# SUMMARY

PhD thesis **"Research concerning the residual effect of herbicides used in field crop technogies in Moldavian Plain"** has the general objective to establish the effect of technological treatments on the level of organochlorine herbicides in soils and plants.
For this purpose it was intended to optimize an analytical technique that uses accelerated solvent extraction and to develop a high precision and sensitivity chromatographic method which can ensure the detection and quantification of the pesticides from the environment.

In order to achieve the general objective of the PhD thesis it has been developed and realized the following specific objectives:

- ✓ Acetochlor and s-metolachor sorption on chernozem soil;
- ✓ Determination and quantification of acetochlor and s-metolachlor residues in soil by GC-MS technique;
- ✓ s-metolachlor and acetochlor leaching in soil;
- ✓ Determination and quantification of acetochlor and s-metolachlor residues in plants by GC-MS technique;
- ✓ The effect of herbicides doses on soil microorganisms;

PhD thesis is structured in two parts and contains ten chapters. The first part introduces a bibliographic study including general characteristics related to physical and chemical processes which cause pesticide residues.

First Chapter pursues the documentations concerning the occurrence of pesticide in water, soil and air matrices and the assessment of xenobiotic compounds risk on human health. Also, describes the main aspects of the behavior of herbicide in soil by analyzing the state of the knowledge about sorption, degradation and leaching processes.

Second part of the thesis contains the research results obtained from the development of a comprehensive experimental program in agreement with proposed objectives.

Third Chapter presents the environmental conditions in which researches were conducted. It has been realized a characterization of the climatic conditions, vegetation description, physico-chemical, mineralogical and microbiological soil properties.

Chapter Four includes an extended discussion among the materials, sample preparation methods and chromatographic techniques used. To assess the effect of herbicide doses on soil conservation as well as along the food chain (soil-plants-seeds), soil and plant samples were collected to determine acetochlor and s-metolachlor residues. For monitoring pesticide residues it was used an accelerated solvent extraction method, highly competitive for GC-MS analysis, based on the following consideration: reduced working time and solvents volumes, repeatability, reproducibility, specificity and high accuracy.

The Fifth Chapter of the thesis presents the results obtained after acetochlor and s-metolachlor sorption study on chernozem soil. The studies have been focused on parameters which influence sorption processes. The results obtained indicate that the physico-chemical properties of acetochlor and s-metolachlor molecules and how their concentrations significantly influence their retention and leaching. By comparing the results obtained there is a retention capacity of xenobiotic compound that decreases in the order s-metolachlor, acetochlor. Following sorption isotherms analysis, it was found that acetochlor and s-metolachlor sorption is widely described by Freundlich model, confirming soil heterogeneity. The *n* parameter, indicate a medium leaching potential of acetochlor and relatively high for s-metolachlor.

The Sixth Chapter of the thesis, analysis the effect of herbicide doses on acetochlor and s-metolachlor residues from soil. The results showed that the soil is a reservoir for pesticide; the herbicides dose had an influence on acetochlor and s-metolachlor residues. The annual variation of organochlorine level indicates a maximum level for s-metolachlor compared with acetochlor. At recommended dose, are obtained the lowest acetochlor and s-metolachlor residues due to biodegradation by microorganism and by environmental action, temperature and precipitation. The differences between the quantities of residues detected one year after application are assigned to chemical structure and physico-chemical properties of the molecules. The presence of leaching is a consequence of weak bonds between herbicides molecules, clay and humus and obviously the values of water solubility and octanol-water coefficient partition. Also, the *n* constant which is the intensity sorption coefficient increase leaching and ground and surface water contamination with increasing concentration. To evaluate acetochlor and s-metolachlor residues in soil, we determined half-life, where the smallest value of this parameter was

registered by acetochlor. Also, environmental factors have an influence on herbicide persistence by soil type and its elements: uniformity, texture, organic matter, clay content and pH. Clay type has an influence on sorption capacity and herbicide persistence, and among the mineralogical types it was establish a classification after sorption capacity that increase in order kaolinit, illit, montmorillonite.

In the Seventh Chapter of the thesis, we evaluate the organochlorine herbicides along the food chain, soil-plants-seeds. The annual variation of organochlorine herbicides level, registered a maximum level for s-metolachlor and a different dynamic for acetochlor in 2009/2010 compared to 2010/2011. There were no above maximum residues limits, published by Regulation (EC) No. 149/2008.

The Eighth Chapter includes the results obtained following the effect of herbicides doses on soil biological activity. Soil microbiota showed quantitative variations between sampling time, type and herbicide concentration applied. For s-metolachlor is a decreasing microbial activity even at recommended dose (which is maintained after 21 days of application) being the inhibiting effect conditioned by herbicide molecules. Also, the high concentrations did not cause an additional reduction on soil microbial activity. Comparative dynamics, shows that the micromycetes spectrum did not changed significantly, which prove that the species responded to active ingredient acetochlor excess by resistance mechanisms. In order of toxicity, established by concentration values which determined microbial activity decreasing, it was determined that s-metolachlor was more toxic compared to acetochlor.

The Ninth Chapter relates the modification on weed characteristics as a result of herbicide treatment. From the annual weed characteristics, the fluctuating values of weeds $m^{-2}$ resulted were due to climatic conditions, degree of infestation and applied dose. The efficacy of increased preemergent dose, indicate the same level, because by discharge the competition made by the major weed group, the species with low frequency grows fast and compete the crop, particularly when weed seeds reserves indicating an infestation potential with minority species. Compared to standard treatments, the postemergent variants were above the recommended dose efficacy.

At the end of the thesis are the general conclusions and bibliographic references studied.