INTEGRATING EDUCATION AND SCIENTIFIC ACHIEVEMENTS TO SOLVE ORGANIC FARMING PROBLEMS

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Abstract. *The purpose of the study is to analyse the impact of ecological education on the sustainable development of society and to determine the role and place of this important type of activity in social and life processes for solving educational and ecological problems. When conducting the research, general scientific methods of knowledge, information search methods and implementation of scientific achievements were used, which allowed the collection of the necessary material on the research topic. The research touches on the problems of ecological education formation in different groups of audiences (bachelor, master, doctorate, agricultural specialists, organic agriculture operators). The materials on ecological education issues are summarized and proposals are made for the use of new forms of environmentally efficient work organization, as well as the perspectives of applying the results of ecological education to strengthen ecological agriculture through the sustainable development of society.*

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1. Introduction

The worsening of environmental problems, which endangers the very existence of nature and humanity, reflects a transformation in nature's role: shifting from a provider and friend to a formidable adversary. This shift necessitates the adoption, development, and implementation of effective mechanisms governing the relationship between humans and nature. The current situation compels human society to build a comprehensive body of knowledge regarding the integrity of nature and, leveraging the inherent unity of humanity, society, and the natural world, to foster the competencies, values, behaviors, and activities that ensure a responsible attitude toward nature. Environmental education plays a pivotal role in addressing these challenges [8].

Environmental education encompasses the full range of pedagogical responses and activities aimed at understanding and resolving issues concerning the human-nature relationship. It seeks to regulate interactions with the environment

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by utilizing scientific knowledge grounded in global responsibility and by helping humanity gain a profound understanding of environmental issues and global challenges [5].

The primary goal of environmental education is to facilitate the acquisition of information needed to understand environmental issues and to make decisions based on ecological knowledge, while also addressing accumulated environmental problems. Today, education aimed at fostering environmental awareness is becoming a fundamental element for families, educational institutions, and society at large and is particularly relevant to new forms of agriculture that support sustainable socio-economic development [6].

Given the ecological characteristics of humans, it is essential to recognize that *Homo sapiens* L. can only grasp the necessity and obligation of complying with environmental legislation by participating as a subject of environmental education and being guided by these values.

2. Materials and Methods

The research objective was achieved through the accumulation and processing of gathered information and practical experience, alongside an analysis of existing sources. Methods and techniques in environmental education were tailored to specific age groups, employing oral, written, and visual communication, both collective and individual, as well as systematic exploration of objective reality and methods grounded in practical laboratory work and activities on experimental and production plots [9].

The research conclusions and results rely on logical reasoning and generalization. Current information regarding environmental education is derived from research reports by global, regional, and national organizations, scientific publications, expert opinions, materials from scientific and practical forums and meetings, and online resources [10].

Consequently, there is a need to master and acquire practical skills, integrated into knowledge models, and to implement technological and behavioral measures in alignment with the regulatory and value-based standards approved by decision-making bodies. The establishment of moral and aesthetic foundations is of particular importance; these form the basis and the means for shaping one's attitude toward nature, a process that unfolds over a long period through interaction with the elements of agro-ecosystems.

3. Results and discussions

3.1. Fostering Ecological Culture in the Context of Promoting New Types of Agriculture

Against the backdrop of worsening ecological problems on the one hand, and a significant surge in research and publications aimed at resolving them on the other, it has become an axiom that the level of ecological culture is determined by the state of the Earth's environment and depends largely on ecological education. Currently, ecological culture has the primary mission of contributing to the resolution of ecological problems, a role it has fulfilled for decades through ecological education. This culture is defined by adherence to moral standards and an attitude toward nature rooted in the informed conviction of every member of society. Scientific and educational activities have defined the purpose, set the objectives, and developed the methodological mechanisms that have led to undeniable successes in ecological education, an approach based on the premise that every individual and member of society must possess sufficient knowledge of nature and attain an adequate level of ecological education. Armed with this knowledge and an active civic stance, every member of society becomes prepared to realistically assess the nature and consequences of their practical activities and their impact on the environment; to determine the extent to which natural and anthropogenic factors affect the surroundings; and to understand how measures can be implemented to mitigate this impact [7].

Activities focused on ecological education, particularly those designed for practitioners in modern agricultural sectors (conventional, organic, and regenerative), stimulate interest in the components and characteristics of natural phenomena. They encourage the application of acquired knowledge to maintain and improve environmental conditions, the analysis of practical outcomes regarding natural elements and phenomena, the development of concepts concerning the role of humans in relation to nature, and the cultivation of a sense of responsibility toward living things [2].

