ABSTRACT

The thesis "***Revaluation of Eroded Slopes from the South of Moldova Plain with Several Annual and Perennial Agricultural Cultures***" has been carried on for 4 years on field studies and for almost 4 years of laboratory and office work for the interpretation of the results and thesis elaboration.

The greatly productive, modern and intensive agriculture performs significant stresses over the soil and the insufficient knowledge of the way in which the soil reacts to such frequent stresses might end up with negative consequences, manifested through processes of degradation, even destruction of its capacity of production *(Canarache A. and colab., 1978, 1990; Hamza M.A. and colab., 2005; Garcia-Orens F. and colab., 2005).*

The necessity of obtaining constant and increased productions, on surface unit, by elaborating new technologies which should assure the highest efficiency, under the terms of reduction of energy consuming and elimination of huge losses provoked by erosion, weeds, diseases, pest and unfavourable weather climate are all imposed yet not without taking into account the evolution in time of the soil fertility.

The intensification of the use of agricultural areas, as a consequence of the increasing demand of food products has lead to a more and more marked degradation of the soil quality. This has very serious consequences not only for the present population but also for the future generations since the soil recovery is a long term process which takes tens and even hundreds of years.

The variety and increase of the production will not be possible without the optimization of the crop rotation a possible desideratum only if the following are known: land condition (fertility, degree of infestation with weeds and parasites), weather conditions (suitability and aggression of environment factors), technical, biological and non biological resources (technical and biological capital, wear degree, working period, etc.), the economical perspectives (market demands, currency) and last but not least the qualitative criteria and the restrictions (sensitivity to risks, managerial skills marketing education, regulations regarding the working period of the system of culture, reactions to production abandonment, etc).

The modern agriculture, like any other intensive form of human activity, is involved in the normal development of natural phenomena, increasingly stressing its constituents, in our case, the soil. An insufficient knowledge of the way in which the soil reacts to such stresses might have negative consequences, manifested through processes of degradation, even destruction of its productivity capacity. The soil durability depends, on the one hand, on its chemical,

physical and biological features which determine its relative stability and, on the other hand, on the way in which the natural and especially anthropical factors, act on it.

The rational use, the protection, the improvement and preservation of the soil represent a permanent preoccupation of the contemporary world, the development success depending on it. The soil resources together with all the other constituents of the environment are directly or indirectly involved in all the aspects of the development having an impact on the economic power of any country, at all levels of development.

The traditional approach of the research from the area of crop rotation, soil works, and nutrition and plant protection was to achieve the optimization, one by one, of all the factors that influence the soil production and fertility.

The application of measures and agro-technical methods for the protection of the environment resources is based on advanced scientific knowledge in the area of technologies, which are to put in harmony the demands of a lucrative production with the exigencies of protection and preservation of the environment.

The succession of crops in time and space, in an integrated system of organization and location of the territory, accompanied by an optimized technological system regarding the soil works, the fertilisation, weeds, pest and pathogenic factors control assure the increase of production and the preservation of water, soil and air resources.

The results of previous research have proved that crop rotation keeps its importance even in the conditions of intensive technologies, being the main measure for protecting the soil, for the phytosanitary protection of the crops and for the efficient revaluation of all the technological factors. *(Timariu Gh., 1957; Ionescu-Siseşti, 1958; Vasiliu A., 1959; Hulpoi N., W. Braun 1965, 1968; O. Furrer, 1969; Staicu I., 1969; Onisie T., 1989, 1991, 1999; Jităreanu G., 1999, 2000, 2006; Ionescu N. 1985; Budoi G., 1996; Dincă D.,1957, 1982; Sin Gh., 1993, 1987; Pintilie C., 1980, 1993; Petrovici P., 1987; Popa A., 1994; Săndoiu D., 1973; Guş P., 1985, 2003; Lăzureanu A., 1994; Neamțu T., 1996; Rusu T., 2006; Nistor D., 2002; Catargiu D., 1996; Rusu M., 1996) .*

The present research represents a preparing stage for the realization of calculation models for the optimization of culture systems, the precision of which depends a lot on the volume of information regarding the phenomena that need to be modelled.

The elaboration of these ecosystems must correspond to the demands regarding the preservation of soil fertility and the obtaining of maximum efficiency in the terms of a technical and economical efficacy proper to the exploitation.

We have proposed in this thesis to bring several theoretical and practical contributions, regarding the quantification of the effects of the main constituent elements of the culture systems on the level of the crops and on the productive potential of the soil, as well as those of the decisive factors, an alternative according to the new socio-economical demands, of becoming aware of the danger of erosion and then a series of technical measures concerning

the revaluation of the productive potential of these sloped areas, without irreversibly degrading them.

