RESEARCH REGARDING THE RELATIONSHIPS FROM SOIL-WATER-PLANT-ATMOSPHERE SYSTEM IN MAIZE FROM CRIȘURILOR PLAIN

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Abstract

The paper is based on researches performed in the field of review of the water in the soil placed in year 1976 at the Station of Research and Agricultural Development Oradea.

As the number of days with water reserve under the minimum limit on the depth of 0-75 cm has increased, the values of the total consumption of water has decreased. Also a reverse correlation was quantified between the number of days with pedological drought and the maize productions.

Between the number of days with pedological drought and the increases of yield determined by the irrigation of the maize, were underlined these direct connections very significant statistically.

The content in protein of the maize beans is a reverse relation with the numbe of days with pedological drought .

The increase of the values of the report water/temperature (the index of drought of Martonne) has determined the increase of the values of the total consumption of water of maize . Between the values of the aridity index of Martonne and the content in protein of the maize bens, was underlined the connections very significant statistically.

The increase of the total consumption of water has determined the increase of the productions obtained, for maize the connection is significant statistically.

Key words: soil, water, plant, atmosphere, maize, production

INTRODUCTION

According to Borcean I., 2003, the Crișurilor Plain of rivers is situated in the area I of favorability for the culture of maize, because the sum of the temperatures biologically active is of 1400-1600ºC and the soils are fertile.

Is considered that, "manipulating a vegetation factor of the most vital important for the life of plants (and not only of the plants), that is the water, irrigations represent a factor of first order that influences the conditions of environment, with decisive effects on the plants, soil and atmosphere by creating a specific fitoclimate" (Grumeza and collab., 1989). On the relations from the soil-water-plant-atmosphere systems were published many researches, most of them concerned the correlation of water consumption – production: Botzan, 1966; Grumeza, 1989, 2005; Domuţa C., 1995; Tuşa, 1994. Other researched concerned the correlation climate-yield (Domuţa C., 1995, Tuşa, 1994, and others concerned the correlations between the number of days with pedological drought – yield (Domuţa C., 2003, 2005).

The quantification of these correlations argue the opportunity of the irigations in a climatic area or another (Domuţa C., 2005).

MATERIAL AND METHOD

The researches were performed beginning with 1976 in the research field of the water review in the soil placed at the Station of Research and Agricultural Development Oradea, by Eftimiu Stepănescu, in the program "Exploitation of the establishments of irrigation and drainage of ICITID" coordinated by Nicolae Grumeza. The soil from the research field is a preluvosoil (Domuța) and the water used for irrigation is very good for irrigations from the physical, chemical and microbiological point of view, (Domuța Cr.).

In the irrigated version, on the depth of 0-75 cm the water reserve was maintained between the minimum limit and the field capacity, determining the humidity of the soil from 15 to 15 days. The data of humidity allowed the elaboration of the graphics of dynamics of the reserve of humidity, these graphics allowed the establishing of the pedological indicators of drought.

The indicators of the soil-water-plant system studied were the following:

- the pedological drought and accentuated pedological drought;
- meteorological indicators – de Martonne aridity index;
- total consumption of water.

Between these and the maize productions were quantified corelations between the 5 functions existent in Windows program being preferred the function with the greatest coefficient of correlation.

RESULTS AND DISCUSSION

The correlation between the number of days with pedological drought and the water consumption.

The decrease of the water reserve on the irrigation depth under the minimum limit is considered pedological drought. For the crop studied the irrigation depth is of 0-75 cm (Grumeza, Klepş, 2005). The results obtained show that between the number of days with pedological drought and the total consumption of water of maize crop from the versions studied there is a reverse connection, the increase of the number of days with pedological drought determining the decrease of the total consumption of water. The exponential function has quantified the best the connection between the number of days with pedological drought and the total consumption of water. The connection is very significant statistically (Fig.1).

