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Research on the economic efficiency of organic farming versus traditional farming

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Abstract

The method of organic farming is becoming more and more popular. All farmers are still concerned about finding workable ways to cut back on the number of treatments and minimize the usage of pesticides. The effort aims to establish a technical technique for producing some horticultural species that satisfies ecological agriculture requirements, as well as to explore some aspects of biological control to limit the spread of some diseases and pests in some horticultural species. The goal of this research is to investigate some aspects of biological control in order to prevent the development of certain diseases and pests in some horticultural species, as well as to design a technical approach for producing some horticultural species that fits the standards of ecological agriculture. It also includes a study on the economic effectiveness of an ecological culture technology for producing goods with high ecological purity in certain horticulture plants. Because the cost of the seedlings obtained ecologically is 50–150% greater than that of the conventional system, the total cost of tomato crops in the ecological system is higher than that of the conventional system.

Keywords: Ecological agriculture; Economic effectiveness; Horticulture species; Treatments

1. Introduction

New agricultural technologies and the extensive use of chemical pesticides, herbicides, and fertilizers during the last century ensured larger yields at lower costs. Numerous studies have found a correlation between the usage of these chemicals and an increase in cancer and congenital disorders in humans. The use of these compounds has also caused environmental imbalances and pollution [1]. Growing numbers of people are willing to pay more for food produced using environmentally friendly methods and free of pesticide residues, therefore organic farming has expanded over the last 20 years to meet their expectations [2,3]. The goal of this research is to investigate some aspects of biological control in order to prevent the development of certain diseases and pests in some horticultural species, as well as to design a technical approach for producing some horticultural species that fits the standards of ecological agriculture. It also includes a study on the economic effectiveness of an ecological culture technology for producing goods with high ecological purity in certain horticulture plants.

In Romania, organic agriculture was officially recognized by the Emergency Ordinance on organic food products no. 34/17 April 2000, followed by other specific normative acts such as: H.G. no. 913 of September 13, 2001 regarding "Methodological rules for applying the provisions of O.U.G. no. 34/2000"; order of M.A.P.D.R. no. 417 of September 13, 2002 regarding "Specific rules regarding the labeling of ecological agro-food products"; order of M.A.P.D.R. no. 527 of August 13, 2003 for the approval of the Rules regarding the Inspection and Certification system and the conditions for accreditation of inspection and certification bodies in ecological agriculture; order of M.A.P.D.R. no. 721 of September 26, 2003 for the approval of the Rules regarding the Import and Export of ecological agri-food products; order no. 190

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of June 28, 2006 regarding the amendment and completion of the annex to the Order of the Minister of Agriculture, Food and Forestry and of the President of the National Authority for Consumer Protection no. 417/110/2002 [4].

Organic agriculture is a global system of agricultural management and food production that combines best environmental practices, a high level of biodiversity, natural resource conservation, the application of high plant welfare standards, and a production method that respects certain consumers' preferences for products obtained through the use of natural substances and processes [5].

The benefits of organic farming include the restriction of pesticide use, the reduction of ammonia, carbon dioxide, and methane emissions, the decrease of controlled waste levels, higher energy efficiency, and better water quality.

The disadvantages of ecological agriculture include lower production levels compared to the conventional system, higher product production and utilization costs, the need for time, dedication, patience, and skills developed over time, and the prohibition on the use of GMOs and their derivatives. Biological control, often known as biocontrol, is a way of controlling pests such as insects, mites, weeds, and plant diseases through the use of living organisms. It relies on natural forces such as predation, parasitism, herbivory, and so on, but it also requires deliberate human control. It can play an essential role in integrated pest management systems [6-8]. There are three basic biological pest control strategies: *classical* (importation), which introduces a pest's natural enemy in the hope of achieving control; *augmentation*, which administers a large population of natural predators for rapid pest control; and *inoculative* (conservation), which takes steps to maintain natural enemies through regular restoration [9,10]. Classical biological control is long-lasting and affordable. When a natural enemy is effectively developed, it rarely requires additional input and continues to kill pests without human intervention and at no expense. Unfortunately, classical biological control is not always effective. It is frequently more effective against exotic pests than against native insect pests [11]. The reasons for failure are frequently unknown, although they may include releasing too few individuals, inadequate adaptation of the natural enemy to the environmental circumstances at the release location, and a lack of synchronization between the life cycles of the natural predator and the pest host.

