INFLUENCE OF THERMAL AND HYDROSTATIC STRUCTURE ON GROWTH PRODUCTION TO WHEAT AND MAIZE IN THE CARACAL FIELD

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ABSTRACT

In this paper an analysis of the complex influence of the agroclimatic resource variability on the vegetation state and yields on the autumn and maize wheat field crops in the Caracal Plain is carried out for a period of 3 years during the whole autumn wheat and maize vegetation season, the agrometeorological conditions varied significantly from one agricultural year to another depending on the evolution of the agrometeorological parameters on specific phases of plant growth and development.

The amount of precipitation and its distribution over months and critical vegetation intervals varies from year to year compared to the optimum limits specific to each month, season or agricultural year as a whole, significant negative deviations from them, causes unfavorable conditions for growth and development of plants during vegetation with influence on production. The combined and lasting action of the agrometeorological parameters of thermal and hydrological stress, respectively the days with maximum temperatures in the air that frequently exceed the critical biological threshold associated with insufficient precipitation (<10 l / mp / month), led to a significant decrease of the soil water reserves up to the values that characterize the occurrence of the pedological drought with varying degrees of intensity, the level of crops thus being in obvious correlation with their evolution and duration.

INTRODUCTION

The determinant impact of climatic factors on the agricultural sector necessitates the development and use of mechanisms through which agro-climatic risks can be managed more efficiently.

But agriculture, in all its segments, is directly affected by extreme weather phenomena, and their negative effects can not be minimized or ignored.

Regarding the analyzed area, the Southern Plain Plain Region, it is most frequently covered by the drought phenomenon, being highlighted at national level through one of the largest arid regions: (Sandu et al., 2010; Nikolova and Boroneanţ 2011, Bojariu et al., 2012).

In 1997, Romania signed ("Law on Combating Desertification (CCD)", adopted in Paris on 17 June 1994 and in force on 26 December 1994, based on United Nations General Assembly Resolution 47/188 22 December 1992, following the United Nations Environment and Development Conference in Rio de Janeiro (1991).

The objective of the Convention is "to combat desertification and mitigate the effects of drought in countries with severe drought and / or desertification through effective measures at all levels, in order to contribute to sustainable development in the affected areas."

Every physical, chemical and biological process that determines the growth and development of agricultural crops is regulated by specific climatic requirements, and any deviation from these requirements can result in great variability in agricultural output, and implicitly, major negative consequences on food security.

An important role for the development of agricultural crops in southern Oltenia is the management of chemical fertilizers based on nitrogen and phosphorus, with a decisive role in increasing the quantity and quality of some maize hybrids (Pandia Olimpia 2006, Pandia Olimpia, Ion Saracin 2009) .

The prevention and combat of the degradation processes are based on land improvement works on the one hand, and on the other hand on agropodo-omeliorative works and specific crop technologies. South Oltenia requires specific works for agricultural works (Ion Saracin, Pandia Olimpia 2013).

Of all the climatic hazards, the most impressive are drought and drought phenomena and surplus precipitation, with multiple consequences for the environment and society, and with direct influence on the sustainable development process.

Another indicator of agricultural drought is the temperature of the plant cover, when the water becomes limiting for plants, the heat load is intensified at the surface of the leaf and its temperature is similar to that of the surrounding air.

In our country, a climatic classification of the territory (after Köppen) was made by Ionescu-Siseşti (1947), based on two major climate elements, namely temperature and precipitation.

Subsequently, on the basis of reporting annual or monthly rainfall to the average air temperature and other parameters for a given period of time, "humidity indices" were obtained that determined the spatial and temporal distribution of the degree of humidity (Donciu, 1986).

MATERIAL AND METHOD

The CERES-Wheat and CERES-Maize simulation models were used for assessing the impact of climate change on agricultural crops in autumn and maize wheat crops in combination with the climate predictions of two regional models for two future time intervals , respectively 2021-2050.

The simulated results under conditions of climate change were compared with those simulated under the current climate and the changes in the production levels and the length of the vegetation period were thus quantified.

The agrometeorological stations where simulations were performed, considered to be representative of the crops of the Leu-Rotunda Plain (Caracal, Calafat, Băileşti, Craiova and Bechet) for both autumn wheat and maize crops, were selected so as to be representative of the agro-climatic conditions and the requirements of the two crops against the main environmental variables (air temperature and precipitation).

RESULTS AND DISCUSSIONS

The studies and researches were carried out in the Caracal Microzone, Olt County, where the annual fluctuation of climatic factors determines significant variations in agricultural outputs from one year to another, and knowledge of the impact of climate variability on vegetation and yields is one of the direct applications of agro-meteorological scientific research in agriculture.

