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THE IMPACT AND VULNERABILITIES OF AGRICULTURE IN NORD-WEST REGION OF ROMANIA TO CLIMATE CHANGE

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Abstract

Global environmental change has the potential to exacerbate ecologically and societally the impact of biodiversity change. In many regions, land conversion is forcing the population to decline to the edges of the coverage of their species, where they become increasingly vulnerable to collapse if exposed to additional human impact. Degradation of natural resources is one of the greatest vulnerabilities to the impact of climate change. Rising temperatures will have a negative impact on crop yields, especially in southern Romania, where there are already crops approaching their temperature tolerance threshold. While the direct impact is associated with rising temperatures, the indirect impact is due to changes in soil moisture and probably the incidence of pests and diseases. The most significant effects is probably be borne by small farmers who have a limited financial and technical capacity to adapt to climate variability and change. This article aims to improve the understanding of the impact of climate change, the vulnerability of agricultural adaptation practices to climate change.

Key words*:* Climate change, agriculture, vulnerability, impact

INTRODUCTION

Global warming currently involves two major problems for humanity: on the one hand, the need to drastically reduce greenhouse gas emissions, in order to stabilize the level of concentration of these gases in the atmosphere, to prevent anthropogenic influence on the climate system and to enable natural ecosystems to adapt naturally, and on the other hand, the need to adapt to the effects of climate change, given that these effects are already visible and inevitable due to the inertia of the climate system, regardless of the outcome of emission reduction actions. (4).

Despite all global efforts to reduce greenhouse gas emissions, the global average temperature will continue to rise in the coming period, requiring the most urgent measures to adapt to the effects of climate change. The "5th Global Report on Climate Change Assessment (AR5)" IPCC (Intergovernmental Panel on Climate Change) comprehensively presents the latest scientific findings and observations on the causes of climate change and its impact in the short, medium term. and their length (12). The report examined various options for adapting to the effects of climate change and reducing emissions, including the interdependencies specific to the sustainable development of society, given the relevant long-term socio-economic and scientific aspects.

Mitigating the effects of climate change in agriculture is a priority objective in strategic development actions. The interdisciplinary nature of the actions implies a global approach by identifying and correlating the activities of development and implementation of intra- and intersectoral measures with those of responding to the effects of climate change. Plant production varies from year to year, being significantly influenced by fluctuations in climatic conditions and especially by the occurrence of extreme weather events. Climate variability affects all sectors of the economy, but agriculture remains the most vulnerable, and the impact on it is more pronounced today, as climate change and variability are becoming more pronounced. (12).

MATERIAL AND METHOD

The environmental issues and their consequences on alive organisms have extended, becoming a threat to survival. We are facing a full ecological crisis, crisis which requires an international approach of the environmental issue. The „biocapacity" of the Earth exceeds today with 25% the capacity to support the needs of human kind, thus this crisis is manifested in three directions (8): - in the multiplication 4 times of the globe's population in the XXth century, from 1,6 billions in 1900 to 6,4 billions in 2000; - in the development of dangerous technologies and their export in the 3rd world countries, poor countries, which lead to the deterioration of their environment due to the lack of instruments for the environmental control; - the replacement of natural products with synthetic, toxic ones, which accumulated in the environment's biosystem. (1,2)

At the level of Central and Eastern Europe, the scenarios show a clear decrease in rainfall, especially in the summer season, so a rainfall deficit that will affect all areas of activity, mainly agriculture, population and ecosystems. The most vulnerable cultivated species will be especially the annual cereals and hoe crops, the water deficit in the summer season, which coincides with the period of maximum water requirements, causing significant decreases in production. In this sense, a new reorientation in the structure of agricultural crops is required, respectively varieties with a high tolerance to high temperatures and water stress generated by lack of water. At the same time, it is necessary to adapt agricultural technologies to water resources, soil water conservation by choosing a system of minimum works representing a new trend of reorientation of requirements on quality and conservation of soil and water resources. Also, the decrease of water resources by 10-30%, especially in deficient areas, will accentuate the consequences of lack of water, the effects being amplified by pollution and inadequate technologies.

The complex effects of climate change on agriculture underpin the need for risk reduction decision-making in order to maintain appropriate crop standards and promote sustainable agriculture. Thus, climate variability and change must be addressed in the light of daily agricultural activities, with the help of mitigation strategies and adaptation measures.(3,6)

In the field plant cultivation sector, the selection of cultivated varieties mainly includes the correlation of local environmental conditions with the degree of resistance of genotypes (varieties / hybrids) to limiting vegetation conditions (drought, excess moisture, high temperatures, cold / frost, etc.).

The succession of crops in time and space are efficient ways for each agricultural user to protect the productive potential of the soil and, implicitly, to ensure constant yields.