Amelioration entails the release of additional natural predators in a given area, which boosts the populations that already exist there. To increase efficiency, modest numbers of predators are released at short intervals to allow them to reproduce in the intention of establishing long-term control and keeping the pest at a low level, so achieving preventive rather than eradication [12]. Instead, in sustainable organic agriculture, a high number of predators are released with the goal of swiftly lowering a pest population and resolving an existing problem. Biological control can be effective, but it is not guaranteed to succeed and is dependent on the specific specifics of each pest's relationships with its predator [13].

2. Material and methods

In this paper, a study of the economic efficiency of an ecological culture technology was carried out in order to obtain products with high ecological purity in some horticultural plants. In terms of costs, the new ecological and conventional tomato cultivation technologies were compared, in protected spaces. The cultivation was located in the village of Bilciureşti, Dâmboviţa county, at a private producer, being allocated a plot of 1000 m2 for each type of culture. For cycle I, tomatoes were planted on March 25-27, harvesting began on May 11 and lasts until the end of July. For the culture in the conventional tomato system, phytosanitary treatments were used as needed, preventive and warning according to the recommendations of the profile companies and fertilizers according to the composition of the soil, the products being approved for the respective crops. For the ecological tomato culture, multicomposite magnetic fertilizer was used, created by Ioan Davidoni, which remains in the soil for 7 years.

A strong treatment with ozone (12.5 ppm) was used to disinfect the soil and the solarium. For example, for a 500 m2 solar, an ozone generator with a flow rate of 20 g/h was used for 50 minutes, with the solar being closed during the treatment.

By passing the water through a magnetic bar, which generates a magnetic field with an intensity of 13000 Gs, we were able to obtain magnetized water for irrigation.

For the treatment of diseases and pests, treatments with colloidal silver (77 ppm), essential oil solution, and ozone were used as needed, preventively, and as a warning.

(Source: https://www.davidoni.ro/produse-magnetice/ingrasamant-magnetic-granule)

Figure 1 Davidoni magnetic fertilizers

The plant material consists of tomatoes.

The cultivation of tomatoes in solariums is practiced on very large surfaces in our country, especially recently when high-rise solariums were built. The following tomato hybrids with indeterminate growth and multiple resistance to diseases and pests were used for greenhouse cultivation.

- Hector F1 semi-early hybrid, with large fruits of 200-220 g,
- They were grown in greenhouses in experiments for all three cycles:
- the short cycle, in which planting is done between March 20 and April 5, and harvesting is done until July 15-20;
- the long cycle that starts on the same date as the short cycle, but the abolition of culture is done around September 15–20;
- cycle II with planting from June 20 to July 10 and harvesting until end of September or even October. This system is practiced by those who want to make other crops in the greenhouse in early spring.

The preparation for planting involves two stages - preparing the land and preparing the solariums for planting.

The preparation of the land starts in the fall with the clearing of the previous crop when all the vegetable remains have been collected and removed from the solar. Then the soil was mobilized and leveled. On an average soil supplied, a quantity of 50-70 t/ha of well-decomposed manure was applied, then the chemical fertilizers 200 kg/ha superphosphate and 400 kg/ha potassium sulfate. The soil was deeply mobilized at 28 - 30 cm using the MSS 1.4 or the vine cultivator plow (PCV - 1.2) without a coulter.

2.1. Statistical analysis

Statistical analysis ANOVA (analysis of variance) is a statistical test that looks for significant variations between the means of data sets. It is often used in experimental research to compare the impact of several treatments or interventions on a specific result.

The primary principle behind ANOVA is to separate data variability into two components: variation between groups (due to treatment) and variation within each group. The ANOVA test generates a F statistic, which represents the ratio of between-group variation to within-group variability.

If the F-statistic is sufficiently large and the associated value is less than a predefined level (e.g., 0.05), there is strong evidence to imply that at least one of the group means differs significantly from the other. In this scenario, additional post-hoc tests can be employed to establish whether these distinct groups differ from one another.

One-way ANOVA is a statistical test that determines whether there are significant differences between the means of two or more distinct groups. It is used to compare the null hypothesis, which states that the means of all groups are equal, to the alternative hypothesis, which states that at least one or more groups' means differ from the others.

To do a one-way ANOVA, the following procedures were taken:

- Step 1: Statement of Hypothesis

The null and alternative hypotheses were defined. The null hypothesis states that there are no significant differences in group means. The alternative hypothesis states that at least one group's mean differs significantly from the others.