As a result of ecological education, environmentally conscious individuals demonstrate ecological thinking; they correctly analyze situations and establish appropriate responses to environmental issues, while also forecasting the impact of personal and human activities on the natural world. The outcomes of ecological education across different groups can be observed through behavioral patterns and the display of respect for life and nature, ranging from treating natural components with care to utilizing them wisely. Achieving this noble goal is inextricably linked to the educator's intellectual qualities and attentive attitude in imparting necessary knowledge about nature, sparking interest, and fostering a genuine friendship with the natural world.

Starting from the increase in the impact of harmful organisms against the background of worsening climate change and the continuous deterioration of the ecological status, the obligations of human society to establish the knowledge system oriented to the formation of skills, value orientation, conduct and activities, which would ensure a responsible attitude towards nature, are increasing. In solving these problems, a primary role belongs to ecological education and scientific creativity. Taking into account the particularities of man, it is necessary to take into account that *Homo sapiens* L., only by participating as an object of environmental education and being guided by these values, can they become aware of the need and obligation to comply with environmental legislation.

Activities education-oriented Organic farming, especially those applied to operators in modern types of agriculture (conventional, organic, regenerative) through recognized mechanisms and methods, arouse the interest of audiences in the components and particularities of natural phenomena. The intercalation between environmental education with the results recorded by the scientific community is achieved by applying the knowledge acquired for maintaining and improving the conditions of the environment, analyzing the results obtained in practical activity on natural components and phenomena, forming ideas about the role of man and natural phenomena, cultivating feelings of responsibility for the manifestations of living entities.

As a result of environmental education, advanced people in this field manifest elements of ecological thinking, correctly analyzing and stabilizing appropriate relationships when various environmental problems arise, but also to forecast the consequences on nature and the natural environment of personal and human activity. The results of environmental education in different groups of audiences can be examined by reflecting people's behavior and showing respect for life and nature, going through activities that are careful of natural components until they are used wisely [3].

Thus, integration combines academic theory with innovative thinking oriented to the application of achievements in organic farming. Particularly important are the results aimed at the implementation of sustainable agriculture based on the "One Health" concept, such as: monitoring the development of harmful organisms with the application of methods and achievements of information technologies, use of knowledge on the particularities of soil biota entities, development and implementation of biological fertilizers and pesticides (biological means developed and approved in the Republic of Moldova based on various biologically active substances for monitoring, sterilization, mass capture and control of harmful insects, efficient entomophages for combating harmful

arthropods, effective biological preparations based on useful bacteria, fungi and viruses), analysis of climate data to optimize the application of advanced technological processes, monitoring the phytosanitary status of agricultural ecosystems and soil health by applying biological indicators, modern machinery and artificial intelligence.

Ecological education in raising awareness and sensitization of agricultural producers and operators in the field of organic farming is indispensable related to stimulating creativity and innovation by organizing round tables, seminars and scientific forums, setting up direct experiments in community pilot farms, applying environmentally harmless means based on the use of natural mechanisms of regulating the density of harmful organisms, which serve as effective solutions for obtaining and processing organic products [1].

The teaching experience gained both in reading biological, ecological and agrobiologically courses, as well as the numerous trainings of specialists and operators in organic farming, creates a substantial foundation for theoretical and practical awareness of the study programs. They constituted a valuable material for the initiation and deepening of the accumulated knowledge and contributed as a methodological support to orient the behavior of the audience groups on the formation of the feeling of responsibility for caring attitudes towards nature and the rational use of natural resources. Thus, it becomes evident that environmental education is an imperative and the chance for food security in the sustainable development of humanity.

3.2. Addressing the Functional Blocks of Plant Protection Systems

Diagnosis, monitoring, and forecasting of the development of harmful and beneficial organisms.

Development of decision-making systems (for assessing the spread of harmful organisms, determining their impact on organisms, and analyzing economic injury thresholds) [4].

Determination of the role of plant protection methods (organizational and management-related, agrotechnical, genetic and breeding, chemical, biological).

Development of plant protection machinery and technologies.

Optimization of plant protection systems using traditional, linear, and non-linear methods, as well as dynamic programming.

Training and professional development of personnel for the implementation of sustainable plant protection systems.

Against the backdrop of the deteriorating phytosanitary condition of agricultural crops, shifting the plant protection paradigm has become timely, both a solution to and a result of humanity's struggles. Based on the research practice and the

consensus in the "Plant Protection" science, which does not have sufficient theoretical and applied arguments to solve the problems, the foundation and implementation of the phrase "Plant Health" became rational.

