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# ECOLOGICAL MANAGEMENT SYSTEM FOR PROTECTION AND PRODUCTION OF BLACKCURRANT (RIBES NIGRUM L.) IN SOUTH OF ROMANIA (I)

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***Abstract***

*The formulation of agricultural policies in Romania, starting with the European ones will lead to the development of sustainable agriculture, which will take into account the environmental component, but also the protection of consumers. Creating a sustainable agriculture may not be a feasible approach without an interdisciplinary contribution, firstly without implementation of biotechnology to reduce the impact of disruptive and command for the removal of certain risk factors that may be present in certain points of the food chain. The activities undertaken in the framework of the study achieved the overall goal: to present the pilot-phase of agricultural technology to the culture of Ribes nigrum, with the goal of obtaining and use of plant biomass in the pharmaceutical and food industries in line with EU criteria relating to food safety and security. The methodology developed in the framework of the theme was particularly complex but can be synthesized according to the objectives pursued, the life cycle of a case study in populations and of the factors involved in developing ecological management for control in working methods for biological field studies (life cycle study methods and control of the main pest Aphis grossulariae Sulz. (Homoptera:Aphididae) and the main pathogenic fungus Mycosphaerella grossulariae (Auers.) Lind. The main results obtained from research carried out refer to the implementing of the ecological management system model.*

***Key words*****:** *biological control, blackcurrant**,** food security, sustainable development*

## INTRODUCTION

Like any other conception of science, integrated control concept had his own development, at the first crystallization of the concept by S. A. Forbes in 1880 [3] until the introduction of the wording "integrated control" by J. S. Kennedy in 1953 [6] (quoted by Teodorescu [15]) and developed into a first step in an experimental work by Stern [14]. In 1966, at the first FAO Symposium on integrated control issues, held in Rome, R. F. Smith and H. T. Reynolds have released "integrated pest control formulation" (IPM), defining the method as "a system of management of pests using all appropriate techniques, in a interdisciplinary manner to reduce the pest population density and to keep them at levels lower than those at which produce economic damage" [12]. Subsequently, the understanding of the important role of biological component within the integrated control led recently to a new wording ("Ecological Pest Management Based") (EBPM), proposed by the Committee on Agriculture, National Research Council of the National Academy of Sciences of the USA. EBPM represents a holistic approach of problem pests, based on knowledge of the principles and ecological processes, biological interactions that take place across cultures and seeking solutions to manage the expense of pests. This concept is defined by three fundamental goals:

i) the protection of man and the environment;
ii) assure a profit for farmers;
iii) long-term sustainability.

Ecological management is appropriate content of current situation, in which, as a result of various human activities and primarily the

abuse of insecticides, there has been an increase in the pest population specific to different cultures and polyphagous, but also the manifestation of some species attack that they posed no problems so far, there are just as effective, with faunal elements reduced populations. What is missing in plant protection, at least in some cases, is an organic base. Influencing of plant pests and natural enemies of pests, without looking at these organisms as components of biocenoses, in interaction with various other bodies, without knowing well what are the factors inducing their population dynamics, without looking at the pests and their natural enemies as subsystems of a system integrator, within which there is reciprocal mechanisms regulating staff is the cause of global imbalances in recent decades in agricultural crops. Trying to solve the problem of pests without a global approach to the effects of human intervention on the close interdependence of species within the biocenoses, may not lead to effective solutions to economic and ecological development [8]. In this respect, opportunities are necessary to achieve the strategic objectives of ecological management in blackcurrant crops are:

1) the assessment of the level of control naturally;
2) determination of economic threshold for the application of alternative methods;
3) maximizing action of natural biotic factors;
4 simultaneous application of the different control methods.

## MATERIALS AND METHODS

The methodology developed in the framework of the theme was particularly complex but can be synthesized according to the objectives pursued, the life cycle of a case study in populations and of the factors involved in developing environmental management control:

A. working methods for biological field studies;
B. working methods in the laboratory

In view of the spread of medicinal and aromatic plant research will take place in two locations (case studies) to comparison of the signs.

A.1. Methods for the study of the egg stage

Depending on how ovipositors are used two ways:

• analysis of plant organs (leaves, shoots, stem, flower, root, fruit) through observations and dissections;
• soil surveys

A.2. Methods for the study of the stage of larva /pupa

The methodology of the study for highlighting the various aspects of the larva or pupa stage is similar to the egg stage of study. The dimensions of the polls and their number are the same.

