

# PROJECTION OF EFFECTS OF THE IRRIGATION SYSTEM IMPLEMENTATION IN AGRICULTURE ON THE TERRITORY OF SREM<sup>1</sup>

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## Abstract

*Large influence on improvement of plant production lines competitiveness indicators within the national agriculture would have a wider use of agro-technical measure irrigation. Although the implementation of mentioned measure requires relatively large investments, it would certainly contribute in many ways to the improvement of current production results. In focus of this paper were projections of possible effects that will happen after the wider implementation of irrigation on the territory of the Srem Region. Positive effects are recognized in change of the utilized agricultural area (UAA) structure, growth of achieved yields and total production of produced plant species, as like in growth of total incomes from agriculture on mentioned territory. Among all, projections were shown that it will come to relatively small decrease in total utilized agricultural area UAA, then to light changes in the structure of UAA, as well as the establishment of seed production and double cropping system in some portion.*

**Key words:** *Srem, implementation of irrigation, UAA, sowing structure, yields, incomes.*

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## Introduction

In all developed countries, even those that do not have adequate conditions for continuous performance and development of agricultural activities, as the main goal is set the primary function of agriculture, provision of a certain level of food security of its citizens. Considering its valuable impact in the process of gross domestic product creation, agricultural production is highly ranked within the Serbian economy, so it could be marked as economy branch with strategic importance.

Although it has being carried out in more than satisfactory natural-climatic conditions, with a firm reliance on tradition, available land complex and human capital, unfortunately during the the last few decades its development often did not follow the trends of modern international practice and scientific-technical progress, so currently its not at the level of its real possibilities in many elements (Jeločnik et al., 2012).

In general, today, the national agriculture is facing with numerous issues, where some of them can be marked off (Jeločnik et al., 2011; Pejanović et al., 2009): from the aspect of organization of large scale commodity production, there is unfavorable ownership structure of family agricultural holdings (expressed fragmentation and atomisation of the estate); in general disunity and disorganization of agricultural producers (fragmentized offer), usually followed with small bargaining power (lack of real cooperatives, associations and clusters); unregulation on the segment of national market oriented to agriculture (monopolized demand, price instability and disorders in price parities, spatial and quantitative limitation of the national market, weak or non-existence of vertical and horizontal links in the production chains, administrative barriers in export to the foreign markets, low efficiency of the commodity reserves system, etc.); presence of elements of the agricultural production uncompetitiveness (production extensiveness based on technical and technological obsolescence of the material base, inadequate application of agro-technical measures and chemicals, lack of irrigation systems in function, low level of labour education, etc.); inadequate state support (in creation of the adequate business environment, restrictive agricultural budget, insufficient incentives for agriculture, issues in land policy and agrarian legislation, some privatization of large agricultural holdings were carried out wrongly, etc.); problems in financing (chronic lack of investment, scarce in credit lines adjusted to the needs of primary agriculture, expensive commercial credits, etc.); and other.

By focus just on the results achieved in agriculture from the aspect of hydro-reclamation system use, next issues are imposed: generally small surfaces of arable land are under the irrigation systems; obsolescence, low level of functionality and poor maintenance of existing hydro-reclamation systems; often use of inappropriate technical solutions that are not in line to established crop production; lack of experience and low level of education, at qualified labor, which is required by intensive agricultural production and the irrigation systems use; often inadequate cooperation between water management companies and water users in agriculture; significant water losses during the irrigation activity; undervalued price of water in primary production; low compatibility of grown crops with the time of application and irrigation norms; inadequate implementation of legislation related to use of water and hydro-reclamation systems; and other (Sredojević et al., 2011).

Some of the basic stances of the Gustav Papanek, scientist who was among the first who recognized the need that agricultural development has to have absolute priority, should be also mentioned (Papanek, 1954): modernization, or constant technical and technological improvement of agriculture usually has the need for labor from many segments of the national industry; results in agricultural production can be significantly increased with a relatively small amounts of additionally invested capital; as it requires a relatively small investments, agricultural development can represent a significant savings in human capital; many structural changes, within the agriculture, can be realized before initiation of the next level of its technological development and industrialization; some difficulties that are characteristic for industry and service sector development in developing countries, caused by the lack of capital, entrepreneurial skills, or some institutional limitation and inadequacy of physical infrastructure (transport, IT, energetics, etc.), are not so presented in agricultural production, considering that relatively small changes in applied technology may lead to its expressed progress; the overall economic development of certain country, considered through higher incomes and more expressed consumption, initiates or the development of national agricultural, or the import agricultural products; etc.

Reindustrialization of Serbian agriculture, from the standpoint of the used technology and human capital development, should be a factor of agricultural production prosperity, especially in rural areas, as it offers the possibility of more equitable development adjusted to the local natural and economic resources. Experience of developed countries in the field of planning of more balanced regional development, indicate the need for reindustrialization of, before all, outdated agriculture in line with the new industrial policy based on

knowledge. In other words, both, concept of balanced development of the entire economy, and concept of balanced development of individual regions, jointly promote the reindustrialization of national agriculture (Njegovan, Jeločnik, 2013).

