

Kljajić, Nataéša; Mijajlović, Nada; Arsić, Slavica

Conference Paper

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Provided in Cooperation with:

The Research Institute for Agriculture Economy and Rural Development (ICEADR), Bucharest

Suggested Citation: Kljajić, Nataéša; Mijajlović, Nada; Arsić, Slavica (2012) : The functions of land in irrigation in Serbia, In: Agrarian Economy and Rural Development - Realities and Perspectives for Romania. 3rd Edition of the International Symposium, October 2012, Bucharest, The Research Institute for Agricultural Economy and Rural Development (ICEADR), Bucharest, pp. 181-187

This Version is available at:

<https://hdl.handle.net/10419/76863>

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THE FUNCTIONS OF LAND IN IRRIGATION IN SERBIA¹

KLJAJIĆ NATAŠA², MIJAJLOVIĆ NADA³, ARSIĆ SLAVICA⁴

Summary

Land represents one of the key factors limiting crop production due to the simultaneous action of two processes as demand for food increasing, on the one hand, and reducing the area of agricultural land, on the other. Production capacity of the land reduces the continuous processes and damages toward agricultural areas. Of the total available land of approximately 8.8 million ha, agricultural land in the Republic of Serbia covers 5.9 million ha, of which 4.7 million ha represents arable land, and 3.7 million hectares are fields. Since not all arable land is suitable for irrigation, 3.6 million ha are of that kind. So, Serbia has around 0.4 ha of arable land per capita and the land fund is constantly decreasing. This small area should provide enough food for the population. Accordingly, this paper shows the structure of agricultural land, irrigated area in ha and their percentages, area under different irrigation systems (surface, spraying, dripping) and area of arable land covered with gardens, orchards, vineyards and meadows, in the period 2000-2010. At the end of the paper tables are given showing areas where irrigation is applied under different crops in 2010.

Keywords: rural development, land use, irrigation, protection.

INTRODUCTION

Land as a gift of nature has no value, but from the moment of its use in the production process, it becomes a product of human labor, which can be sold and purchased at a specified price, as a function of potential for the production of goods and services. For this reason, almost all states initiate and implement concrete measures in practice in terms of land use, preservation of fertility, protection of property rights and ecological system [7].

Rural development involves the integrated management of natural resources in a sustainable manner (harmonization of economic, social and environmental principles) in the rural community. Rural Development is a program of activities geared towards the needs of rural communities. It is also a response to the pressure that accompanies the modernization of European agriculture and reconstructs the disturbed economic base of rural economy and farm businesses. Agriculture and forestry are the main land users and play a key role in managing natural resources in rural areas. The latest rural development policy provides a smooth and balanced development in all rural areas in the EU. All activities of rural development and forestry are defined by agricultural policies.

Land and climate conditions are very favorable for Serbian development of agricultural production. Flat regions, according to its natural characteristics, are favorable for crop and vegetable production, while higher elevations areas are favorable for fruit growing, wine-growing and cattle breeding.

General picture of development of agriculture in Serbia is almost impossible to give. The degree of development is determined by areas and regions. The most fertile, lowland areas, although not at a high level, has agricultural production much developed than in mountainous areas. We can conclude that in addition to the large number of people engaged in agriculture, few of them are ready and able to apply modern methods and introduce innovations in their production. Average yields of most agricultural products are far below the European and world average. Agricultural land is an important natural advantage in Serbia relating to many European countries,

¹ This paper is part of the research project number 46 006: "Sustainable Agriculture and Rural Development in the purpose of achieving the strategic objectives of the Republic of Serbia within the Danube region," an integral and interdisciplinary research (period 2011-2014), funded by the Ministry of Education and Science of the Republic of Serbia.

² PhD, Nataša Kljajić, Research Associate, Institute of Agricultural Economics, 11060 Belgrade, Volgina 15 Street, www.iep.bg.ac.rs, e-mail: natasa_k@iep.bg.ac.rs

³ M.A., Nada Mijajlović, Research Associate, Institute of Agricultural Economics, 11060 Belgrade, Volgina 15 Street, www.iep.bg.ac.rs, e-mail: nada_m@iep.bg.ac.rs

⁴ M.A., Slavica Arsić, Research Associate, Institute of Agricultural Economics, 11060 Belgrade, Volgina 15 Street, www.iep.bg.ac.rs, e-mail: slavica_a@iep.bg.ac.rs

due to its total volume and its regional distribution. Agricultural land, coupled with other favorable natural conditions (altitude, climate parameters, relief), in our region is very suitable for the development of diversified agricultural production.

