ANNALS OF THE UNIVERSITY OF ORADEA, FASCICLE: ECOTOXICOLOGY, ANIMAL SCIENCE AND FOOD SCIENCE AND TECHNOLOGY 2024

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REVIEW, RESEARCH ARTICLE

Abstract
Agricultural adaptation strategies and actions, included in the One Health concept, which are highlighted at the local and regional level are: the agrotechnical management of the genetic potential specific to varieties and hybrids, innovative breeding techniques of animal breeds, water and soil management, training of farmers and knowledge transfer, financial schemes, insurance, agrometeorological services, including the development of early warning systems. Adaptation strategies depend on the local context, region or country; limiting the discussion of options and measures to a single type of approach—"top-down" or "bottom-up"—may lead to unsatisfactory solutions for those areas affected by climate change but with few resources to adapt to it. Biodiversity-based or "ecologically intensive" agriculture and climate-smart agriculture are low-impact strategies with a strong ecological modernization of agriculture that aim to sustainably increase agricultural productivity and income while addressing the challenges interdependence of climate change and food security.

Keywords: climate change, One Health management, agriculture systems

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INTRODUCTION

Human activities contribute to current environmental problems such as climate change, degradation of natural resources, including soil degradation and biodiversity loss, and environmental pollution. According to the World Economic Forum Global Risks 2021–2022 perception survey, "Climate Action Failure" and "Extreme Weather" were identified as the 1st and 2nd worst risks on a global scale for the next 15 years. The world's population is currently growing and is projected to reach 9.5 billion by 2050, which represents a major challenge for socio-economic progress and requires expanding the contributions of all resources to meet the needs of such a large population growth.

Food security is one of the main problems of the 21st century and due to population dynamics, agricultural production, both food and non-food, will have to increase by 47% by 2050 compared to 2020.

Understanding the major changes in soil and plants due to climate change

In the plant:

Prolonged pedological drought can prevent the emergence of plants or can lead to the death of plants during the vegetation;

External temperatures (late frosts at the beginning of vegetation, very high temperatures correlated with drought or early frosts before harvesting) can completely destroy crops. Stressed plants turn from carbon dioxide consumers (as is normal) into carbon dioxide producing plants (a less obvious aspect when talking about CO_2 emissions);

Plants subjected to increasingly strong solar radiation suffer burns, on the background of which diseases set in or continue the process of dehydration (alteration of tissues and organs), leading to important harvest losses or the death of the plants. Atmospheric drought has a major impact on crops, especially in areas with a temperate-continental climate (such as Romania), acting particularly on reproductive organs or causing rapid water loss through evapotranspiration;

Strong winds and storms, in addition to moving air masses very quickly (which can have disastrous effects) are also the main sources of infestations with harmful agents that can be transferred from thousands of kilometers.

In the soil:

The number and spectrum of macro and micro-organisms is majorly influenced by the climatic evolution, eg: in periods with large day and night amplitudes, parasitic fungi develop more;

In periods of pronounced pedological drought, most of the bacteria die that are responsible for making nutrients available to plants;

The mineralization process of organic residues requires sufficient reserves of water and air in the soil;

Very high temperatures on the soil surface can lead to the appearance of burns on plants in the area of contact with the soil;

Most crop damage agents (weeds, diseases, insects, mites, etc.) multiply faster and are more virulent under climate change conditions;

Long periods of pedological drought can lead to the total loss of production and if the drought periods last for several years, the phenomenon of "desertification" appears.

The climate is changing because of the way people live today, especially in richer and more economically developed countries.

In the long term, widespread climate change may lead to regional conflict, famine and refugee movements, as food, water and energy resources may become scarce. Globally, up to a billion "climate refugees" could be driven from their homes and may need help, especially from wealthier nations.

Climate and agriculture influence each other. This mutual impact is more significant today as climate change and variability manifests itself on a large scale. Climate change is a huge challenge for agriculture. On the one hand, agriculture is a source of greenhouse gas emissions, on the other hand, it is extremely vulnerable to the impact of climate change as the ability of rural areas to provide adequate food, support economic development and providing a safe living environment for rural communities directly depends on the existence of favorable climatic conditions.

Climate change affects agriculture globally. Negative effects on agricultural production will be influenced by extreme weather events. The efficient management of these extreme phenomena is of particular importance for the agricultural production process. Subsistence agriculture will be particularly affected because it has less capacity to adapt. This will cause the risk of starvation to increase.

