Економика пољопривреде
СБ/SI-1
УДК: 631.147(497.11)

# SIGNIFICANCE IN INNOVATION AND KNOWLEDGE APPLIANCE IN SYSTEM OF ORGANIC AGRICULTURE IN SERBIA[1]

Svetlana Roljević[2], Radojica Sarić[2], Boris Kuzman[2]

## Abstract

Organic production is a specific system of food production determined by a set of very strict standards which protect natural resources and cultural identity. It requires greater effort on the side of producers in the implementation of the innovations. It also contributes to opening of new areas for scientific research, so special attention in this paper was given to application of bio-pesticides in organic production, as one of new and, in environment sense, harmless form of crop protection. The use of biological pesticides increases the size of organic production, but contributes to better quality and look of organic products, too, making them more attractive for consumers. In a way that management in organic agriculture confronts decision-making, based on ambiguity which comes primarily from natural surrounding, there was pointed out also on significance in using information technologies, in order to manage the production in more easily way. The aim of this paper is to point out to a need and importance of correlation between the science, technology and producer in our country in unique entirety, because only then the science and technology could be useful and the organic production – efficient.

**Key words:** Organic production, bio-pesticides, information systems, knowledge, innovations.

---

[1] Paper work is part of the project research „Multifunctional agriculture and rural development in the function of accession of Republic of Serbia into EU“, no. 149007, financed by the Ministry of Science and Technological Development of Republic of Serbia

[2] Svetlana Roljević, B.Sc., e-mail: svetlana_r@mail.iep.bg.ac.rs, Radojica Sarić, B.A., e-mail: radojica_s@mail.iep.bg.ac.rs, Boris Kuzman, M.A., Institute of Agricultural Economics Belgrade, Volgina 15, 11060 Belgrade, Republic of Serbia, phone: +381 (011) 2972-842.

## Introduction

The application of knowledge is inevitable in all aspects of human life, first of all, in food production, which represents man's existential base. In 90's of XX Century, marks the first contour lines of organic agricultural production, together with inflow of ecological sciences in conventional agriculture system. This food production form has been based on increased consciousness on preservation of environment quality and ecological model of crop protection, which had encircled tradition, innovation and science. In all high developed countries, the organic production expands, while the government plays important role in supporting it by better cooperation between scientific institutions and producers. Namely, modern model of food market is quality-oriented, not quantity, because choosey consumers, especially in high developed countries, require permanent and increasingly better quality of food. Therefore is necessary constant education and improvement of our organic producers regarding advantages in applying innovative methods in production and suitable food quality standards, in order to fight elemental force of competitive products, both from organic and conventional agriculture.

## 1. Definition, function and importance of organic agriculture

Organic agriculture is defined as the unique production system, based on exploitation and improvement of its own resources and preservation of the nature balance, which part it is as well. According the „Organic Trade Association“ organic agriculture is a complete system of production management which promotes and stimulates healthy agro-systems, biodiversity, biological cycles, biological ground activity, to sum up, organic agriculture and organic production, understand the use of methods and means which are in conformity with nature and which do not disturb it in no case.

The role of organic agriculture, disregarding if it is the matter of production, processing, distribution or consuming of food, is to support and to create strengthen the ecosystem health and creation of balance between market demand and preservation of life environment. Organic agriculture is led by the traditional way of production, however, application of new scientific knowledge elevates it to much higher level since it must be based on modern comprehension of ecology, with the use of adequate technical solutions and mechanization.

General principles in organic production are based on use of the means and in discovering the way which leads to the ecological balance of natural systems. This system of food production understands the maximum use of regenerative energy sources, maintenance of agro and ecosystem genetic diversities and protection of living environment, reduction of all kinds of pollution which can be

the result of agricultural production, in order to create the conditions for covering the basic life needs for agricultural producers, for acquiring suitable income and satisfaction of their own work.

The food produced by principles of organic agriculture is safe from any artificially synthesized ingredients. Beside that it enables nutrition with products of richer nutritive value from those of conventional production.

Organic agriculture is important for the state and social community, specially the rural one, form several reasons:

- Stimulates healthy food consumption within the region;
- Reduces the production and transport costs;
- Realizes the base for development of eco-tourism, for it is possible to create, within the national and natural parks only organic agricultural production;
- Maintain the diversity of living creatures; but also
- Social and cultural heritage of the rural areas (Šiljković, 2002).

## 2. Application of bio-pesticides and information systems as innovative methods in organic system of food production in Serbia

Application of new knowledge and technology in organic agriculture is justified under the condition that leads to the increasing of products quality together with protection and regeneration of natural resources in the same time. One of the methods for work productivity increase in organic agriculture, production volume and quality of product is introduction of information systems, which use in, so called, „precise agriculture“. However, using GPS (Global Positioning System) and GIS (Global Positioning System) alleviate production management, while those systems contain data on soil, climate, grown plant, previously grown plants and all other parameters significant for product's quality and quantity, as well as for preservation of natural resources (Gavrić, Sekulić, 2004). Use of this technology alleviates proper selection of plant cultures which can be grown by organic production system in some region, determines place of the plant in crop rotation, accurately doses a quantity of fertilizers and protective substances, but also decreases dependence on additional labour and costs. However, introduction of new discoveries in the field of agriculture into efficient *on-line* supporting systems is a matter of utmost importance for potential use and benefit from information technologies.