RESULTS AND DISCUSSIONS

Structure of agricultural land

Based on the data of the Republic Statistical Office in Serbia 67.3% of the total area (88,361 km²) is agricultural land of different solvency classes. The remaining 27.5% consists of forests and forest lands, and 5.2% is non-productive land.

From the point of organizing a modern market production, current state of the spatial arrangement of farmlands is unsustainable. Factors reducing and degrading agricultural land in Serbia are: the expansion of settlements, industrial, mining, energy and transportation facilities, water erosion, wind erosion, soil salinity, nutrient loss, chemical pollution of bio - industrial sources, mechanical compaction of soil in the processing of heavy machinery, water logging land, flood, etc.).

Land use in Serbia is followed by a number of different issues such as land fragmentation, the extensiveness of use, inadequate intake of organic matter degradation processes caused by the action of nature and man. The solution is in the intensive land use, enlargement of holdings, greater intake of organic matter and reducing the degradation process.

In the structure of agricultural land, by categories of use a high share of arable land (83%) is evident. Observed by average for the period 2000-2010 of the total area of arable land, which amounts 5.086 million ha, 65.5% represents arable land, 4.8% are orchards, 1.4% vineyards, 12.0% meadows and pastures 16.3% (Table 1).

Table 1 Agricultural land use by category (period 1999-2010) (000 ha)

Year	Total	Arable land					Pastures	Marshes, ponds and swamps
		sum	Fields and gardens	Orchards	Vineyards	Meadows		
Republic of Serbia								
1999	5119	4252	3352	245	72	583	835	32
2000	5109	4259	3356	245	71	587	815	35
2001	5112	4256	3355	244	69	588	821	35
2002	5107	4255	3351	245	69	590	817	36
2003	5115	4253	3345	246	67	594	826	36
2004	5075	4252	3344	244	66	598	823	-
2005	5074	4242	3330	239	64	609	832	-
2006	5066	4228	3318	238	62	610	838	-
2007	5053	4218	3299	240	59	620	835	-
2008	5093	4260	3302	242	58	621	833	-
2009	5058	4224	3301	240	58	625	834	-
2010	5052	4216	3295	240	57	624	836	-
Central Serbia								
1999	3329	2605	1768	228	60	549	720	5
2000	3322	2614	1776	227	59	552	703	5
2001	3324	2611	1775	226	57	552	708	5
2002	3325	2608	1771	227	57	554	711	6
2003	3322	2602	1762	228	56	557	713	6
2004	3315	2604	1762	226	55	561	711	-
2005	3316	2593	1748	221	53	571	723	-
2006	3318	2587	1744	220	52	571	731	-
2007	3305	2576	1727	222	49	578	729	-
2008	3312	2585	1728	223	48	580	727	-
2009	3312	2580	1723	222	48	584	732	-
2010	3301	2568	1717	222	48	581	733	-
AP Vojvodina								

Year	Total	Arable land					Pastures	Marshes, ponds and swamps
		sum	Fields and gardens	Orchards	Vineyards	Meadows		
1999	1789	1647	1584	17	12	33	115	28
2000	1787	1645	1581	17	12	35	112	30
2001	1788	1645	1580	18	12	35	113	29
2002	1783	1647	1581	18	12	36	106	30
2003	1794	1651	1583	18	11	38	113	30
2004	1760	1648	1582	18	11	37	112	-
2005	1758	1649	1582	18	11	38	109	-
2006	1748	1641	1574	18	11	38	107	-
2007	1748	1642	1572	18	10	42	106	-
2008	1781	1675	1574	19	10	41	106	-
2009	1747	1646	1578	18	10	41	101	-
2010	1750	1648	1578	18	10	42	102	-

Source: Statistically Yearbook of Serbia, 2004, 2009.