European agriculture is also affected. Climate change is also a real concern for EU agriculture. Agriculture will face many challenges in the coming decades, such as:

• increasing international competition,

• liberalization of commercial policy

• the continued decline of the rural population in many regions.

Climate change adds to the already existing pressures. It is true that some of the effects of climate change could be beneficial for agriculture in certain regions of Europe, especially in northern areas, but most of the consequences are likely to be adverse and occur in regions already under socio-economic pressure and other environmental factors such as water scarcity. This unequal effect of global warming amplifies the economic differences between the rural regions of the European Union, produces a greater risk of land abandonment and regional marginalization.

The biggest impact of climate change on agriculture will come through water. Climate change may lead to a decrease in annual water availability in many parts of Europe as a result of reduced summer rainfall, mainly in southern areas and some parts of Central Europe. In Western Europe and the Atlantic areas, summers are likely to be drier and warmer, with reduced water resources during this season. Many EU countries, especially in the southern states, have practiced irrigation for hundreds of years - this being part of the agricultural tradition, but this sector will need irrigation technique revisions in the context of climate change. For several regions it may be necessary to increase the irrigated area to ensure continuous production. But there is no doubt that agriculture must continue to strive to improve water use efficiency to reduce losses.

The consequences of the increasing frequency of extreme weather events such as hail, heavy winter precipitation, heat waves and drought will be felt across Europe. The succession of floods, droughts and storms in recent years has demonstrated Europe's vulnerability to extreme conditions. Their frequency could increase in the short and medium term (up to 2040). Also, the risk of drought in the southern EU and the risk of flooding in Central and Northern Europe will increase.

The probability of reduced production, in some regions of the EU, the variability of production, changes in the seasonal structure of production, possible increased costs for farmers are consequences of climate change that have negative effects on consumers.

MATERIAL AND METHOD

The specialist literature consultation was carried out during 2023-2024, accessing electronic databases such as Google Scholar and Scientific Electronic Library, which contain summaries and full texts of studies related to the issue addressed. We also studied representative works, recognized worldwide. Relevant studies were selected to present the consequences of climate change in the period 2000-2023.

RESULTS AND DISCUSSIONS

Good agricultural practices, integrated into the One Health concept, can reduce the vulnerability of crops to the effects of climate change. Climate variability and change must be addressed through the lens of daily agricultural activities, with the help of mitigation strategies and adaptation measures. Agricultural crops are vulnerable to exposure to limiting vegetation conditions generated by climatic extremes, are sensitive to their fluctuation and variability and depend on the ability to adapt to periods of thermal and water stress.

The benefits of choosing a sustainable management system, such as the One Health bioeconomic management, in the structure of crops and the choice of employment, include:

• adaptation of varieties/hybrids to the potential of ecological zones;

• direct effects on the physico-chemical and biological properties of the soil;

• reducing the risk of disease and pest transmission or weed development;

• efficient use of plant nutrients;

• agricultural land management through crop rotation, maintaining a ratio between the share of permanent and annual crops;

• prevention of water pollution through seepage and percolation outside the areas traversed by the plant root system, in the case of irrigated crops;

• protecting soils against erosion, surface runoff and crust formation on the surface;

• reducing the degree of erosion and maintaining agricultural production at constant values.

For the livestock sector, the code of good practices in agriculture recommends:

• large, sealed and properly equipped manure storage platforms;

• storing manure in cool and shady places;

• covering the basins with liquid residues to reduce ammonia emissions in the atmosphere by using impermeable tarpaulins;

• ensuring appropriate amounts of manure within farms specialized in its collection and processing;

• building some installations for capturing biogas, thus resulting in the reduction of methane emissions;

• outdoor grazing versus rearing in sheltered systems;

• educating and raising awareness among farmers about the consequences determined by the effects of climate change.

Climate change and the possible depletion of conventional energy sources have led to a new approach through the use of biofuels. They are obtained from renewable resources, i.e. from a raw material that can be permanently renewed

As a result of the increased heat and aggressiveness of the sun's rays, protected spaces must be equipped with shading nets to prevent this phenomenon. At the same time, favorable conditions were created for the aggressive development of diseases and pests, with growers having to apply repeated treatments with high cost prices and often with a negative impact on production, the environment and people. Because of the strong and frequent winds in recent years, growers have great problems with soil preparation, due to its strong settlement, leading to the evaporation of water and the main nutrients.

The main problem faced by Romanian farmers in the context of climate change is the fact that most of the time they cannot establish their crops in the optimal time. For example, in Braila county, in the cold protected spaces, the establishment of crops took place around April 1st, and in the field, around May 1st. Due to temperature drops and large oscillations between day and night, the establishment period of crops started to lag by 15-20 days, both for the protected spaces and for the field.

