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## THE IRRIGATION INFLUENCE ON AGRICULTURAL INTENSIFICATION IN SERBIA

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### Abstract

*The factors that influence on the intensification of agriculture on our estates (internal and external) are analyzed. Depending on the level of development and measures of agricultural policy, intensification process can be encouraged on many ways. In our case, the influence of constructing regional hydrosystem to increase the intensity (of production and economic effects) was investigated. Depending on the size of the hydrosystem, the volume of invested funds, as well as suggestions about possible reconstruction of the production, doubling of the economic and production effects can be achieved, on the condition that production management is in function of achieving our objectives. Realistically, in this case, the regional hydrosystem should be holders of intensification. They initiate the development of manufacturing industry and provide more quality goods for processing and market. Besides positive effects (direct and indirect) impact of irrigation on intensification, during long-term use on the same land, some negative effects were noticed (soil salinization, deterioration of water quality, irrigation erosion).*

**Key words:** *irrigation, regional hydrosystem, production and economic effects*

### Introduction

The effect of irrigation on the primary production on agricultural estates in Serbia, especially in regions with the built up or planned hydro system is reflected in several ways. So far, numerous studies were conducted both in our country and other countries. They included new criteria for evaluation in determining the level of intensity. Numerous product models that help farms to improve economic performance were developed. It is believed that mechanization, use of mineral fertilizers and plant protection contributed most to the intensification of agriculture (FAO, Rome, 2005).

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Intensification in agriculture is most often associated with land use. According to surveys (Bosnjak D, Rodic V., 2010.) In Serbia, in the period 1996-2005, over 60% of arable land was covered by grain, industrial crops over 10%, vegetables by 8% and forage crops over 14% which indicate extensive use. Countries that want to improve their agriculture develop different scenarios. Thus, for example, in Brazil (Goulart FF at all, 2008.) was developed a simulation model which has 21 levels of intensity. Inclusion of irrigation in the production process is on the eighth level.

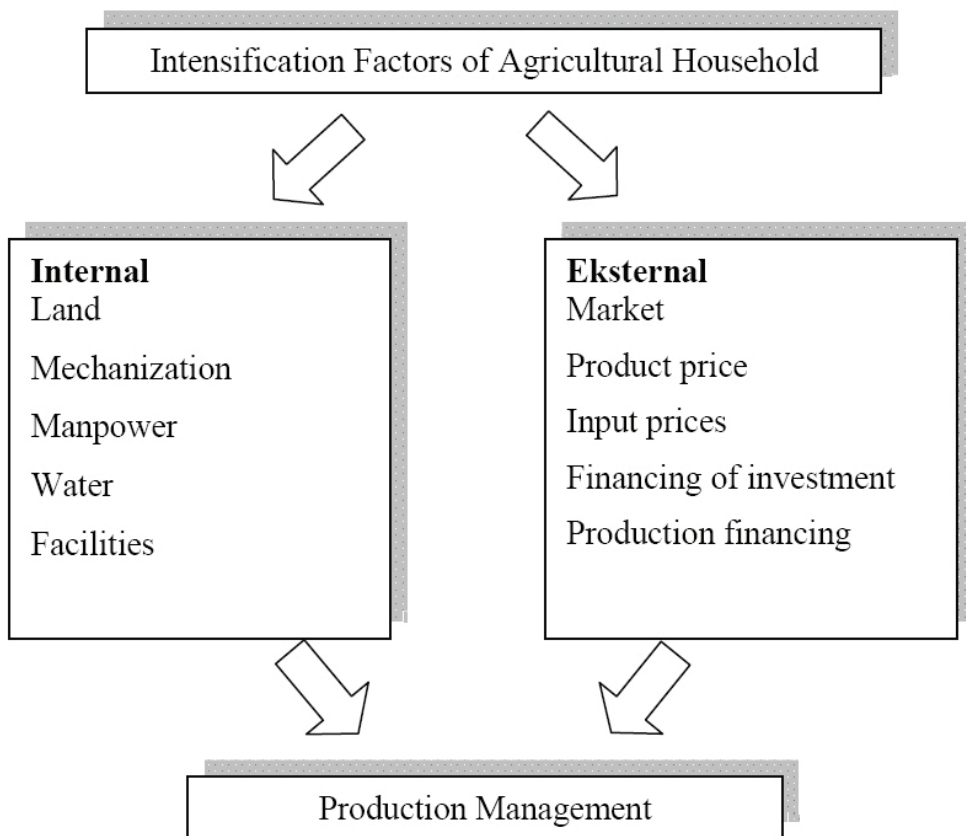
Intensification causes changes in agriculture. There are direct and indirect effects of intensification (Harms WB, at all, 1997). They are manifested in three ways: as a biotic component of ecosystems, anthropogenic elements of spatial development and as a visual spatial aspect of spatial development. The effects of irrigation (production and economic) were assessed on an area of 100,000 ha, which is within the DTD Hs (S. Potkonjak, Zoranović T., Mackic K, 2006). At the same time, it has been stated that for this development strategy is necessary to make additional investments in mechanization, irrigation and animal husbandry. Realization of this project would, in any case, contribute to increase of the intensiveness of agricultural production.