Irrigation provides a multifaceted contribution to the improvement and intensification of agricultural production. By providing irrigation the change of agricultural production structure is carried out, along with deadlines and standards of planting, cultivation methods; plant nutrition also contributes to the irrigation by obtaining higher yields and intensification of livestock production. As a result of irrigation direct engagement of the food industry processing capacities in price of final products reducing occurs. [2, 3, 4, 5].

Irrigation in the global context is applied to more than 1/6 of arable land. The main factor in the spread of irrigation are rainfall, or lack thereof, because 55% of the land surface is placed in the areas of arid and semiarid climate, and therefore there is the need for irrigation. On the other hand, an unfavorable distribution of rainfall, both during the year and during the growing season, and frequent drought periods shift this limit to 75% of areas in need of permanent or temporary irrigation system.

In general one could say that the spread of irrigation globally is directly proportional to air temperature and evapotranspiration, and inversely proportional to the quantity and distribution of rainfall during the growing season.

The level of irrigation development reached in Serbia does not satisfy the needs of a stable and efficient agricultural production. Irrigation has not found its rightful place in our agriculture because each fertile year places it into the background. According to the percentage of irrigated area to total area of land suitable for irrigation, our country lags far behind all the neighboring countries and is on almost the last place among the countries of Europe. In Serbia there are about 180,000 ha under irrigation system, but the extent of their use is of 50-60%. It is estimated that currently in operation is approximate 30,000 ha [1].

The most common reasons for low use of existing irrigation systems are the disadvantage of agriculture, insufficient equipment of farms that have irrigation equipment for the production of additional resources, and general lack of financial resources for equipment maintenance and operation of irrigation systems.

For the period 2000-2010., the average irrigated area was 0.54% of total agricultural land used in the Republic of Serbia. Central Serbia for the same period irrigated 0.14% and AP Vojvodina 1.47% from used agricultural land.

In the past 11 years an average of 27 550 ha, which represents only 0.54%, of total arable land in the Republic of Serbia (5.086 million ha) was irrigated. Surface irrigation method is applied to a surface of 3939 ha, spraying to the 22 850 ha, and drop by drop to 438.5 ha. Most of the irrigated land are fields and gardens (an area of 26 034 ha or 94%), orchards (1323 ha or 0.03%), vineyards (an area of 169 ha or 0.4%) and finally the meadows (on the surface of 37.4 ha or 0.1%). In Central Serbia 4611 ha are irrigated, which makes 0.15% of total arable land in Central Serbia, while in Vojvodina 22 939 ha is irrigated which represents 0.01% of total arable land of Vojvodina. Surface irrigation is actually a 429 ha in Central Serbia, and the 3390 ha in Vojvodina, while the

spraying is applied to 3807 ha in Central Serbia and 19 043 hectares in Vojvodina. Most of the irrigated areas are fields and gardens (3 549 ha are in Central Serbia and 22 484 ha in Vojvodina), followed by orchards (436 ha in Central Serbia, 1151. ha in Vojvodina), vineyards (61 ha in central Serbia and in Vojvodina 119 ha) and meadows (32 ha in central Serbia and 13 ha in Vojvodina).

