STUDIES ON WATER REQUIREMENTS IN CORN CROPS UNDER THE CONDITIONS OF ARAD

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Abstract. *By analyzing the evolution of rainfall last year, it concludes that summers are becoming increasingly droughty and the extreme weather is causing large losses of agriculture production. To limit the adverse effects of these phenomena, researchers permanently are studying alternatives and new tehnologies and their application in a reasonably and efficient manner. The evaluation of water requirements for crops is related to evapotranspiration potential (ETP), wich is the water consumption of the ground covered by a carpet of perennial herbs, water supplied to the field capacity. Optimal real evapotranspiration (ETRO) represents water consumption for plants, consumption, wich provides higher economically efficient harvests. In the paper was determined monthly and annual potential evapotranspiration, also it was compiled a hydroclimatic balance and balance curves for the years included in the study, comparing the average of monthly, annual temperature and precipitation with normal areas. Also, the water consumption of grain maize culture (ETRO) in Arad for 2016 and 2017 was determined by indirect methods, namely the Thornthwaite method, the most used method for the conditions in our country, and the Lawry Jhonson method dispatch and extremely fast. The monthly, annual and daily average consumption of corn crops were determined using these methods during the two years studied. The total water consumption of the corn crop in the Arad area was 5272 mc/ ha, representing an average value on the two methods studied in 2016. The total water consumption of maize in 2017 was lower compared to the one in 2016, (3980 mc/ ha) the year being a droughty year with high air temperature compared to the normal area.The highest water consumption was in the June, July and August warm months, and the lowest monthly water consumption to maize was recorded in April and September. The rainfall coverage of water consumption of corn crops was 79% in 2016 and 74% in 2017, resulting in a water demand of 1300 mc/ha in 2016 and 1500 mc/ha in 2017, which it should be supplemented by irrigations.*

Keywords: *corn crops, total water consumption, monthly consumption, water requirements*

INTRODUCTION

By studying the rainfall during the years, we can observe that the summers are becoming increasingly drought and hydrological extremes cause very large losses in agricultural production.

The corn plant is demanding to moisture but due to reduced transpiration coefficient (230-600), well developed root system and the possibility of reducing the surface transpiration by turning leaves in case of drought, is considered a drought resistant plant. [9, 11, 12]

The range of appearance tasseling until the end of filling the grain is one of the most important phases critical moisture corn that last roughly 50 days and overlaps in normal years in terms of climate in July and August when rainfall is very low. After this phase same requirements decrease gradually to full ripeness. The average daily water consumption at higher corn is recorded in June, July and August with 57-40mc/ha/day in silvosteppe areas, respectively higher values between 62-37 in steppe area. [11, 12]

By irrigating crops represent only measure supplementing the amount of soil water in dry years or placements deficient rainfall in the growing season of crops.

MATERIAL AND METHOD

In this study were analyzed the climatic conditions of the years studied, namely:

- monthly and annual thermal regime or its evolution during the analyzed period are calculated as differences from the annual average.

-rainfall and the vegetation period registered in Arad or its evolution and deviation from the annual average.

- evapotranspiration (ET), monthly values , yearly and during the vegetation period are calculated using the formula Thornthwaite.

- hydroclimatic annual balance and during the growing season.

Potential evapotranspiration was calculated with Thornthwaite method, based on the average air temperature, with the relationship:[1,8,9]

$$ETP = 16\left(\frac{10 \cdot tn}{I}\right)^{a} \cdot K$$

Optimal potential evapotranspiration or the consumption of water of a culture harvests allows economically efficiency to be determined by the formula:

ERO = Kpx ETP, where

Kp- characteristic coefficient cultivated and climatic zone

ETP –potential evapotranspiration determined by the Thornthwaite method, m / ha

Lawry-Johnson method - is the most expedient method for the determination of water consumption, but the results are not as accurate and is given by:

E = 45 x t, **mc/ha** where [1,7,8]

t- the monthly average temperature in ° C

The data obtained using these formulas are multiplied by the correction coefficients from the special literature for each month for the given conditions.

