ABSTRACT

of the doctoral thesis entitled:

RESEARCH ON THE INFLUENCE OF FERTILIZATION SYSTEMS AND CONSERVATION TILLAGE ON EROSION AND SOIL FERTILITY IN THE BÂRLAD PLATEAU

The doctoral thesis entitled "Research on the Influence of Fertilization Systems and Conservation Tillage on Soil Erosion and Fertility in the Bârlad Plateau" addresses an extremely current and highly important topic for sustainable agriculture: the impact of fertilization systems and conservation tillage practices on soil erosion and fertility in the Bârlad Plateau – a region with a high risk of erosion.

The main objective of the research is to identify sustainable technological solutions capable of reducing soil and water losses on sloping land through the efficient use of soil tillage and fertilization. Thus, the objectives pursued in the experiment include:

- Studying the influence of crop structure and a 3-year crop rotation (wheat – peas – corn) on yield levels and soil fertility, expressed through changes in key physico-chemical indicators;
- Evaluating the impact of differentiated soil tillage systems (primary tillage and subsoiling) on the physical and physico-mechanical properties of the soil and the way these influence crop development;
- Analyzing the effects of differentiated fertilization on soil quality and on the yield of the main crops, monitoring specific fertility indicators;
- Determining water and soil losses through erosion by directly monitoring runoff on 2 m² experimental mini-plots.

For the purpose of conducting the studies, an experimental field was established at the Soil Erosion Control Research and Development Station “Mircea Moțoc” Perieni. Within the experiment carried out at SCDCES “MM” Perieni, the monitoring of the three experimental factors was performed: the year, the soil tillage system, and differentiated fertilization.

- Factor A – Year, with 3 levels:
    1. A1 – 2021
    2. A2 – 2022
    3. A3 – 2023
- Factor B – Soil tillage system, with 3 levels:
    1. B1 – conventional – land tilled by plowing (SC)
    2. B2 – minimum tillage – land tilled with a disc harrow (MT)
    3. B3 – no-tillage – direct seeding (NT)
- Factor C – Fertilization, with 4 levels:
    1. C1 – unfertilized
    2. C2 – mineral
    3. C3 – plant residues + mineral
    4. C4 – manure + mineral

The structure of the thesis is divided into two parts:

Part I – Current State of Knowledge: This section provides a theoretical framework on fertilization, soil tillage systems, types of erosion, and the influence of these factors on agriculture. It details the impact of climate change on the intensification of erosion phenomena and emphasizes the importance of soil and water resource conservation.

Chapter 2 discusses the factors that influence the efficiency of fertilizers: soil type, climate, and crop. A classification of fertilization is presented: organic and mineral. The chapter offers principles for fertilizer application tailored to field crops, aimed at increasing yields and maintaining soil health.

Chapter 3 compares the conventional tillage system (with plowing) to non-conventional ones (minimum tillage, direct sowing). The advantages and disadvantages of each system are analyzed, especially their impact on soil structure, water retention, and erosion reduction. The importance of soil conservation in modern agricultural technologies is emphasized.

Chapter 4 presents a historical overview of land degradation research. It discusses the importance of erosion prevention, types of erosion (water and wind), and the ways agricultural crops can influence erosion levels. This is an essential section for understanding the environmental impact of agricultural practices.

Part II – Personal Contribution: This section presents the field experiments conducted under the specific conditions of the Bârlad Plateau, using experimental microplots and statistical analysis methods. Aspects such as bulk density, penetration resistance, moisture, water runoff, and yields obtained for each system and technological combination are evaluated.

Chapter 6, entitled Material and Method, describes the organization of the experiment: the biological material used, soil types, and field methods applied. The experimental factors (tillage system, fertilization, crop) and the statistical methods used for data analysis are also explained.

Chapter 7, entitled Experimental Conditions, details the natural context (location, climate) and pedological factors (moisture, bulk density, penetration resistance). The influence of these factors on wheat, corn, and peas is analyzed according to the soil tillage system.

Chapter 8 presents the experimental results, focusing on the yields obtained for wheat, corn, and peas. An analysis of variance is conducted for various factors (year, tillage system, fertilization). The individual and combined effects of these factors on crop yield are discussed. The F-test is used to assess statistical significance. In summary, the following conclusions were drawn:

- For winter wheat:
- The year had a significant impact on yield, especially due to variable climatic conditions (rainfall and temperatures).
- The tillage system: plowing and scarification resulted in higher yields compared to minimum tillage. However, differences were not always statistically significant.
- Fertilization: the application of fertilizers led to significant yield increases. The highest fertilization level was associated with the highest yields.
- Combinations of year, tillage system, and fertilization showed important interactions, confirming that productivity is strongly influenced by these interrelated variables.

- For maize:

- The year was again a major determining factor, significantly affecting yield.
- More conservative tillage systems (scarification and minimum tillage) performed well, yielding results comparable or even superior to plowing under favorable conditions.
- Fertilization produced evident yield increases, with strong responses to medium and high doses of nitrogen and phosphorus.
- The analysis of multiple interactions revealed that the positive effects of fertilization can be amplified or diminished depending on the type of tillage and climatic conditions.

- For peas:

- Peas reacted differently compared to wheat and corn. As a leguminous crop, it required less nitrogen fertilization but responded positively to phosphorus application.
- Minimum tillage practices were favorable, showing the crop's good adaptability to reduced tillage systems.
- Although the year influenced yield, the differences were not as pronounced as with the other two crops.
- Multiple interactions (ABC) were not always statistically significant but provided useful insights for optimizing pea cultivation technologies.

The analyzed factors – year, soil tillage, and fertilization – significantly influence agricultural production, but their effects depend on the crop and the complex interaction between climatic conditions and the applied technology.

The use of rigorous statistical methods allowed for a deeper understanding of these relationships and supports the final recommendations formulated in the thesis.

Chapter 9 synthesizes the main conclusions of the study, highlighting the effectiveness of certain tillage and fertilization systems. Recommendations are provided to support soil resource conservation and the achievement of high and sustainable yields.

Therefore, this research aims to scientifically substantiate applicable measures for areas with a high erosion risk, while also providing an integrated perspective on the relationship between cropping systems and soil degradation processes.