Harmful consequences of chemical pesticides use aimed the man to turn to natural bio-active potentials in the battle against harmful insects. Biological

control, as a discipline, had significant rise in XIX Century and kept rising, as regarding its achievements, as well as its importance for agricultural production. The significance of natural enemies, as components of efficient management of agro-ecosystem, has been more and more understood. The joint name for all bio-active potentials is *„bio pesticides"*. Bio-pesticides are bio-synthetic, bio-active materials used for elimination of harmful organisms and within which three categories can be recognized:

1. Living organisms (invertebrates and microorganisms);
2. Bio-chemical pesticides (insect hormones and pheromones, plants and microorganisms extracts);
3. Protective materials incorporated into the plant (GMO).

*Advantages* in using bio-pesticides are: they are less toxic than conventional pesticides, have specific affect on the target group of harmful organisms. They are effective in small quantity, have faster wrecking, do not pollute the living environment and less data and time is needed for their registration (up to one year).

*Disadvantages* of bio-pesticides: short time of preservation, noncompetitive economy comparing to conventional pesticides, inadequate formulation, narrow spectrum and slower affection and the higher knowledge of those who deal with them is necessary so the permanent education of agricultural workers is indispensable.

By application of such preparations in the system of organic agriculture the basic assignment is fulfilled and this is the protection of living environment, eco-system balance, respectively preservation of biodiversity. It is important to mention that those preparations can be used also in conventional system of agricultural production, aiming at decrease of chemical pesticides use, and therefore quality increase of got products. Their usage in green houses and plastic tunnels (polythene green houses) represents the significant advantage for organic production, for in controlled conditions some of the problems that follow those preparations in the field, such as negative conditions of living environment that reduce the efficiency of biological preparations, do not exist. In protection of crops from harmful insects most frequently are used the insects kinds (Copping LG, 1998) out of which the most frequent are:

1. Predator bedbug (*Orius minutus*) which is applied indoors for wiping out trips, red fruit mites (*Panonichus ulmi*) and leaf louses;
2. Ladybirds (fam. *Coccinelidae*) are let on crops outdoos and are successfully used for wiping out colonies of leaf louses;

3. *Encarsia Formosa* - parasite of the butterfly white louse (*Trialeurodes vaporariorum*) and for the time being is successfully used for protection of crops indoors.

Predator species of mites used for commercial purpose are used indoors where they reduce the number of harmful mites, most frequently the common cob-web mite (*Tetranichus urticae*). The highest success in crops protection, for now, is achieved with preparations based on bacteria *Bacillus thuringiensis*[3] (Copping LG, 1998) with subgroups:

1. *B.t. kurstaki* - with activity against butterfly larva;
2. *B.t. izraelensis* - with activity against butterfly, mosquito and fly larva;
3. *B.t. aizawai* - with activity against butterfly larva;
4. *B.t. tenebrionis* - with activity against butterfly larva, coleoptera larva and imagoes and above all potato beetles.

Different kinds of virus and fungus have their role in biological control. The virus species of the family Baculoviridae offer most promises due to their specificity for the host. New species of fungus are registered in Europe and USA that control phyto-pathogen fungus species. One of them is *Apmelamyces quisqualis*, (isolate 10), produced for control fruit, vegetable and above all vine rust disease (*Uncinula necator*). Micro insecticides are slow in action, several to 48 hours are needed to create the infection, the higher humidity is needed for spore-creation and demand more frequent application.

Pheromones are unstable and evaporable substances that are formed in the insect body and are used for communication on great distances. They are very specific within one species. These compounds have different functions and influences and are named according the shown reaction (sexual, alarm and aggregation). Its alarm pheromone the common cob-web mite (*Tetranychus urtice*) emits in natural conditions when the population is threatened or is attacked by predators. With application of synthetically produced pheromone, analogous with the natural one of this mite, they are disturbed, increase their activity and in the same time they are more exposed to the impact of applied accaricides. Beside that these disturbed mites take less food than the undisturbed ones.

Each of mentioned kinds of living organisms formulate on specific way and with more or less success represents to the market. For needs of conventional agriculture advises also mixing with some sorts of chemical preparations for their

[3]According to the different percents Bt preparations represent 80 - 95% microbial pesticide and 80 - 90% biological preparations at the world market

better efficiency, however, as the use of chemical pesticides in organic agriculture has been forbidden, the bio-pesticides apply independently. For their utilization is necessary to have more knowledge and readiness of producers to study permanently and to receive advanced training, so in developed countries, where is no lack of science and practice correlation, the application of bio-pesticides realizes along with control of scientific institutions, while the producers ready to protect their crops by those preparations, educate adequately.

