Comparative Studies Regarding the Water Consumption at some Field Crops in the Transylvanian Plain Conditions

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Abstract. The paper presents a part of the research regarding the water consumption and the sources that it covers, research made in the Transylvanian plain conditions (in Jucu centers- Cluj county, in Turda and Târnăveni), between 2006 and 2008, at corn crops, sugar beet and soybean. The research highlighted different water consumptions from one year to the other, in report, first of all, with the evolution of the downfall regimen. At each of the three crops was established the importance of completing the water necessary in the years that have a poor downfall regimen.

Keywords: irrigation, water consumption, corn crops, sugar beet, soybean

INTRODUCTION

The water consumption at the agricultural crops is an important element for appreciating the necessity of irrigation, as well as for establishing and applying correctly the irrigation regimen. Adjusting the water supply of the plants, through increasing the soil humidity, the irrigation influences favorably on the food factor by making soluble the nourishing substances and by increasing the life conditions of the soil microorganisms (Botzan, 1972; Grumeza, 1989; Nagy, 1982; Onu, 1988; Rieul et al., 1992; Luca, 1994; Luca et al., 2008).

The total water consumption at one agricultural crop depends of the plants that is cultivated and of the natural conditions, the climatic factors, the soil and of the phreatic water level, as well as of the concrete conditions of the crop, the agrotechnical method that is applied, including the irrigation regimen.

Establishing by the concrete conditions of vegetation, the total water quantity that plants need in the culture, the critical periods of maximum water consumption, the moment when watering the plants is necessary and the amount of the water norm is a fundamental element of irrigation (Merculiev, 1961; Luca and Nagy, 1999).

For determining the water consumption and the contribution of each of its covering sources, in the Transylvanian Plain conditions, there have been performed comparative studies at the corn crops, sugar beet and soybean between 2006 and 2008.

MATERIALS AND METHODS

The experiences that stand for the paper basis where located in three different places in the Transylvanian Plain, in Jucu, Turda and Târnăveni. The biological material that was used was represented by varieties and hybrids that were adapted for the culture conditions particular for the zone.
In this way, in the corn experiences placed in Jucu- Cluj, was cultivated a ‘Pioneer’ hybrid- ‘Monalisa’ hybrid- that is a simple, early, and with a very high production potential hybrid. It is known after the big productions that were obtained, of over 10 t/ha, in different climatic conditions, tolerant at drought and heat, the medium-big bean, which has a yellow-orange color. Because the plant is green when is mature, it can be cultivated even for silo. It is cultivated with very good results in the plain and hill areas.

In the experiences with sugar beet at Turda, was experienced the Rosita variety, that has its origins in Sweden and was registered in culture in the year 2002. It is a diploid variety, with a long, truncated root, placed in the soil at a medium level. Its leaves are healthy throughout the vegetation period. It has high sugar content, even if infested with Rizomania. The reaction at irrigation is excellent. The level of root production is of 68.4 t/ha, and the production of white sugar is of approximately 8.7 t/ha.

For the soybean experiences at Târnăveni, it was experienced ‘Perla’ variety, created at Agricultural Research and Development Station Turda and approved in the year 1987. It is characterized by a compact bush, erect strain and semidetermined growth. The height of the plant is about 77 cm, with variation limits between 70-84 cm, and it is framed in the medium height soil group.

The medium height of insertion of the basal soybeans was of 12 cm with variations of 10-13 cm. The pubescence is dark red. The leaves of the ‘Perla’ variety are oval-pointed and their color is light-green. The inflorescence is a raceme, with violet flowers. When it is mature, the hull has a light-brown color. When it is ripened, the bean is oval and yellow.

The methodology used for calculating the water consumption was the one of the water balance in soil. The water balance in soil notion defines the report between the quantity of water that gets into the soil, through different methods, and the consumed quantity of water.

For determining the water consumption it was precisely determined the store of soil water from the beginning and the end of the vegetation period, and was realized a strict evidence of the quantity of water that came from downfalls and from waterings. It was pursued that when watering, the values of humidity were not over the plain capacity, so that the water loss could be avoided.

For realizing the water soil balance, where registered the entries- all the sources of water supply, water reserves from the beginning of vegetation, the sum of useful downfalls from the vegetation period, the quantity of water applied through irrigation (the irrigation norm) and the outputs- the total water consumption and the water reserve that was left in the soil when harvesting, the final reserve.

**RESULTS AND DISCUSSION**

The research highlighted different water consumptions from one year to the other, first of all in report with the evolution of the downfall regimen.

