

# RESEARCH CONCERNING THE ECONOMIC EFFICIENCY OF IRRIGATION FOR THE SUGAR BEET CULTIVATED IN TRANSYLVANIAN PLAIN

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**Abstract.** *The present study aims of to analyze the economic efficiency of the irrigation of the sugar beet crops cultivated with the aim of obtaining bioethanol. The analyzed crops were obtained within Viișoara - Turda conditions, during 2008 – 2009, in a tri – factorial experiment (irrigation x fertilization x variety). Compared to 2008 and 2010, in 2009 a very significant ( $p < 0.001$ ) increase of the profit was recorded for the irrigated sugar beet crops. The Libero variety recorded the biggest profit for all three fertilization rankings that were practiced, followed by Clementina and Leila varieties. The irrigated x fertilized variants led to high efficiency in all studied sugar beet roots, within the conditions of the experimental field from Viișoara - Turda, during 2008 – 2010.*

**Keywords:** benefit, variety, fertilization, ranking, bioethanol

## INTRODUCTION

It is well known that as a consequence of global warming, draught has already affected almost 50 % of the agricultural surfaces of Romania. In this context, the irrigation of crops is a real necessity in the steppe, silvo - steppe and wet area of the former oak forests, in plain and hilly areas and also in areas where precipitations, even satisfying the water necessities of the plants, still do not have a suitable distribution in time (Budiu, 1994; Luca et al., 1994, 2008). Concerning the sugar beet cultures (Bârsan Simona-Clara et al., 2009, 2011), an appropriate irrigation regimen supplies both a high crop level and a special economic benefit. Thus, by formulating a rational irrigation regimen, a good water supply for soil is aimed, in tight connection with sugar beet physiological needs (Pușcaș Ancuța – Maria et al., 2008, 2010).

Taking into consideration that the irrigation norm depends on plant water requirement, on momentary soil water content and also on phreatic layer, its size is not a fixed element, but varies as function of the above mentioned parameters (Luca et al., 2008). The aim of this study was to analyze the economic efficiency of the irrigation of the sugar beet crops cultivated with the aim of obtaining bioethanol.

## MATERIAL AND METHOD

The economic efficiency analysis of the irrigation regarding the sugar beet crops cultivated with the aim of obtaining bioethanol was carried out within the conditions of Transylvanian Plain, in the Viișoara – Turda experimental field, during 2008 – 2010, within a tri-factorial experiment ( $2 \times 3 \times 3$ ), represented by: factor A, irrigation regimen with two rankings ( $a_1$  – non irrigated, and  $a_2$  – irrigated); factor B, fertilization with three rankings ( $b_1$  – NPK 250 + 55 kg N/ha;  $b_2$  – NPK 250 + 65 kg N/ha;  $b_3$  – NPK 250 + 75 kg N/ha), and factor C, variety ( $c_1$  – Clementina;  $c_2$  – Libero;  $c_3$  – Leila).

According to the National Administration of Land Improvement RA, in 2008, the average cost for irrigation water supply in Mureș basin was of 108.75 RON/1000 m<sup>3</sup>, to which 30 % (32.63 RON/1000 m<sup>3</sup>) were added as transport and maintaining expenses. In 2009, 113.86 RON/1000 m<sup>3</sup> (to which 30% transport and maintaining expenses were added: 34.16 RON/1000 m<sup>3</sup>), and in 2010, 114.60 RON/1000 m<sup>3</sup>, (to which 30% transport and maintaining expenses were added: 34.38 RON/1000 m<sup>3</sup>).

## RESULTS AND DISCUSSION

In 2008, in the sugar beet experimental field from Viișoara - Turda, it was applied a single watering, during 1.08.2008 – 15.08.2008, with an irrigation norm of 500 m<sup>3</sup>/ha. Thus, it resulted a total irrigation cost of 141.38 RON/1000 m<sup>3</sup>. The value of the sugar beet production was calculated taking into consideration the purchase price of sugar beet, which was, in 2008, of 110 RON/t (EUROSTAT). The profit obtained in 2008 for all three considered varieties is presented in fig. 1.

Analyzing the figures, it results that profit is proportional with fertilization ranking for each studied variety. The biggest profit was obtained for the Libero variety, of 1,260.31 RON/ha, fertilized with NPK 250 + 75 kg N/ha. The expenses with irrigation were fully covered by the supplementary production that was obtained.

In 2009, according to thermic and rainfall regimens, two waterings were performed, during 16 – 31. 07.2009 and 1 – 15.08.2009, each with an irrigation norm of 500 m<sup>3</sup>/ha. Taking into account the total irrigation norm of 1,000 m<sup>3</sup>/ha, in 2009, it resulted a total cost of sugar beet irrigation of 148.02 RON/ha.