In regard to the further development of agriculture in Serbia and the importance given to building regional hydrosystem, the impact of building them on the intensification of agriculture was studied.

### **Factors of agricultural intensification in conditions of irrigation**

Research of the important factors of intensification of agriculture in our country may have several different approaches. External factors are particularly important for Government for improving nutritional balance of the country. Certain regions, particularly Vojvodina, should be interested because of the comparative advantages in relation to some intensification factors (land, water). Agricultural farm also have an interest in improving their production and economic results. To that objective, a systematization of these factors in relation to the mode of action was made (internal and external factors), the Scheme No. 1.

The task of management at the farm, in this case, would be coordination of available resources of the farms (marked as internal factors) with external factors. It is not an easy assignment, especially if it is for a longer period. New knowledge that provides information technology and GIS technology could be useful in this case. For each farm the optimal level of intensity compared to the available production factors can be calculated. However there are still components of risk and uncertainty which we have not mastered enough in practical conditions. Because of this, intensification process is long-term research task.

*Scheme No. 1: The intensification factors on agricultural estates*

### **Model of agricultural intensification of the regional hydro system**

Bearing in mind that irrigation is an important factor of the intensification of agriculture production, an analysis of potential areas for irrigation in the present and future single or multi-purpose hydro system was conducted, table No 1. If this plan implements, irrigation would be enabled for 26% of cultivated area or 37% of arable land in Serbia. Effects of such enterprise should be investigated by more comprehensive study analysis.

There are numerous studies on the effects of irrigation in our production-economic conditions, particularly in already built Hs Danube-Tisa-Danube (Potkonjak S. 2002). Within this study we have investigated the influence of irrigation on the intensification of agriculture production on the example of a future regional system Grocka-Smederevo. On an area of 5,000 ha, where is to begin with the realization of the irrigation project, there is already, for our conditions, intensive production of vegetable

crops and perennial plantations. With the current representation, and returns that are achieved in existing production, benefit is 176,895.00 cereal unit.

*Table 1: The review of regional hydrosystem in Serbia – built up&planned*

No.j	RHS	Purpose	The potential area for irrigation, ha
<b>I</b>	<b>AP Vojvodina</b>		<b>950.200.00</b>
1	Hs Dunav-Tisa-Dunav	VVS	510.000.00
2	Hs Bačka	VVS	138.000.00
3	Hs Srem	JVS	200.000.00
4	Hs Novi Kneževac	JVS	23.200.00
5	Hs Kikinda	JVS	30.000.00
6	Hs Nadela	JVS	29.200.00
7	Hs Nova Crnja Žitište	VVS	19.800.00
<b>II</b>	<b>Central Serbia</b>		<b>304.415.00</b>
1	Hs Negotinska nizija	JVS	12.000.00
2	Hs Mačva	JVS	76.500.00
3	Hs Kolubara	JVS	200.000.00
4	Hs Ključ (Kladovo)	JVS	10.915.00
5	Hs Grocka-Smederevo	JVS	5.000.00
<b>III</b>	<b>TOTAL SERBIA</b>		<b>1.254.615.00</b>

In the case of implementation of the proposed design solution, it is necessary to change the production structure, increase the individual contribution as well as introduce a second crop of annual crops. That would be an amount of 371,187.50 cereal unit, which is double the intensity. Except production, the economic effects of the intensification are very important. In this sense, comparison of the effects of intensification with and without irrigation, is conducted, Table 2. Undisputed effects in this case are: increase in product volume and intensity, increasing value and profit of production, and increase of production costs following by the applied measures.