- Step 2: Data collecting.

Data were acquired from each culture that we compared. Each group should be independent and have a comparable sample size.

- Step 3: Determine the mean and variance for each crop.

The mean and variance for each culture were computed.

- Step 4: Calculate the global mean and variance.The mean and variance were derived by averaging the key worldwide civilizations' means and variances.
- Step 5: Calculate the sum of squares between groups (SSB).

The sum of squares across groups (SSB) is determined using the formula: SSB = $\Sigma ni (\bar{x}i - \bar{x})^2$, where ni is the sample size of the ith group (culture), $\bar{x}i$ is the mean of the ith group (culture), and $\bar{x}$ is the overall mean.

- Step 6: calculating the sum of squares within groups (SSW).

The sum of squares within groups (SSW) was determined using the following formula:

SSW equals $\Sigma\Sigma(xi - \bar{x}i)^2$. where xi is the second observation in the second group; $\bar{x}i$ is the mean of the second group; and j ranges from 1 to k groups.

- Step 7: Calculate the F statistic.

The F statistic was computed by dividing the between-group variance (SSB) by the within-group variance (SSW): $F = (SSB / (k - 1)) / (SSW / (n - k))$, where k is the number of groups and n is the total sample size.

- Step 8: Calculating the critical value of F and the p-value.

F's critical value and corresponding p-value were calculated using the specified significance level and degrees of freedom.

- Step 9: comparing the obtained F statistic to the crucial value of F

When the estimated F statistic exceeded the critical value of F, the null hypothesis was rejected and it was determined that there was a significant difference between the means of at least two groups. If the estimated F statistic was less than or equal to the critical value of F, the null hypothesis was not rejected, and it was concluded that there was no significant difference between the two groups' means.

- Step 10: Post-hoc analysis (if needed)

If the null hypothesis was denied, a post-hoc analysis was used to identify whether groups differed significantly from one another. Tukey's HSD test, Bonferroni adjustment, and Scheffe's test are examples of commonly used post-hoc tests.

3. Results and discussion

3.1. Results regarding the economic efficiency of an organic tomato crop

The root and foliar fertilization plans used for the calculation are supported by soils with a light texture, with an average content of organic matter, a soil pH of 5.5-7, a relatively high level of salts, and the water used for irrigation comes from drilled wells, water with a very low level of nitrites and nitrates, is not very hard (low concentrations of calcium and magnesium carbonate), pH 6-7, salinity index as close as possible to 0 The recommendations for the treatment of the tomato crop depending on the development phases of the plants and the main diseases that may appear, are indicative and were used to calculate the total cost of a tomato crop. The results of treatment applications may change depending on local circumstances, environmental conditions, infection pressure, etc.

3.2. Results regarding the particularities of tomato growth subject to particular (ecological) light conditions

The essay concerns the implementation of experimental models on tomato seedlings. The plant material used consisted of tomato seedlings that had 3-5 leaves.

The statistical analysis regarding the development of tomato plants is centralized in table 1.

Table 1 Statistical results on the average growth rate of tomato plants for the experimental model - ozone, red light, yellow light and orange light (2020, 2021, 2022)

Type of irrigation	Year	Mean Value Control	Ratio % Control	Difference	Estimate
Witness - Daylight	2020	23.67	100.00	0.00	o
	2021	15.00	63.38	-8.66	o
	2022	0.00	0.00	-23.66	o
Ozone	2020	29.00	122.54	5.33	*
	2021	17.67	74.65	-6.00	oo
	2022	0.00	0.00	-23.66	ooo
Red light	2020	31.00	130.99	7.33	**
	2021	16.00	67.61	-7.66	oo
	2022	0.00	0.00	-23.66	ooo
Yellow light	2020	34.00	143.66	10.33	***
	2021	16.00	67.61	-7.66	oo
	2022	0.00	0.00	-23.66	ooo
Orange light	2020	32.67	138.03	9.00	***
	2021	17.00	71.83	-6.66	oo
	2022	0.00	0.00	-23.66	ooo

In table 2 are centralized data regarding the statistical analysis regarding the average number of leaves of tomato plants for the experimental model experimental model types of light - control - daylight, ozone, yellow light, red light, orange light.