Blaney-Cridle m**ethod** – uses monthly average temperature in the calculation and other coefficients.

E= 0,254 (1,8*t+32) P*K, where: [1,7]

t- the monthly average temperature

k, P- characteristic coefficient

RESULTS AND DISSCUSIONS

Analyzing the graphics balance climate of Arad in the two years, we can observe the curves of monthly precipitation and evapotranspiration monthly from years 2016 and 2017, especially periods of moisture deficiency, size and extension. Moisture deficit is observed when the curve is positioned above the curve of monthly potential evapotranspiration.

By analyzing the two graphics, the year 2017 was characterized by a large deficiency, in time duration (April to October) and fluid deficiency was much higher than in 2016.

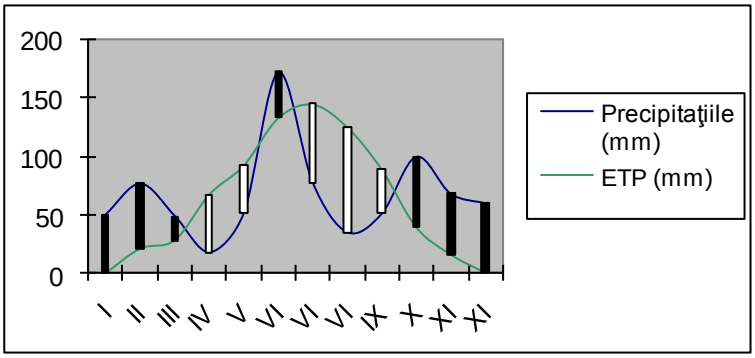

Figure 1. The evolution of the climate curves balance Arad, 2016

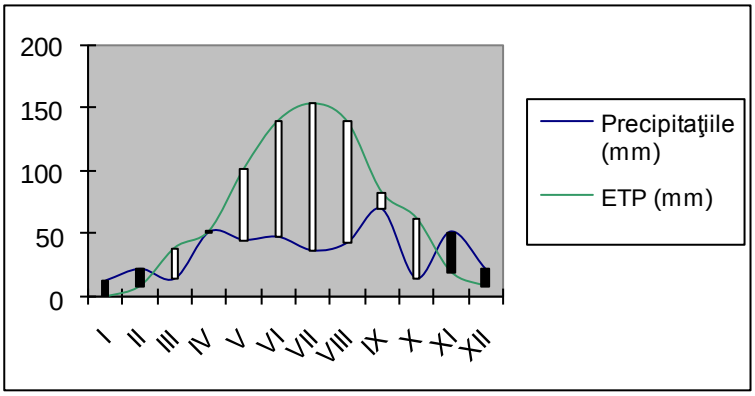

Figure 2. The evolution of the climate curves balance Arad, 2017

The highest values of water consumption are obtained by the method of Thornthwaite, followed by Lawry-Johnson determined by the method of Johnson and Blaney-Cridle in June, July and August.

The total consumption of water to corn crops in Arad area was 5071 m/ha, representing an average value for the three methods studied in 2016 (fig. 3).

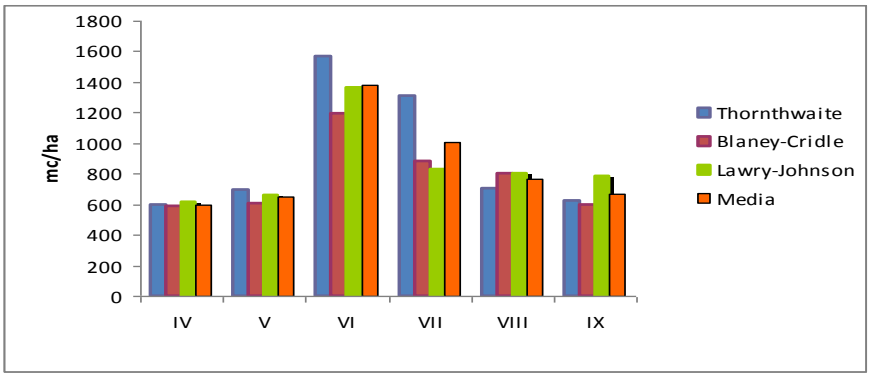

Figure 3. Monthly water consumption trends in corn crops, 2016 Arad

The average daily consumption of corn in the Arad area in 2016 was highest in the warmer months, June, July and August, with a maximum of 47 mc/ha in June, ranging from 20-47 mc/ha.

