# SUMMARY

**Key words: ecological agriculture, compost, corn, hybrids, plant density**

Ecological agriculture represents a system that answers to all demands of worldwide agriculture and agriculture sustainability, as an important segment concerning economical development; due to some multiple causes, it still is very little spread worldwide, in the European Union and also in Romania.

Its essential purpose is to produce vegetal and animal ecological products as diverse as possible and in a quantity that will fully satisfy the local community necessary situated near specific farms, but also the demand of certain groups of persons interested of healthy food.

Also, the fundamental idea that supports this kind of process and which is constituted as primordial object and functional rule, is that the amelioration, maintenance and continuous growth of the agrarian soil health (which needs to be fertile, equilibrated an alive) represents the key of success, on long term, regarding the vegetal production, always on the grow and domestic animals, their productivity and product quality.

The way it is conceived and applied, according to strict rules and an authorized control, the ecological agriculture corresponds to the demand of diminishing the proportions and intensity of the ecological crisis.

Applying the principles and rules in the vegetal sector is based on three central pillars, around which revolves all farmers actions : the fertilization with an organic character with fertilizers produced in his own farm (compost, green fertilizers); organizing some long rotations, with a great variety of cultures, among which the legumes should not be missing; maintenance and growth of wild life biodiversity, including the edifice one, with an important role in plant conservation and protection.

Among the cultures which should be taken into consideration when organizing the rotation, corn shouldn't miss because it is very important to an ecological farm structure, functionality and economy.

In our country, corn is the most wide spread culture, due to its food, fodder and industrial value; the cultures are still very low, because of some factors, which could be: extension on cliffs exposed to erosion

with thin soils and poor in nutrition. A big cliff represents a limited factor in the case of corn, which is a breed plant who encourages the erosion processes.

This is why we can say that the corn's future lies in ecological farms, several studies demonstrating that the conditions found here are far more favorable, insured by the specific anti-erosion arrangements. Also, corn reacted more favorable than any other cultures to fertilization with green fertilizers and composts or culture systems practiced at these farms.

Although many studies have been undergone and a vast bibliography was accumulated regarding the corn, due to its phenomenal importance, it refers, in general, to the intensive system of agriculture; the ones concerning the ecological culture of corn are few worldwide and in our country.

It represents sequential approaches of the ecological agriculture problematic, such as studies on theoretical essence and the process technique of obtaining composts, effects on soils as amendment and breeder or the effects of composts on agrarian plants, growth, development, productivity and quality.

In the first chapter are presented, from the literature, the theoretical and practical information regarding the ecological agriculture system and its spread through history, until 2007 and 2008; the second chapter presents a synthesis of researches regarding the composts, its production, quality, its effects on soils and plants, and also on corn, as object of study from the PhD thesis.

Along with some data regarding the importance and spreading of corn, there are also presented some new data concerning corn adaptability to ecological system, its behavior to organic fertilization and especially to several applications of composts and dosage and the complicated problematic of suitable hybrids and researches of plants densities on corn.

The researches from the PhD thesis were made in Coraclau, Barsanesti, county of Bacau. The place, as well as the climatic conditions or soil were described in the third chapter.

The experiments lasted for three years (2005, 2006, 2007), very different under climatic conditions, the year 2005 being, in general very favorable to corn growth, 2006 was dried and warm and 2007 even drier, the worst year(analytical data presented in the third chapter).

The aim of our researches was, based on thorough knowledge about the ecological agriculture and its techniques, to produce a compost made from agrarian residues and to test its effects on corn, depending on the hybrid to be cultivated and plant density. Compost production and its usage as soil breeder and fertilizer represent some very important steps of ecological agriculture. They were introduced into the experiment based on some very important fito-technical measures, but less studied in the case of ecological agriculture : the hybrid and plants density.

The objects of researches, very complex through its approach, were : annual preparation of a compost, after all the rules that need to be followed in biological farms (including process monitoring), its quality analysis, under physical and chemical aspect and economic efficiency; testing the effect of this compost, with different dosage, on growth, development and productivity of corn, depending on the cultivated hybrid and plants densities, compared to the two witnesses : unfertilized and exclusively optimal chemical fertilized (N60P80K80).

