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RESEARCH REGARDING CLIMATE CHANGES ON CROPS EVOLUTION IN CENTRAL PART OF THE ROMANIAN PLAIN

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Abstract

The evolution study of the meteorological parameters in our country evinces a raising frequency and an intensified occurence of extreme phenomena, especially in the last years, under global warming conditions. Immediate effects can be observed at the level of biocenoses: degradation of soil natural characteristics, reduction of crops obtained mostly in the central part of the Romanian Plain where aridity is obvious.

Agrometeorological data analysis for the period 2000-2007 shows a higher frequency of climate stress phenomena (2003, 2005 and 2007); (hydric and thermal) variations are significant as compared to the optimal requirements of field crops (frequency, intensity and duration), which causes production and phenological anomalies as compared to the mean multiannual values typical to the zone and genetic potential of cultivated plants.

INTRODUCTION

The environment influences agricultural production efficiency. The most dynamic ecological factors are the climatic ones (temperature, solar radiation, wind, etc) which are also difficult to monitor and control, especially in the case of field crops.

Lately, in our country, large land areas are exposed to thermal and hydric stress (drought, floods, late frost, hail, intense heat, etc.) exceeding natural systems capacity of adaptation and recovery; this fact may have long term effects on food security and human health, generally, on human life quality.

To limit expansion or intensification of degradation phenomena through drying it is necessary to rigorously evaluate environmental conditions as bedrock for new potential programmes and efficient technologies adapted to the varying climate manifestations.

In agriculture, climate risk management means to identify, analyse, evaluate and permanently monitor the dynamics of climate stress factors on growing plants in order to elaborate preventive measures and reduce damages.

MATERIAL AND METHODS

Research regarding the dynamics of meteorological parameters between 2000-2007, evinces a higher incidence of climate stress phenomena (2003, 2005 si 2007) in relation to cultivated plants, which results in reduced adaptation and crop yields.

The comparative analysis is based on the following agroclimate parameters:

- precipitations amount registered along the whole agricultural year, monthly values, or from the active growing season as well as from the period of maximal water consumption of plants(wheat/May-June, corn/June-August);
- intensity of heat expressed in intense heat units ($\Sigma T_{max} \geq 32°C$) from 01 June to 31 August;
- duration of intense heat, consecutive days of $T_{max} \geq 32°C$;
- soil humidity equivalent at different depths in relation to the growing phase of the main field crops (20 cm, 50 cm and 100 cm).

Reference zone is represented by the agricultural land areas situated in the central part of the Romanian Plain and bordered as follows: in the west, the Olt river, in the north, the Getic plateau and the sub- Carpathians of curvature, in the east, the Baragan Plain, the Saratei Valley up to the confluence with the Ialomita river, further the Dambovitei Valley continued by the Argesului Valley up to the confluence with the Danube river edging the whole southern limit of this region. Climatic data come from the main meteorological stations providing a succesion of phenological observations, biometrical and crop measurements: Alexandria, Fundulea, Giurgiu, Pitesti, Ploiesti, Rosiori de Vede, Oltenita, Targoviste and Turnu Magurele.

RESULTS AND DISCUSSION

The Romanian Plain is the first zone of favourableness for the main cereal crops and technical plants, having the advantage of sufficient thermal resources along the whole growing season. The restrictive factor is represented by atmospheric precipitations that register variations in time and at territorial level. In the last decade the incidence of droughty periods has become higher while floods have manifested themselves for short intervals and related to very great amounts of precipitations, as it happened, for example, in 2005.

The agricultural year September 2004 - August 2005 was characterized by rainy and excessively rainy pluviometric condition.

In 2005, the thermal condition dynamics was close to the climatic norms whereas the hydric condition was described as rainy and excessively rainy in the most of the agricultural land areas; precipitation excess was registered in the majority of months (January-May, July-September). In the central zone of the Romanian Plain the water amounts were between 801-1330 l/mp and in the majority of crop land

areas (figure 1), rains had a heavy character; locally, there were over 100 l/m^2 water in 24 hours (Targoviste, 137.6 l/m^2 in May) exceeding the maximal values registered along the years (1961-2000).

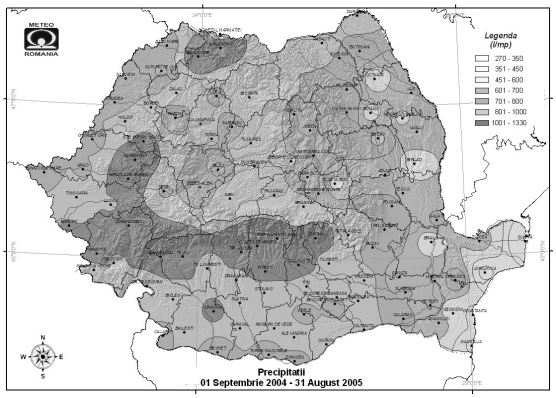

Fig. 1.

Under these circumstances, in 2005, in the central part of the Romanian Plain wheat crops varied between 2200-4500 kg/ha, while corn crops, between 4300-9900 kg/ha.

Climatic data regarding annual precipitation amount show a decreasing tendency, the first years (2000-2003) of the twenty-first century being droughty. Precipitations of 2005 improved to a certain extent the water supply in soil; however, it is drought and not excessive rains that is the main danger to our agriculture. Progressive air warming and significant reduction of precipitation amount in the last decades are restrictive elements for crop development and productivity as well as for water resources use. Variation of crop yields is presented in figures 2 and 3; it can be noticed that in 2005, a rainy year, winter cereal and corn crops were higher than in 2007, an extremely droughty year.