Simulations of current wheat and corn production have been carried out, influenced by future climate change.

Table 1

The area cultivated with wheat, maize in the localities of the Caracal microzone in the period 2004 - 2012 (hectares)

Culture	2004	2005	2006	2007	2008	2009	2010	2011	2012
Wheat	18.815	19.890	18.334	16.606	14.187	18.230	18.379	20.517	19.539
Corn grains	10.299	7.555	6.382	6.708	7.781	4.727	4.329	5.544	7.015
Total	29.114	27.445	24.716	23.314	21.968	22.957	22.708	26.061	26.554

Source: INS data processed by the author

The total area cultivated with wheat, corn and sunflower has steadily decreased since 2004, reaching 34,354 ha, cultivated in 2004 to only 26,336 in 2009, so that it will grow steadily from 2010, and in 2012 it is growing 36,034 ha. As can be seen from the table above, wheat occupies the largest area of the two crops throughout the analyzed period, followed by corn.

As a matter of fact, the wheat culture remained relatively constant throughout the analyzed period, the largest variations on the decrease were recorded between 2006-2007 (-1.728 ha) and 2007-2008 (-2.419 ha) and the largest variations on growth between 2008-2009 (+4.043 ha).

Corn crops had a more oscillating evolution, characterized by repeated declines in cultivated areas, between 2004 and 2012 the area cultivated with maize fell from 10,299 ha to 7,015 h. The largest area cultivated with maize was registered in 2004 (10,299 ha) and the smallest in 2010 (only 4.329 ha, less than the half cultivated in 2004).

Table 2

The surface cultivated with wheat in the localities of the Caracal microzone, in the period 2004 - 2012 (hectares)

Locality	2004	2005	2006	2007	2008	2009	2010	2011	2012
Brastavăţu	3.204	3.170	3.188	895	895	2.716	2.716	1.915	2.491
Bucinişu	1.321	1.447	227	1.783	1.262	1.364	1.364	2.587	2.748
Caracal	2.574	1.853	1.327	1.415	1.083	1.711	1.711	1.902	2.788
Deveselu	1.410	2.204	2.035	1.315	1.313	1.701	1.701	1.592	1.919
Obârşia	1.649	2.250	3.747	1.690	1.621	1.471	1.471	1.419	1.497
Redea	5.628	5.008	3.710	5.498	4.860	5.479	5.497	8.212	4.348
Rotunda	920	1.397	1.500	1.406	1.380	1.700	1.700	1.040	960
Traian	930	995	905	905	8.03	1.000	1.000	1.025	884
Vlădila	1.179	1.566	1.695	1.699	970	1.088	1.219	825	1.904
Total	18.815	19.890	18.334	16.606	14.187	18.230	18.379	20.517	19.539

Source: INS data processed by the author

On the surfaces of the nine localities, data from 2012 show that the wheat was cultivated most in the commune of Redea, followed by Braşţăţu and Caracal commune, and the smallest areas were cultivated in Traian and Rotunda.

This is explained by respecting the proportions of the total cultivated areas of these localities. From the analysis of surface dynamics we can see changes in sense and volatility different from one year to another.

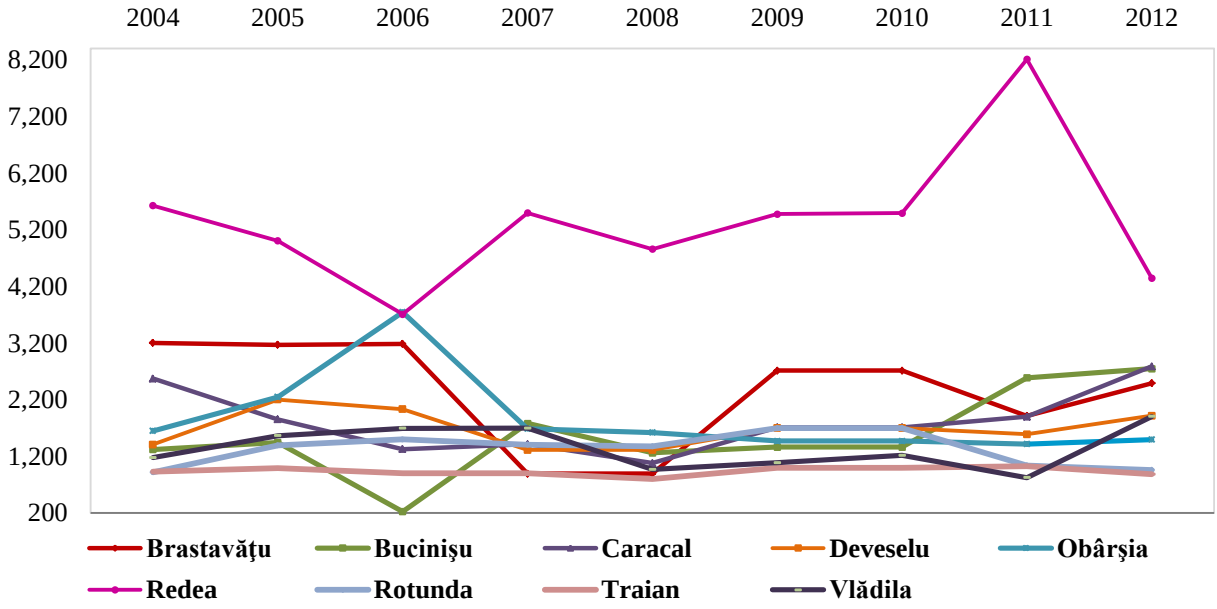
In the analyzed period it can be noticed that 5 localities recorded increases in the areas cultivated with wheat between 2004 and 2012 (Bucinişu, plus 1,427 ha, Caracal, plus 214 ha, Deveselu, plus, 509 ha, Rotunda, plus, 40 ha, Vlădila, plus 725 hectares) and 4 recorded decreases in the areas cultivated with wheat during the analyzed period (Braşţăţu, minus, 713