The total water consumption of corn in 2017 was on average in the three methods, lower than in 2016, of 3980mc/ha, the year being a dry year with high air temperature compared to the normal area, into one year warm. The highest water consumption was in the June, July and August warm months, and the lowest monthly water consumption figures were recorded in April and September.

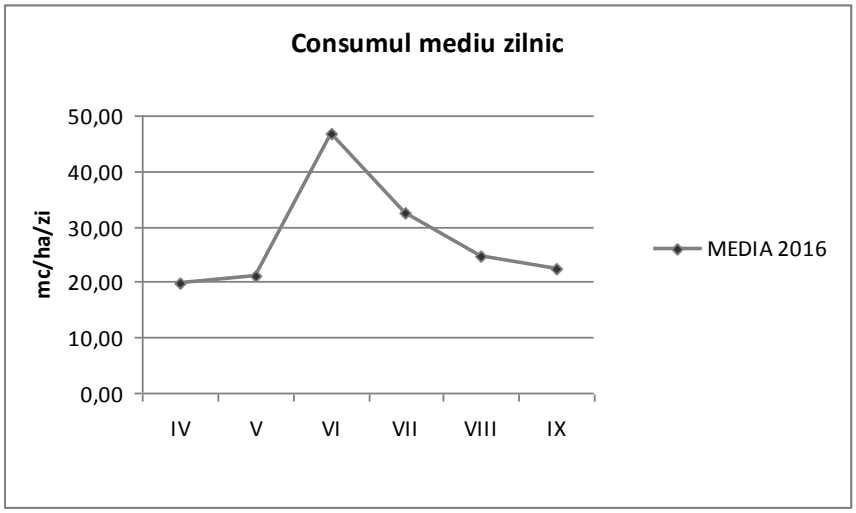

Figure 4. Daily average of water consumption of corn , 2016 Arad

We can see also in the folowing pictures the evolution of total water consumption of corn in 2017 and the average daily consumption of corn in the Arad (figures 5,6).