Table 2 Area under irrigation in R. Serbia in the period 2000-2010

Years	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Republic of Serbia											
Used agricultural land (thousands ha)	5.109	5.112	5.107	5.115	5.113	5.074	5.066	5.053	5.055	5.058	5.091
Irrigated area (ha)	26.845	29.688	37.017	28.072	21.287	26.845	25.566	25.763	26.260	30.576	25.128
Irrigated area (%)	0,52	0,58	0,72	0,55	0,42	0,53	0,50	0,51	0,52	0,60	0,49
<i>Surface</i>	4.828	5.384	5.940	4.916	4.596	4.828	5.437	3.067	1.571	1.506	1.261
<i>Sprinkling</i>	20.964	23.614	30.220	22.439	16.243	20.964	19.647	22.061	24.172	28.585	22.442
<i>Drip</i>	1.053	690	857	717	438	1.053	482	635	517	484	1.425
Fields and gardens	24.054	27.852	35.111	26.250	19.836	24.054	24.025	24.339	25.035	29.781	-
Orchards	2.593	1.730	1.883	1.550	1.451	2.593	1.521	1.204	924	728	-
Vineyards	178	79	-	212	-	178	-	-	302	67	-
Meadows	20	27	60	60	-	20	-	-	-	-	-
Central Serbia											
Used agricultural land (thousands ha)	3.322	3.324	3.325	3.322	3.321	3.316	3.318	3.305	3.306	3.311	3.502
Irrigated area (ha)	5.557	3.746	4.208	3.014	3.114	5.557	3.698	3.675	4.130	3.863	10.156
Irrigated area (%)	0,17	0,11	0,13	0,09	0,09	0,17	0,11	0,11	0,12	0,12	0,20
<i>Surface</i>	1.326	873	232	434	342	1.326	324	96	201	76	810
<i>Sprinkling</i>	3.901	2.660	3.775	2.496	2.762	3.901	3.357	3.398	3.752	3.589	8.288
<i>Drip</i>	330	213	201	84	10	330	17	181	177	197	1.058
Fields and gardens	4.345	3.070	3.782	2.750	3.040	4.345	3.524	3.258	3.784	3.595	-
Orchards	1.145	649	366	144	74	1.145	154	197	263	227	-
Vineyards	60	-	-	60	-	60	-	-	84	41	-
meadows	7	27	60	60	-	7	-	-	-	-	-
AP Vojvodina											
Used agricultural land (thousands ha)	1.787	1.788	1.783	1.794	1.792	1.758	1.748	1.748	1.749	1.747	1.589
Irrigated area (ha)	21.288	25.942	32.809	25.058	18.173	21.288	21.868	22.088	22.130	26.713	14.972
Irrigated area (%)	1,19	1,45	1,84	1,40	1,01	1,21	1,25	1,26	1,27	1,53	2,94
<i>Surfaces</i>	3.502	4.511	5.708	4.482	4.254	3.502	5.113	2.971	1.370	1.430	451
<i>sparkling</i>	17.063	20.954	26.445	19.943	13.481	17.063	16.290	18.663	20.420	24.996	14.154
<i>Dripping</i>	723	477	656	633	438	723	465	454	340	287	367
Fields and gardens	19.709	24.782	31.329	23.500	16.796	19.709	20.501	21.081	21.251	26.186	-
Orchards	1.448	1.081	1.517	1.406	1.377	1.448	1.367	1.007	661	201	-
Vineyards	118	79	-	152	-	118	-	-	218	26	-
Medows	13	-	-	-	-	13	-	-	-	-	-

Source: Calculation based on data of the Statistical Office of Serbia, Statistical Yearbooks 2001. - 2011.

The data regarding irrigated areas covered by specific crops and the overall yield in the terms of irrigation is very difficult to obtain because the reporting units registered in Address Book Group for Environmental Statistics of the Statistical Office, collect data annually with the response of 75%. Many of the reports are often empty or incomplete, and some of the notes include an explanation of the reason for unfilled questionnaires (the company in bankruptcy, disabled or defective irrigation systems, etc), according to this only approximately 45% of questionnaires have operational data. In particular, the data on the quantities of water for irrigation, as well as irrigated

areas per crop are unreliable because in most cases an assessment is necessary (especially for data on the quantities of water for irrigation).

During 2010. in the Republic of Serbia 25 128 ha (of which in central Serbia on 10 156 ha in Vojvodina on 14 972 ha).was irrigated.

Table 3 Irrigated area in the Republic by the cultures (ha)

Crop plants ⁵	2010		
	R. of Serbia	Central Serbia	AP Vojvodina
Total irrigated area of biotech crops (ha)	25.128	10.156	14.972
Cereals for grain production, but corn	1.694	10	1.684
Corn grain and silage	6.289	2.398	3.891
Pulses	2830	232	2598
Sugar beet	1.682	450	1.232
Sunflower	49	0	49
Oilseed rape and fodder beet	445	0	445
Plants for the production of textile fibers	70	70	0
Mixture of grasses	674	662	12
Potatoes (including early)	1.878	1.406	472
Vegetables, strawberries and watermelon (open)	6.351	3.130	3.221
Other crops on arable land and gardens	1.141	620	521
Meadows and Pastures	69	44	25
Orchards	1.264	826	438
Vineyards	1	1	0
Other permanent crops	691	307	384