The objectives mentioned above could not be achieved without a good knowledge of ecological agriculture and composts, which represented the primary objective.

The aim and objectives of the researches imposed a different manner of organization, along with a time delay, on two different directions:

- organizing the annual activity production of the necessary compost, during 2004, 2005 and 2006(the used compost was made the previous year);
- organizing field activities for testing the effect of this compost, regardless of dosage, with different corn hybrids and densities.

Depending on the necessary compost for field activities, the production of compost was increased and depending on the quality of compost from each year it was taken into account its intake as a nutrient (N, P, K), with every dosage or the cost of economical efficiency from field activities.

The three factors considered her in this study were:

A. fertilizer (type) and dosage, with five gradation :

a1 – unfertilized

a2 – chemical fertilized with N60P80K80

a3 – compost – 10t/ha

a4 – compost – 20t/ha

a5 – compost – 30 t/ha

B. corn hybrid, with three gradation :

b1 – Dana

b2 – Elan

b3 – Turda – SU – 210

C. plants density, with two gradation :

c1 – 48 thousand plants/ha

c2 – 60 thousand plants/ha

The soil preparation technique was a conventional one.

The chemical and physical analysis, biometrical measurements were made with the respect to standards. The results of the biometrical measurements and production ones were statistical processed with the help of variation analysis method, and the mathematical modeling with the help of square regression for correlation between different variables. A more detailed plan is presented in the fourth chapter.

From our researches regarding compost production (chapter V) was concluded that, despite research and production difficulties, the compost needs to be prepared annually; more precisely, it needs to be used immediately maturated in order not to lose its qualities. In order to be used in the autumn, its preparation has to start in the early spring (April), being necessary 6 – 6, 5 months to achieve a quality compost.

In the case of a small, mixed farm we can obtain, with some difficulties and small expenses, quality composts, using as priming materials several vegetal scraps (cereal straws, corns, woody scraps) with a ratio of 60% and animal dejections/filth (solid, fresh garbage from cattle with vegetal bedding; garbage from sheep and solid garbage from chicken) with a ratio of 40%.

The mixture gave a ratio C: N of 39: 1, with an average humidity of 38%, insufficient, which needs to be adjusted by wetting/moistening the hole material until it reaches 60%. The technology used here was the hot aerobic one, with monitoring and process controlling in lots or turves with a base width of 2 meters and 1, 5 at the top, covered with a layer of dirt and straw.

The vegetal materials, with big sizes (corn maize, straws, timber) - DA under 0, 65t/m3 - needed to be chopped in fragments of 1 and 3 cm (timber) and 5 to 8 cm the cellulose ones.

The piles were placed on the clean, leveled and pounded soil, bordered by collecting trenches and arranged by alternating the vegetal residues with the animal dejections; the vegetal layers were spread with soil from cleaning.

The composting needs to be directed in the right way, so we can obtain a mature and quality compost; it was absolutely necessary to monitor the process, which took into consideration only the temperature and humidity of the material.

The results from monitoring revealed that that the temperature evolves along with the transformations which were recorded; its increase is seen as a consequence of organic matter decomposition, rather than a rise of atmospheric air temperature. Even if the outside temperature increased, the one inside never exceeded the

normal values for each phase. Material humidity was seriously influenced by the external environment; during the rainy 2005 it exceeded the normal values of 60 and 65% and in 2004 - 2005 it decreased under the permitted limit.

After monitoring it resulted that , every year, the process was helped by a different number of reshuffles and rewetting or just rewetting without reshuffle : during 2004 it was necessary two reshuffles followed by rewetting; during 2005 it was necessary three reshuffles, two in May and one in July, all of them being made to ventilate and reduce the humidity; during 2006 it was sufficient a single reshuffle followed by a rewetting (in April) and a spraying in June, in order to correct the humidity.