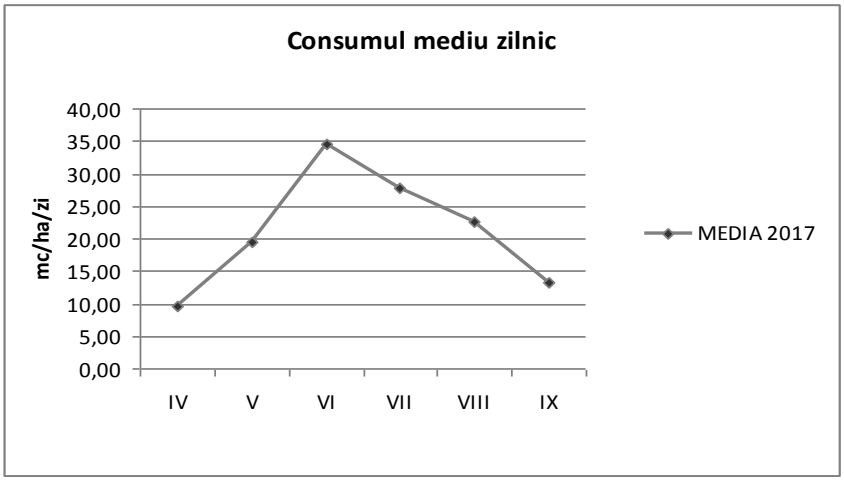

Figure 5 Daily average of water consumption of corn, 2017, Arad

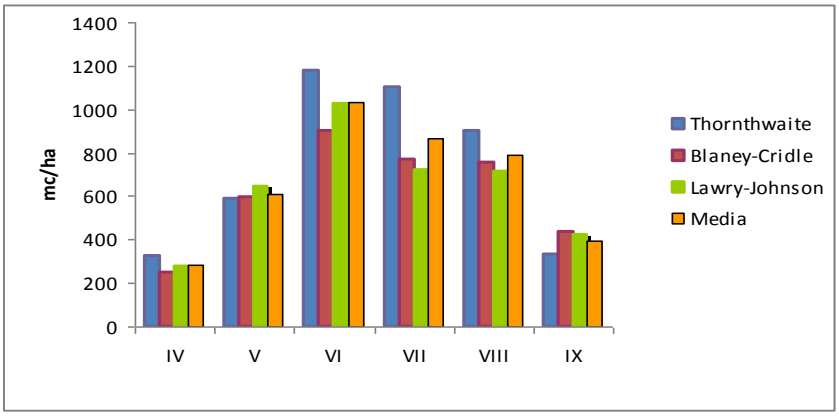

Figure 6. Evolution of the monthly water consumption of corn crop, Arad, 2017

Following the determination of water consumption by the three indirect methods, by calculation, for the corn culture under the conditions of Arad, for two years was studied, we analyzed the extent to which the total monthly water consumption of corn from the fallen rainfall is covered. It resulted in a 79% coverage of water consumption in maize crops from precipitation in 2016 and 74% in 2017. Then the monthly and total water demand for maize crop was determined in the years 2016-2017.

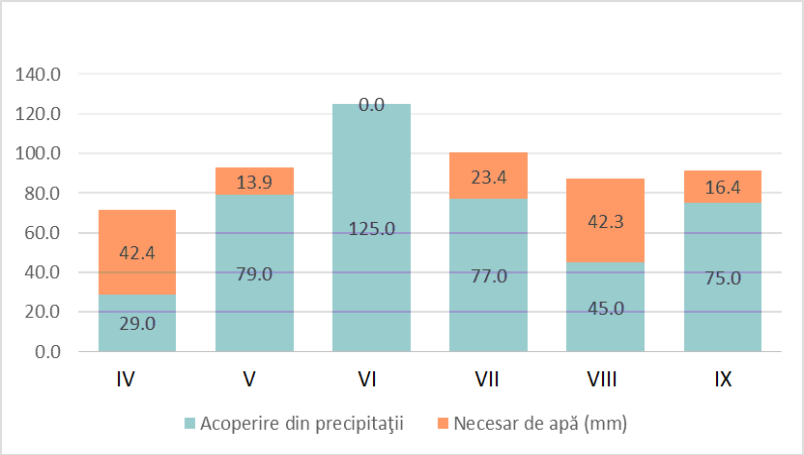

Figure 7. Covering the monthly water consumption of maize from rainfall, 2016, Arad

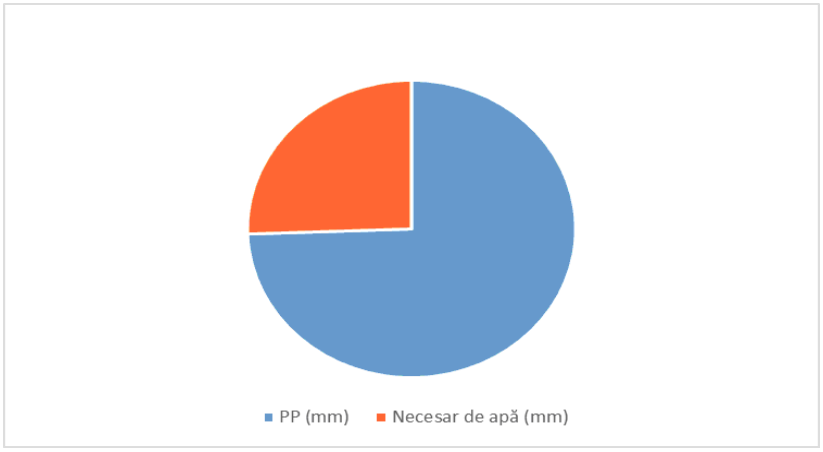

Figure 8. Covering the total water consumption of maize from rainfall, 2016, Arad

