IRRIGATION IMPLICATIONS ON THE SOYBEAN CROP IN THE PEDOCLIMATIC CONDITIONS OF THE CARACAL PLAIN

IMPLICAȚIILE IRIGAȚIEI ASUPRA CULTURII DE SOIA ÎN CONDIȚIILE PEDOCLIMATICE ALE CÂMPIEI CARACALULUI

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Abstract: *The purpose of this study was to identify the specific water consumption level for the soybean crop that grow well in the pedoclimatic conditions of the Caracal Plain. Using the irrigation for maintaining water reserve between minimum level of easily water content and field capacity has improved the crop water consumption and yield too. Further more, there are presented useful data for water application forecast and warning from the corresponding methods and equipment standpoint.*

Rezumat: *Scopul acestui studiu a fost să identifice nivelul consumului de apă al culturii de soia cultivată în condițiile Câmpiei Caracalului. Folosirea irigației pentru menținerea rezervei de apă din sol între plafonul minim şi capacitatea de câmp pentru apă a solului a îmbunătățit consumul de apă al culturii şi, de asemenea, producția. Mai mult, în lucrare sunt prezentate date folositoare pentru prognoza şi avertizarea momentului aplicării udărilor.*

Key words: *soybean, water consumption, evapotranspiration coefficients, yield response*
Cuvinte cheie: *soia, consum de apă, coeficienți de transformare a evaporației, răspunsul producției*

INTRODUCTION

Source of life, the water is the most important substratum of the photosynthesis. Absence of water directly limit plants growth and yield too. The increasing global demand for food and other products calls for urgent measures to increase water use efficiency which is, with plant nutrient availability, one of the two main limiting factors in crop production.

First such as research was started in 1945 from M. BOTZAN at the Research Stations Mărculeşti-Călăraşi and Studina (Caracal)-Olt. The main purpose of the research is establishing of the technical elements necessary for the irrigation systems and for the water application forecast and warning.

Caracal research experimental field for study the correlation between water consumption and yield response of the main agriculture cultures has been working since 1969. The goal is to obtain research results in this part of Oltenia's field to help with data Irrigation Systems and Farmers too.

So, in this paper are presented data refering to daily and total water consumption and his covering sources for soybean crop, evapotranspiration coefficients and yield response too.

MATERIALS AND METHOD

The results are obtained at the Caracal Agricultural Research Station, in the field of the water balance. This is amplased on a typical illuvial clay chernozem. The physical and hydrophysical index of this soil on 0-75 cm depth are: 1,36 to/m^3 volumetric weight; 24,9% field capacity. Irrigation was applied at the level of 50% from Active Humidity Interval on the 0-75 cm depth. The water norm was 650 m^3/ha. Humidity was determinated by gravimetric method. It was used an optimmum technology, recommended for the zone conditions.

RESULTS AND DISCUSSION

The annual precipitation and temperatures (Fig.1) were different from year to year durind 1975 – 2000. For example, since 1980-1982 period, the rainfall have been decreasing and, by the other hand, the temperatures have been increasing. The annual average temperature for 1975-2000 period was 11.0^{0}C, 0.4^{0}C higher than the average (10.6^{0}C) of the area. The average rainfall for this period during 1975-2000 was 502.6 mm compared with 537.4 mm for the 70 year aveage at Caracal.

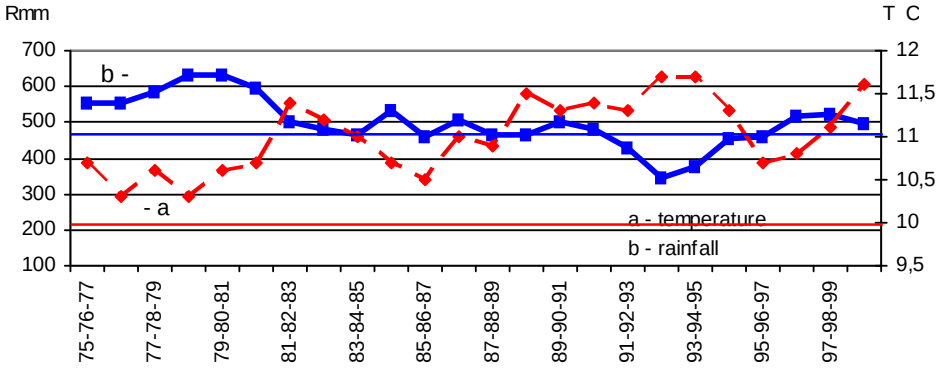

Figure1-Temperatures and annual precipitations (mobile average)
C.A.R.S. Caracal, 1975-2000

The average rainfall on the growth season in the 1975-2000 interval was 249 mm, with annual oscillations of 69 mm in 1987 and 512 mm in 1991.