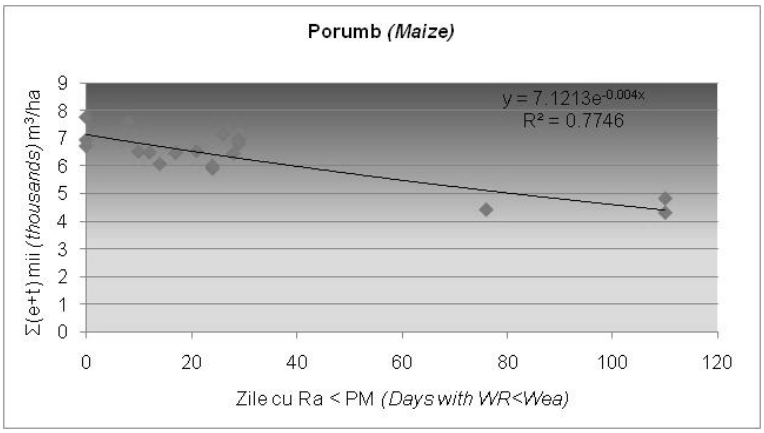

Fig. 1. Correlation between the number of days with pedological drought (WR-Wea) and the total water consumption, ∑(e+t), in maize, Oradea 2014-2015

The correlation between the number of days with pedological drought and yield

Also a reverse correlation was quantified between the number of days with pedological drought and the yield obtained. The correlation was very significant statistically, the polynomial function has quantified the best this connection (Fig.2).

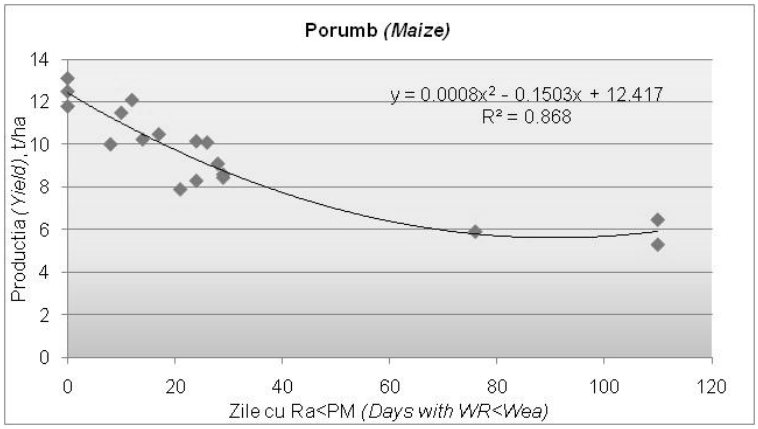

Fig. 2. Correlation between the number of days with pedological drought (WR-Wea) and maize yields, Oradea 2014-2015

The correlation between the number of days with pedological drought and the increase of yield determined by the irrigation in the versions with suspending the irrigations

Between the number of days with water reserve under the minimum limit on the depth of irrigation and the increase of yield compared to the irrigated version determined by the suspending of the irrigations in the months of the irrigation season was quantified a reverse correlation very

significant statistically, with the following mathematical expression: $y = 0{,}0028x^2 - 0{,}2076x + 6{,}8507$, $R^2 = 0{,}7771$ (Fig.3).

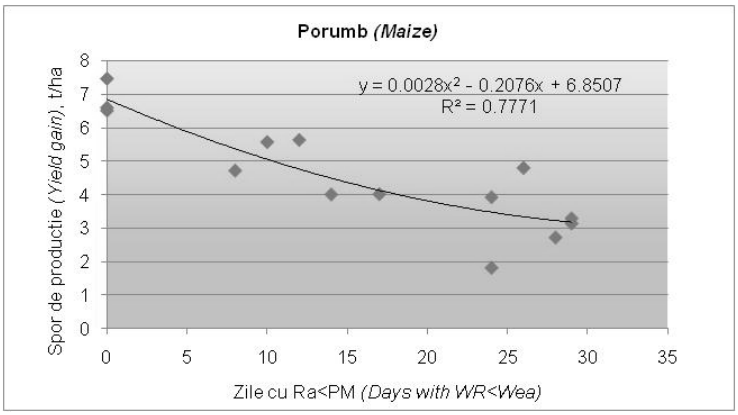

Fig. 3. Correlation between the number of days with pedological drought (WR-Wea) registered in the months irrigation suspending and yield gains obtained in comparison with the unirrigated variants of maize, Oradea 2014-2015

The correlation between the number of days with pedological drought and the quality of yield

On the maize crop, the increase of the number of days with pedological drought has determined the decrease of the content of protein, the function of regression being $y = 0{,}0008x^2 - 0{,}1307x + 11{,}31$, $R^2 = 0{,}8997$, very significant statistically (Fig. 4).