A.3. Methods of study required by imago

For adult study 6 methods will be used:

A. 3.1. Barber traps method

Barber traps are traps installed at the surface of the ground in order to capture mobile fauna of arthropods on the surface of the ground in a given period of time. The trap consists of a container with a capacity of 300 cm3 which is inserted into the soil with ground-level opening. Inside this container is inserted a 4% formaldehyde solution. The opening dish cover with a plastic cap leaving between opening and cover a distance of 4-5 cm. collection time for such a trap is 48 hours after installation. Biological material collected is conserved in alcohol 70% and are studied in the laboratory.

A. 3.2. Light traps Method

In general, the imago stage of many insect species showing a positive phototropism to UV radiation, and this behaviour is based on the method of study. The traps are made of a metal or plastic Cone (funnel-shaped). Above the funnel snaps a portable with a fluorescent light bulb installation of pile head R3. The hopper is fixed in a cubic box or metal frame with sides covered with a wire mesh or plastic. This is the collection of biological material. Samples are taken at 24 hours, per hectare are required a minimum of two such traps. Biological material collected be similarly anaesthetized with ether or ethyl

acetate are preserved in alcohol and the sieve in the laboratory.

A. 3.4. Pheromone traps method

This method of capturing adults applies in particular to the species of Coleoptera and Lepidoptera which synthesized a specific sexual pheromone. For the research proposed in this project, where the method can be patentable as for the most important pests specific to medicinal and aromatic plants has not been synthesized a specific pheromone. Exceptions are the species studied recently in Cluj-Napoca for a collective from ICCRR the *Byturus tomentosus* F. (Coleoptera: Byturidae), *Synanthedon tipuliformis* Clerck (Lepidoptera:Sesiidae) [2], [4], [9].

A. 3.5. Sticky traps with bait type Multigard®.

The method is based on the principle that the insects exhibit positive phototropism to a certain spectral components of the white light or a specific attraction for certain vegetable substances. They are made from plastic panels with dimensions of approx. 28 x 23.5 cm and is lubricated with a special adhesive. The number of such traps is variable according to the area (currently 10/ha).

A. 3.6. Method of direct collections

Unlike the previous ones which are quantitative methods this qualitative method is one that allows us a more rigorous analysis in relating to its host plant-insect relations or between the latter and other useful species of biocenosis.

A. 3.7 Methods concerning the application of integrated ecological control

In at least two towns in the area of research will be chosen for experimental batches of 100 $m^2$ that will test the integration of alternative control methods known and currently applicable as new solutions proposed by this study within the framework of environmental management.

## RESULTS AND DISCUSSIONS

In this study we want to reveal theoretical and practical aspects of the basic principles for the implementation of the components of an environmental management model based exclusively on alternative methods of control had established. For the conceptual working base the next strategic ways was taken into account:

• the basic principles of systemic ecology;
• the establishment of the dominant populations;
• correlation of dominant populations of biological cycles;
• knowledge of the factors which influence the dynamics of dominant populations;
• environmental control management applies a specific localized and delimited ecosystem spatial and temporal;
• harmful organisms are not eradicated but maintained at or below a level called the economic threshold (PED);
• potentiation or maximizing natural factors;
• shaping culture technologies (especially those intensive) in the direction of monitoring the impact of factors which can cause unexpected consequences;
• introduction to decision support systems within the framework of interventions on the control of pests and diseases (expert systems, simulations of processes, precision farming);
• environmental management model is based on modular, harmonious processes associated and flexible, able to replace each other according to certain unexpected changes of the factors;
• the use of biological control agents in accordance with the culture and technology with economic needs, requirements\/energy and the ecosystem toxicological;
• apply model considering the interdisciplinary methods and the possibility of applying statistical and mathematical modeling;

A key stage in any program of ecological management refers to the precise identification of the lowering of the main agents significantly affecting the economically productive capacity of the system. The effectiveness of both types of measures (preventive or curative) is largely dependent on correct identification and determination of lowering agents. In this study although the notion of impact is in accordance with the definition of Clark