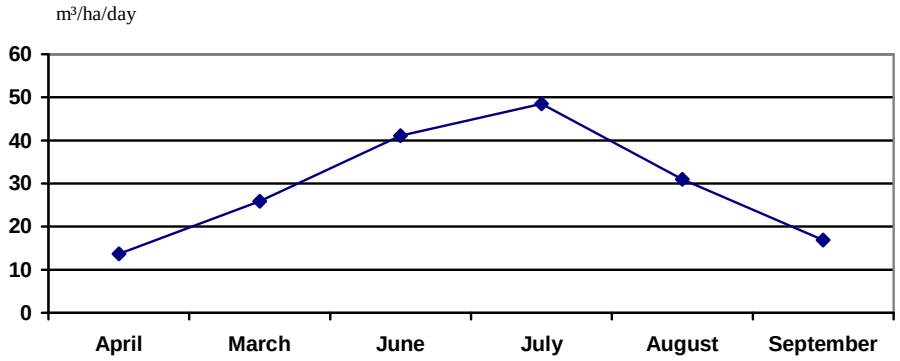

Figure 2. Soybean daily average water consumption
(C.A.R.S. Caracal, 1975 – 2000)

Daily and monthly consumption of water increased from April to July, when the maximum value was recorded and then it decreased until harvest. So, in April this was 13.7

m³/ha/day, in May 25.9 m³/ha/day, in June 41.1 m³/ha/day and this presented the maximum value in July, when it was 48.5 m³/ha/day. At harvest, the value was lower, 16.9 m³/ha/day.

Table 1

Covering sources of water consumption – C.A.R.S. Caracal, 1975-2000

Total consumption (ET)	From soil reserve		From rainfall		From irrigation	
m³/ha	m³/ha	%	m³/ha	%	m³/ha	%
5068	**696**	**13.6**	**2495**	**49.1**	**1877**	**37.3**

In the pedoclimatic conditions of the Caracal Plain, the main source for ensuring the soybean water consumption is water from rainfall. This has a participation percentage of 49.1%. Function of the annual climatic conditions, the percentage was between 14.2% in 1993 and 85.9% in 1991.

Irrigation water was the second source for ensuring the water needs of the soybean crop. This source participated with 37.3% from total requirement. In 6 years from all period this source participated with more than 50% from total water consumption.

Soil reserve water participated only with 13.6% from total requirement.

Table 2

Coefficients for transforming the evaporation from BAC evaporimetres in monthly water consumption C.A.R.S. Caracal, 1975 - 2000

April	May	June	July	August	September
0.37	**0.55**	**0.74**	**0.81**	**0.58**	**0.39**

These coefficients are very useful in the irrigation systems exploitation activity and in the project activity. In April the coefficient have an lower value, of 0.37. Maximum value of the coefficient is in July, when it is 0.81.

Table 3

Irrigation influence on yield level and soybean water use efficiency C.A.R.S. Caracal, 1975 - 2000

Entry	Yield (kg/ha)		Difference		Total water consumption	Water use efficiency	
	Average	Variation interval	kg/ha	%	m³ / ha	Total water (kg/ m³)	Irrigation water (kg increase yield / m³)
No irrigated	1833	355-4766	Mt.	100	3616	0.51	-
Irrigated	3353	1245-5206	1520	83	5068	0.66	0.81

Table 3 shows the benefic influence of irrigation. Under irrigated conditions, the obtained yield was 3353 kg/ha with a variation interval of 1245-5206 kg/ha. To get this yield, soybean needs 5068 m³ water/ ha . In conditions with no irrigation (natural conditions), the yield obtained by soybean is lower, of 1833 kg/ha. In addition, the variation interval of yield is very large, from 355 to 4766 kg/ha. Yield difference on 26 years average was 1520 kg/ha.

Total water use efficiency has presented values of 0.1 in no irrigated conditions and 0.66 in irrigated conditions. Irrigation water use efficiency has presented value of 0.81.

In the pedoclimatic conditions of this area, the role of irrigation is to increase the yield but the most important thing is to ensure the yield stability.

CONCLUSIONS

- the evolution of the climatic factors in the last 26 years shows an dryness of the climate in the area of the Caracal Plain;
- the annual medium temperature on 1975 – 2006 period was 0.4^0C higher than multi-annual average of the area and the rainfall 34.8 mm lower than the multi-annual average;
- by application of irrigation the total water consumption has increased by 40.2%;
- irrigation has participated with 37.3% from total water requirement;
- maximum value of the coefficient is in July, of 0.81;
- the influence of irrigation on soybean yield was materialized by an increase by 83 %;
- irrigation application has conducted to obtain of an yield increase of 0.81 kg increase yield / m³ irrigation water.

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