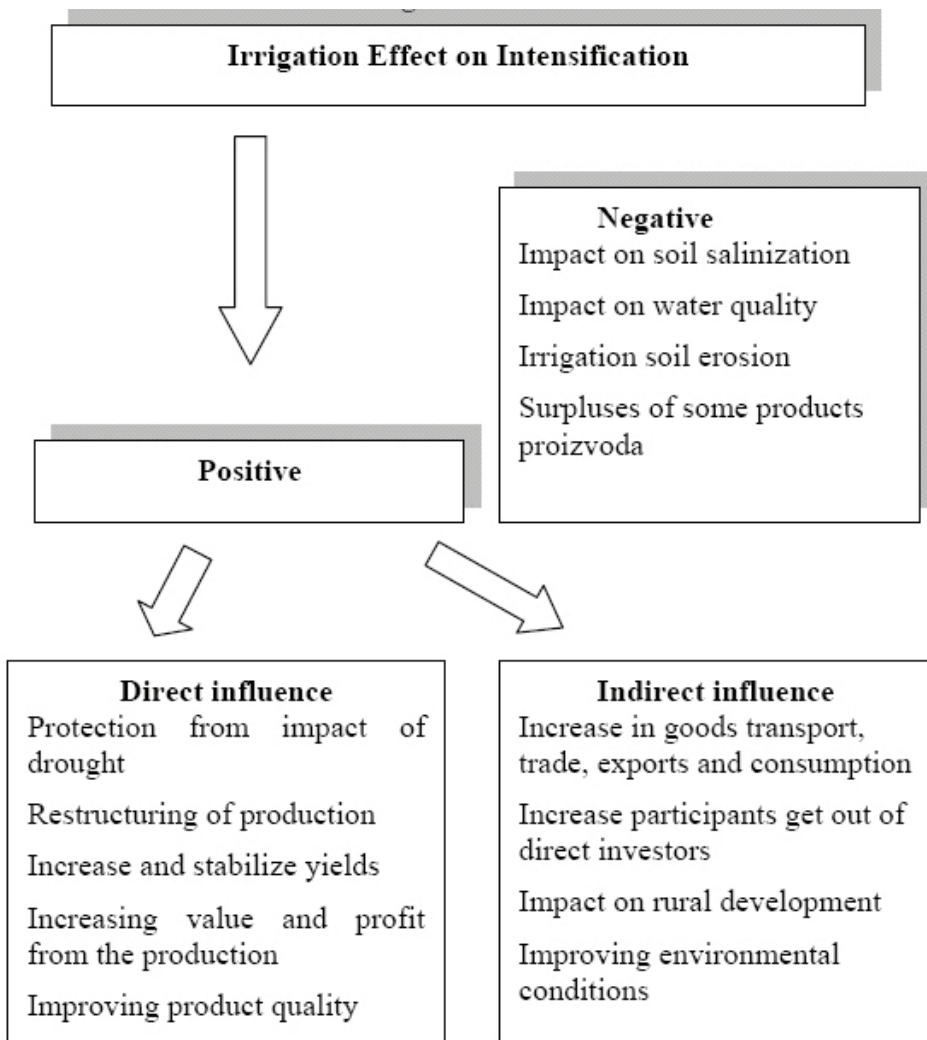
*Table 2: Comparison of intensification effects*

No.	Parameters	With project	Without project	% of increasing
1	Value of production, €	40.432.955	22.892.330	176,62
2	Cost of production, €	34.269.305	21.301.505	160,87
3	Profit, total, €	6.163.505	1.590.825	387,44
4	Profit, unit, €/ha	1.232,70	318,16	387,45
5	Quantity of production, ton	149.205	79.895	186,75
6	Increasing of intensity, CU	371.187,50	176.895	209,83

### The effects of irrigation on intensification (advantages and disadvantages)

Summing up the experience of the impact of irrigation on the intensification of agriculture production, observed over long period, may identify positive and negative effects that manifest at the same time, scheme No 2. It may be noted that this process is much wider, and its management touches several disciplines (water, land, environment, rural development). It is evident that the regional irrigation systems, along with other means of production are the holders of intensification. These systems should be linked with industry and market.

*Scheme No. 2: The irrigation influence on intensification*



## Conclusion

Investigation of the effects of irrigation on the intensification of agriculture in Serbia, which are presented in this paper, showed that the factors of agricultural intensification can be recognized as an internal (land, machinery, labor, water and facilities) and external (market, prices of inputs and products, financing investment and financing of production).

Surface irrigation (built or planned) belongs to one-purpose or multi-purpose hydro-systems. AP Vojvodina has 950,200 hectares of potential areas for irrigation and Central Serbia 304,415 ha. If these systems were built, irrigation would be enabled at 26% of cultivated area and 37% of arable land in Serbia. Irrigation could at least double the increase of the intensity of agricultural production (from 176,895 to 371,187 cereal unit). Volume and value of production also increase twice.

The effect of irrigation on the intensification of agriculture has a more positive direct effects such as protection from the influence of drought, the restructuring of production, increase and stabilize yields in some crops, improving product quality etc. Positive indirect effects are the increase in commodity markets and transport, the impact on rural development and improving environmental conditions.

Too intensive irrigation could negatively effect on water quality and soil salinization. Irrigation erosion and possible market surpluses of certain agricultural products could be also observed if structure of production was not carefully planned.

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