The main objectives formulated in order to realise the thesis were:

- The evolution of some chemical items of the soil as a consequence of the use of organic and mineral fertilizers;
- The effect of fertilization on wheat and corn production located on cambic chernozem with different degrees of erosion;
- Influence of crop rotation and of fertilizers on physical, chemical and biological features of the soil;
- Role of rotation and structure of crops in combating the soil erosion;
- The effect of the interaction between crop rotation and fertilizers on crops and production costs;
- The proportions of the process of erosion under the influence of anti-erosion protection of different agricultural crops;
- Influence of drains and erosion on losses of organic substances and nutrient elements from the soil;
- Estimation of water and soil drains through erosion on arable lands located in the hydrographical basin Popesti Iugani;
- Influence of erosion on losses of humus and nutrient elements from the soil.

Within the research, there has been pursued the revaluation of eroded sloped areas from the South of Moldova Plain, with certain annual and perennial agricultural crops. There have also been experimented different doses of mineral and organic fertilizers applied to these crops which together with the anti-erosion measures, lead to the improvement of the physical and chemical properties of the soil, to the reduction of soil losses, water preservation, realization of important increases of production and protection of the environment.

In order to elaborate this thesis, I have used the results obtained in several experiments located on an area with 14% slope, with a chernozem cambic soil, which has a clayey texture, a neuter reaction towards acid weak and a moderate provision of nutrient elements and an Eastern exhibition in the Scobalteni farm which belongs to SCA Podu Iloaie, located in the inferior basin of river Bahlui.

The location of the experiments has been made according to the experimental scheme on the blocks method and the physical and chemical analyses, to the soil tests and from the experimental variants have been realised according to the well known national and international methodologies. The studied factors have been represented by the crop rotation consisting of corn monoculture, wheat-corn rotation as well as 3 and 5 years crop rotations (pea-wheat-corn; pea-wheat-corn-sunflower + one field of leguminous plants and perennial gramineae which was planted with grass for 3 years and their fertilization with 5 degrees: N_0P_0, $N_{40}P_{40}$, $N_{70}P_{70}$, $N_{100}P_{100}$, $N_{40}P_{40}$ + 30 t/ha manure)

The hydric stability of the soil structure was determined through the Erikson method.

The soil humidity was realised by drying the soil tests in the drying oven, at a temperature of 105 degrees Celsius.

The determination of the humus quantity was obtained by multiplying the content of organic carbon with 1.724.

In order to study the edaphic fauna and the biological activity of the soil, the soil tests collected from the experimental field variants, from a depth of 0-20cm, were passed through a sieve of 2.5mm, homogenized, brought to the humidity of 16-18%, kept in plastic bags for 2-3 weeks (for the homogenization of the vital processes) and then biotically and enzymatically analysed.

The study of water and soil losses through erosion was developed by means of lots for erosion control (4X25), with a surface of 100 square metres. They were isolated from the rest of the surface with metallic walls.

The water drained during rains is collected in basins provided with distribution devices, from which water and soil tests are taken to determine partial turbidity and chemical analyses regarding the losses of humus and nutrient elements.

The soil quantity lost together with the water drain was made by drying in the drying oven, weighing on analytical balance and calculation.

The productions were expressed in kg/ha and the statistic calculation of the results was made by means of analysis of variation.

Regarding the evolution of the physical features of the soil, during the experimented period, the following conclusions have appeared:

The main limiting factors are soil erosion, which determines the removal of the horizons with humus, a weak settling of the horizon to a depth of 15÷20cm (hardpan in formation) and degradation of the structure to the soil surface, as a consequence of the technological fluxes and practice of corn mono crop or of wheat-corn rotation.

By increasing settling, the porosity weakens and at the same time, the permeability and the water accessible to plants, that is, if the apparent density raises with 0.1g/cm^3 the quantity of accessible water decreases with 10%.

In order to remove these inconveniences, we consider necessary the application of certain agro-phyto-technical measures, such as: loosening with subfields, organic-mineral fertilization, and the compulsory introduction of ameliorating plants for soil structure.

The research made regarding the influence of crop rotations and fertilizers over the evolution of the main agrochemical indexes of the soil signalled important changes during the research period. By synthesising the obtained results, it has been established that on sloped areas, where the soil-weather conditions are less favourable for agricultural crops, by organizing the crop rotations and by a long term use of doses of $N_{70}P_{70}$ sau $N_{40}P_{40}$ + 30 t/ha manure, the

main agro chemical indexes were maintained within the limits favourable for plant growing and development.

To maintain the fertility of sloped lands, it is necessary to assure a balance of the process humification-mineralisation, which supposes the evaluation and the control of the nutrient elemnets from the soil which suffer more rapid changes that the plain fields, due to the applied technologies and the process of erosion.

Crop rotation represents a basic technological element to maintain the soil fertility with a positive influence on the biological activity of the soil.

The soil is a living organism and the whole activity of formation, development and evolution takes place under the action of physical, chemical and biological factors. As a consequence of the action of these factors, the soil acquires the feature of fertlity, which makes it different from the rock on which it was formed during time, under the action of pedogenetical factors.

