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ENVIRONMENT AND SUSTAINABLE AGRICULTURAL DEVELOPMENT[2]

Abstract

The concept of sustainable development came out from the need to preserve the environment in order to maintain its quality at the appropriate level for future generations. Direct dependence on natural resources and the necessity of their use in the production process make agriculture to be a sector which has to intensively increase environmental awareness. Therefore, sustainable agriculture focuses on three main goals: a healthy environment, economic profitability, and social and economic fairness. In addition to multiple and unquestionable impact on the resource base and environmental quality, there are some methods in agriculture that already contribute to the achievement of mentioned goals. Nevertheless, there is a need for their further improvement, development of new methods and strengthening the environmental aspects of agriculture.

Keywords*: agriculture, environment, sustainability, environmental awareness.*

JEL klasifikacija: *Q50, Q51*

ЖИВОТНА СРЕДИНА И ОДРЖИВИ РАЗВОЈ ПОЉОПРИВРЕДЕ

Апстракт

Концепт одрживог развоја се изнедрио из потребе очувања животне средине како би се њен квалитет одржао на одговарајућем нивоу и за будуће генерације. Директна зависност од природних ресурса и неопходност њихове употребе у процесу производње, чине пољопривреду сектором у коме се мора интензивно развијати еколошка свест. Одржива пољопривреда се у том настојању фокусира на три основна циља: здраву животну средину, економску профитабилност и друштвену и економску правичност. Поред вишеструког и неспорног утицаја на ресурсну базу и квалитет животне средине, у пољопривреди се већ могу се издвојити методе које доприносе остварењу напред поменутих циљева. Ипак, неопходно је даље радити на њиховом усавршавању, развијању нових метода и јачању еколошког аспекта пољопривреде.

Кључне речи: *пољопривреда, животна средина, одрживост, еколошка свест*

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Introduction

Environmental issues come to the forefront along with accelerated economic development, provoking interest as issues that need to be paid more attention, such as air and water pollution, the survival of plant and animal species, the excessive use of chemicals that damage human health and the environment, etc.

For these reasons, consensus on the need to preserve a healthy environment has been growing over the past years within the framework of world politics. States are increasingly confronted with the ecological limitations of rapid economic growth leading to the evolution of the environmental awareness. There is a general agreement that environmental policy and eco-innovation can improve economic growth, maintain and increase employment in all sectors, including the agricultural sector (Stojanović, Radukić, 2006, pp. 471-485).

Agriculture has an inevitable place in ecological policy given its direct connection with the environment. The concept of agricultural sustainability is gaining an importance. Nevertheless, in spite of the fact that it is recently gaining momentum, this concept had its roots in the past decades. That is confirmed by numerous examples as evidence for taking into account it in the past (OECD_b, 1999).

Agriculture has gone through different stages throughout its evolutionary path, where the ecological consciousness gradually matures. However, appropriate measures and activities are needed in order to raise this awareness among farmers to a higher level, but not only of themselves than also the awareness of relevant institutions and policy makers (economic, environmental protection, etc.).

Agricultural sustainability does not mean completely to abandon the existing mode of production and all technologies, especially having in mind that the most are harmful to the environment. On the contrary, technology that contributes to greater productivity and does not jeopardize the environment can be considered as "sustainable" and used in agriculture. In addition to providing healthy and safe food with the application of adequate technology, the agricultural sustainability is also reflected in the conservation of public goods (clean water, conservation of animal habitats, flood protection, etc.) (European Commission, 2014).

1. Environmental impact on the agricultural development

There are numerous approaches to define sustainable development. However, generally is accepted that it represents "satisfying the needs of development and environmental protection of the current and future generations at the same time" (World Bank, 2001). The concept of sustainable development clearly requires a comprehensive, systematic and integrated approach for achieving long-term development, while balancing different dimensions of economic growth, social stability and environmental sustainability (National Research Council, 2010).

Being one of the millennium development goals set by the World Bank proves the importance of sustainability (World Bank, 2011, p. 52). However, setting goals in the context of sustainability is much easier than achieving them. Implementation requires a close cooperation of various institutions, the adoption of appropriate policies and the choice between quite different approaches for economic development and improving competitiveness.

There is a close link between economic and agricultural development and environment, which can be presented through the following:

- quality of growth,
- quality of regional and global goods,
- quality of life.

The *quality of growth* is not easy to be achieved. Proper use of natural resources is a key issue while considering the ecological aspect. Economic theory and practice emphasize that the use of resources will be effective if the agricultural markets are functioning well. However, this is not always the case. Environmental problems are most often caused by market disruptions, inadequate policies, or both. The markets for organic products and services are underdeveloped or not developed at all. Therefore, the prices of these products often do not reflect their real value. On the other hand, there are often no prices at all, making these products totally free for users. This ultimately leads to their uncontrolled use, or on the other hand to their insufficient supply.

Global goods are often exposed to the influence of people in all parts of the world. The ecosystem does not recognize the administrative barriers since the pollutants cross over long distances and effect on neighbouring countries and regions. Individual attempts of countries to contribute to sustainable development will largely depend on the protection of global goods. Therefore, the key questions of the environmental protection in the context of global goods and their protection can be divided into two categories:

1. Global goods that are directly related to the maintenance of the basic components of the earth system:
   - climate changes,
   - damage the ozone layer,
   - accumulation of organic pollutants,
   - endangering biodiversity.