The results of the statistical analysis show us that the tomato plants registered very significant increases in terms of the average number of leaves for the plants influenced by the spectrum of light, oxon, red, yellow and orange light.

Regarding the average height of the tomato plants, it is observed that they develop very well under the spectrum of red, yellow and orange light, registering very significant increases from the point of view of plant development.

In table 3, the statistical data on the average rate of development of tomato chains are centralized.

Table 2 Statistical results on the average growth rate of tomato plants for the experimental model - ozone, red light, yellow light and orange light (2020, 2021, 2022)

Tomato Number of leaves (no.)	**2020**			**2021**			**2022**		
	Average value	**Overall average ratio%**	**Overall average difference (cm.)**	**Average value**	**Overall average ratio%**	**Overall average difference (cm.)**	**Average value**	**Overall average ratio%**	**Overall average difference (cm.)**
Witness - Daylight	22.35	73.17	-8.06^{ooo}	21.16	69.84	-9.06^{ooo}	28.14	93.13	-2.06^{ooo}
Ozone	27.15	89.80	-3.06^{ooo}	28.25	93.13	-2.06^{ooo}	32.56	106.43	1.93^{***}
Red light	29.33	96.45	-1.06^{ooo}	31.45	103.10	0.93^{***}	33.66	109.76	2.93^{***}
Yellow light	33.15	109.76	2.93^{***}	34.13	113.08	3.93^{***}	35.18	116.41	4.93^{***}
Orange light	31.66	103.10	0.93^{***}	33.28	109.76	2.93^{***}	34.33	113.08***	3.93^{***}

Table 3 Statistical results on the average growth rate of tomato plants for the experimental model - ozone, red light, yellow light and orange light (2020, 2021, and 2022)

Tomato Height (cm.)	**2020**			**2021**			**2022**		
	Average value	**Overall average ratio%**	**Overall average difference (cm.)**	**Average value**	**Overall average ratio%**	**Overall average difference (cm.)**	**Average value**	**Overall average ratio%**	**Overall average difference (cm.)**
Witness - Daylight	14.23	85.71	-2.33^{ooo}	15.34	91.84	-1.33^{ooo}	16.83	97.96	-0.33^{ooo}
Ozone	16.73	97.96	-0.33^{ooo}	18.35	110.20	1.67^{***}	19.62	116.33	2.67^{***}
Red light	15.51	91.84	-1.33^{ooo}	16.42	97.96	-0.33^{ooo}	17.33	104.08	0.67^{***}
Yellow light	15.64	91.84	-1.33^{ooo}	16.46	97.96	-0.33^{ooo}	17.33	104.08	0.67^{***}
Orange light	16.93	97.96	-0.33^{ooo}	17.46	104.08	0.67^{***}	18.46	110.20	1.67^{***}

3.3. Results regarding the particularities of tomato growth subject to particular (ecological) water conditions

The statistical analysis regarding the development of tomato plants for the experimental model - types of water is shown in table 4.

Table 4 Statistical analysis regarding the average growth rate of tomato plants for the experimental model magnetized water, ozonated water and magnetized water + magnetic fertilizer (2020, 2021, 2022)

Type of irrigation	**Years**	**Mean Value Control**	**Ratio % Control**	**Difference**	**Estimate**
Witness - tap water	2020	11.33	100.00	0.00	
	2021	13.33	117.65	2.00	*
	2022	13.33	117.65	2.00	*
Magnetized water	2020	13.00	1141.71	1.67	*
	2021	16.33	144.12	5.00	**
	2022	17.33	152.94	6.00	**
Ozonated water	2020	16.67	147.06	5.33	**

	2021	17.00	150.00	5.67	**
	2022	17.00	150.00	5.67	**
Magnetized water + magnetized fertilizer	2020	19.33	170.59	8.00	***
	2021	20.33	179.41	9.00	***
	2022	31.00	273.53	19.67	***

* significant growth of the plant; ** distinctly significant growth of the plant; ***very significant growth of the plant

From the statistical analysis represented in table 4, it appears that the tomato plants irrigated with magnetized water + magnetic fertilizer had the best development, registering a very significant growth of the plants, and the plants irrigated with magnetized water, ozonated water registered distinctly significant increases.