Also it is indisputable the importance of investments in scientific-research development, from the aspect of sustainability of entire economic growth, as well as the importance of science in industrial recovery of all economy branches, so even a small country can be in possession of, or it can access to development of high technology elements.

Experience shows that these countries are more resilient in transitional periods, or in periods of economic crisis. Of course, the previously mentioned also implies more expressed cooperation between scientific-research and educational institutions with all participants in the economic (agricultural) activity, how beside the economic growth and development, and better employment of available human capital, in certain moment it could be set adequate competitive position within the world market (Zubović et al., 2013).

Therefore, considering the obsolescence of used equipment and technological solutions, or lack of equipment in primary agriculture (irrigation systems are included), there is a need for higher investments in the modernization of agriculture, which would contribute to its greater competitiveness on the world market (especially the EU market). So, it should be borne in mind that the implementation of modern technological and production solutions into the agricultural practice requires usually large size and financially strong (commercial) holdings (Nastić et al, 2012).

Unfortunately, for a long period is presented certain disparity between the share of agriculture in total investments and the share of agriculture in gross domestic product establishment, as some form of national agriculture negligence. The disproportion is mainly aftermath of the re-allocation of achieved accumulation in agriculture to investments in non-agricultural sectors (Bogdanov, 2004).

### **Methodology and data sources**

The main goal of the paper is to give a projection of assumed effects after the implementation of agro-technical measure irrigation on the entire territory of the Srem Region in the Republic of Serbia, throughout the change of the

utilized agricultural area (UAA) structure, increment of yields and total production of grown crops, as well as through the growth of total incomes from the agriculture, within the aforementioned territorial unit. In accordance to that, research firstly presents a current state of agricultural production without use of irrigation, and then expected future state of agricultural production within the potentially implemented irrigation system. Special accent was on production volume and economic effects of irrigation.

As a starting point for the projection of the total utilized agricultural area, after the implementation of irrigation, was taken the statistical database of the Statistical Office of the Republic of Serbia (SORS), leaned to the results of the Census of Agriculture 2012, which includes the structure of agricultural land by way of usage, or by individually sown/planted plant cultures. Also, the assessments have been predicted some changes in the structure of the UAA that will happen after wider implementation of irrigation.

It should be noted that all presented line in plant production are usually in line to the production system in the open field. All projections of the grown crops yield (in t/ha) are based on five-year averages for yields achieved on the territory of Srem, where were used statistical data from the annual publication od SORS (Municipalities in the Republic of Serbia for the period 2008-2012) for the observed territory, as well as the data that represent the results of field research of the Institute of Agricultural Economics (IAE), carried out on the territory of Srem and entire Vojvodina.

Such in case with yields, all price projections for the grown crops are derived from their multi-year trends, taken from the official statistical sources, the database of the Ministry of Agriculture (System of Agricultural Market Information in Serbia - STIPS), as from internal documentation of IAE Belgrade related to completed field research at the territory of Srem Region and entire Vojvodina. All used and by calculation obtained data were presented by tables and graphs in absolute and relative values. All values for plant production are expressed in national currency (RSD).

For the purposes of this research, it was adopted the technical solution for irrigation system in Srem Region developed by the research team from the Institute for development of water resources "Jaroslav Černi". This solution is in line with existing water sources, demand for water, projected sowing structure, current division of hydro-reclamation system Srem on 5 subsystems and other parameters. Solution includes: a) Territory of Lower Srem (lowland area), which covers: West Srem (lower zone), East Srem

(lower zone) and East Srem (middle zone); and b) Territory of Upper Srem (slopes of Fruška gora), which covers: West Srem (upper zone) and East Srem (upper zone).

### **Sowing surfaces on the territory of Srem Region**

After introspection into the structure of utilized agricultural area (in use are 229,196 ha) for the territory of Srem (Table 1. and Graph 1.), it can be seen that arable land and gardens dominate with a share of over 93%. Observing the used land fund of arable land and gardens per groups of grown plants, or per individual plant cultures, it is clear that in sowing structure prevails cereals (mainly corn and wheat), followed by industrial crops (mainly soybean) and sugar beet.

From the aspect of intensity of agricultural activities, the focus is directed to the surfaces under the category of perenial crops (plantations). It can be noted their relatively small share in totally utilized agricultural areas (about 2.8%), where within this category dominates orchards (about 81%) over vineyards (18.4%). In group of grown fruits species prevails apple, plum, peach, sour cherry and pear.