The use of Romanian varieties and their promotion in production can be a viable alternative for mitigating the negative effects of climate change.

Concerns and directions of action at the level of the European Union

There is a wide range of adaptation measures, from technological options to improved farm management practices, but also policy instruments (eg adaptation action plans). To cope with anticipated changes in climate conditions, agricultural producers can change their crop rotation for the best use of available water, adjust sowing dates according to temperature and rainfall patterns, use crop varieties better suited to new weather conditions (eg more resistant to heat and drought) or they can plant small areas of shrubs or forests on arable land to reduce water runoff and act as windbreaks. It is also important to better inform agricultural producers about climate risks and feasible adaptation solutions. The member states of the European Union have already taken action to adapt. Much of the effort to date has focused on preventing the effects of extreme weather events, perceived as an imminent risk (such as flooding).

Agricultural producers cannot face the burden of climate change alone. Public policy must provide the right support so that agricultural producers adapt their agricultural structures and production methods and continue to provide services for the countryside. The Communal Agricultural Policy already contains constituent elements that should facilitate adaptation to climate change. Facilitating agricultural producers' access to risk management tools, such as insurance programs, that can help them cope with losses from weather-related disasters as a result of climate change. Rural development policies offer opportunities to offset the adverse effects that climate change can cause on agricultural producers and rural economies, for example by providing aid for investment in more efficient irrigation equipment. Agricultural and environmental programs to encourage better management of soil and water resources by agricultural producers are also important for adaptation.

One Health management and climate smart agriculture

Agricultural ecosystems, like other ecosystems, depend on biodiversity, and animal and plant species depend on sustainable agricultural landscapes. But in recent decades, due to intensive monoculture, agrobiodiversity has been reduced, along with the sowing of large areas of land with corn, wheat, rice, soybeans and others. It is estimated that in the 20th century, 75% of the world's food crop diversity was lost due to the replacement of local varieties by genetically uniform, high-yielding varieties. Biodiversity-based agriculture, or "ecologically intensive agriculture", is an agricultural system that is based on a large biological diversification of cultivated species and that potentiates the intensification of ecological interactions between the components of the agroecosystem, contributing to productivity, fertility and resilience to disturbances external. Biodiversity-based agriculture, as a way of adapting to the current changing climate, is characterized by stimulating natural food chains and by reducing the use of chemicals.

To better adapt to climate change, farmers need to develop or transform their farming systems by replacing old procedures and practices with a suite of climate-smart technologies. Climate Smart Agriculture (CSA) is an integrated agricultural approach to One Health bioeconomic management aimed at sustainable growth of agricultural productivity and income, solving the interrelated problems of food security and climate change, reorienting agricultural development to achieve climate change adaptation goals. Climate-smart agriculture includes a range of adaptations and mitigation practices aimed at sustainably increasing productivity (food, fiber and fuel production), reducing greenhouse gas emissions, improving resilience and advancing national food security goals and development.

Climate-smart agriculture activities are a combination of technologies and practices implemented at the macro-economic level. These include traditional methods of sustainable agricultural practices and innovative agricultural technologies, such as conservation agriculture, biodiversity-based agriculture, water management and sustainable land management technologies. At the farm level, the implementation of climate-smart agriculture practices depends on the socio-economic environment, which in turn is influenced by institutional patterns, resource accessibility and climatic conditions.

CONCLUSIONS

The objective of this paper was to carry out a brief analysis of the influence of climate change on agricultural systems currently practiced worldwide, and to promote the concept of One Health management, integrating the specificity of agriculture with other areas of economic life.

The negative impact of climate change is characterized by the capping of productive yields, the significant reduction of the genetic potential for a whole series of crop plant species, the reduction of the arable land surface, economic losses and last but not least, increased labor and equipment costs.

The recommended strategies and actions for adapting agriculture to climate change, which can be implemented at the local and regional level, are agrotechnical management specific to the conditions existing at the farm level, water and soil management, training of farmers and knowledge transfer, financial schemes to stimulate the practice of agricultural systems that implement One Health bioeconomic management, agricultural insurance adapted to the risks identified by farmers, high-performance agrometeorological services, including the development of early warning systems.

Climate Smart Agriculture (CSA) is an integrated agricultural approach to One Health bioeconomic management aimed at sustainable growth of agricultural productivity and income, solving the interrelated problems of food security and climate change, reorienting agricultural development to achieve climate change adaptation goals.

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