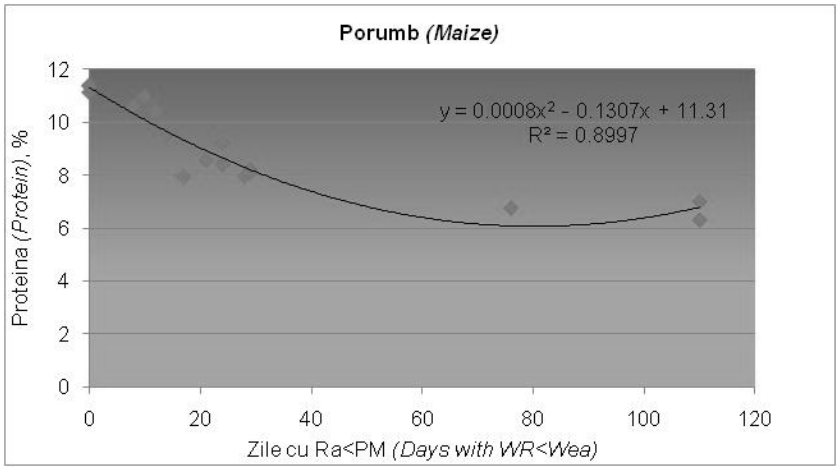

Fig. 4. Correlation between the number of days with pedological drought (WR-Wea) and the quality of the yield in maize, Oradea 2014-2015

Corellation between the Martonne aridity index (IdM) and the water consumption of maize

Between the values of the Martonne aridity index and the total consumption of water determined in the 6 versions and in the three years studied was registered a direct connection very significant statistically.

On the maize crop, the coefficient of correlation was $R^2 = 0,8736$ and the mathematic expression of the connection between the IdM value and the water consumption was $y = 0,7846x^{0,5697}$ (Fig. 5).

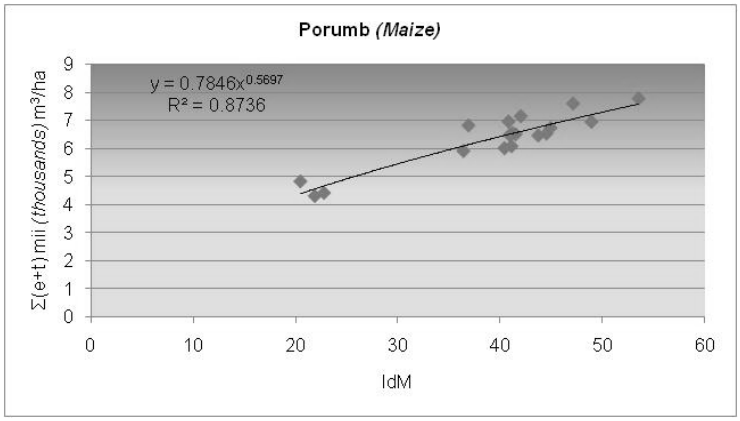

Fig. 5. Correlation between de Martonne aridity index (IdM) and the water consumption, ∑(e+t), of the maize, Oradea 2014-2015

Corellation between the Martonne aridity index (IdM) and the yield of maize

Between the values of the Martonne aridity index and the yield was quantified a correlation very significant statistically with the form $y=0,4406x^{0,8369}$ (Fig. 6).

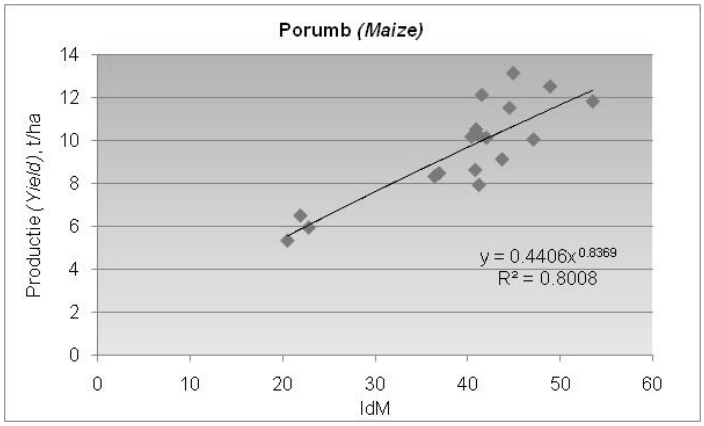

Fig. 6. Correlation between the values of the de Martonne aridity index (IdM) and yields in maize crop, Oradea 2014-2015

