

ABSTRACT

Key words: seedbed, tillage systems, soil, yield.

Seedbed preparation is the link of utmost importance in the crop technology without which the result, both qualitatively and quantitatively, could not be corrected by other types of tillage. Thus, the need to obtain sufficient food for the world population requires more rational use of productive resources and finding ideal solutions to modernize agriculture without producing disturbances in the environment.

The thesis entitled "Seedbed preparation in difficult conditions" was developed from the desire to find the best tillage option to obtain a seedbed that can ensure optimal conditions for plant growth and development of four crops in rotation (winter oilseed rape, winter wheat, maize and soybean) under the current circumstances, when drought is increasingly present in Moldavia. For this, we tested several variants of tillage systems on a sloping plateau, taking into account both basic tillage and seedbed preparation. By testing different conventional and conservative tillage systems, we studied the effects on soil physical properties and quantitative change in the main production.

In order to achieve the objectives, we conducted a series of activities, including the establishment of the work plan and the experimental field with four crops, applying all links in the crop technology, collection of soil samples, field and lab analyzes regarding the evolution of soil physical condition, determining the characteristics of productivity and yield, statistical analysis of the results and substantiate technological options adapted for implementation in the area of interest.

The experiment was carried out at the Research and Development Agricultural Station from Secuieni, Neamț County. The land of the experience has 10-12% slope, cambic chernozem, with low acid pH (6.29), humus content of 2.55-3.1%, medium content of

nitrogen and good content of phosphorus and potassium. The experimental design consisted of 84 plots, 21 for each crop, on a total area of 2.03 ha.

The doctoral thesis has two parts and comprises eight chapters. The first part presents the research carried out regarding the studied subject.

The second part presents the natural environment conditions, material and method and also the results and conclusions.

The first chapter „Short history of unconventional soil tillage systems” presents data regarding the soil tillage evolution carried out by humans first with wood or stone tools, then with animals and nowadays, with highly performant equipment.

In the second chapter is presented the actual state of research regarding seedbed preparation in Romania and abroad.

Seedbed preparation before sowing consists in mobilization, shredding and loosening the soil to a depth equal to or 1-2 cm higher than the depth of seeding, ensuring the best conditions of moisture, light and heat for germination and uniform emergence. If these requirements are not respected and vital elements are not optimum seed germination and emergence are staggered, with gaps in culture, debilitated plants reach the surface, being more susceptible to attacks of phytopathogenic agents, all causing losses.

In the third chapter are presented some elements of the natural environment, geology, geomorphology and hydrology, soils, temperatures and rainfall, animals and main plant species from the area.

The fourth chapter presents the aim, objectives, experimental factors and research methods used.

In order to carry out the research, soil samples were taken, in natural and modified settlement, from 0 to 30 cm depth. The samples taken in natural settlement were analyzed in the laboratory, to determine bulk density and other compaction indicators.

Samples in modified settlement were analyzed for structural elements by dry sieving and for hydric stability by wet sieving, in distilled water. Soil penetration resistance was determined in the field, with a penetrometer. Also, were made determinations regarding the productivity elements. All results were statistically analyzed using ANOVA and regression curves.

The fifth chapter deals extensively with the results regarding the influence of conventional and unconventional tillage on seedbed quality indices for all four crops in rotation. The quality indices of the seedbed preparation characterize the degree in which the requirements imposed are satisfied. Thus, there were analyzed the results from measurements

on average working depth, crumbling, loosening and leveling degree and weed control. It was noticed that there are statistically assured differences between the variants for all crops, seedbed preparation quality being reflected in the yields obtained.

The drought in recent years in Moldova demonstrated the need for detailed studies regarding how seedbed preparation is carried out and the equipment used for it, in order to have high and profitable yields, but at the same time preserving soil resources.

Following the research carried out, it was found that the conventional tillage variant with the highest values of seedbed quality indicators, was the one in which the basic tillage was made with the reversible plow and the seedbed preparation with the Combigerm implement.

From all the five minimum tillage variants, the most efficient was the one in which the basic tillage was made with the scarificator and the seedbed preparation was carried out simultaneously with sowing, reducing the number of passages. This variant had optimal values of seedbed quality indices, very close or even equal to those obtained for the control.

Chapter six – „Results regarding the influence of seedbed preparation on soil physical properties”, presents the results for each crop, regarding the soil bulk density, compaction, penetration resistance, total porosity, porosity categories, hydric stability of the macrostructural aggregates, structural aggregates distribution and weighted average diameter.

Soil tillage systems influenced the physical properties, with statistically very significant, distinctly significant or significant differences compared to the control.

As a consequence of soil characteristics modification, the compaction degree presented particular importance in yield evolution. The effects of soil tillage on it depend on soil type, climate, equipment used. The results show that the most important indicators of soil compaction, bulk density and penetration resistance, influenced the yields.

Analysing the bulk density values from sowing to harvest, was observed an increase in all variants and all depths, with obvious amplitude in conventional tillage variants. Regarding the compaction degree, good values were obtained for variants where the basic tillage was performed with chisel plow or scarificator and seedbed preparation with the complex aggregate Vibromix or vertical rotary harrow. milling with vertical rotors. Regardless of tillage system, it was noticed an increase of this parameter, from sowing to harvest. Analyzing the average values of penetration resistance on all four crops in rotation, except variants with basic tillage performed with heavy disk harrow, which slightly exceeded the value of 2 MPa, other variants showed average values on 0-50 cm profile below this threshold considered as critical level at which is affected the normal growth of plant roots. The total porosity values

decreased from sowing to harvest on all depths. Hydric stability of macrostructural aggregates is a measure of vulnerability to external destructive forces and represents their characteristic to resist the water dispersion action in motion or at rest. This parameter has increased with depth, regardless the vegetation stage or tillage.

The seventh chapter includes the results regarding the influence of experimental factors on biometric parameters, productivity elements and yield. The highest yields were obtained for the conventional variant Plow+Combigerm, followed by the conservative one Scarificator+Venta, and the lowest yield were registered for the variants with basic tillage made with heavy disk harrow. In conventional variant Plow+Combigerm followed by version conservative Rippers+Venta, and yields the lowest were obtained in variants that work basic soil was performed with a disc harrow heavy. Also, correlations were made, between yields and seedbed quality indices.

At the end of the thesis, in chapter eight, overall conclusions are presented, followed by references.