed in MDL, they were obtained from dollars, recalculated cost of 60 small irrigation systems and of irrigation sectors and from EURO, of the 7 largest of irrigation systems. Specific investigations, 19,200 lei per hectare (situation of the 12.01.2016) are taken from the strategic plan of action. We realize that such recalculations are essential guidance and yet we use to

some conclusions.

We may remark that:

1. It is necessary to consider that for 16 years (2000-2016), there were more expensive building materials, the pipes used in irrigation equipment and sprinkler irrigation installations, pumping equipment and installations etc., that the construction and rehabilitation of irrigation systems have become more expensive, the specific value of investments increased. In this period, the expensive cost of electricity.
2. The generalization of information relating to the 67 systems and sectors of irrigation shows that investigations were provided, basically for the purchase of new techniques of irrigation (equipment sprinkler, pump systems and watering) without reconstruction of the existing network of irrigation or construction of new networks. So the investigation indicated in Table 2 refers absolute majority irrigation the endowment value by means of watering.
3. Agribusiness Development Project (ADP) that is implemented by CNFA American organization supported by the US Agency for International Development (USAID) so condition that the average specific of the small sectors sprinkler irrigation reaches 15751-26250 lei/hectare, which depends on the type of sprinkler installations and equipment (Gherciuc, 2007). According to the same information, specific capital investments to the drip irrigation constitute on average, for the cultivation of vegetables, 9450-15750 lei/hectare and for the cultivation of fruit and vines 14700-21000 lei/hectare. To emphasize that USAID ADP data are the latest and deserve greater truthfulness and these investments include only the cost of watering equipment and facilities without taking into account the cost of irrigation network with hydro technical constructions and related facilities.

Table No. 2.

Technical and economic indices of planning the systems and of irrigation sectors in the Republic of Moldova (situation to the 04.10.2002)

Rehabilitation of irrigation systems with spray irrigation with an area between 100-650 hectares		**Rehabilitation of irrigation systems with spray irrigation with an area between 15-100 hectares**		**Arrangement of drip irrigation sectors ranging in size from 7-100 hectares**	
Area, hectares	***Specific investment, MDL per hectare***	***Area, hectares***	***Specific investment, MDL per hectare***	***Area, hectares***	***Specific investment, MDL per hectare***
2432	**6314**	**1138**	**6342**	**491**	**15697**

4. Execution of the plan on development of irrigation will condition the major capital expenditures more like those provided (Table No.1). Approximately, the rehabilitation investment will be increased by 1.5-2 times, and the construction of new systems - by 4.5-5.0 times.

From intensive cultural practices, irrigation is the most contradictory practice. The irrigation can lead to erosion and salinisation, reduce the level of sequestered organic carbon and increases emission level, reduces productivity and can even lead to total loss of soil fertility. Salinization affecting at least 10% of irrigated areas worldwide. For these reasons, some researchers refuse irrigation within the sequestration carbon practices. In other cases, the negative effects of irrigation are due to faulty management of water (Moraru et al., 2010).

For further development of irrigation, the Republic of Moldova's natural need to reduce specific investments. We believe that guidance for this purpose is arranging irrigation systems with two categories of land: with guaranteed irrigation and mobile irrigation (Coşuleanu, 1978; 1998).

Lands with guaranteed irrigation will be serviced by a traditional network, of irrigation engineering, will achieve this regime the designed agricultural crops. The mobile irrigation lands, adjacent to guaranteed

irrigation sectors, will serve a network of rarer, simple or demonstrable irrigation that transports the water up to mobile watering installations. Such systems allow the growing of higher overall; a few extra watering areas increased, occupied with agricultural crops that are watered only 1-2 times.

Economic opportunity of these systems is higher than those with guaranteed irrigation, used on lower areas of agricultural crops. It is significant that pedologic action of irrigation on these lands is much slower as compared with guaranteed irrigation land.

Currently, it is designed the program to rehabilitate 11 irrigation systems with an area of 15 500 ha (Andrieș et al., 1998; 2014).

CONCLUSIONS

The development of irrigation problems in Republic of Moldova contains discrepancy and inconsistencies, their economic argument is difficult.

For the achievement of irrigation development programs, in the future, it is necessary to focus on specific investments relating to new systems of construction and rehabilitation of existing irrigation systems.

For the purpose of current social-economic scientific argumentation of irrigation, it is necessary to organize a laboratory, as soon as possible, in a research institution in this field. Such research will be focused mainly on optimizing the correct setting of the regime of irrigation and economic opportunity of agricultural crops' irrigation.

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