### 3. The significance of effectuate application and expand of scientific discoveries and technological innovations in Serbian organic production

In Serbia is noticeable increase of demand for food, which is marked by organic trademark. It is characterized by quantitative increase of exported quantities and increase of number of countries interested for our organic products. Nevertheless, on production aspect, there are various problems and limitations, such as:

1) Insufficient knowledge and information on methods and certification of organic production (missing the science and practice correlation),

2) Un readiness of agricultural producer for excepting innovations and lack of entrepreneur's spirit, marketing orientation absence of agricultural producers (insufficient activities on brand development, finding foreign markets, missing more significant and mutual participations on international fairs),

3) Insufficient financial power of agricultural producer for new investments (expensive certificate for organic production, as well as insufficient investing possibilities for organization of production on larger surfaces).

What hinders development and expansion of organic production here is, before all, weak cooperation of scientific institutions with producers and therefore weak informing as producer, as well as consumer, and also low social and political conscience about significance of organic agriculture for nation's life and health, like as economic advantages of this agriculture aspect. Than follows that education and adopting new knowledge are crucial factor of organic agriculture effectuation in these regions, so, by making appropriate infrastructure, the organic production would draw merited attention.

One of the weak points of organic production in our country is quality, while misses use of means for protection from various pests, so realized yields are very low. The practice is to remove all undesirable organisms from crops, mechanically, by engaging the labour, in order to protect grown plants and insure yield. In such circumstances, with support of scientific institutions and educative offices, the bio-pesticides have a chance to present, as better as possible, to agricultural producers,

as new and easier method of crops protection. However, one of possible obstacles during application of biological preparations in organic agricultural production is additionally increase of initial costs. Major biological preparations on the market are more expensive than chemical preparations, which use in conventional agriculture, but observing long-term, those preparations are profitable, because they protect plants from diseases, pests and weed, providing therefore planned production size. Besides, their use would avoid engagement of additional labour, necessary for removing weeds and pests from the crops. Here follows that the production would be more efficient, the fruits (yields) would be without damages, nice coloured and symmetrically shaped, and therefore more attractive to buyers. Except for that, carried on stored yield, it could prevent their decay, i.e. effect on quality.

The biological pesticides apply in our country, but only at minor producers of organic food, before all, the preparations based on bacterial type *Bacillus thuringiensis.* The products based on these methods are relatively new and unknown and for their commercialization is necessary to prepare the market carefully, as well as consumers' education on characteristics, advantages and deficiencies of the bio-pesticides (Filajdić et all, 2003). The experts' guarantee, that use of these preparations would be profitable through yield increase and better quality of product, would certainly stimulate the interest of organic producers for their application.

Besides a need for expanding knowledge and education of organic producers about new methods of crop protection, there is necessary to spread consciousness on advantages in using information technologies, poorly present in this region. The producers confront with decision-making based on ambiguity, which originates from three main reasons: ambiguity due to lack of data on current nature condition; the ambiguity due to incomplete knowledge on biological and physical systems and the ambiguity for extraordinary accidental (random) processes, so the information technologies provide possibility of more precise decision-making about specific operations in productive process.

## Conclusion

Beside the fact that it protects and saves natural resources the organic agriculture contributes to introduction of innovations in agricultural production which are based on the systems of natural balance. One of the basic problems, which block development of organic agriculture in the Republic of Serbia, is non-existence of strong relations between the science and practice. We already have fertile ground areas, numerous personnel highly educated and experienced, high quality hybrid maize, wheat and other agriculture plants and numerous ecological

associations which hamper the spreading of bio-technological products and genetically changed food but it is of utmost necessity that all this knowledge and experience be transferred to interested producers willing to produce in conformity with nature. From all quoted facts on insufficient informing of organic producers in Serbia about new techniques of crop protection and technologies, which alleviate decision-making on necessary operations in productive process, it is clear that the support of science and technology to producers is inevitable. In order to point out to necessity of cooperation between the science, technology and producers, it is inevitable to say that introduction of scientific discoveries in the field of agriculture in efficient *on-line* supporting systems, is of crucial importance for potential use and benefit of information technologies.

## Literature

1. Copping LG (ed), 1998: "The Bio Pesticide Manual", First Edition, British Crop Protection Council, Farnham, UK, str. 1-333;
2. Filajdić N., Vukša P., Ivanović M., Rekanović E., (2003): *„Biološke mere zaštite bilja: problemi i perspektive"*, časopis „Pesticidi", 18 (2), Beograd, str. 73;
3. Gavrić M., Sekulić P., (2004): *„Primena GIS-a i GPS-a u poljoprivredi"*, Zbornik radova, Sveska 40, Naučni institut za ratarstvo i povrtarstvo, Novi Sad, str. 171;
4. Kovačević D., Oljača S., (2005): *„Organska poljoprivredna proizvodnja"* Poljoprivredni fakultet Beograd - Zemun, str. 308;
5. Sredojević Z. (2002): *„Ekonomski problemi ekološke poljoprivrede"*, Poljoprivredni fakultet Beograd - Zemun, str. 136-167;
6. Šiljković Ž. (2002): *„Organska poljoprivreda Srednje Evrope"*, časopis „Geoadrija", Vol. 7/2, Filizofski fakultet, Zadar, str. 78;
7. http://www.orgcg.org/org/index
8. http://www.vet.bg.ac.yu