SUMMARY

RESEARCHES CONCERNING THE MECHANIZATION OF THE NO-TILL CORN SEEDING TECHNOLOGY IN UNPLOUGHED SOIL CONDITIONS

The PhD thesis with the above title follows the actual tendencies of development and implementation of new technologies in agricultural practices, in order to develop a sustainable agriculture. These new tendencies have the main objective to contribute to the soil conservation and to maintain the soil potential for crop production.

The opportunity of this thesis is distinguished by the following facts:

- The agricultural soil is the most precious richness of our country and of human kind in general.

- The classic methods for seeding, which are commonly used in Romania, requires the soil tillage, which lead to financial loses and to the continuous degradation of the soil. This soil degradation is manifested through the excessive ramming of the soil and erosion.

- Nowadays, as a requirement for a sustainable agriculture, there is necessary to develop new alternative seeding technologies in order to reduce the energy consumption and to maintain the soil potential for crop production.

- The implementation of the alternative seeding technologies in Romania and the researches regarding this subject will contribute to the improvement of the soil and to the acknowledgement of the soil processes under the influence of the external factors (tractor, agricultural machine and agro-chemicals).

The PhD thesis has six chapters, a foreword and introduction, and it ends with the bibliography and three annexes. It has 195 pages and includes two relevant scientific papers presented in two international symposiums.

Inside the foreword and introduction there is mentioned the role, importance, and the facts of present interest and the objectives of the thesis.

Chapter one named “A general look over the no-till technology” refers to the up-to-date approaches in the plant growing field. It also refers to the sustainable agriculture concept, describes the main characteristics and reveals the structure of a sustainable agriculture system. The growing plants technologies are analysed with a special interest upon the no-till maize seeding technology.
Chapter two called “The actual knowledge and the comparative analysis in the field of seeding technology” reveals a synthetic evolution of the no-till seeding technologies in Romania and abroad. It also analyse the influence of the no-till system upon the soil from the point of view of the pluvial and wind erosion, the apparent density, soil cone index, mulch, aggregation state of the soil and distribution of the soil pores of different sizes.

Finally, a comparative evaluation is made for the no-till seeding machines. There is distinguished the dependencies between the active devices and the qualitative parameters of the seeding process.

Chapter three – “The theoretical basis of the no-till seeding process for maize” analyses the agro-technical requirements for the seedbed, the specific conditions for the no-till technology, mentioning the particularities for maize. It also defines and analyzes the parameters which evaluate the quality of the seed process (seed rate, the uniform distribution of the seeds along the working width, seed damage degree, seeding precision on the row, number of seeds in one place, the medium depth of seeding, medium and maximum deviation from the seeding depth). Another point analysed is the dependencies between the factors which compete to the guarantee of the optimum conditions for germination and growth in corn technology.

Chapter four – “Theoretical and applicative research regarding the seeding process” analyses the influence factors upon the direct seeding process with regard to the geometry of the opening and crushing devices. A conclusion is formulated, that the no-till seeding process is influenced mostly by the devices which forms the seeding bed. In accordance, there are mentioned the advantages of the disc coulters over the classic ones. Starting from this point, the researches are focused on the optimization of the rifle disc geometry. An analysis is made for the working process of the rifle discs, from the quality point of view and also from the energetic point of view. There are elaborated the mathematical models which generates the surface of the rifle discs and the computer applications for three rifle discs, namely “SURFACE 1”, “SURFACE 2” and “SURFACE 3”. With these three applications a program is developed, named “RIFLE DISC” for discs design. These represent the author personal contribution to the optimization of the rifle discs geometry, including the whole no-till seeding process.

Chapter five – “Experimental researches concerning the no-till seeding for the maize”, developed over 50 pages, includes the objectives followed during the experimental researches, the methodology of research and the interpretation of the results.
The main goal of the researches was to improve the direct seeding process by optimizing the geometrical and functional parameters of the seeding bed makers’ devices. Three series machines and an experimental model were tested in laboratory conditions. These machines were equipped with different row openers.

The series machines were meant for the three agricultural systems: minimum tillage, no-tillage and classic system.

During the experiments, the following factors were studied: dynamic behaviour, determination and variation of the soil mechanics properties before and after seeding, determination of the qualitative index of the seeding process, influence of the working speed over the soil cone index, influence of the geometrical parameters of the openers over the quality of the seeding bed, influence of the seeding bed over the soil-seed contact and sprouting degree and variation of the forces in accordance with the working speed.

For laboratory testing, the author used the technical devices of the Institute of Agricultural Engineering, within Hohenheim University (Germany), which was completed and adapted according the requirements for research methodology.

Following the laboratory observations, a field research program was developed. In this research program an experimental model was conceived. During tests in the field, among the parameters described above, it was also studied the vegetable residues cutting percentage, the sprouting time and the sprouting degree.

Using the results was possible to improve the no-till seeding process and the disc design with the computer applications developed within this thesis.

**Chapter six** – “Final conclusions, personal contributions, suggestions and recommendations” synthesises the results obtained from the no-till technology studies. In this chapter, there are presented the main achievements and contributions. Finally some suggestions are made regarding the future researches in the field and the implementation of these new solutions into the nowadays agricultural technologies.