During all three years we obtained composts with a relative different quality and costs, which depended on the number of reshuffles and rewetting used.

In 2004, which we considered to be a normal, favorable year, we obtained a compost with a medium-coarse texture, mellowed, dry, stable, with the lowest degree of demineralization , with a ratio C/N of 14,1 : 1, pH – 8,1, a very good concentration of nitrogen, phosphorus and potassium, a good ratio between nitrogen and potassium, as well as between nitrogen and phosphorous (digestible).

The year 2005 was very unfavorable and difficult for the processor, but very in the case of compost quality (chemical aspect) with a ratio C/N – 12, 47 : 1, more phosphorous and less potassium; it also resulted a much pounded, wetter and intensely mineralized soil.

An average estimation of the three years, could tell us that the quality of the compost could be considered a good one, under physical appearance and a very good one concerning the chemical properties. The compost had a medium- coarse texture, it was mellowed, dried, with a good flow and medium mineralized. The ratio C/N of 13, 3, the pH of 8,1, a high content of N, a very good content of potassium and a good one of phosphorous, justifies it.

Compost production costs even when we do not buy the residues. The monitoring costs a lot (54, 3 – 62%), the transport, manipulation, material preparation (11 – 12%) and pile arrangement (9,4 – 10,8%) being added to this. The total expenses went to the working hand (labor) (82. 4% from which 61% went to monitoring).

The cost of one tone of compost differs from one year to another, depending on the number of reshuffles and rewetting, and also the cost of residues, when not produced at the farm.

With our own residues, one tone of compost was produced with 162,8 lei in 2004, 172, 8 lei in 2005 and 158, 6 lei in 2006 (an average of 164, 73 lei per three years).

At a minimum price of fructification in the European Union (63 euros/t) and level of costs, the profit rate exceeded 70, 5%, but was strongly negative influenced by the increase of reshuffles. Processor's experience, as well as composting a higher quantity of residues (than 10 t), will improve the economical efficiency.

Researches made on the field, highlighted the fertilizer and dosage effect, hybrid and plant density, in interaction with the climatic conditions of that year and between the three factors, on some important components of production and corn grains productivity and economical efficiency.

Among the individual components of productivity we could mention here the ones that we determined: strain height, cob weight, grain efficiency/yielding, grain weight from the cob, MMB and MH (quality measures).

We also determined the essential elements regarding the biomass structure: the ratio of vegetative parts and that of grains from the total biomass of the plant before harvesting.

Strain height, different from one hybrid to another, bigger in the case of Turda-SU-210, increased during the rainy year, especially at Dana and Elan, due to the increase of compost dosage, with up to 20% rise of plant density with 7,3%, with some differences between hybrids.

The fertilizers, mostly the 20 and 30 t/ha compost dosage, diminished the negative effect of density increase from 48 to 60 thousand plants/ha, of reducing the individual components of productivity.

The biomass structure was also influenced by the climatic conditions; during the rainy year the ratio of vegetative parts increased in contrast with the grains. The same thing happened in the case of chemical fertilization with N60P80K80, but the compost, with dosage of 20 and 30t/ha reduced the ratio of vegetative parts, especially in the case of Turda-SU-210, increasing the grains. The increase of density had no significant effect on the structure of the biomass.

During fertilization, the three hybrids reacted different : the hybrid Turda-SU-210 fructified best the 30t/ha compost dosage, and Elan and Dana the 20 t/ha compost dosage, at a maximum density.

MMB and MH increased along with fertilization, although there are some differences between hybrids; so, at higher dosage of compost their values are almost the same at a maximum density. MMB increased more than the hectoliter mass through fertilization; when density increased, it decreased and MH increased, but insignificant.

Grain production correlated positively with the height of the strains>MMB>the weight of cob grains>average weight of a cob, when fertilizer X hybrid X plants density interacted. It also were reported

some important differences between hybrids regarding the significance of the correlation between production and different components of individual productivity.

The production of corn grains depended on the climatic conditions of that year, which influenced the efficiency of fertilizers on hybrids or the effect of increasing plants density, recording big annual fluctuations.