Corellation between the Martonne aridity index (IdM) and the quality of the maize yield

On the maize crop, between the IdM values and the content in protein of the maize beans from the 6 versions studies, was quantified a correlation very significant statistically (y = 5,1413ln(x)-9,4907, R^2 = 0,7383) (Fig.7).

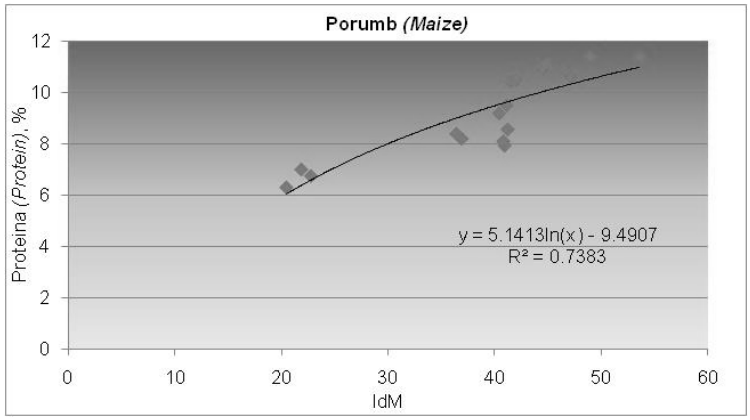

Fig. 7. Correlation between the values of the de Martonne aridity index (IdM) and the quality of the yields in maize, Oradea 2014-2015

Correlation between the water consumption and the yield

On the maize crop (R^2 = 0,6027) the correlation between the water consumption and the yield is significant statistically (Fig. 8).

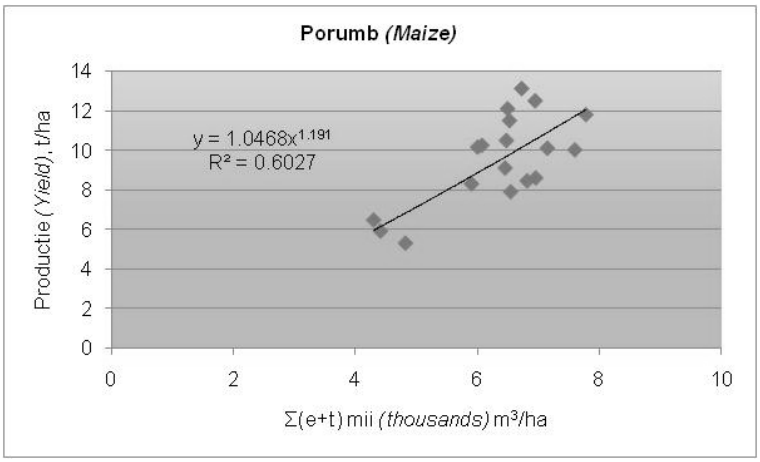

Fig. 8. Correlation water consumption-yield in maize in the conditions of irrigation suspending in different months, Oradea 2014-2015

CONCLUSIONS

The researchs on the relations between the soil-water-plant-atmosphere system has at the basis the results obtained in the field by the

review of the water in the soil. Are considered parameters of the soil-plant-atmosphere system the following:

- Pedological drought; between the pedological drough and the total consumption of water, yield and the content in proteins of the maize beans was quantified a reverse connection, and between the pedological drought and the increase of yield obtained by irrigation were quantified direct relations.

- The Martonne aridity index (IdM); was chosen this indicator because is the most known climatic indicator. Between its values and the water consumption, yeild, respectively content in protein were quantified direct relations.

The correlations from the soil-water-plant-atomsphere system argues mathematically the need of irigation of maize in the conditions of the Plain of rivers.

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