The value of the sugar beet production was calculated taking into consideration the purchase price of sugar beet in 2009, of 130 RON/t (EUROSTAT). The profit obtained in 2009, for all variants, is presented in fig. 2. Analyzing the data, it results that, similarly with 2008, the profit is proportional with the fertilization ranking for each studied variety. The biggest profits was obtained for the Libero variety, fertilized with NPK 250 + 75 kg N/ha, namely, 1,260.31 RON/ha,. The expenses with irrigation were covered by the obtained supplementary production. In 2009, the biggest profit was obtained for Libero variety, fertilized with NPK 250 + 75 kg N/ha, namely, 2,464.98 RON/ha,

In the conditions of a warm and excessively dry year, the expenses with irrigation of the sugar beet culture were entirely justified by the obtained high production.

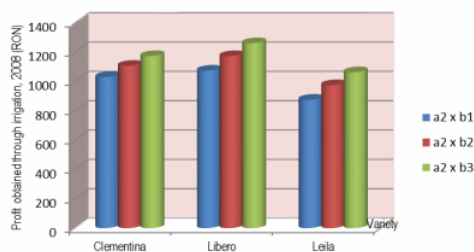


Fig. 1. The economic efficiency of sugar beet crop irrigation, Viișoara - Turda, 2008

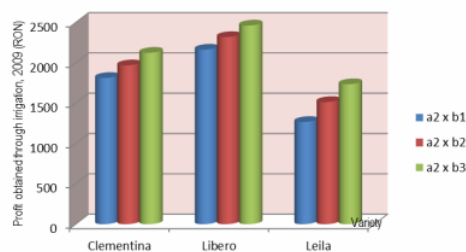


Fig. 2. The economic efficiency of sugar beet crop irrigation, Viișoara - Turda, 2009

In the third experimental year, 2010, only one single watering was practiced during 1 – 15.08.2010, with an irrigation norm of 500 m<sup>3</sup>/ha and which cost 74.49 RON/ha.

The value of the sugar beet production was calculated taking into consideration the purchase price of sugar beet in 2010, of 120 RON/t (EUROSTAT). The profit obtained in 2010, for all variants, is presented in fig. 3. Similarly with previous years, the profit is proportional with the fertilization ranking for each studied variety. The biggest profit was obtained for the Libero variety, namely, 1,449.51 RON/ha, crop fertilized with NPK 250 + 75 kg N /ha.

The analysis of the annual average profit (fig. 4) in irrigated sugar beet crops, shows that, in 2010, it was recorded a strong increase of the profit, as compared with 2008 and 2009.

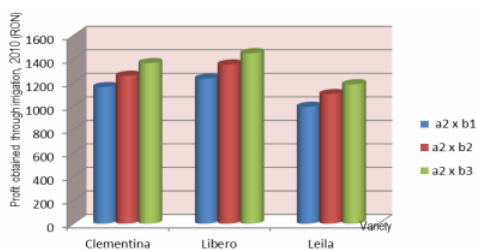


Fig. 3. The economic efficiency of sugar beet crop irrigation, Viișoara - Turda, 2010

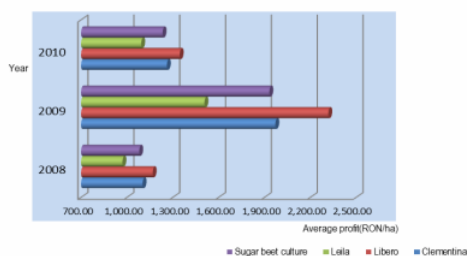


Fig. 4. The evolution of the annual average profit for sugar beet, irrigated conditions, Viișoara - Turda, 2008 - 2010

This fact can be put on the differences of the sugar beet productions by hectare obtained in irrigated conditions in 2009, characterized from meteorological point of view as warm and excessively dry. Compared to 2008, in 2010 a slight increase of the profit was obtained, having as explanation the clearly bigger differences of sugar beet productions obtained in irrigation conditions.