After the realization of assumed wider implementation of irrigation as agro-technical measure on the entire territory of Srem, it could be expected relatively small decrease of the totally used agricultural surfaces (for about 1.8%), what is primarily a result of the decrease in the land surfaces that by the rules are not subject to the application of irrigation (crofts and meadows), but if necessary can be irrigated. Also, the implementation of irrigation assumes slight changes in the structure of the UAA, before all relative increase in the participation of categories of land use - arable land and gardens, at almost 95%, as well as category plantations, to around 3%.

Within the sowing structure by the category of use of agricultural land fund, assumption is that the most of grown plants were represented at approximately identical surfaces. More expressed, absolutely presented variations in sowing surfaces can be observed only in the group of cereals (wheat and corn) and industrial crops (soybean and sunflower). Made projections also assume the establishment of seed production (mainly crops) and establishment of double cropping system (mainly sweet corn and vegetable).

**Table 1. Utilized agricultural area (UAA) in Srem Region by land categories and sown plants (current state and coverd by irrigation system)**

No.	Description	Current state			After wider implementation of the irrigation measure			
		Area (ha)	Share in surfaces by category (%)	Share in total surfaces (UAA), (%)	Area (ha)	Index	Share in surfaces by category (%)	Share in total surfaces (UAA), (%)
<b>I</b>	<b>UAA - Total</b>	<b>229.196</b>	<b>100,00</b>	<b>100,00</b>	<b>225.129</b>	<b>98,23</b>	<b>100,00</b>	<b>100,00</b>
<b>II</b>	<b>Croft</b>	<b>1.703</b>	<b>100,00</b>	<b>0,74</b>	<b>0</b>	<b>0,00</b>	<b>-</b>	<b>0,00</b>
<b>III</b>	<b>Arable land and gardens</b>	<b>213.715</b>	<b>100,00</b>	<b>93,25</b>	<b>213.306</b>	<b>99,81</b>	<b>100,00</b>	<b>94,75</b>
<i>1</i>	<i>Cereals</i>	<i>147.058</i>	<i>68,81</i>	<i>64,16</i>	<i>140.664</i>	<i>95,65</i>	<i>65,94</i>	<i>62,48</i>
1.1	Wheat and spelt	54.928	25,70	23,97	52.540	95,65	24,63	23,34
1.2	Rye	71	0,03	0,03	68	95,65	0,03	0,03
1.3	Barley	3.775	1,77	1,65	3.611	95,65	1,69	1,60
1.4	Oat	154	0,07	0,07	147	95,65	0,07	0,07
1.5	Corn (mercantile)	86.810	40,62	37,88	83.036	95,65	38,93	36,88
1.6	Other cereals (grains)	1.320	0,62	0,58	1.263	95,65	0,59	0,56
<i>2</i>	<i>Seed production</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>5.500</i>	<i>-</i>	<i>2,58</i>	<i>2,44</i>
2.1	Seed corn	0	-	-	2.000	-	0,94	0,89
2.2	Seed sugar beet	0	-	-	1.000	-	0,47	0,44
2.3	Seed sunflower	0	-	-	750	-	0,35	0,33
2.4	Seed soybean	0	-	-	1.500	-	0,70	0,67
2.5	Other cultures grown for seed	0	-	-	250	-	0,12	0,11
<i>3</i>	<i>Legumes</i>	<i>83</i>	<i>0,04</i>	<i>0,04</i>	<i>83</i>	<i>100,00</i>	<i>0,04</i>	<i>0,04</i>
3.1	Peas (dry grain)	12	0,01	0,01	12	100,00	0,01	0,01
3.2	Beans	68	0,03	0,03	68	100,00	0,03	0,03
3.3	Other legumes	3	0,00	0,00	3	100,00	0,00	0,00
<i>4</i>	<i>Potatoes</i>	<i>205</i>	<i>0,10</i>	<i>0,09</i>	<i>205</i>	<i>100,00</i>	<i>0,10</i>	<i>0,09</i>
<i>5</i>	<i>Sugar beet</i>	<i>12.235</i>	<i>5,72</i>	<i>5,34</i>	<i>12.235</i>	<i>100,00</i>	<i>5,74</i>	<i>5,43</i>
<i>6</i>	<i>Industrial plants</i>	<i>41.332</i>	<i>19,34</i>	<i>18,03</i>	<i>44.590</i>	<i>107,88</i>	<i>20,90</i>	<i>19,81</i>
6.1	Tobacco	2.768	1,30	1,21	3.000	108,38	1,41	1,33
6.2	Hop	-	-	-	0	-	-	-
6.3	Oilseed rape	914	0,43	0,40	1.500	164,11	0,70	0,67
6.4	Oil pumpkin	0	0,00	0,00	0,00	0,00	0,00	0,00
6.5	Sunflower	8.756	4,10	3,82	10.000	114,21	4,69	4,44
6.6	Soybean	28.851	13,50	12,59	30.000	103,98	14,06	13,33
6.7	Other plants for oil production	14	0,01	0,01	14	100,00	0,01	0,01

