ABSTRACT

Throughout the history, the development of agriculture was a prosperity antecedent. Nowadays, agriculture is and will continue to be the only sector able to ensure food security for more than seven billion people around the world, a population that is expected to increase by one billion until 2025. But the intensification of agricultural systems i. e. aggressive soil tillage or excessive use of mineral fertilizers led to negative side effects such as soil pulverising and desertification, the increase of carbon emissions into the atmosphere, and environment pollution. Therefore, it is necessary to implement those agricultural systems that, besides yield maximization, should aim at protecting natural resources in the context of recent climate change.

Finding those technological options adapted to local environmental conditions, sustainable and leading to winter rapessed (*Brassica napus* L.) yield maximization were the main reasons that led to the development of the PhD thesis entitled ***"Optimizing rapeseed crop technology for adaptation to biotic and abiotic stress conditions in the Central – Northern Area of the Moldavian Plateau".***

For that reason, we tested 50 rapeseed cultivars in Agricultural Research and Development Stations from Suceava, Secuieni – Neamt county and Podu Iloaiei – Iasi county. Different tillage systems were also implemented to provide research based cropping system options for farmers in the area.

We also aimed at testing the adaptation abilities of the selected rapeseed cultivars to the new biotic and abiotic stress conditions, to implement certain tillage systems, to determine the influence of cultivars on some plant biometric parameters and on yield components, to quantify the effects of tillage on soil compaction and structure indices. We also aimed at explaining the variations of seed and oil yield, and the economic efficiency of cropping system options under those circumstances.

For achieving those objectives, we conducted activities such as performing field studies and laboratory analysis regarding the soil fertility from the experimental fields, implementing the trials with 50 rapeseed cultivars in three tillage systems, using inputs and performing

technological operations, taking soil samples, performing direct determinations and laboratory analysis regarding the evolution of soil physical properties, trials harvesting, assessing yield components and yield variations of the selected rapeseed cultivars, performing statistical analysis on trial results, and substantiating the implementation of technological options in the selected area.

In ARDS Suceava, the soil from the experimental field is a moderate acid (5.75 pH units) loamy (31.6% clay in 0-20 cm) cambic phaeozem with 3.69% humus in the top 40 cm of soil profile. In ARDS Secuieni and Podu Iloaiei, the soil is a moderate acid to neutral (6.1 – 7.0 pH units) loamy to clay – loamy cambic chernozem. The Central – Northern Area of the Moldavian Plateau is characterised by a continental climate, as it is a component of Df.b.x climatic subdivision according to Köppen; in Suceava Plateau, the climate is cooler and more humid than in the rest of the area.

The PhD thesis is generally divided into seven chapters, of wich the first three chapters, adressing theoretical issues related to the topic, are extending on almost 32%, and the next four chapters, wich are representing the personal contribution to the topic, are occupying more than 68% of the thesis. It has 227 pages and includes 89 tables and figures, and 36 relations.

The first chapter presents some aspects related to the importance, cultivation area, rapeseed yield and its possible uses, plant growth stages and their international codification according to CETIOM and BBCH, climate and soil related plant requirements. Then, the crop technology, from possible rotation schemes to crop harvest, is shortly presented.

Theoretical aspects regarding plant stress and the biotic and abiotic factors that are causing plant deviation from the optimal physiological state are summarized in the second chapter of the thesis.

In the third chapter we are presenting the current state of the research regarding the optimization of rapeseed crop technology for adaptation to stress conditions, both in terms of soil and water sustainable management related to recent climate change and also as plant adaptation possibilities to biotic factors such as pathogens, insects and weeds.

The fourth chapter presents the purpose, main and specific research objectives, also the experimental design and research methods. For highlighting the impact of tillage on soil physical state, we collected undisturbed core samples from 0 – 40 cm depth and disturbed samples from 0 – 30 cm depth, every 10 cm. The cores were then transported to the laboratory where bulk density and others soil compaction indices were determined. The disturbed samples

were analyzed as soil aggregates size by dry sieving and as hydric stability by wet sieving in distilled water, using standard methods. Soil penetration resistance was determined in field conditions using a penetrologger in early rapeseed flowering to correlate soil compaction with plant root growth. We also measured root and stem length, counted stem ramifications and yield components. Rapeseed yield was determined with the sensor system from the plot combine used for harvesting. Oil content of seed samples taken from every plot was assessed using near-infrared spectroscopy (NIR). Statistical analysis of data was performed for separating the effects of treatments from random influences and for highlighting the most valuables combinations. The economic efficiency of cropping schemes was determined to provide an overview of efforts (costs), risks and results (net profit, net profit rate) of rapeseed crop in the area.

The fifth chapter presents environmental conditions in the research area: geological, geomorphological, hydrographic, climate, soil and natural vegetation related aspects.

The sixth and largest chapter presents in detail the trial results from each location regarding the influence of treatments (tillage and rapeseed cultivar) on studied parameters both for the entire research period and for every growing season, growth stages and different soil depths. Best combinations are highlighted in terms of yield, seed oil content and economic efficiency, and also regarding their impact on soil physical state.

In each location, tillage significantly influenced rapeseed yield averaged over two growing seasons. Highest yield values were obtained in conventional tillage, but insignificantly different from chisel tillage in Secuieni and Podu Iloaiei trials. In Suceava, the most productive remained conventional tillage. The effect of cultivar on rapeseed yield was insignificant in Suceava trial, where PR46W30 gave highest yield values. In Secuieni and Podu Iloaiei significant differences existed among the cultivars of the same company.

In the seventh and last chapter we summarize the trials results and present some location based recommendations regarding rapeseed cultivar and tillage treatments as yield, economic efficiency and cropping system sustainability.

The PhD thesis ends with 231 references of books, scientific papers and internet pages used within its chapters.