Due to drought, during the dried year, we lost 506kg/ha when unfertilized, 680kg/ha with a 10t/ha compost dosage, 1450kg/ha when using N60P80K80 or 20 t/ha compost dosage and 1548kg/ha with a 10t/ha compost dosage.

During the rainy year, the compost was very efficient in the case of the three dosages and was poorly valued during the dried years, althpugh during those three years, it increased the corn production even when was used a fertilizer or not.

The best recorded results were obtained with the 20t/ha compost dosage, which proved an average production of the three years of approximately 6220kg/ha, equal with the 30 t/ha compost dosage, with 37,5% bigger than when a fertilizer was used and 13,7% than N60P80K80; the gross profit was 1662 lei/ha and a profit rate of 61% (66% during 2005).

The 10t/ha compost dosage was noticed by the reduced dependence to climatic conditions; it achieved a production increase of 20%, equal with the N60P80K80 dosage, although it contains 50% active substance, 5,03kg gain/kg, the best production stability from one year to another and a much better efficiency than the 20 and 30t/ha compost dosage.

During the rainy years we recommend the use of chemical fertilizers and during the dried ones the 10t/ha compost dosage; as we can see the latter ones are more predominant. So, we recommend the 10t/ha compost dosage to chemical fertilization.

The 30t/ha compost dosage revealed the best results (41% than fertilized and 17, 1% when chemical fertilization was used, during the rainy year), but was poorly valued during the dried years, having the most inefficient production, increasing the price and diminishing the profit and its rate.

It could be taken into consideration in the case of the transition period, due to its breed effect much stronger than the 20t/ha compost dosage.

Corn production depended, in a small manner, on the hybrid, than the fertilization or climatic conditions; the best hybrid with the best economical efficiency was Turda-SU-210, followed by Elan. The hybrid Dana reacted less to the compost fertilization and it is not preferred. It is recommended, due to similar qualities, to promote both hybrids, with the following order: Turda-SU-210 and Elan.

The individual components of productivity, which correlates positively with the production, decreased due to the increase of plants density from 48 thousand to 60 thousand plants/ha; the grains increased significantly with 317kg/ha – 5,8%, an average estimation of the three years. The increase of density proved to be more efficient during the rainy years, to all hybrids which interacted with all fertilizers.

The best density - 48 thousand plants/ha, was well valued by the Turda-SU-210 hybrid, during all three years, but mostly during the rainy year. The same hybrid and Elan achieved bigger productions rates when the density increased, especially when were fertilized with high dosages of compost (20 and 30t/ha).

Economically, the increase of density in the case of Turda-SU-210 and Elan, with an interaction with higher dosage of compost, insured a much better economical efficiency to those doses; it becomes more and more obvious the need to practice a density of 60 thousand plants/ha, in order to obtain bigger productions and to capitalize the high dosage of compost.

It also became obvious the fact that in the case of chemical fertilization or 10t/ha compost dosage, the increase of density to 60 thousand plants/ha determined a production increase with up to 11,5%, being very equal to the values of the fertilizers at the same density.

In the case of a rainy year, like 2005, the hierarchy of combinations – fertilizer X hybrid X density, depending on grain production level and economical efficiency, was :

1. 20t/ha compost X Turda-SU-210 X 60 thousand plants/ha
2. 20t/ha compost X Elan X 60 thousand plants/ha
3. 20t/ha compost X Turda-SU-210 X 48 thousand plants/ha, but the productions rate were obtained at : 30t/ha compost X Elan X 60 thousand plants/ha and 30t/ha compost X Turda-SU-210 X 48 thousand plants/ha.

During the dried years (2006 and 2007) only the interactions of the 20t/ha compost dosage with Turda-SU-210 and Elan at both densities, kept their economical efficiency (with a profit rate of 62 – 64% in the case of Elan and 64% in the case of Turda-SU-210, regardless of density), along with the high production rate of grains, efficient in the case of fertilizer fructification.