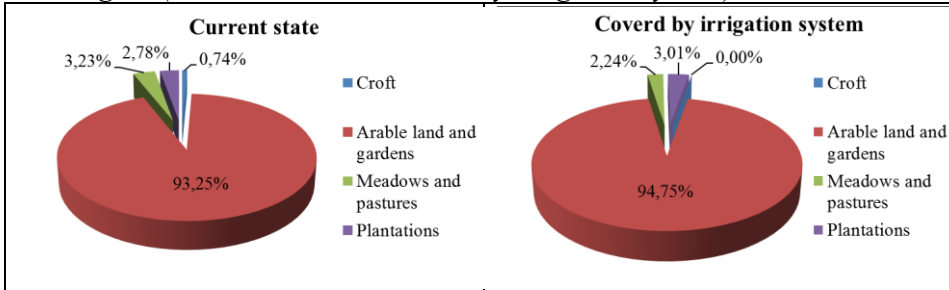
6.8	Plants for textile fibers production	1	0,00	0,00	1	100,00	0,00	0,00
6.9	Medicinal and aromatic plants	9	0,00	0,00	45	500,00	0,02	0,02
6.10	Other industrial plants	19	0,01	0,01	30	157,89	0,01	0,01
7	<i>Vegetable, melons and strawberry</i>	<i>2.342</i>	<i>1,10</i>	<i>1,02</i>	<i>2.342</i>	<i>100,00</i>	<i>1,10</i>	<i>1,04</i>
7.1	Tomato	166	0,08	0,07	166	100,00	0,08	0,07
7.2	Cabbage and kale	94	0,04	0,04	94	100,00	0,04	0,04
7.3	Paper	255	0,12	0,11	255	100,00	0,12	0,11
7.4	Onion	157	0,07	0,07	157	100,00	0,07	0,07
7.5	Garlic	5	0,00	0,00	5	100,00	0,00	0,00
7.6	Cauliflower	14	0,01	0,01	14	100,00	0,01	0,01
7.7	Carrot	15	0,01	0,01	15	100,00	0,01	0,01
7.8	Peas	12	0,01	0,01	12	100,00	0,01	0,01
7.9	Other fresh vegetable	187	0,09	0,08	187	100,00	0,09	0,08
7.10	Melon	1.417	0,66	0,62	1.417	100,00	0,66	0,63
7.11	Strawberry	20	0,01	0,01	20	100,00	0,01	0,01
7.12	From that in protected area	95	0,04	0,04	95	100,00	0,04	0,04
8	<i>Flowers and ornamental plants</i>	<i>10</i>	<i>0,00</i>	<i>0,00</i>	<i>10</i>	<i>100,00</i>	<i>0,00</i>	<i>0,00</i>
9	<i>Fodder</i>	<i>6.369</i>	<i>2,98</i>	<i>2,78</i>	<i>6.369</i>	<i>100,00</i>	<i>2,99</i>	<i>2,83</i>
9.1	Mixed grasses	81	0,04	0,04	81	100,00	0,04	0,04
9.2	Silage corn	366	0,17	0,16	366	100,00	0,17	0,16
9.3	Clover	2.542	1,19	1,11	2.542	100,00	1,19	1,13
9.4	Alfalfa	3.259	1,52	1,42	3.259	100,00	1,53	1,45
9.5	Other fodder legumes	41	0,02	0,02	41	100,00	0,02	0,02
9.6	Other plants harvested as green	15	0,01	0,01	15	100,00	0,01	0,01
9.7	Fodder beet	8	0,00	0,00	8	100,00	0,00	0,00
9.8	Other root and leafy fodder plants	57	0,03	0,02	57	100,00	0,03	0,03
10	<i>Other crops</i>	<i>1.308</i>	<i>0,61</i>	<i>0,57</i>	<i>1.308</i>	<i>100,00</i>	<i>0,61</i>	<i>0,58</i>
11	<i>Fallow</i>	<i>2.773</i>	<i>1,30</i>	<i>1,21</i>	<i>0</i>	<i>-</i>	<i>-</i>	<i>-</i>
12	<i>Double cropping system in projection</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>53.327</i>	<i>-</i>	<i>25,00</i>	<i>23,69</i>
12.1	Sweet corn	-	-	-	15.091	-	7,08	6,70