Fig. 2.

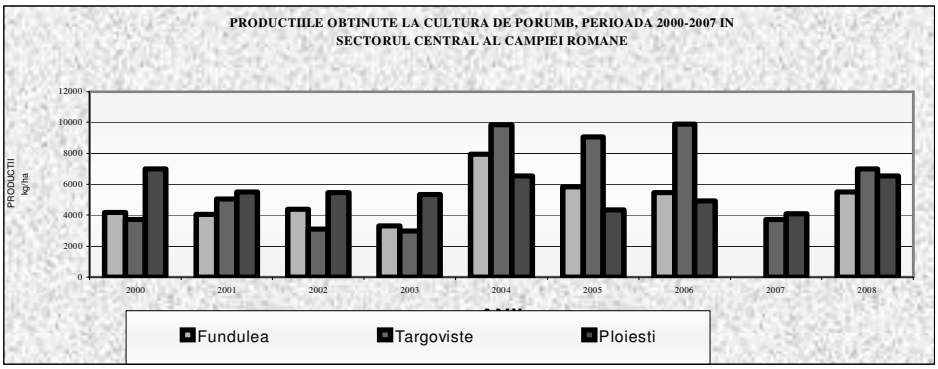

Fig. 3.

2007, the year of climate hazards, was characterized by related risk, extremely high temperature and reduced precipitations/no precipitations, which led to water exhaustion in soil. Days of intense heat (ΣT_{max}>32°C) are specific to summer time (June-August), but sometimes they may happen since May or last till September. Intense heat exceeding 20 units in 5-7 consecutive days is considered a thermal risk factor for crops. As compared to top years 1987 and 1993 when 20-45 days of intense heat were registered, in 2007 there were 30-60 days of high intensity, (91-150 units of intense heat) and extremely high intensity (151-223 units of intense heat) in the largest part of Muntenia, (figure 4), and in comparison to the mean multiannual value of the period 1961-2000, (figure 5). At the same time, days of intense heat ($\sum T_{max} \geq 32$°C) were accompanied by tropical nights ($\sum T_{min}$>17°C), which reduced the rhythm of substance accumulation in beans/seeds up to a temporary stagnation.

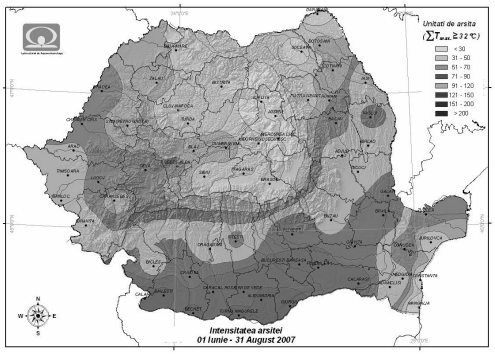

Fig. 4.

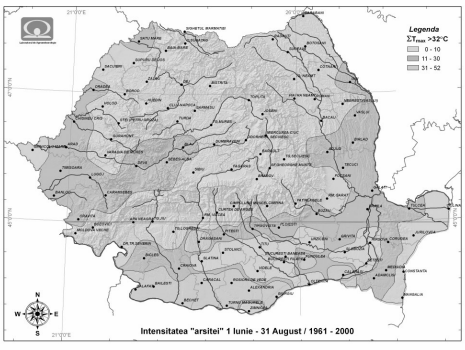

Fig. 5.

Simultaneously, in April, June and July, precipitations were extremely poor and the mean national deficit in the period April- July 2007 was 39.4%, this fact intensified

deterioration of the growing phase of winter cereals that needed maximal water supply and accelerated ripening and even partial or total degradation of crops (50-100%).

In 2007, crops in the southern part of the country were subject to long term hydric and thermal stress (sharp solar radiation, lack of precipitations) intensifying evapotranspiration; the loss of water from the plant body caused temporary and long term withering up to partial or total degradation of plant system. On some corn-cultivated land areas, plants were harvested for fodder.

CONCLUSIONS

1. Climate change is an important challenge for experts in agriculture in the sense that they have to establish the most efficient measures to reduce negative effects on crops and to assure food security.
2. The permanent character of the droughty climate causes first of all degradation of soil features, reduction or loss of biological productivity. Improvement of water condition, especially in soil, can be achieved by having adequate tilling for different types of soil, namely, minimal tillage or no tillage at all (by sowing directly in the stubble field) or by tilling superficially or less deeply.
3. In the southern zones of the country with permanent hydric deficit it is necessary to rebuild the irrigation systems in order to apply the watering norms according to the economical optimum and at the optimal time for agricultural plants.
4. Pedological drought has different effects on agricultural plants; thus, when choosing new culture structures there are some aspects to be taken into account: the dominant species should be the most fitted species (sorghum, corn) to drought or some hybrids with reduced growing season and smaller water consumption; transgenic species and genetically modified organisms should also be used; field density of plants should be small and sowing seasons should be adapted to the evolution of the air and soil hydric- thermal condition; fertilization should be balanced so that water in soil is efficiently used.
5. Regional sustainable management involves harmonization of natural and anthropic landscape, provision of ecosystems stability, as well as reduction and prevention of erosion.

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