The new paradigm is based on recognized scientific achievements, which offer original approaches to problems and model solutions to the scientific community and specialists in the field.

Achieving these goals can become a reality through collaboration between the scientific and educational communities.

Development and approval of environmentally friendly plant protection products:

- Technological processes for the production of 15 entomophages, especially those applied in the protection of greenhouse crops;
- Technologies for the production and application of microbiological agents for combating pests and the approval of 16 biological preparations based on them;
- Identification and synthesis of sexual pheromones of 18 species of harmful insects and the development of original synthesis schemes for pheromones in 72 species and technological processes for their production and use for monitoring, mass capture, sterilization and disorientation of harmful insects. All of this is promoted through (Table 1).

Table 1. Combining scientific and pedagogical activities

1.	Indicator	Activity
2.	Conducting expert assessments and issuing opinions on scientific activities and the implementation of results	Expert assessment and endorsement of materials in the fields of microbiology, ecology, and plant protection, as well as educational projects.
3.	Ensuring the testing, certification, and standardization of products and services	Development and submission of microbiological plant protection agents to the State Center. Contracting for the testing, certification, and standardization of phytosanitary products.
4.	Perfecting and launching collaborative applied projects between the scientific and educational community and representatives of the business environment.	The launch and execution of collaborative and applied projects in order to develop manuals, prepare and perfect staff, develop and approve decision-making documents, and solve phytosanitary problems in agricultural operators....
5.	Realization of student accommodation programs on the occasion of themed holidays	Implementation of student hosting programs for World Science Day and Researchers' Night.
6.	Maintaining dialogue with civil society representatives	Participation in discussions organized by the Ministry of Agriculture and Food Industry, the Ministry of the Environment, and civil society representatives regarding issues of biological plant protection, agroecology, and biosafety.

3.3 Prospects for environmental awareness

- This integration combines academic theory with innovative thinking focused on applying scientific advancements to organic farming.
- Implementation of sustainable agriculture based on the "One Health" concept: monitoring pest development using information technology methods and tools; utilizing knowledge regarding soil biota characteristics; and developing and implementing biological fertilizers and pesticides (biological agents developed and approved in the Republic of Moldova).
- Scaling up results based on:
  - biologically active substances for monitoring, sterilizing, mass-trapping, and controlling insect pests;
  - effective entomophages for controlling harmful arthropods;
  - effective biological preparations based on beneficial bacteria, fungi, and viruses.

The Contribution of Environmental Education to Raising Awareness and Sensitizing Agricultural Producers. Raising awareness and sensitivity among agricultural producers and organic farming operators regarding ecological education is inextricably linked to fostering creativity and innovation through:

- organizing roundtables, seminars, and scientific forums,
- conducting hands-on trials at community pilot farms,
- applying environmentally safe methods that utilize natural mechanisms to regulate pest populations, serving as effective solutions for the production and processing of organic products.

Perspectives on integrating environmental education and awareness. The teaching experience gained through delivering courses in biology, ecology, and agrobiology, combined with extensive training provided to organic farming specialists and operators, establishes a solid foundation for the theoretical and practical understanding of these study programs.

This experience has served as a valuable resource for initiating and deepening knowledge, acting as a methodological guide to shape the mindset of participants. It fosters a sense of responsibility regarding the conscientious treatment of nature, the promotion of environmentally friendly practices, and the rational use of natural resources.

Thus, it becomes evident that environmental education is an imperative and a key factor in ensuring food security within the context of humanity's sustainable development.

4. Conclusions

Implementing modern, competency-based educational processes is impossible without interdisciplinary learning that directly integrates the natural, life, and social sciences. Correlating knowledge across different subjects fosters the education of learners and develops both cognitive flexibility and the ability to apply acquired knowledge to new forms of agriculture.

Strengthening knowledge through the integration of natural and life sciences with educational disciplines is achievable only by promoting interdisciplinarity; the need for such an approach is driven by the worsening of complex ecological issues and the promise held by the implementation of modern biotechnological methods to boost contemporary agricultural yields.

Pedagogical activities at various levels of professional training provide a substantial and sufficient foundation for recognizing that the theoretical and practical aspects of these programs are invaluable for shaping learner behavior—fostering a sense of responsibility and a caring attitude toward nature, promoting the rational use of natural resources, and ultimately building a profitable agricultural sector and a sustainable society.

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