USE OF GROUNDWATER FOR IRRIGATION IN ROMANIA

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Abstract

The National Land Improvement Agency has in its administration a number of 296 irrigation systems which cover a total land area of 2998255 of hectares. The main source of water for irrigation systems in Romania is the Danube River, followed by smaller rivers and water reservoirs. According to the data presented in this study, in Romania for all five studied years the effectively used groundwater volume for irrigation was smaller than the required volume. Also there is an annual tendency of growing of the effectively used groundwater volume. For the year of 2015 a volume of 6148.07 cubic meters of groundwater were used for irrigation of an area of 10089 hectares. From the data reported in this study it can be observed that a village from Tulcea county has an irrigated area of 2023 hectares with groundwater, representing about 65 % from the total arable area. The largest area where irrigation with groundwater was applied was recorded within the villages of Galati county, over half of the total irrigated area of 10089 hectares. It is well known that Galati county is one of the largest vegetable basins of our country, which is located around the Matca village.

Key words: groundwater, irrigation system, water requirement

The National Land Improvement Agency has in its administration a number of 296 irrigation systems which cover a total land area of 2998255 of hectares. The main source of water for irrigation systems in Romania is the Danube River, followed by smaller rivers and water reservoirs.

According to the data available from the National Land Improvement Agency, for the time period after the year of 1989 irrigations were less applied, with great variations between years of irrigated areas, when compared with the time period before 1989.

There is also a significant reduction of the water quantities used for one application of irrigation, from which it can be deduced that incomplete irrigations of crops have been done.

The main causes that led to reduction in irrigated land areas were as follows: dissolution of large-scale agricultural cooperatives following the Law no.18/1993, of the Land Fund and then of the Law no.1/2000; degradation of irrigation systems through destruction, abandonment, disinterest of new landowners; transition to a market economy, which aims to obtain profit exclusively at the level of economic operator and not at the level of national economy; progressive increase in irrigation prices; lack of interest of many landowners in economic benefits of applying irrigation; deficiency of equipments for water supply to plants; bad correlation of the irrigation infrastructure rehabilitation activities with the real water demand at hydrotechnical level.

The main goal of the work presented in this paper was to evaluate the groundwater resources that can be used for crop irrigation as an alternative to surface waters.

MATERIALS AND METHODS

The data used in the present study on the evolution of groundwater requirements and consumption are provided at river basin level by the National Agency ”Romanian Waters” (ANAR). The water data were then aggregated by using the Arc GIS software together with layers in which irrigation with groundwater was applied on physical blocks, which are provided by the National Agency for Payments and Intervention in Agriculture (APIA).

RESULTS AND DISCUSSIONS

Annual variation of the groundwater requirements and effectively used for crops irrigation for the time period between 2011 and 2015 is shown in table 1. According to the data presented in table 1, in Romania for all five studied years the effectively used groundwater volume for irrigation was smaller than the required volume. Also there is a annual tendency

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of growing of the effectively used groundwater volume. For the year of 2015 a volume of 6148.07 cubic meters of groundwater were used for irrigation of an area of 10089 hectares (*figure 1*).

Table 1

Variation of required/used groundwater volumes for irrigation between the time period 2011 – 2015

(thousands of cubic meters)

River basin	Year 2011		Year 2012		Year 2013		Year 2014		Year 2015	
	required	used	required	used	required	used	required	used	required	used
Someș Tisa	2.96	9.15	3.81	12.99	8.32	2.63	3.28	209.94	184.40	135.47
Crișuri	47.55	80.67	74.38	76.96	92.53	62.11	107.76	43.57	150.49	198.05
Mureș	550.83	269.13	678.60	251.11	380.37	133.99	360.10	355.59	882.16	1072.60
Banat	4.60	47.60	5.85	9.08	47.50	45.45	142.60	59.75	63.10	82.07
Jiu	201.54	223.39	339.38	74.95	680.68	351.48	842.31	122.08	586.15	380.11
Olt	10.40	132.90	138.10	152.09	154.60	163.30	154.10	175.86	135.92	165.48
Argeș Vedea	1087.82	708.31	1401.37	869.23	912.52	952.12	1079.02	929.54	1089.74	858.99
Buzău Ialomița	2242.74	962.36	2273.42	1948.84	2820.47	1857.65	3540.48	1641.82	3543.10	2235.20
Siret	161.00	38.87	183.00	151.85	61.80	239.20	68.40	191.11	192.43	85.87
Prut Bârlad	318.76	315.34	331.97	279.66	289.58	269.07	370.36	350.18	279.96	273.50
Dobro-gea Litoral	528.95	440.78	426.20	511.30	395.30	522.00	671.46	567.43	708.82	660.73
TOTAL	5157.15	3228.50	5856.08	4338.06	5843.67	4599.00	7339.87	4646.87	7816.27	6148.07

