

ABSTRACT

The doctorate thesis is presented in 361 pages and has attached a bibliography which consists of 186 titles. The thesis itself is structured on nine chapters and has attached in the end 5 drawings.

Key words: biological technology, savory, wild thyme, basil, sage, spices, security, productive potential, biochemical potential, etc.

The theme chosen for the study is one of very much interest if we consider the fact that, since present, in our country there are few dates concerning drawing up biological techniques for aromatic and spicy plants crops destined to give more certitude to producers in obtaining safe productions, with a smaller risk coefficient.

The importance of research. Enlarging the knowledge concerning the purpose of some characteristics and indicators of biological cultivation in raising the efficiency and quality of production may contribute to raise the chances of extending the cultivation area of aromatic and spicy plants and to create technologies with better performances.

The biological agriculture has really flourished in the 80's when the new production model and the consumers interest for these products continued to raise, both in most European countries and in others countries as USA, Canada, Australia and Japan. We are now assisting at a large growth of producers number and at starting off of initiatives in the field of biological production processing and selling. This context favorable to the development of biological agriculture is mostly due to the consumers concern to see healthy products and to respect more the environment.

Simultaneous, the administrative services are gradually resort to the recognition of biological agriculture, introducing it in research themes and passing proper legislation for this sector (for example in Austria, France and Denmark). On the other side some member countries give subsidies from the profit obtained from this type of agriculture, both at national and regional level.

In Romania, in the last five years, the surfaces used for biological agriculture have increased over six times, from 17.438 ha in 2000 to 110.400 ha in 2005, for the year 2007 being estimated an increase of the surfaces to 170.000 ha. At present there are 2.920 ecological producers, which is almost double from the number of the producers recorded in 2004 and here are also 12 certifying organisms.

In chapter I is presented the history of aromatic and spicy plants, it is presented and the importance of cultivation and the importance for the therapeutic part.

In chapter II is presented the systematic, the origin, the spreading and the usage of the plants described in this paper, plants which belong to *Labiatae* family, are annual plants (savory, basil) or perennial plants (wild thyme, sage), and the eatable organs are very divers : stem, leaves, fruits or seeds, and they can be consumed fresh or dry and ground.

In chapter III I give general considerations regarding biological agriculture: the object of agriculture, the institutional frame and laws concerning biological agriculture, the world-wide agriculture situation, in Europe and Romania, the potential trends of biological agriculture in Romania.

The third chapter also emphasizes the beginning of biological thinking in Romania.

In chapter IV of the paper is widely presented the requirements and the relations between aromatic and spicy plants and the environmental factors to express the biological potential of plant varieties in direct relation with the environment and human intervention in which is mentioned the place of vegetation factor in the relationship: *cultivated plant – environment – cultivation technology*.

The biological production methods used in obtaining vegetable products must meet certain conditions and rules included in CEE Regulation 2092/1991: eliminating any polluting technology, realizing production structures and crop rotations, the species and varieties with highly adaptability having the main role, continuously supporting and improvement of the natural fertilization of soil, using the conventional energetic resources in an economical way and replacing them by rational use of secondary reusable products, using crops technologies to satisfy the requirements of species and varieties.

In chapter V I am presenting the purpose, the objectives and the research method. The main elements involved in drawing up crops biological technologies of some aromatic and spicy plants were also the objectives of the research theme:

- The evaluation of the environment in order to determine the degree of favorability for aromatic and spicy crops in biological agriculture conditions;
- The age of the seedling, the age and crop density, the crop year of aromatic and spicy perennial plants;
- Leaves fertilisation with substances allowed in biological agriculture;
- Watering, satisfying in an optimum way the water requirement of aromatic and spicy plants, in order to obtain maximum efficiency.
- Biological pest control of some aromatic and spicy plants by taking into consideration the elements: the lending of savory, wild thyme, basil and sage plants to biological agriculture, in the seedling stage, the qualitative and quantitative composition from the fauna point of view, pointing to pests which cause economic losses, the study of the efficiency of pest control treatments allowed for biological crops. An other objective was:
- Physiological and biochemical studies of aromatic and spicy plants in biological agriculture system.

To achieve the objectives I have studied four aromatic and spicy species of plants: *Satureja hortensis* L. - Daria variety, *Thymus vulgaris* L – local population „De Dolj”, *Ocimum basilicum* L .- varieties Vert, de Buzău and Dark Opal, the variety Nana, the variety Bulatum, *Salvia officinalis* L .- local population De Răsmirești.

The experiments were conducted in the experimental polygon from SCDL Bacau, placed between Bistrita and Siret rivers, with a surface of 7,28 ha, the terrain is biological certified by Eco Inspect. The terrain is used for biological crops since the year 1992. On this surface were strictly respected the requirements imposed by the conditions of contract IFOAM and EC Reglementation no. 92/1991, concerning the rule of allowed inputs.

In chapter VI is presented the natural environment and research conditions.