Out of the realised analyses regarding the potential of respiration and cellulozolitic of the soil, it has been established that the organic-mineral fertilization and the 4 year rotation with ameliorating plants have favourably influenced the level of soil life and contributed to the stimulation of the vital activity of the soil. Both the respiration potential and the cellulosic one of the soil increased together with the fertilizing organic-mineral doses applied and with the introduction in rotation of a greater number of plants, especially the plants with an ameliorating role.

The analysis of the quantitative results regarding the dynamics of the lumbricides and micro arthropods to different plants, from the Scobalteni area, emphasised the fact that the soil works and the chemical treatments applied had consequences over the variety and density of the edaphic fauna.

The results obtained regarding the average densities of macro arthropods signalled great value differences, due to the season variation of the weather factors and especially because of the degree of intervention and human control over the analysed agro ecosystems.

The early covering of the soil with a well joined vegetal carpet of cultures of wheat and perennial plants positively influence the density of individuals and on the soil open during winter, on which it is intervened with different mechanic works in spring (corn crop), there appear kenotic disequilibrium which recover quite hard, usually together with the growing of the crops' vegetal mass.

The organic-mineral fertilization and the crop rotations with ameliorating plants had a special role in maintaining the soil microbiological equilibrium. The annual fertilization with high doses of Azotes and phosphorous determined an increase of the colonization index to the Fusarium type while the other fungus types were inhibited. The highest density of bacteria population, micro mycetes and actyomycetes were met in the case of the organic-mineral fertilization and in crop rotations with ameliorating plants.

By analyzing the influence of the crop rotation on the wheat production from the whole research period (2001-2004), it can be noticed that it determined, in comparison with the monoculture, the obtaining of crop increases of 30% (700kg/ha) in the 3 year rotation (pea-wheat-corn) and of 34% (790kg/ha) in the 4 year rotation (pea-wheat-corn-sunflower + one field of leguminous and perennial gramineae plants). The production increases obtained due to the applied fertiliser doses oscillated between 51-156% (620-1900 kg/ha).

At the corn crop, during the years 2001-2004, the production increases realised due to the rotation were of 25 % (700kg/ha)in the 3 year rotation (pea-wheat-corn) and of 30% (790kg/ha) in the 4 year rotation (pea-wheat-corn-sunflower + one field of leguminous and gramineae perennial plants) and the fertilization determined a growing crop with 30-119% (910-3000kg/ha).

The results obtained on sloped lands from Moldova Field, where they represent more than a half of the arable surface, show that the crop framing in 3 and 4 year rotation with ameliorating plants determines the obtaining of production increases of 30-34% (700-790kg/ha) for wheat and 20-25%(700-790kg/ha)for corn.

At the pea crop, under the conditions of lack of fertilization, the average production obtained during the whole research period (2001-2004) was of 1243 kg/ha. The production increase obtained because of the fertiliser doses oscillated between 16% (202kg/ha) and 69% (857kg/ha), thus illustrating the necessity of fertilisation of the eroded sloped areas weakly supplied with humus and nutrient elements.

In the conditions of lack of fertilisation at the sunflower crop, the average level of production between 2001 and 2004 was of 1748 kg/ha. The organic-mineral fertilisation determined the obtaining of significantly increased productions, their value oscillating between 34% (602kg/ha) and 84% (1470kg/ha).

In the Southern Moldova Plain, during the period 2001-2004, out of the total of 2175.9mm registered rainfalls, it has been established that 957.9mm (44%) determined drains and out of these, drained, by erosion, volumes of water between 36.31mm (1.67%) to the perennial leguminous and gramineae after the second year of vegetation and 79.92mm (3.67%) to corn and sunflower.

The introduction in rotation of the crops with ameliorating plants on eroded sloped lands from the Southern Moldova Plain determined an improvement of the erosion process and a preservation of the production capacity and it also lead to the obtaining of significant quantities of high quality fodder. The quantity of raw protein, obtained in average during the research period, was between 548kg/ha to the unfertilised plants and starting with the application of fertiliser doses, it reached a maximum value of 834kg/ha.

Starting from the proportions of the damages produced by this process of degradation, it is necessary that for each area, it should be established a long term program for the soil protection against erosion, where, if the expensive preservation measures are less accessible,

the use of a crop structure (which should offer increased anti-erosion protection, according to the slope and the erosion degree) and of certain proper agro-technical methods should be compulsory, because they do not require any special financial efforts and they assure a corresponding exploitation of the sloped areas.

The quantification of the performance of a rotation must be realised for long period of time, to several rotation cycles, because in this way, one can know its influence on the stimulation of production which, in certain years, can be influenced more by the weather conditions and less by the soil fertility.

The results obtained are characteristic to the area from the Southern Moldova Plain and in this way we pull the alarm wires to find a solution of making aware the farmers who, after retrocession of the agricultural lands, by practising monoculture of corn and simple rotations of wheat-corn, lead to the soil degradation in a rapid and irreversible rhythm.