ha, Obârşia, minus, 152 ha, Redea, minus, 1,280 ha and Traian, minus, 46 ha).

On the total area cultivated with wheat, we find that between 2004 and 2012 it increased from 18,815 ha to 19,539 ha (a modest increase of 724 ha - 3.8%).

As far as maize culture is concerned, as shown in the data in the table below, it occupies extensive areas in agricultural crops in the localities of the Caracal micro region.

From the data for 2012, maize was cultivated most in the commune of Redea, followed by Braşţăţu and Caracal commune, and the smallest areas were cultivated in Traian and Rotunda.



Source: INS data processed by the author

Figure 1. The surface cultivated with wheat in the localities of the Caracal micro-region, in the period 2004 - 2012 (hectares)

During the analyzed period it can be noticed that almost all the localities of the Caracal micro zone have decreased the areas cultivated with corn.

On the total area cultivated with maize we find that between 2004 and 2012 it fell quite significantly from 10,299 ha to 7,015 ha (minus 46.8%) (Table 3, Figure 2).

Table 3

The surface cultivated with grain maize in the localities of the Caracal microzone in the period 2004 - 2012 (hectares)

Localiy	2004	2005	2006	2007	2008	2009	2010	2011	2012
Brastavăţu	1.753	1.686	1.308	604	1.549	18	18	1.134	106
Bucinişu	910	717	16	13	857	530	530	397	614
Caracal	819	704	642	708	584	268	268	464	869
Deveselu	1.183	979	931	1.074	1.130	380	380	437	572
Obârşia	1.138	803	476	555	761	573	573	702	931
Redea	1.774	1.140	974	1.781	770	729	729	379	1.985
Rotunda	1.280	8	579	647	634	546	546	879	1.132
Traian	1.002	863	985	146	1.071	890	890	680	672
Vlădila	440	655	471	1.180	425	793	395	472	134
Total	10.299	7.555	6.382	6.708	7.781	4.727	4.329	5.544	7.015

Source: INS data processed by the author

Table 4

The surface cultivated with grain maize in the localities of the Caracal micro-region in the period 2004 - 2012 (hectares)

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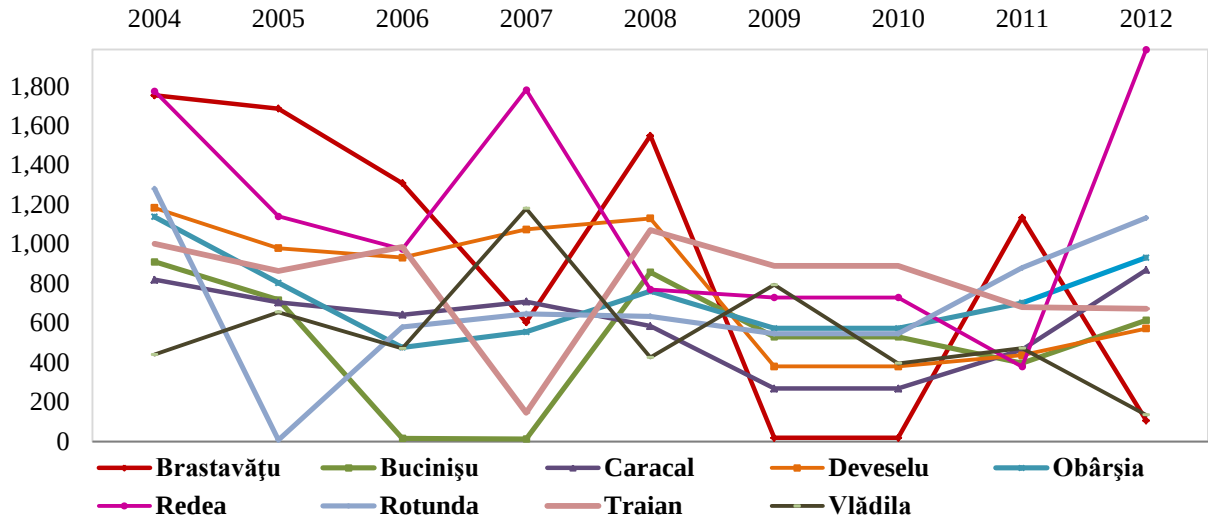
Source: INS data processed by the author