Table 5 Statistical analysis on the average number of tomato plant leaf development for the magnetized water, ozonated water and magnetized water + magnetic fertilizer experimental model (2020, 2021, 2022)

Tomate Number of leaves (no.)	**2020**			**2021**			**2022**		
	Average value	**Overall average ratio%**	**Overall average difference (cm.)**	**Average value**	**Overall average ratio%**	**Overall average difference (cm.)**	**Average value**	**Overall average ratio%**	**Overall average difference (cm.)**
Witness - tap water	23.11	74.59	-7.83^{ooo}	27.14	87.57	-3.83^{ooo}	26.38	84.32	-4.83^{ooo}
Magnetized water	25.17	81.08	-5.83^{ooo}	31.42	100.54	0.17***	33.57	107.03	2.17***
Ozonated water	30.46	97.30	-0.83^{ooo}	30.63	97.30	-0.83^{ooo}	31.44	100.54	0.17***
Magnetized water + magnetized fertilizer	37.23	120.00	6.17***	38.66	123.24	7.17***	39.56	126.49	8.17***

It can be seen from the statistical data centralized in table 5. that tomato plants recorded a very significant increase in the average number of leaves in plants irrigated with magnetized water + magnetized fertilizer.

Table 6 Statistical analysis on the average height of tomato plants for the experimental model magnetized water, ozonated water and magnetized water + magnetic fertilizer (2020, 2021, 2022)

Tomato Height (cm)	**2020**			**2021**			**2022**		
	Average value	**Overall average ratio%**	**Overall average difference (cm.)**	**Average value**	**Overall average ratio%**	**Overall average difference (cm.)**	**Average value**	**Overall average ratio%**	**Overall average difference (cm.)**
Witness - tap water	11.35	60.55	-7.16^{ooo}	13.54	71.56	-5.16^{ooo}	14.48	77.06	-4.16^{ooo}
Magnetized water	14.62	77.06	-4.16^{ooo}	18.67	99.08	-0.16^{ooo}	19.25	104.59	0.83***
Ozonated water	20.26	110.09	1.83***	21.58	115.60	2.83***	20.94	110.09	1.83***
Magnetized water + magnetized fertilizer	21.83	115.60	2.83***	23.03	126.61	4.83***	24.33	132.11	5.83***

3.4. Results regarding the particularities of tomato growth subject to particular (ecological) soil conditions

The statistical analysis regarding the development of tomato plants for the experimental model - fertilization types is shown in table 7.

Table 7 Results on the average rate of tomato plant development for the experimental model - magnetic fertilizer and control - tap water (2020, 2021, 2022)

Type of fertilizer	Year	Mean Value Control	Ratio % Control	Difference	Estimate
Witness - tap water	2020	16.00	100.00	0.00	
	2021	17.67	110.42	1.67	*
	2022	19.67	122.92	3.67	**
Magnetic fertiliser	2020	18.00	112.50	2.00	**
	2021	18.33	114.58	2.33	**
	2022	19.00	118.75	3.00	**

From the centralized data in table 7. regarding the average growth rate of tomato plants, it can be seen that the plants fertilized with magnetic fertilizer developed better, registering a distinctly significant growth compared to those fertilized irrigated with the control.

Table 8 Statistical analysis on the average number of leaves in tomato plants for the experimental model - fertilization - control - tap water, magnetic fertilizer (2020, 2021, 2022)

Tomato	2020			2021			2022		
Number of Leaves (no.)	Average value	Overall average ratio (%)	Average difference general (cm)	Average value	Overall average ratio (%)	Average difference general (cm)	Average value	Overall average ratio (%)	Average difference general (cm)
Witness - tap water	25.69	83.33	-5.00^{ooo}	29.27	96.67	-1.00^{ooo}	33.45	110.00	3.00***
Fertilizer magnetic	31.59	10.33	1.00***	31.51	10.33	1.00***	31.45	10.33	1.00***

The results regarding the average height of the plants are centralized in table 9.

Table 9 Results on the average rate of tomato plant development for the experimental model - magnetic fertilizer and control - tap water (2020, 2021, 2022)

Tomato	2020			2021			2022		
Plant height (cm)	Average value	Overall average ratio (%)	Average difference general (cm)	Average value	Overall average ratio (%)	Average difference general (cm)	Average value	Overall average ratio (%)	Average difference general (cm)
Witness - tap water	23.47	94.52	-1.33^{ooo}	24.52	98.63	-0.33^{ooo}	26.28	106.85	1.67***
Fertilizer magnetic	23.62	94.52	-1.33^{ooo}	24.95	98.63	-0.33^{ooo}	26.05	106.85	1.67***

From the data centralized in table 9. regarding the statistical analysis of the average height of tomato plants, it is observed that the plants develop much better when they are fertilized with magnetic fertilizer, registering very significant plant growth.