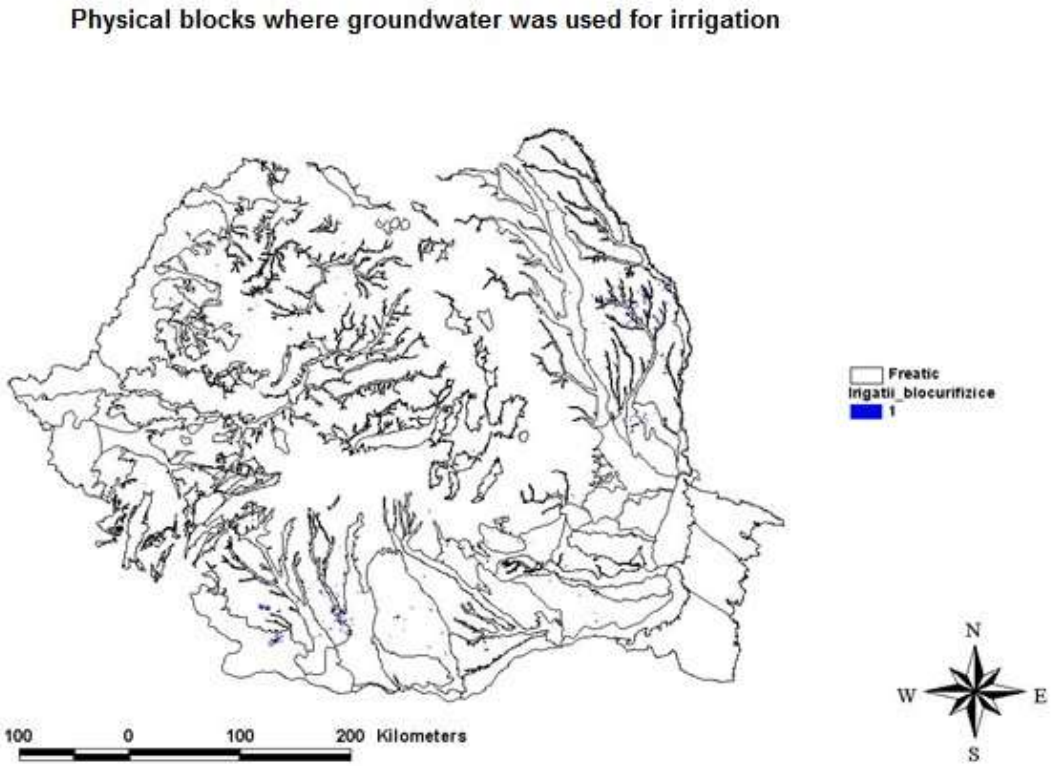

Figure 1 **Location of physical blocks where irrgation using groundwater was applied**

Table 2

Physical blocks areas where groundwater irrigation was applied in 2015

Crt. N°	County	Commune	Physical blocks:		
			Arable land (ha)	Irrigated with groundwater (ha)	Non-irrigated (ha)
1	DOLJ	Brabova	5692	581	5111
2		Bradesti	3272	23	3249
TOTAL DOLJ			8964	604	8360
3	GALATI	Corod	8379	181	8198
4		Gohor	3542	50	3491
5		Matca	7589	1517	6071
6		Oancea	3058	163	2895
7		Priponesti	4037	669	3368
8		Smulti	3976	55	3921
9		Tepu	2501	86	2416
10		Valea Marului	3688	731	2957
11		Varlezi	6707	295	6412
12		Vladesti	3755	1363	2392
13		Radesti	2340	35	2305
TOTAL GALATI			49571	5145	44426
14	OLT	Bals	2935	412	2524
15		Dobretu	1841	550	1292
16		Morunglav	1844	327	1517
17		Vulpeni	2965	35	2930
TOTAL OLT			9586	1323	8263
18	TELEORMAN	Videle	5927	82	5845
19		Dobrotesti	9144	118	9026
20		Silistea Gumesti	3592	177	3415
21		Stejaru	4354	81	4273
22		Tatarastii de Jos	7619	232	7387
23		Frasinet	3191	304	2886
TOTAL TELEORMAN			33827	994	32832
24	TULCEA	Maliuc	3077	2023	1053
TOTAL TULCEA			3077	2023	1053
TOTAL GENERAL			105025	10089	94935

The areas were irrigation was applied using groundwater are presented in table 2 and figures 2 and 3 for the year of 2015. From the data shown it can be observed that a village from Tulcea county has an irrgated area of 2023 hectares with groundwater, representing about 65 % from the total arable area. The largest area where irrigation with groundwater was applied was recorded within the villages of Galati county, over half of the total irrigated area of 10089 hectares. It is well known that Galati county is one of the largest vegetable basins of our country, which is located around the Matca village.