12.2	Green beans	-	-	-	7.572	-	3,55	3,36
12.3	Cabbage	-	-	-	7.786	-	3,65	3,46
12.4	Cauliflower	-	-	-	7.786	-	3,65	3,46
12.5	Other plants in double cropping system	-	-	-	15.091	-	7,08	6,70
<b>IV</b>	<b>Meadows and pastures</b>	<b>7.409</b>	<b>100,00</b>	<b>3,23</b>	<b>5.045</b>	<b>68,09</b>	<b>100,00</b>	<b>2,24</b>
<b>V</b>	<b>Plantations</b>	<b>6.369</b>	<b>100,00</b>	<b>2,78</b>	<b>6.778</b>	<b>106,42</b>	<b>100,00</b>	<b>3,01</b>
<i>1</i>	<i>Orchards</i>	<i>5.153</i>	<i>80,91</i>	<i>2,25</i>	<i>5.562</i>	<i>107,94</i>	<i>82,06</i>	<i>2,47</i>
1.1	Plantation	4.090	64,22	1,78	4.499	110,00	66,38	2,00
1.2	Extensive	1.063	16,69	0,46	1.063	100,00	15,68	0,47
<i>2</i>	<i>Vineyards</i>	<i>1.172</i>	<i>18,40</i>	<i>0,51</i>	<i>1.172</i>	<i>100,00</i>	<i>17,29</i>	<i>0,52</i>
2.1	Sorts for wine with geographical indication	141	2,21	0,06	141	100,00	2,08	0,06
2.2	Other wine sorts	826	12,97	0,36	826	100,00	12,19	0,37
2.3	Sorts for consummation in fresh	205	3,22	0,09	205	100,00	3,02	0,09
<i>3</i>	<i>Nursery gardens</i>	<i>38</i>	<i>0,60</i>	<i>0,02</i>	<i>38</i>	<i>100,00</i>	<i>0,56</i>	<i>0,02</i>
<i>4</i>	<i>Other</i>	<i>6</i>	<i>0,09</i>	<i>0,00</i>	<i>6</i>	<i>100,00</i>	<i>0,09</i>	<i>0,00</i>
<i>5</i>	<i>Fruit</i>	<i>5.153</i>	<i>80,91</i>	<i>2,25</i>	<i>5.562</i>	<i>107,94</i>	<i>82,06</i>	<i>2,47</i>
5.1	Apple	1.639	25,73	0,72	1.769	107,94	26,10	0,79
5.2	Pear	503	7,90	0,22	543	107,94	8,01	0,24
5.3	Peach	728	11,43	0,32	786	107,94	11,59	0,35
5.4	Apricot	130	2,04	0,06	140	107,94	2,07	0,06
5.5	Sour cherry	620	9,73	0,27	669	107,94	9,87	0,30
5.6	Plum	959	15,06	0,42	1.035	107,94	15,27	0,46
5.7	Walnut	112	1,76	0,05	121	107,94	1,78	0,05
5.8	Hazelnut	328	5,15	0,14	354	107,94	5,22	0,16
5.9	Other	112	1,76	0,05	121	107,94	1,78	0,05
5.10	Raspberry	3	0,05	0,00	3	107,94	0,05	0,00
5.11	Blackberry	6	0,09	0,00	6	107,94	0,10	0,00
5.12	Other berry fruit	13	0,20	0,01	14	107,94	0,21	0,01

**Source:** Authors calculations according to SORS data.

**Graph 1. Structure of Utilized agricultural area (UAA) on the territory of Srem region (current state and covered by irrigation system)**



**Source:** Authors calculations according to data from the Table 1.

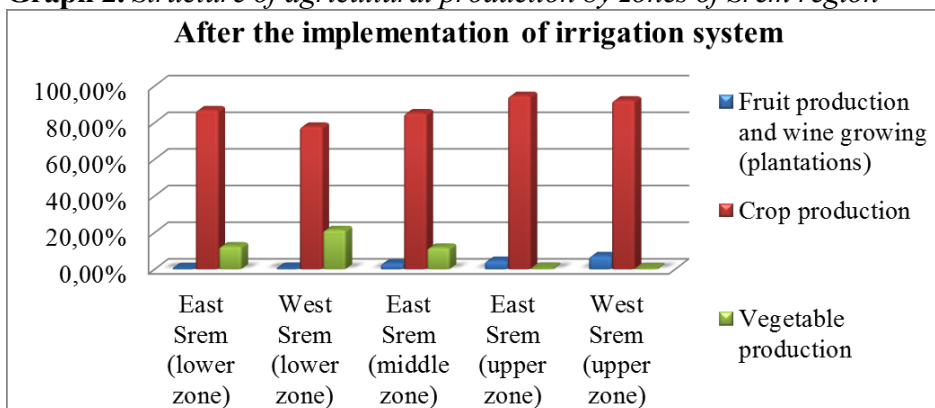
Observing the structure of utilized agricultural surfaces after the wider implementation of irrigation systems (on entire surface of 225,129 ha), by previously determined zones of the territory of the Srem Region: (East Srem (lower zone), West Srem (lower zone), East Srem (middle zone), East Srem (upper zone) and West Srem (upper zone)), according to available natural and climatic predispositions, after investing in irrigation systems (Table 2. and Figure 2.) it can be noticed that in all zones will prevail crops production (in the zone of East Srem (upper zone) with up to 95%), while in some zones in higher percentage will be presented vegetable production (West Srem (lower zone), with slightly more than 21%), or fruit and grape production (West Srem (upper zone), with around 7%).