Opportunities in establishing a sustainable management system in crop structure and crop rotation choice include:

- adaptability of genotypes to the potential of ecological areas;
- direct effects on the physical (structural structure and stability), chemical (nutrient content) and biological (amount of organic matter) properties of the soil;
- reducing the risk of transmitting diseases and pests or developing weeds;
- protection of soils against erosion, surface runoff and crust formation;
- decreasing the degree of erosion and maintaining agricultural productions at constant values;
- efficient use of plant nutrients;
- management of agricultural lands by using a rotation system, maintaining a balance regarding the share of permanent crops in relation to the annual ones;
- prevention of water pollution by drainage and percolation of water outside the areas crossed by the root system of plants, in the case of irrigated crops.

In the structure of crops, the choice of varieties / hybrids is based on their adaptability to the pedoclimatic conditions specific to the area, in correlation with market requirements. In terms of relief, knowledge of the depth of groundwater and surface water ensures the prevention of pollution risks as a result of the technologies applied.

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- use of varieties / hybrids adapted to the crop rotation system on the farm;
- use of mixed crops, intercropping, permanent crops, double crops on the same plots or within the farm to increase biodiversity.

Irrigation agriculture is based on the artificial distribution of water in agricultural land to establish crops and ensure the growth of agricultural plants.

The choice of irrigation system according to local needs and conditions regarding the area, type of crop and soil properties are the basic requirements in a sustainable agricultural management system.

The main directions for the revitalization of the irrigation sector, as a first measure to reduce the effects of drought, are the following:

- elaboration of a complex study regarding the prioritization of the rehabilitation of land improvement arrangements and of the irrigation sector in North-West Romania;
- rehabilitation of pumping stations from irrigation facilities declared of public utility, in order to reduce energy consumption and increase hydraulic efficiency;
- waterproofing of water transport, supply and distribution channels in irrigation facilities; adapting the hydrotechnical schemes of the irrigation systems to the new operating conditions and establishing the areas that can be declared of public utility, in order to optimally operate them.

RESULTS AND DISCUSSION

Recommendations and adaptation measures:

- selection of cultivated varieties by correlating local environmental conditions with the degree of resistance of genotypes to limiting vegetation conditions (drought, excess humidity, high temperatures, cold / frost, etc.);
- crop management and rational land use, while maintaining a low impact of agricultural practices on the environment and climate;
- cultivation of a larger number of varieties / genotypes, respectively varieties / hybrids, in each agricultural year, with different vegetation period, for a better capitalization of the climatic conditions, especially the humidity regime and the staggering of the agricultural works;
- the choice of genotypes resistant to limiting vegetation conditions, with a high tolerance to "heat", drought and excess moisture;

- selection of varieties of plants with natural resistance to specific diseases caused by pathogens;
- practicing crop rotation and establishing a crop structure that includes at least 3 groups of plants, respectively straw cereals 33%, hoes 33% technical plants and legumes 33%. The following types of crops can be used in vegetable production: agricultural, fodder, special and mixed.(4)

CONCLUSIONS

The direct and indirect effects of global warming will be manifested, thus, in several general directions: - *modifications of vegetation,* the appearance of weeds which may become fatal for the ecosystem, in time; - *the increase of the level of seas and oceans* with approximately 50 cm in the year 2050, which might put in danger lots of ecosystems, especially by an increase of salinity; - *weather abnormalities* manifested though tropical rains, storms, tornados, waves of heat, etc. With an impact on the entire biosystem and on all alive mechanisms; - *the appearance of diseases transmitted through vectors,* in some regions of the globe this phenomenon may lead to incidence, prevalence and, possibly, mortality; - *the food safety is threatened*, high temperatures will affect crops in some regions of the world, especially due to modifications of the rainfall regime and the soil's humidity; - *emphasis on the desertification,* due to the „green revolution" which lead to a dramatic increase of the agricultural production, especially in the past 40 years after the second world war; - *withdrawal of alpine glaciers* has as main cause the increase of green house gas concentration, phenomenon noticed for the first time in the XIXth century, leading to the withdrawal of river flows (used in irrigations and as drinkable water), which generated a real "water crisis" with consequences in the limitation of population increase in many regions from the globe.

Our society must adopt a practical attitude in solving the *environmental issues*, instead of the one adopted until now, a reactive attitude, taken each time when a crisis appears. An optimism reason might be the fact that the great majority of alive organisms from Terra are robust, powerful, which many times demonstrated the ability to adapt to a large scale of precarious weather conditions. Mankind enters into the largest crisis ever encountered, but the man is full of resources and in the best shape, even in crisis moments.

IPCC, in its report, approached *several options to diminish* these global modifications: non-polluting methods of transportation, reduction of gas emissions of human establishments, preservation of agricultural

fields, policies and strategies of management of woods from the Earth, an efficient industry, so on.

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