Source: National Statistical Office, the Group for Environmental Protection

According to this wheat for grain production (corn) cover to 1694 ha (in central Serbia, 10 ha, 1684 ha in Vojvodina), corn for grain and silage on 6289 ha (in 2398 ha Central Serbia, Vojvodina in 3891 ha), pulses 2830 ha (in central Serbia, 232 ha, 2598 ha in Vojvodina), 1682 ha of sugar beet (in central Serbia, 450 ha, 1232 ha in Vojvodina), sunflower 49 ha (in central Serbia 0 ha, 49 ha in Vojvodina), oilseed rape and fodder tail 445 ha (in central Serbia 0 ha, 445 ha in Vojvodina), plants for production of textile fibers 70 ha (in central Serbia, 70 ha in Vojvodina 0 ha), a mixture of grass 674 ha (in central Serbia, 662 ha in Vojvodina 12 ha), potatoes (including early) 1878 ha (in 1406 ha Central Serbia, Vojvodina 472 ha), vegetables, strawberries and watermelon 6351 ha (in 3130 ha Central Serbia, Vojvodina in 3221 ha), and other crops on arable land and gardens 1141 ha (in central Serbia, 620 ha, 521 ha in Vojvodina), meadows and pastures of 69 ha (in central Serbia, 44 ha, 25 ha in Vojvodina), 1264 ha of orchards (in central Serbia, 826 ha, 438 ha in Vojvodina), vineyards 1 ha (in central Serbia 1 ha 0 ha in Vojvodina), other permanent crops 691 ha (in central Serbia, 307 ha, 384 ha in Vojvodina).

CONCLUSION

Common Future for agriculture in Serbia and in the EU has to be an efficient, market-oriented production, one in which issues such as food safety and environmental protection contribute to the overall development of rural society. Serbia can produce more food (safe and of high quality) attractive to consumers at home and abroad, can impact on the environment, submit the changes that are needed to enable this state to join the EU. The future must be based on the production that is more specialized and focused on market requirements.

"The strategic goals of sustainable land use to be implemented should be directed to:

⁵ List of agricultural crops has been made on the basis of a list of irrigated crops in the current Census of Agriculture questionnaire

- the harmonization of legislation concerning the use and protection of land with EU legislation;
- prevention of further loss of land and the preservation and improvement of its quality, especially for industrial, mining, energy, transportation and other activities;
- protection against degradation, changing the use and regulation of agricultural land. To achieve these objectives it is necessary to: harmonize existing legislation with EU and UN on land use and environmental protection; identify and select groups of soil quality parameters that will be applied in monitoring and control of fertility; create fertility control networks to strengthen its land to be deal with the protection, development and use of agricultural land, and establish a laboratory at the national level to deal with land and mineral resources. It is necessary to establish a database on land " [5]..

Strategic starting point for irrigation in Serbia lies in the fact that it should not be treated only as a measure of the fight against drought and further measure to stabilize agricultural production in its present structure has to be applied. Construction of irrigation systems is expected to create economic and organizational framework to overall agricultural production, with all related sectors (farming, processing, purchase, transport, etc.) and to transform in accordance with primary production through irrigation. The whole structure of the food industry, to the highest level of finalization, should be transformed and developed keeping in mind a whole new resource, economic and manufacturing base that performs in terms of agriculture with irrigation.

The real development of irrigation implies providing technical, economic and social conditions. "The main factors of irrigation development in terms of its impact on the development of agro-industrial complex are:

- Restructuring primary agricultural production and increasing yields of irrigated crops, which will help to increase the efficiency of irrigation;
- Mechanization in agriculture, where irrigation development will cause the increase of technical equipment, the purchase of specialized machinery and greater degree of readiness;
- The labor force, where irrigation contributes to increased employment, both in primary and in secondary production;
- The market, where irrigation development has an impact on better supply of the domestic market and for placement on the international market;
- Protecting the water, where the area of water use should choose the appropriate transformation model of water management;
- Looking at the structure of land ownership, particularly in some regional hydro systems, the private sector should be included in irrigation. Based on experiences from other countries is necessary to choose ways of including these factors in our country " [6].

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