**Table 2. Utilized agricultural area (UAA) on the territory of Srem region (after the implementation of irrigation system) by defined zones**

No	Zone	Structure of agricultural production after the wider implementation of irrigation measure							
		Fruit production and wine growing (plantations)		Crop production		Vegetable production		Total	
		ha	%	ha	%	ha	%	ha	%
1	East Srem (lower zone)	458	0,7	56.773	86,8	8.200	12,5	65.431	100,0
2	West Srem (lower zone)	304	0,8	29.607	77,8	8.163	21,4	38.074	100,0
3	East Srem (middle zone)	1.026	3,1	27.723	85,1	3.830	11,8	32.579	100,0
4	East Srem (upper zone)	2.487	4,6	51.349	94,6	444	0,8	54.280	100,0
5	West Srem (upper zone)	2.503	7,2	32.034	92,1	227	0,7	34.765	100,0
<b>Total</b>		<b>6.778</b>	<b>3,0</b>	<b>197.486</b>	<b>87,7</b>	<b>20.865</b>	<b>9,3</b>	<b>225.129</b>	<b>100,0</b>

**Source:** Authors calculations according to SORS data.

**Graph 2. Structure of agricultural production by zones of Srem region**



**Source:** Authors calculations according to data from the Table 2.

### **Incomes from agriculture on the territory of Srem Region**

In Tables 3 and 4 are given as gained incomes from certain crops production (based on achieved yields), as well as expected incomes after the wider implementation of irrigation on the entire territory of Srem (based on the expected yields).

It can be noticed that the currently achieved yields at the mentioned territory are satisfactory, if are observed in relation to the average crops yields achieved at national level. On the other hand, achieved yields at all grown crops are far below their yield potential, which could be activated after the wider use of irrigation. In this case, yield growth is especially expressed at some crops, such as corn, sugar beet and soybean. In general, use of irrigation (with certain adjustments in sowing structure and implementation of some new production lines) would lead to duplication of current incomes gained from the production of crops on arable land and gardens (from 27.4 to 59.7 mld RSD).

Also, it has to be explained the basic assumptions of yield and income growth in fruit and grape growing, after the introduction of irrigation. So, irrigation assumes a comprehensive replacement of currently prevailing extensive fruit and grape plantations in conventional form of growing (with a much smaller number of bearing trees/vines per hectare (for example, at apple plantations is usually present planting density of around 2,300 trees/ha), with representation of sorts with lower yield potential and worse quality characteristics of fruits, which are sold in the market at relatively lower prices).

Newly established intensive plantations would be performed by the technology based on integral production, growing form that is based on so-called knip seedling (which in the first year after planting has been already brought to producer certain yields), which allows significantly higher planting density (greater number of bearing trees/vines per hectare of orchard/vineyard (for example, at apple plantation density is about 4,100 trees/ha)), by the presence of modern, higher yields fruit and vine assortment, which gives fruits with better quality. Mentioned is recognized in the production indicators achieved in some modern apple plantations in Vojvodina (Podunavlje a.d., Čelarevo, or Apple World Ltd., Ridica), established in line to technology of South Tyrol (Italy), where at stage of full yielding are achieved average yields of apples of over 70 t/ha. Also, since this is the technology, in which within the production structure dominates the first class fruit (after fruits picking, they are usually classified, packaged and cooled), the fruits and grapes sale on national and international markets is usually strategically planned and agreed in advance.

Above mentioned, has implications both to gained incomes (yields), or profitability of established production per unit of production area, as well as on the level of required investment. This type of production requires several times higher investment, given that imposes the need for setting up of multipurpose (modern) irrigation system (function of fertigation, classical irrigation, anti-frost protection, etc.), system for anti-hail protection, as well as the use of special machinery and equipment, or construction of cold storage and ancillary facilities.

Presence of pure economic logic dictates that a high level of investment in production must be justified by higher yields, incomes and total effects of production, together with reduction and control of all production risks, given that all producers expectations are facing in the direction of the investment return within a reasonable period, as to acquisition of a certain profit level. With this in mind, the expectations are that with the intensification of production in orchards and vineyards at the territory of Srem the total incomes will double in fruit production, or tripled in grape production. Observing the individual fruit species, expectations from the implementation of irrigation are going in to direction of duplication of incomes gained in the peach and sour cherry production, to their increase for about 2.5 times in the apple and pear production.