In order to watch the evolution of the main weather factors which influenced the experiments results, I have presented the monthly and annual medium daily temperatures, absolute maximum and

minimum air temperatures, soil temperature, rainfalls, atmospheric humidity, medium and maximum wind speed between 2004-2007 compared with the normal medium between 1954-2004. Weather conditions from the experimental period were favorable for biological agriculture of aromatic and spicy plants, the risk factors being represented by low temperatures in the period after planting for annual species, especially for basil, but also the heavy rainfalls which affects herba production.

Chapter VII of the thesis presents the experimental part, in which I presented the results of personal research.

Analysing the results of my research we can conclude that: the production of any aromatic plant is the result of the interaction of all factors which participate, in a way or another, to crop shaping. The quantity of aromatic and spicy crops is connected to the degree in which every factor and all of them is getting near the optimum values required by the plant biology. This global condition is seldom met in natural environment. I have tried to lead the vegetation factors in such way that the human intervention to be closer to plants biology.

After the research concerning the seedling age, i have seen that it has a very important influence on the obtained production. Using a very young seedling or an old one we can influence the quantity and the quality of production, and in biological agriculture we can endanger the crops.

Concerning the values recorded by the four ages of the seedling, respective 30 days, 35 days, 40 days and 45 days for the obtained production, it results that the production varied within variants.

At savory, from 14,8 t/ha with a seedling age of 40 days to 9,2 t/ha with a seedling age of 30 days, while the medium of experiment had the value 12,1 t/ha. Towards the experiment medium (12,1 t/ha), in the situation in which is used the 40 days seedling, we obtained important supplements (2,7 t/ha), while in the situation in which is used 45 days seedling (1,2 t/ha) and 30 days seedling (-2,9 t/ha) were recorded negative differences.

For basil crops – the values recorded by the four seedling ages for obtained production varied from 16,3 t/ha for 40 days seedling to 14,5 t/ha for 30 days seedling, while the medium of the experiment was 14,9 t/ha.

- Planting age – when we choose the planting age we must take into consideration the plants sensibility towards late frosts and the fact that the planting age influences both the quantity and the quality of crops.

After the experiments conducted for aromatic and spicy plants in Bacau area I concluded that the optimum period is between 5-15 May. The production and quality is reduced as we delay the planting.

At savory, superior differences from the medium is recorded only within 15.05. period which exceed the medium of experiment with 17,5% which is a semnificative value. In the other two planting ages 5.05. and 20.05 de production differences towards the medium were negative. At basil, superior production differences is recorded only in 10 may and 15 may planting age which exceed the experiment medium by 6,6%, respective 4,6%, being semnificative production progress. When we take into consideration the 5 may variant, the production records semnificative losses, almost 1,6 t/ha.

- Planting density

Temperature and light (nonbiological factors) are locally modified by the vegetal layer. For biological agriculture, the density is a very important factor for the success of a crop. Because there are not used chemical fertilization substances, the plants need a larger feeding space and a better airing. The plants density is a factor which determines directly the feeding surface at the ground level and light conditions and also the efficiency of using the field. In direct manner, the distance assures the mechanization care works and generally a better crop management.

The results obtained between 2004-2006 shows that there were obtained different production quantities in the situation in which at Daria savory the planting density was 100.000 plants/ha while at a density of 80.000 plants/ha the results were negative.

At wild thyme – the variant in which the density was 75.000 plants/ha the growth of the crops quantity was of 2,5 ha over the average, which is a semnificative growth.

At basil – the largest production quantity was obtained in the variant with 80.000 plants/ha, in which case it was obtained a production of 17,5 tons green herba , more with 1,7 tons. In the variant with a density of 120.000 plants/ha was obtained the smaller production, with -3 tons less from the control plot.

At sage – 65.000 plants/ha the density influenced the crop quantity, 15,2 t/ha. At a density of 65.000 plants/ha, the production raised with 2,5 t/ha. In the other variants, 55000 plants/ha and 85000 plants/ha, the production differences were negative, semnificative, respective insignificant at 75000 plants/ha.

- The influence of production years at sage

Lately, in the conditions of assuring at optimum level the plants requirements towards environmental factors, respective in the conditions of using modern, intensive, optimized crops technologies, the influence of environmental factors is reduced, so the production years have a reduced influence for the production of annual species. But we can not make the same affirmation when we consider perennial plants.

At sage were recorded semnificative differences in second and third year, towards the experiment average – 2,3 to/ha and 2,5 to/ha. In the first production year the harvest was reduced 10,1 t/ha, which led to a negative difference of 4,5 t/ha (toward the experiment average), very significant.

In the fourth year the production began to reduce, being 12,4 t/ha, with a negative difference of 1,1 t/ha.

At wild thyme we obtained significant productions in the third year, with 6,1 t/ha more than the first year, more with 3,1 t/ha than the fourth year, more with 1,9 t/ha than the second year and more with 2,8 t/ha than the average. These results make us conclude that the top production for wild thyme is recorded in third year, after which the production is decreasing. The value of relative production is larger in the third year by 23,9% than the average.

- The influence of foliar fertilization on production of some aromatic and spicy plants, with substances allowed by biological agriculture.

In all variants we conducted foliar fertilization using plants extracts. The effect is based on the

high content of these plants in nourishing content, especially nitrogen and potassium, but also many macroelements, microelements, organic aminoacids and growth energizers, vitamins and enzymes.