3.5. Results regarding the economic efficiency of an organic tomato crop

The results regarding the efficiency of tomato cultivation both in the conventional system and in the organic system are centralized in table 10.

Table 10 Results regarding the cost of tomato cultivation in conventional system versus organic system

Tomato	**Conventional system - lei/1.000m²**	**Ecological system - lei /1.000m²**
Seedlings	8.100	10.350
Treatments	4.534	1.565
Total	12.634	13.915

From the centralized data in table 10. it can be observed that the expenses for tomato cultivation in the organic system were higher (13.915 lei) compared to the expenses for the culture in the conventional system (12.634 lei), these expenses being the result of the purchase of seedlings and the application of fertilization and phytosanitary treatments. It is also observed that although the seedlings for the culture in the ecological system cost more (10.350 lei), the expenses for the application of the treatments were lower (1.565 lei).

4. Conclusion

Medicinal plants, respectively essential oils, represent the oldest category of therapeutic remedies that have accompanied humanity throughout its historical evolution, now also used in ecological agriculture. More recently, colloidal silver is also used in integrated combat and ecological agriculture. It is already known worldwide that silver nanoparticles (AgNPs) are the most used and widespread nanotechnological material.

The total cost of tomato crops in the ecological system is higher than those in the conventional system due to the 50-150% increased cost of the seedlings obtained ecologically compared to the conventional ones.

The costs of phytosanitary and fertilizer treatments in the ecological system are 5-25% lower than those applied in the conventional system.

It remains to be studied whether obtaining the seedlings in their own regime would reduce the total costs of the ecological culture technology compared to the conventional one.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Castells E., Berenbaum M.R., Laboratory Rearing of Agnoptrix altroemeriana, the Defoliating Poison Hemlock (Conium maculatum L.) Moth., and Effects of Piperidine Alkaloids on Preference and Performance, Physiological Ecology, Environ. Entomol. 2006, Vol. 35 (3), 607-615.

[2] Flint M.L., Dreistadt S.H., Natural Enemies Handbook: The Illustrated Guide to Biological Pest Control. 1998, Vol. 3386, University Of California Press, Oakland.

[3] Săvulescu E., Systematics of plants, Printech Publishing, Bucharest, 2016.

[4] M.A.P.D.R., A.N.P.E. et al., Legislative guide for ecological agriculture, Roprint Publishing House, Cluj-Napoca, 2004.

[5] FOLLETT P.A., DUAN J.J., Nontarget effects of biological control. Kluwer Acad. Publ., Dordrecht, NL, 2000.

[6] Hawkins B.A., Thomas M.B., Hochberg M.E., Refuge Theory and Biological Control. Science. 1993, vol. 262, Issue 5138; 1429-1432.

[7] Kross S.M., Bourbour. R.P., Martinico. B.L., Agricultural land use, barn owl diet, and vertebrate pest control implications, Agriculture, Ecosystems & Environment, 2016, Vol. 223;167-174.

[8] Lagunovschi-Luchian V., Vînătoru, C., Vegetable farming, Alpha MDN Publishing House, 2016.

[9] Lemaux P.G., Genetically Engineered Plants and Foods: A Scientist's Analysis of the Issues (Part I), Annual review of plant biology, 2008, Vol. 59: 771-812.

[10] Shanks C.H., Agudelo–Silva F., Field pathogenicity and persistence of Heterorhabditid and Steinernematid nematodes (Nematoda) infecting black vine weevil larvae (Coteoptera: Curculionidae) in cranberry bogs. Journal of economical entomology, 1990, Vol. 83, Issue 1; 107-110.

[11] Shapiro-Ilan D.I., Gaugler R., "Biological Control. Nematodes (Rhabditida: Steinernematidae and Heterorhabditidae)". Cornell University, 2015.

[12] Rădulescu, E., Săvescu, A., Plant protection guide, Agro-forestry Publishing House, Bucharest, 1966.

[13] Xuenong X., Combined Releases of Predators for Biological Control of Spider Mites Tetranychus urticae Koch and Western Flower Thrips Frankliniella occidentalis (Pergande), 2004, Cuvilier verlag Göttingen; 799-843