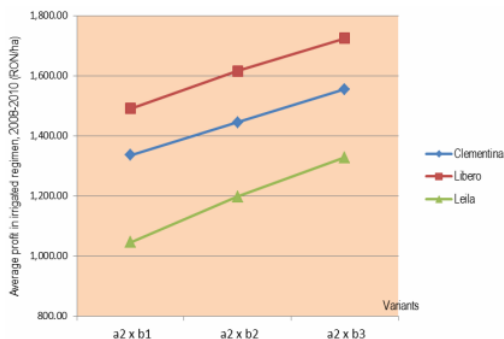


Fig. 5. The evolution of the average profit by three cultivated sugar beet varieties (c<sub>1</sub>, c<sub>2</sub>, c<sub>3</sub>) in irrigated regimen, Viișoara-Turda, 2008-2010

If we consider the Clementina variety, the variant irrigated x fertilized with NPK 250 + 55 kg N/ha had as result an average profit of 1,335.27 RON/ha; for the variant irrigated x fertilized with NPK 250 + 65 kg N/ha, an average profit of 1,444.93 RON/ha was obtained; consequently, for the variant 250 + 75 kg N/ha, the resulted profit was 1.554,93 RON/ha (fig. 5).

If we consider, for Clementina variety, the variant irrigated x fertilized with NPK 250 + 55 kg N/ha as control (fig. 5), the variant irrigated x fertilized with NPK 250 + 65 kg N/ha had an average profit of 109.66 RON/ha (108.21 %), while for the variant irrigated x fertilized with NPK 250 + 75 kg N/ha, it was obtained an average profit of 219.66 RON/ha (116.45 %).

For the Libero variety, the variant irrigated x fertilized with NPK 250 + 55 kg N/ha recorded an average profit of 1,490.93 RON/ha; the variant irrigated x fertilized with NPK 250 + 65 kg N/ha had an average profit of 1,615.93 RON/ha and the variant 250 + 75 kg N/ha recorded an average profit of 1,724.93 RON/ha (fig. 5).

If we consider the variant irrigated x fertilized with NPK 250 + 55 kg N/ha as control (fig. 5), the variant irrigated x fertilized with NPK 250 + 65 kg N/ha had an average profit of 125.00 RON/ha (108.38 %), while the variant irrigated x fertilized with NPK 250 + 75 kg N/ha recorded an average profit of 234.00 RON/ha (115.69 %).

Concerning the Leila variety, the variant irrigated x fertilized with NPK 250 + 55 kg N/ha recorded an average profit of 1,045.93 RON/ha; the variant irrigated x fertilized with NPK 250 + 65 kg N/ha had an average profit of 1,197.27 RON/ha, while the variant irrigated x fertilized with NPK 250 + 75 kg N/ha recorded an average profit of 1,328.27 RON/ha (fig. 5).

If we consider the variant irrigated x fertilized with NPK 250 + 55 kg N/ha as control, the variant irrigated x fertilized with NPK 250 + 65 kg N/ha recorded an average profit of 151.34 RON/ha (114.47 %), while for the variant irrigated x fertilized with NPK 250 + 75 kg N/ha had an average profit of 282.34 RON/ha (126.99 %).

## CONCLUSIONS

Analyzing the benefits of the sugar beet cultures in terms of profit, during 2008 - 2010, by variants, result the following conclusions:

1. Compared to 2008 and 2010, in 2009 a very significant ( $p < 0.001$ ) increase of the profit was recorded for irrigated sugar beet crops. This fact may be explained by the increased differences between productions by hectare obtained in irrigated conditions in 2009, year characterized as warm and excessively dry. The modification of the purchase price of the sugar beet roots represented another factor that affected the profit evolution during 2008 – 2010 (fig. 6 and fig. 7).

2. Analyzing the values of the average profit by variety, during 2008 – 2010, one can find that the Libero variety recorded the biggest profit for all fertilization rankings that were practiced, followed by Clementina and Leila varieties.

3. During 2008 – 2010, the cultivation of all studied sugar beet roots was efficient, in all irrigated x fertilized variants, within the conditions of the experimental field from Viișoara - Turda.

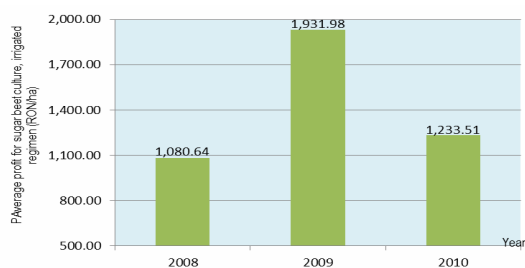


Fig. 6. The evolution of the average profit, by years, for sugar beet culture, in irrigated regimen, Viișoara - Turda

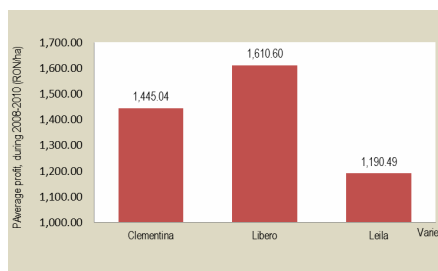


Fig. 7. The average profit by sugar beet varieties cultivated at Viișoara - Turda, 2008 - 2010

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