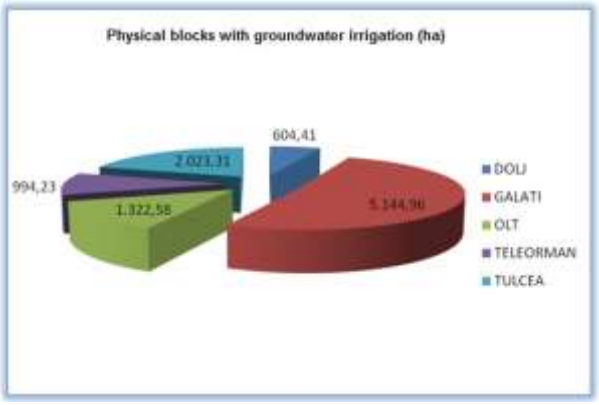

Figure 2 **County areas irrigated with groundwater**

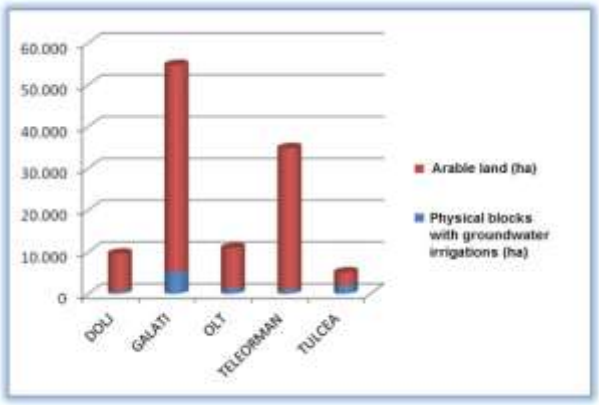

Figure 3 **The weight of areas irrigated with groundwater from the total county arable area**

Climate variations have increased in intensity across all the country, and can determine prolonged dry periods occurence. In this context, use of groundwater for irrigation is an effective alternative for eliminating the risk of yields losses of agricultural crops as a result of drought.

The advantages of using groundwater for irrigation are as follows: low costs for water pumping (wells are drilled near the farmland to be irrigated); reduced costs with electricity for water pumping; possibility for using diesel generator instead of electricity; automatization for control of

water flow and pumping pressure; low costs for maintenance.

Irrigation systems with groundwater of agricultural crops have positive impacts on the social and economic environment of the rural area where are located, such as providing high quality and quantity crop yields, the welfare of the population in the area increases, and the risk of losses of agricultural crops as a result of drought decreases.

Irrigation systems with groundwater provide a sufficient water amount for optimum plant growth, and the fertilizer doses applied on soils can be used without the risk of soil accumulation and groundwater pollution.

In order to have an efficient irrigation system, the farmer must choose the suitable system for the given situation from the field, it should take into account the costs of purchasing and installing the system as well as the pumping, functioning and maintenance costs and periodic revisions.

In general, when a irrigation system is selected, it should be taken into account: the crop type, the water requirement, the soil type, the energy source, the location of the water source and the financial funds (both for purchasing and for functioning and maintenance). Irrigation systems used in agriculte are very complex due to large areas on which they are settled and also the fert-irrigation must be applied using adjusted doses.

Individual small-scale irrigation systems with water supply from groundwater are more efficient in terms of consumption because they are adjusted to the needs of each farmer. The main advantages of such small irrigation systems are electricity and water savings. Thus, these groundwater irrigation systems are more cost-effective for vegetable farms (vegetable crops grown in greenhouse but also in the field), fruits farms, grapes farms and small-scale vegetal farms.

CONCLUSIONS

Use of groundwater for irrigation is an effective alternative for eliminating the risk of yields losses of agricultural crops as a result of drought due to climate variations. There is an annual tendency of growing of the effectively used groundwater volume in irrigation.

The largest area where irrigation with groundwater was applied was recorded within the villages of Galati county, over half of the total irrigated area of 10089 hectares. It is well known that Galati county is one of the largest vegetable basins of our country, which is located around the Matca village.

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