For corn, the values of the water consumption, registered in the three years of research, in irrigated and non-irrigated regimen, where (Tab. 1):

<table>
<thead>
<tr>
<th>The culture</th>
<th>The irrigation regimen</th>
<th>The total water consumption (m³/ha)</th>
<th>The average (m³/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td></td>
<td>2006</td>
<td>2007</td>
</tr>
<tr>
<td></td>
<td>Non-irrigated</td>
<td>4303</td>
<td>3927</td>
</tr>
<tr>
<td></td>
<td>Irrigated</td>
<td>4708</td>
<td>4432</td>
</tr>
</tbody>
</table>

Tab. 1
The highest level of participation of downfalls at the total water consumption of the corn crops was registered in the year 2006, when were registered 3141 m³/ha of the rainfalls, the inferior limit was registered in the year 2008, 2241 m³/ha.

The irrigation water role was better felt in the years 2007 and 2008, when it covered 11% from the total consumption of maize. Besides, the average of the three years of research, the irrigation water had 11% from the total consumption of maize.

At the non-irrigated corn crops, the downfalls had a greater importance from the total water consumption, to 75% from its total.

For sugar beet, the water sources that have contributed for the assurance of the plants necessary, in the year 2006, in irrigated conditions, where: downfalls that assured 63.07% from the total of water quantity used in the process of growing and development of the plants, and the waterings that were applied in the vegetation period assured 13.51% from the total quantity that the plants needed. The rest (23.42%) was assured by the soil water quantity.

The situation regarding the sources that contributed for the assurance of the plants consumption necessary in irrigated conditions in the year 2007 was the following: the downfalls assured 58.14% from the total water quantity, the waterings 14.29%, and the rest from the soil water quantity.

In Table 2 it is presented the way that the water sources from the soil and downfalls contributed at the covering of the soybean crops water necessary in non-irrigated conditions in the three years of research.

<table>
<thead>
<tr>
<th>The year</th>
<th>The total consumption</th>
<th>From soil</th>
<th>From precipitations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m³/ha</td>
<td>m³/ha</td>
<td>%</td>
</tr>
<tr>
<td>2006</td>
<td>3376</td>
<td>1417</td>
<td>41.97</td>
</tr>
<tr>
<td>2007</td>
<td>3598</td>
<td>882</td>
<td>24.51</td>
</tr>
<tr>
<td>2008</td>
<td>3530</td>
<td>800</td>
<td>22.06</td>
</tr>
</tbody>
</table>

It can be noticed the fact that the downfalls had the biggest contribution at the assurance of the water necessary of the plants. In this way, downfalls assured over 70% from the water necessary of the plants.

In Table 3 it is shown the way in which the water necessary of the soybean crops was assured, in non-irrigated conditions, in the three years of research.

<table>
<thead>
<tr>
<th>The year</th>
<th>The total consumption</th>
<th>From soil</th>
<th>From precipitations</th>
<th>From irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m³/ha</td>
<td>m³/ha</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>2006</td>
<td>3980</td>
<td>1321</td>
<td>33.19</td>
<td>1959</td>
</tr>
<tr>
<td>2007</td>
<td>4598</td>
<td>1382</td>
<td>30.06</td>
<td>2716</td>
</tr>
<tr>
<td>2008</td>
<td>4110</td>
<td>780</td>
<td>18.98</td>
<td>2730</td>
</tr>
</tbody>
</table>

It can be noticed that the water that came from irrigation assured between 10.87 % and 17.59 % of the total water consumption, the highest values for the irrigated soybean variety came from the downfall water (49.22% - 66.42%).
CONCLUSIONS

Throughout the vegetation period the medium monthly consumptions and the diurnal consumptions, in monthly mediums, were a lot different, depending of the vegetation phase of the crop and of the evolution of the climatic factors, the highest values being registered especially in July and August, when where required the interventions for completing the water necessary through applying of adequate water norms.

A rigorous review regarding the way that the water consumption coverage was realized and the level of participation of the different sources at the water supply for the corn crops, sugar beet and soybean, highlighted the big rainfall rate in comparison with other sources, in the Transylvanian Plain conditions.

It is indisputable the fact that the sum of the annual rainfalls is still high, although the tendencies of reducing their values are also obvious. But, mostly, the rainy periods alternated with dry periods, or even excessively dry ones, fact that justified applying waterings with moderate water norms.

The production increases realized on the irrigated crops have been, in general, very significant in report with the productions obtained at the non-irrigated ones.

For each of the three crops was highlighted the necessity of completing water necessary in the years with a poor regimen of downfalls.

REFERENCES