(1989), environmental impact assessment, in this case blackcurrant biocenosis crops cannot be carried out in accordance with EU regulations and Directive 85/337/EEC, whereas the aim of this research does not permit tackling an area so vast. With all the limits and questionable interpretations [2], [19], [20] assessment and evaluation of the impact of agricultural technologies anthropogenic ecosystems biodiversity using of the diversity is up at the moment and in correlation with the possibilities of the proposed research, the only way to reveal the preventively (Williams et al., 1990) direct effects and probable invertebrate populations of these agricultural practices. Sure, for a precise and exhaustive evaluation according to the multidisciplinary evaluation of a communication from the Environmental Impact (CIM) (Lee and Colley, 1992) is a comprehensive and independent study that goes beyond the context of this research. In this sense, the data obtained in this paper may be useful only in terms of qualitative and quantitative parameters comparison of invertebrate populations representing the reflection in the analyzed material changes at the level of biocenoses from which samples have been extracted. Information relevant to the research program on implementation of environmental protection management (EBPM) was highlighted for list of species present in blackcurrant crops in the area of research. Were made quantitative and qualitative methods of inquiry and analysis concerning the collection of biological samples from the two agricultural ecosystems in order to establish plant health in three areas of experimentation, alternative methods of ecological protection of crops against diseases and pests and has achieved the technology for both bushes, currant and raspberry and agro-technical methods for maintenance of specific crops. Achieving the goal on the development of experimental model for environmental management system in crops of blackcurrant in Romania stages of understanding concepts related to environmental protection systems and the necessity of their application have been completed and exceeded by most of those involved, specialists or users. Moreover, it is just interesting to note the fact that practitioners, farmers, especially those in the private sector, have exceeding theoretical knowledge through practical application of components or various components of ecological agriculture to a very broad spectrum of cultures, even of basic agricultural crops. We can cite many examples of this but this is not the scope of this research. If we should relate to the extremes of the two concepts of citing on Pfeiffer, 1951 "which is just under the biological aspect is also advantageous from the economic point of view" [10] should remember that the process now begun more than a century and a half established by Liebig in known work "applications of chemistry in agriculture" [7] and heavily publicized and then to the present day under the assertion of "intensive" type agriculture has exacerbated two high-impact environmental factors: excessive and industrialization. Beginning of the end for this concept generated by revealing all the more salient to the harmful effects of those two factors listed above command began with the concerns highlighted by Rudolf Steiner, to counteract the negative effects of agriculture on the mainly various components of the biosphere, it has developed a coherent system, adding to the effective practices of peasant agriculture specific technologies through the use of subtle energies, can "contribute to the harmonization of terrestrial and cosmic factors" [13].In the international scientific literature have crystallized a number of specific terms which over the last half-century have evolved in accordance with the application and interpretation of the data obtained during and after implementation/experimentation. We will stop at two definitions of significant theoretical, one other fundamental and applied by generating numerous theses resulted from the experimentation of various alternative methods, the final stage is the most difficult to derive their integration into a coherent system of ecological protection, sustainable. The first definition, universally accepted today by

many centres and research institutions is that to which we referred in the preparatory phase of the environmental management system proposed by the Committee on Agriculture, National Research Council of the National Academy of Sciences of the United States and called on the basis of ecological Pest Management or EBPM (short for Ecological Pest Management Based) (Fig.2). This environmental management is a holistic approach to the problem of pests, based on knowledge of the principles and ecological processes, biological interactions that take place across cultures and seeking solutions to manage the expense of pests. This concept is defined by three fundamental goals:

- the protection of man and the environment;
- to ensure a profit for farmers;
- long-term durability.

Biological control is considered as the most important component in this new approach to population control. It is assumed that each culture has its specifics, so that raises different problems for controlling pest populations, what must be known. Environmental protection management is derived from the older formulation of integrated pest management or IPM (short name in English: integrated pest management [6]) (Fig. 1). In the original conception of this type of management proposes lowering agents monitoring by understanding the interactions with other organisms and environmental factors. Over 77 definitions are included in the database, The Database of IPM Resources (DIR) [16] and, despite some differences in forms shall be deemed unanimously on some common elements:

- a conception of resource management such as a culture or a system as a functional component of the ecosystem; the actions, activities that are considering restoring, enhancing and maintaining the natural balance of the system and not the elimination of species; standard monitoring must make it possible to assess the populations of harmful and useful; the manager must consider steps to control natural growth (or at least hinder or restrict the natural biological control disruption) on target organisms;