**Table 3. Incomes from agriculture from the Srem Region by land categories (sown plants), (current state and covered by irrigation system)**

N o.	Description	Current state					After the wider implementation of irrigation measure				
		Yield (t/ha)	Price (RSD/kg)	Income (000 RSD/ha)	Area (ha)	Total income (000 RSD)	Yield (t/ha)	Price (RSD/kg)	Income (000 RSD/ha)	Area (ha)	Total income (000 RSD)
I	Croft			-	1.703	-			-	-	-
II	Arable land and gardens				213.715	27.385.869				213.306	59.701.912
1	Cereals			285,6	147.058	15.265.553			387,9	140.664	21.754.433
1.1	Wheat and spelt	4,8	22,0	105,6	54.928	5.800.397	5,5	22,0	121,2	52.540	6.366.558
1.2	Com (mercantile)	5,8	18,0	104,4	86.810	9.062.964	10,0	18,0	180,0	83.036	14.946.399
1.3	Other cereals (ray, barley, oat)	3,5	21,6	75,6	5.320	402.192	4,0	21,6	86,8	5.089	441.476
2	Seed production			-	-	-			1.934,1	5.500	3.948.780,0
2.1	Seed corn			-	-	-	3,6	232,0	835,02	2.933	2.449.920
2.2	Seed sugar beet			-	-	-	2,7	293,0	791,1	1.467	1.160.280
2.3	Seed sunflower			-	-	-	1,8	171,0	307,8	1.100	338.580
3	Legumes			255,0	83	10.140			533,7	83	24.989
3.1	Peas (dry grain)	5,0	27,0	135,0	12	1.620	8,1	27,0	218,7	12	2.624
3.2	Beans	1,2	100,0	120,0	71	8.520	3,2	100,0	315,0	71	22.365
4	Potatoes	9,9	15,0	147,9	205	30.320	27,0	15,0	405,0	205	83.025
5	Sugar beet	45,6	4,9	223,4	12.235	2.732.949	67,5	4,9	330,8	12.235	4.046.726
6	Industrial plants			1.747,7	41.332	8.065.095			2.530,1	44.590	12.789.088
6.1	Tobacco	2,5	600,0	1.50,0	2.768	4.152.000	3,6	600,0	2.160,0	3.000	6.480.000

6.2	Oilseed rape	2,0	29,0	58,0	914	53.012	3,2	29,0	91,4	1.500	137.025
6.3	Sunflower	2,3	35,0	80,5	8.756	704.858	3,2	35,0	110,3	10.000	1.102.500
6.4	Soybean	2,8	39,0	109,2	28.894	3.155.225	4,3	39,0	168,5	30.090	5.069.563
7	<i>Vegetable</i>			2.256,5	2.342	732.893			4.698,0	2.342	1.210.437
7.1	Tomato	30,0	15,0	450,0	166	74.700	67,5	15,0	1.012,5	166	168.075
7.2	Cabbage and kale	25,0	14,5	362,5	94	34.075	54,0	14,5	783,0	94	73.602
7.3	Paper	15,0	20,0	300,0	255	76.500	27,0	20,0	540,0	255	137.700
7.4	Cauliflower	10,0	17,0	170,0	14	2.380	22,5	17,0	382,5	14	5.355
7.5	Carrot	15,0	30,0	450,0	15	6.750	40,5	30,0	1.215,0	15	18.225
7.6	Peas	6,4	35,0	224,0	12	2.688	9,0	35,0	315,0	12	3.780
7.7	Other fresh vegetable and melon	20,0	15,0	300,0	1.786	535.800	45,0	10,0	450,0	1.786	803.700
7.8	From that in protected area				95					95	
8	<i>Flowers and ornamental plants</i>			-	10	-			-	10	-
9	<i>Fodder</i>			290,8	6.369	548.920			600,8	6.369	1.334.482
9.1	Silage corn	28,0	4,5	126,0	431	54.306	40,5	4,5	182,3	431	78.550
9.2	Clover	6,2	12,0	74,2	2.638	195.634	15,8	12,0	189,0	2.638	498.582
9.3	Alfalfa	6,0	15,0	90,6	3.300	298.980	15,3	15,0	229,5	3.300	757.350
10	<i>Other crops</i>			-	1.308	-				1.308	-
11	<i>Fallow</i>				2.773					-	
12	<i>Double cropping system in projection</i>			-	-				621,0	53.327	14.509.951
12	Sweet										

.1	corn			-	-	-	13,5	14,0	189,0	35.091	6.632.275
12.2	Green bean			-	-	-	10,8	40,0	432,0	18.235	7.877.677
<b>III</b>	<b>Meadows and pastures</b>					<b>7.409</b>				<b>5.045</b>	
<b>IV</b>	<b>Plantations</b>					<b>6.369</b>				<b>6.778</b>	<b>12.598.481</b>
1	Orchards			-	5.153	5.118.285			-	5.562	11.426.481
1.1	Plantation			-		-			-	5.562	11.426.481
1.2	Extensive			-	5.153	5.118.285			-		-
2	Vineyards			318,5	1.172	373.282	20,0	50,0	1.000,0	1.172	1.172.000
2.1	Grape – total	9,1	35,0	318,5	1.172	373.282	20,0	50,0	1.000,0	1.172	1.172.000
3	Nursery gardens			-	38	-			-	38	-
4	Other			-	6	-			-	6	-
<b>Total</b>					<b>229.196</b>	<b>32.877.436</b>				<b>225.129</b>	<b>72.300.393</b>