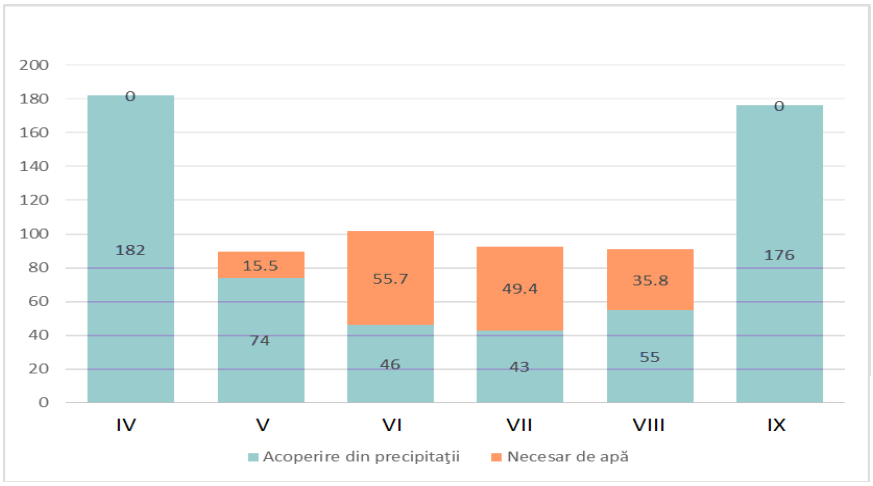

Figure 9. Covering the monthly water consumption of maize from rainfall, 2017, Arad

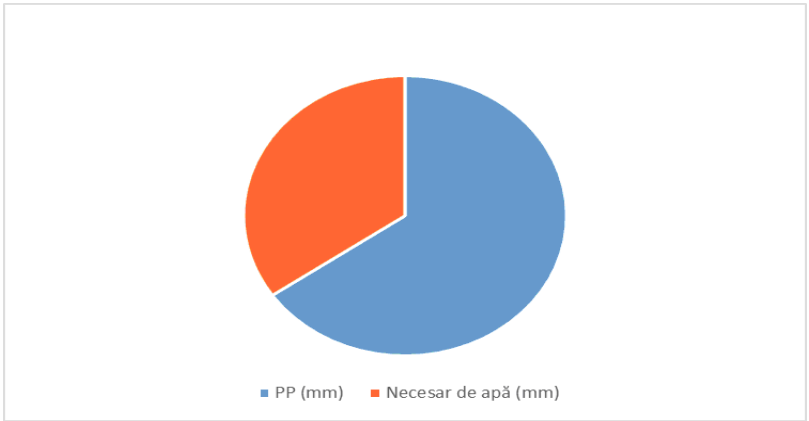

Figure 10. Covering the total water consumption of maize from rainfall, 2017, Arad

CONCLUSIONS

Water consumption of corn crops was determined by indirect methods and was influenced by the climatic conditions of the studied years, it was higher in 2016 and lower in 2017, when rainfall was lower in quantity;

• The highest water consumption was obtained using the Thornthwaite method, and the lowest using the Blaney-Cridle method;

• The total consumption of corn on average on the three methods used was 5071 mc/ha in 2016 and 3980 mc/ha in 2017;

• The highest monthly water consumption was registered during the summer months, in June, July and August, being 1377 mc/ha and 790 mc/ha in the two years studied;

• The average daily average consumption was between 25 mc/ha /day 47 mc/ha/day in the months with maximum consumption;

• In 2017, a dry and warm year, rainfall coverage of corn water consumption was 74%, water demand was 1564 mc/ha;

It is recommended that the need for uncovered water from precipitation, which was required during the two years under study, is covered by irrigation.

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