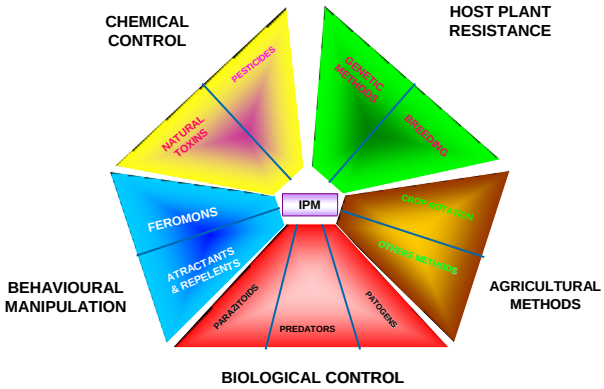


Fig. 1. Integration of components of control and monitoring in the management system of IPM (Integrated Pest Management)

- understanding that the presence of a pest should not necessarily a problem; before applying a disruptive method, an appropriate decision should assess whether a method is to be applied or not;
- a reconsideration of all the shares or pest management options before a decision to be taken;
- a combination strategy of integrating all the methods/techniques/procedures as possible in a manner as consistent. From the multitude of approaches and definitions developed and applied in different areas and different cultures to complete and interesting seems the definition formulated by Stephen R. Gliessman, which assumes and extends deadline for environmental management from that of "sustainable agriculture" understood as "a comprehensive system for the production of food, nutrients and other components are harmoniously balanced resources with which to preserve a clean environment ensure social equity and economic efficiency, viability to all public sectors internationally and intergenerational" [5]. Inherent in this definition is the idea that sustainability must be extended not only global but undefined in time towards all living organisms, including humans. Colorally of this complex definitions are the following add-in system:

**Sustainable agro-ecosystems** based on:

• maintaining the natural resources base;

• establishing minimum of artificial inputs control external factors of culture\/farm system;
• the management of pests and diseases through the mechanisms of the internal control system;
• stability and rapid regeneration after disturbance processes (technology, harvesting, etc.).

**Use of renewable resources**

• the use of renewable energy resources;
• using the jumpers of nitrogen;
• use of any recyclable materials from those manufactured synthetically;
• use your own internal resources to farm;
• waste recycling resulting from internal processes.

**Minimize the use of toxic products**

• reducing or eliminating the use of materials that have a high potential to produce both for the natural environment, health workers or consumers;
• use or approach procedures/processes or methods that lead to the elimination of the possibility of natural environment pollution with nitrates, toxic gases or other materials generated by combustion;
• avoiding overload with chemical fertilizers.

**Soil conservation**

• using sustainable methods for conserving nutrients and organic matter stocks in the soil;
• minimize erosion through: (a) the use of perennials); b) methods of harvesting or reduce non-invasive mechanical ones; c) the use of bio protector mulch).

**Water conservation**

• efficient use of irrigation system;
• the non-irrigated crops;

**Conservation of genetic resources**

• preservation of valuable germoplasms seed;
• maintaining local lines;
• the use of varieties/species in descent.

**Preservation of invested capital**

• Bank debits to a minimum;
• a drastic reduction of expenditure.

**The ecological management of interrelationships between species**

• restoring ecological interspecific relationships and avoiding reduction or simplification;
• management of disease, pest and weed rather than control them;
• the use of cover crops, or intercropping;
• integrated livestock;
• maximizing the density of beneficial organisms
  - o in soil: micorize, Rhizobium, nitrogen clamps
  - o a useful insects: shelters for pollinators, predators, etc.
  - o a potentiating of beneficial species increases and the inundative releases.
• nutrient conscious consumer
  - o a nutrient flows to management recycling and reuse;
  - o a reintegration of the cultural residue as natural fertilizers;
  - o when any are required inputs (input) resource-recycling;
• minimizing system disorders

**Consistency with the characteristics of the local environment**

• correspondence between net culture fund and the productive potential and physical limits of landscape/local territory;
• crops adapted to the local landscape.