**Source:** Authors calculations according to data from SORS, STIPS and IAE.

**Table 4.** Incomes per fruit species in Srem Region (current state and covered by irrigation system)

N o.	Description	Current state					After the wider implementation of irrigation measure				
		Yield (t/ha)	Price (RSD/kg)	Income (000 RSD/ha)	Area (ha)	Total income (000 RSD)	Yield (t/ha)	Price (RSD/kg)	Income (000 RSD/ha)	Area (ha)	Total income (000 RSD)
I	Fruit				5.153	5.118.285				5.562	11.426.481
1	Apple (extensive plantation)	38,4	25,0	960,0	2.320	2.227.200	-	-	-	-	-
	Apple (plantation)	-	-	-	-	-	63,4	32,0	2.029,0	2.504,1	5.080.867
2	Pear (extensive)	30,0	35,0	1.050	843	884.835	-	-	-	-	-

	ve plantation)			,0							
	Pear (plantation)	-	-	-	-	-	54,1	42,0	2.272,4	909,6	2.066.956
3	Peach (extensive plantation)	22,0	50,0	1.100,0	1.075	1.182.390	-	-	-	-	-
	Peach (plantation)	-	-	-	-	-	40,5	57,0	2.308,7	1.160,2	2.678.603
4	Sour cherry (extensive plantation)	15,0	60,0	900,0	915	823.860	-	-	-	-	-
	Sour cherry (plantation)	-	-	-	-	-	25,5	63,5	1.619,4	988,1	1.600.054

**Source:** Authors calculations according to data from SORS, STIPS and IAE.

## Conclusion

Having in mind analysis of the current results of agricultural production in the territory of Srem region, as well as projections of expected results in agriculture after the wider implementation of agrotechnical measure irrigation on the mentioned territory, following conclusions could be done:

- by insight into the structure of agricultural land surfaces, on the territory of Srem will be used 229,196 hectares (arable land and gardens dominate with more than 93%);
- observing the category of utilized agricultural area (UAA), that relates to arable land and gardens, in sowing structure prevails cereals (mainly corn and wheat), followed by industrial crops, primarily soybean and sugar beet;
- permanent crops (plantations) have relatively small share in total fund of UAA (about 2.8%), where within the mentioned category dominates orchards over vineyards (ratio 4:1);
- after investment in irrigation system at the territory of Srem, it is expected relatively small decrease in total utilized agricultural area (about 1.8%), before all as a result of reduction in the land category – crofts and meadows;



- construction of irrigation system assumes light changes in the structure of UAA (relative increase in the participation of category arable land and gardens, at almost 95%, and category permanent crops (plantations), at around 3%);
- by use of the irrigation as a agrotechnical measure, projections also assume the establishment of seed production (mainly crops), as well as establishment of double cropping system (sweet corn and vegetables);
- if it is observed the structure of UAA after the implementation of the irrigation system (on the area of 225,129 ha), at a previously determinated zones of Srem district, it could be noticed:
- in East Srem (upper zone) will prevail production of crops (around 95%);
- in West Srem (lower zone), vegetable production will be presented in higher percent (around 21%);
- in West Srem (upper zone), in higher percent will prevail fruit and grape production (around 7%);
- currently achieved yields in the territory of Srem are satisfactory, if they are observed in relation to the average crops' yields achieved at the territory of entire Republic of Serbia. However, achieved yields for all grown crops are much below their yield potential, which could be activated after the wider implementation of the irrigation measure;
- with implementation of irrigation, increase of yields will be most noticeable at some crops, such as corn, sugar beet and soybean;
- wider application of irrigation (with certain adjustments in sowing structure, as well as introduction of some new lines of production) would lead to a doubling of current incomes achieved in crops production on arable land and gardens (from 27.4 to 59.7 mld. RSD);
- from the aspect of return on investment and gaining of certain level of profit, expectations are that by intensification of fruit and grape production, on the territory of Srem region, overall incomes will be doubled in fruit production, or tripled in grape production;
- observing the individual fruit species, expectations go in the direction of achieved incomes doubling in the peach and sour cherry production, or increase of incomes for about 2.5 times in the apple and pear production.

Presented projections tend to change and adjust stand to irrigation (as the most important factor for increase, stabilization and quality of yield, as well as the factor of national agriculture competitiveness strengthening) to the interests of agricultural producers, as well as to the soil and hydrological conditions.

According to that, the sowing structure in the conditions of irrigation, at the territory of Srem is adjusted to the requirements of intensive and highly accumulative crop production, that cover needs of the processing industry and animal husbandry, while in line to that, leads the agricultural producers to the core need of the irrigation measure implementation (what will significantly increase the achieved yields and profits).

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