Source: INS data processed by the author

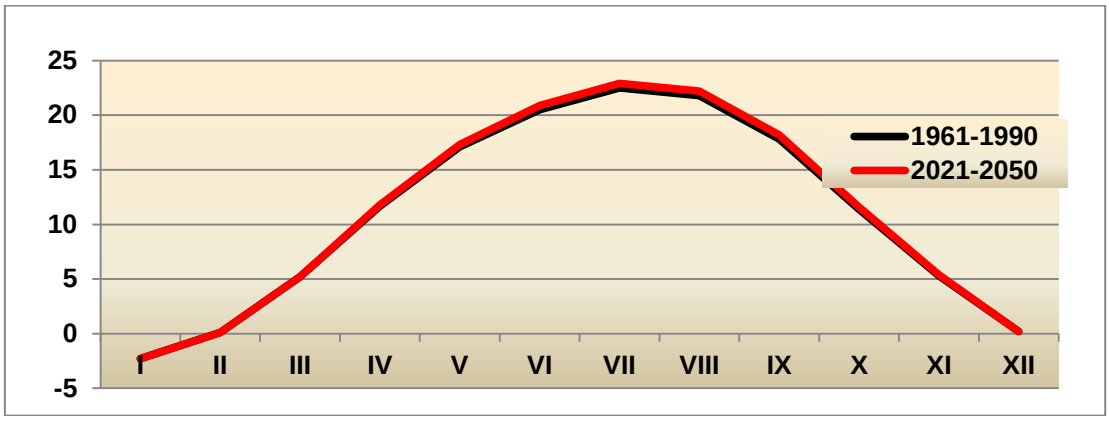
Figure 2. Simulations of the current climate influence on the two crops with the future ones were predicted.

Table 5

Average monthly air temperature

Month	Montly average air temperature -Caracal (°C)/ deviation from the current period (°C)		
	1961-1990	2021-2050	2071-2100
I	-2,3	-2,3 / 0,0	-2,4 / -0,1
II	0,1	0,1 / 0,0	0,1 / 0,0
III	5,2	5,2 / 0,0	5,3 / 0,1
IV	11,7	11,8 / 0,1	12.0 / 0,3
V	17,1	17,3 / 0,2	17,7 / 0,6
VI	20,5	20,9 / 0,4	21,3 / 0,8
VII	22,5	22,9 / 0,4	23,5 / 1.0
VIII	21,8	22,2 / 0,4	22,7 / 0,9
IX	17,8	18,2 / 0,4	18,6 / 0,8
X	11,4	11,6 / 0,2	11,8 / 0,4
XI	5,3	5,4 / 0,1	5,5 / 0,2
XII	0,2	0,2 / 0,0	0,2 / 0,0
AN	10,9	11,1 / 0,2	11,4 / 0,4

Source: NMA



Source: NMA

Figure 3. Evolution of the average monthly air temperature, under conditions of climate change (2021-2050) - CARACAL

In the winter wheat crop, it is possible to decrease the average annual rainfall by -2.2 ... -6.3% in the decade 2021-2050.

The average production of grains having a tendency to decrease, with approx. 6.7 ... 17.0% in the 2021-2050 decade.

CONCLUSIONS

The precipitation regime is the most important feature of the region and is unevenly distributed over time and space.

The comparative analysis of the obtained results highlights that the changes in the future climatic evolution based on the two regional climatic scenarios may have an impact on the growth, development and formation of the winter wheat and maize crops in the Oltenia Plain area.

Regarding the possible effects of climate change on production levels, these may be different depending on the genetic type of plants, the direct effects of CO_2 growth on photosynthesis, the local conditions and the severity of changes in the climatic evolution of the two scenarios.

The Oltenia region may be the region most exposed to the phenomenon of desertification in Romania.

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