**Factors diversification**

• Territory
1. maintaining buffer zones;
2. growing in the strips;
3. the use of crop rotation.
• Biological resources
1. cultures and multiple species;
2. integration of the animals;
3. varieties and varieties as different to boost production throughout the entire production cycle.
• Economics
1. avoiding dependence on a single product/culture;
2. the use of alternative markets;
3. organic products;
4. support of associations of organic agriculture, sustainable community;
5. independent marketing;
6. food processing prior to sale;
7. the orientation of high quality agricultural products;
8. searching methods, or alternative resources;
9. the practice of rural tourism;

10. avoid dependence on external factors

**Preparing the workforce**

• ensure that local workers are aware of sustainable development and control processes in place;
• use of knowledge of local inhabitants;
• promoting leadership and management of knowledge-transfer direction in favor of the boss-underling or "top-down";
• does not require knowledge but uses experts and farmers to learn;
• schools recycling;
• exchange of experience between farmers;
• exchange of experience between farmers and consumers;
• encourage partnerships between local communities and development groups and intergenerational;
• ensure agricultural labor warranty;
• educates and teaches human staff be familiar with the principles of sustainability and environmental/sustainability.

**Management of the whole system**

• use planning processes that are adapted to different agro-systems scales:
• land (landscape);
• individual households;
• farms;
• communities;
• bioregions;
• nation;
• minimizing the impact of adjacent systems.

**Maximizing long-term benefits**

• maximizing the intergenerational;
• maximizing quality of life and livelihoods in rural areas;
• facilitating transfers between community members and the intergenerational;
• the use of long-term strategies;
• development of plans through reassessment and flexible adjustable parameters;
• incorporating the elements/components of sustainable development in the overall design and management of the system;
• preserve soil fertility.

**Conserving and protecting health**

• human health;
• cultural health;
• the health of the natural environment;
• the health of plants and animals.

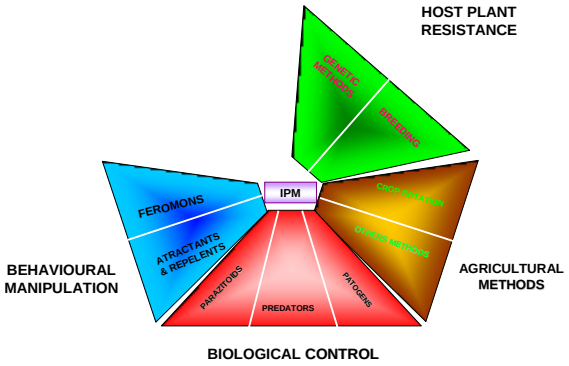


Fig. 2. Pest management on ecological bases (EBPM) by excluding chemical control methods

We mentioned earlier that there are a multitude of definitions in addition to the widely accepted formulated of and the process of redefinition of the concept continues today. A recent formulation of an Australian ecologist Bill Mollison and of his assistant, David Holmgren [1] termed very plastic “permaculture" (abbreviated combination of "permanent and "culture" or "permanent agriculture") our attention lately, not so much by the novelty as defined by the elements or concepts in the field of systemic ecology and, especially, through coherent system model, very close to the concept developed by the Romanian school of ecology as remark Pilarski, 1994: "Pattern < permaculture > is one of the most integrated systems as holist design methodologies in the world" [11]. Extract from the definition given by the two researchers, an item which we emphasize and consider it essential in highlighting the character of the concept: "Permaculture refers to a restructuring of human habitats and food production systems; land use and development needs of the community in the direction of harmonious integration of human settlements, microclimate, perennial and annual plants, animals, soil and water in a steady and productive community; focus is not on these elements alone, but rather on the interrelations that are created between them because of the way and where we place them on the ground (landscape)". This synergy is achieved and shall be consolidated over time through "imitating" the model offered by nature. This system whose features

highlighted by Pilarski in "Restoration forestry" [11]:
 is one of the most integrated systems design holist of methodologies in the world;
 can be applied to create productive ecosystems for human use or for reconstruction of degraded ecosystems; can be applied to any ecosystem, regardless of the degree of degradation;
 analyzing and validating traditional knowledge and human experience; incorporating both sustainable agricultural practices and strategies of environmental and agricultural management techniques from around the world;
 promote clean farming "organic" which does not use chemical pesticides and methods which pollute the environment; It is a bridge between traditional methods and the most modern techniques emerging;
 one of the main objectives is to maximize symbiotic activity and synergistic activities of components;
 is at once an urban development plan and a design of rural land;
 is a system that applies to a specific site, a specific and productive system of a specific crop.
It is closest to the strategy that we wish to apply in carrying out management system of ecological protection of blackcurrant crops in south Romania.
Since the establishment of the research plan of the study and establish of the main objectives was taken into account as a main criterion of necessity, the establishment and development of components of the system of environmental management proposed that the overall objective of the project. Interrelationship between the components patterns resulted in the light of experience and collaborative opportunities related to your field of work highlighted in the diagram (Fig. 3) and everyone's experience in the field of modular components of the integrated system-target goal pursued.
In addition to referencing the processes related to the integration of each component were core activities included:

• study conditions for research and experimentation in the areas where crops were placed; study of faunal structure and biodiversity of species of arthropods in the cultures of research areas;
• evaluation of the local fauna with useful species role in biological control;
• identification of pathogens (viruses, bacteria, fungi);
• identification of harmful and useful arthropods;
• determination of the degree of attack and PED;
• development and implementation of ecological control methods of pathogens;
• development and implementation of ecological control methods of pest;
• development and implementation of agronomic methods;
• elaboration and implementation of biotechnical methods.

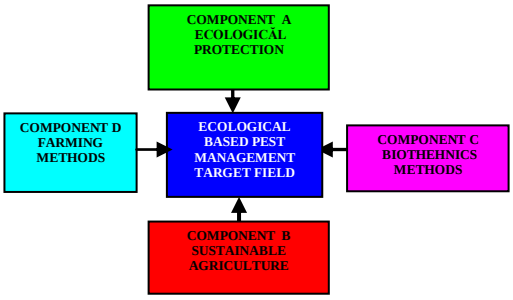


Fig. 3. Integration criteria of components in the ecological management

## CONCLUSIONS

The activities carried out within the framework of the study in the implementation of the model were established the basic principles for the ecological management model based exclusively on alternative methods of control that include:
• basic principles of systemic ecology;
• establishment of the dominant populations;
• correlation of dominant populations of biological cycles;
• knowledge of the factors which influence the dynamics of dominant populations;

• environmental control management applies a specific localized and delimited ecositem spatial temporal;
• harmful organisms are not eradicated but maintained at or below a level called the economic threshold of lowering (PED);
• potentiation or maximizing natural factors;
• shaping culture technologies (especially those intensive) in the direction of monitoring the impact of factors which can cause unexpected consequences;
• introduction to decision support systems within the framework of interventions on the control of pests and diseases (expert systems, simulations of processes, precision farming);
• ecological management model is based on modular, harmonious processes associated and flexible, able to replace each other according to certain unexpected changes of the factors;
• the use of biological control agents in accordance with the culture and technology with economic needs, requirements/energy and the ecosystem toxicological;
• apply model considering the interdisciplinary methods and the possibility of applying statistical and mathematical modeling;
Within environmental protection component has been elaborated methods of protection integrated into the two difference systems consisting of complete elimination within the framework of the eco-system of chemical treatments: insecticides and fungicides;
The main stage in the implementation of the system consisted of investigating and making the conditions relating to the structure of the habitat, climatic conditions, soil structure, material, etc.;
We have been identified the main pathogens that cause diseases of plants with the loss of harvest and it is estimated the degree of dominant populations in case of attack;
We have established means of protection under both management systems: botanical products (biorationale) in the case of EBPM and systemic fungicides in the IPM case and a careful application of all preventive means;
Methods for monitoring the population dynamics of pathogens under prevailing systems/models have been established;
Have been experimentally tested a series of new products including bio-coded P1 and P2 have given very good results against the pathogen identified in principal crops in the southern area of the country (*Sphaeroteca mors-uvi* Berck.et Curt.) under the currant year 2009 and will be able to be patented after testing/experimentation in the next stage;
Species of useful and harmful arthropods, presence, relative abundance, number density, and their share in the dynamics of the system proposed in the model estimation/role of UFS species useful in reconstruction of biocenotic balance similar systems have been identified;
methods for monitoring the dynamics of populations of harmful and useful arthropods during crop vegetation of blackcurrant have been developed;agro-technical methods of crop protection, predominantly preventive role methods with special emphasis placed on the quality of genetic material, prevention of infection agent in nurseries, fertilizing and maintenance non-invasive biological components of the ecosystem were developed;
Biotechnical methods have been developed for monitoring and control of the main pest species integrated into the two systems/experimental models;
Have been carried out methods for useful beneficial insect growth under controlled conditions (species of Coccinellidae for *Aphis grossulariae* target populations).

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