These justify the favorable influence in leading the plants metabolism, materialized in the quantitative and qualitative growth of obtained productions. They act by reducing the metabolical deficiencies on photosynthesis, leading to the growth of carbohydrates in the plant.

The results obtained reveal the fact that all 7 types of liquid fertilisers with experimental ecological proprieties assured important productions of aromatic and spicy crops.

The production is very significant determined by the variants treated with strawberry herb macerate -10% and Cropmax -0,2% and significant in the variants treated with nettle macerate -2%, orache infusion -5%, rose hip decoct - 2%, tomatos leaves macerate -2% comparing with the untreated control plot.

- Studies concerning the forecast of watering in Bacau area, of some aromatic and spicy plants.

The importance of this factor is growing more for aromatic spicy annual plants, especially of those cultivated in biological agriculture system, in which the phytomasis is recovering two-three times during vegetation period.

Analyzing the water balance in soil without water contribution, we can observe that the largest water consumption was recorded for the basil crops in 2006, 2.984,19 cm/ha. Watching dinamically the average water consumption, we can observe an ascending curve from the beginning of the vegetation, curve which reaches maximum values in june-july, after which we can observe a decrease in water consumption. Concerning the water surface vaporisation, it is also observed an ascending curve, but with higher values. The water usage coefficient is between 135,54-169,02 m³/t.

The research method requires a longer period. That's why, for using coefficients for watering prognosis, saving the water and pumping energy, it is necessary to continue the experiments to make a medium in different weather conditions.

- Biological pest control of some aromatic and spicy plants.

The pests which produced economic havoc were pointed to at basil crops just after planting at the permanent plot. It was necessary to make pest control treatments for grey slugs and *Aphys* green flies.

The results of experimenting some plants macerates, infuses and decocts to control green flies concluded that all alternatives have good efficiency, spectacular results being obtained in the variants: - *Coriandrum sativum* fruit decoct 2% plus 2ml sesame oil -95,3 %; *Dryopteris filix-mas* fermented macerate 10 %,- 91,4. %.

To control slugs I made the next treatment variants: the best efficiency was obtained in the variant - snail macerate 100%, after a treatment week the stroke degree being 0.

We can conclude that the vegetal insecticides make up a group which complete the blanks left by modern insecticides, the last ones having remanence and a large action area very necessary in agriculture. We can say that in the future the vegetal insecticides will grow their

role among the products which men use for pest control.

I also identified in plants substances which can be used without processing or major transformations as alimentary attractives or inhibitor, nutrition or reproduction inhibitors.

- Physiological and biochemical studies of aromatic and spicy plants in biological culture system

These studies were made taking into consideration the growth in consumers interest for ecological products, with no polluting substances and the necessity to improve the plants health in order to select homogenously biotypes within species to obtain better productions.

The analysis of the volatile oils content of aromatic and spicy plants reveals the fact that in biological culture the percentage is significantly larger, as also its quality, as it follows:

- the volatile oil obtained from savory, biological crop compared with intensive crop is larger in biological crop - 2,35% as it is in intensive crop 1,05%, being recorded a difference of 1,3%.

- the volatile oil obtained from wild thyme, biological crop compared with intensive crop is significantly larger in biological crop (- 2,75%), than in intensive crop (1,65%), being recorded a difference of 1,1%. The differences between fragrance components of the oil are significant.

- the volatile oil obtained from biological basil crop compared with intensiv one is significantly larger in biological crop (1,85%) as it is in intensive crop (0,95%), being recorded a difference of 0,9%.

- the volatile oil obtained from biological crop of salvia is significantly larger than the one obtained in biological crop, 2,85% as 1,65 % in intensive crop, being recorded a difference of 1,2%.

- **The economic efficiency** reveals the profitableness of aromatic and spicy crops in biological agriculture system, which can give profits of 10000lei/ha. The demand for aromatic plants is increasing, the delivery price being between 7 and 9,6 lei/kg, in the conditions of retail sale.

Chapter VIII presents the extension of the research results in production and the promotion of the biological certified products.

In chapter IX I am presenting the conclusions of the research.

The researches made in Bacau pursued the main elements involved in the drawing up of the biological technologies for some aromatic and spicy plants: the seedling age, density, leaves fertilizations, pest control, watering, biochemical analysis. The ecology of resources and food products is important in order to minimize the noxious effects of agricultural practices towards environment and consumers health.

The studies conducted about bio techniques in cultivating some aromatic and spicy plants have proven that the variability of some indicators, like realized production, pest resistance, active principles composition, dry substance, chlorophyll, total water etc. is mostly due to the biological techniques used (63 – 76%).

The aromatic and spicy plants crops can have a larger efficiency if it has like objective the leading of the vegetation factors so the human intervention is as much possible closer to plants biology.

The experiments conducted shows that the bio techniques used for aromatic and spicy plants can lead to obtaining competitive productions, which do not differ from those obtained in conventional

production, satisfying consumers demands. These techniques have large perspectives because the number of biological farmers is continuously growing, fact which is determined by the higher demands for biological agricultural products.