2. Degradation of natural resources at a global level:
   - degradation of international water and marine ecosystems,
   - degradation of noise,
   - degradation of soil.

Although some issues have a national character, their successful resolution requires coordinated activity at the international level.

The influence of environmental factors on the *quality of life* can be grouped into three categories:

1. *Threats to life*. Nearly a billion of rural households relies on natural resources (forests, water, land, etc.). The survival of these households would be directly compromised by limiting their availability or deteriorating their quality. The main causes are the following:

   - excessive use, poor management and pollution of freshwater resources - nearly one third of the human population faces drinking water problems, especially in Africa and Latin America.
   - degradation of soil - caused by erosion, salinization, compression.
   - rapid destruction of forests, ponds, biodiversity as a result of poor economic policies and incentives and weak regulatory decisions.

2.*Health threats*. Environmental degradation is one of the factors that contribute to various human diseases, disrupting their health and quality of life. Millions of children and adults die each year from causes that could be removed by raising the quality of the environment to a higher level. The most common causes of the disease are:

   - diseases caused by water,

- exposure to polluted air in a closed or open space,
- exposure to agricultural or industrial chemicals.

3. *Sensitivity to changes*. Poorer population is particularly vulnerable to natural disasters and environmental changes. This fact stems from the need for using natural resources located in highly risky areas, in relation to their exposure to various natural disasters. On the other hand, the poorer population is more exposed to the negative consequences in the event of a disaster due to financial difficulties and inability to take loans.

Interconnection between economic and agricultural development, and the environment on the other hand, indicates that a large number of industries and sectors can be identified as potential environmental polluters. Economic motives as drivers of rapid economic growth and development are now losing significance since the priority is given to the environmental goals.

Agriculture certainly has a major impact on the environment with regard to its direct connection and environmental dependence. Indirectly or directly it affects the quality of growth, quality of global goods and quality of life. The use of natural resources in production (forest, water, land, etc.) affects their quality and insufficient accountability can leave far-reaching consequences. Therefore, a special attention in agriculture is given to the concept of sustainable development and the need for environmental protection.

2. Increasing environmental awareness in agriculture

Agriculture has undergone many changes throughout its development, which were more or less fundamental and revolutionary. Adapting to newly discovered tools and inventions that lead to the changed way of production, agriculture went through its transitional phases, growing its ecological awareness (OECD_a, 2001, p. 10).

The term "green revolution" began to use in the mid-1960s in order to emphasise the increase of agricultural production by using new varieties, primarily cereals and rice, adequate irrigation systems and better agricultural techniques. The previously used production system (excessive use of pesticides, fertilizers and other chemicals) is becoming unsustainable, pointing to the antagonism of agriculture and ecology, respectively environment.

Providing food security to the population, a raw material base for industrial production, a source of human resources for non-agricultural activities, etc., agriculture is increasingly oriented towards preserving and improving the quality of the environment in its multifunctionality (Djekic, 2010, p. 23). The role of farmers is not only to produce food, but primarily to serve as environmental managers in order to internalize externalities wherever possible and to ensure proper management and use of natural resources for the purpose of their long-term sustainability (World Bank, 2005).

There are different approaches to define the concept of agricultural sustainability. Starting with the need to ensure the diversity and dimension of the agricultural production system, three criteria can be distinguished (Davidson, 2002).

The first criterion refers to the establishment of internal sustainability, where is expected to maintain an adequate resource base, prevent pollution, salinisation and other forms of soil and water degradation, and develop the ability to respond to plant and animal diseases, periodic climate change, and changes in market conditions. Internally sustainable agriculture contributes greatly to local communities by maintaining the infrastructure and ensuring the stay of the rest of people who could represent the future

generation of farmers. *The second criterion* emphasizes external sustainability where agriculture should not impose externalities to non-agricultural activities, nor to affect the environment beyond the limits of tolerance.

The third criterion indicates that agriculture should be responsibly sustainable in the context of flexibility and dynamism to respond to different (unsustainability) crises in other sectors. Participation of agriculture in solving the problems of global warming is reflected in, for instance, afforestation of different plots, greater use of biodiesel, etc. No system of production should be isolated, but in agreement with other systems should jointly contribute to sustainable development.

Also, generally is accepted to define the sustainability as the possibility to satisfy the needs of the present generation without jeopardizing the possibility of future generations to satisfy their own needs (Horrigan, Lawrence, Walker, 2002, p. 452).

In spite of the fact that the concept of sustainable development is gaining attention in recent times, there are also examples of environmental accounting in agriculture in the distant past. At least three examples can be counted in order to confirm that fact (Ruttan, 1994, pp. 6-7).

The first example of the sustainable agriculture is reflected in the existence of a system of afforestation of untreated areas in most parts of the world in the pre-modern era. This system has provided excellent results in poorly populated areas.

The second example can be found in the agricultural history of East Asian countries as "wet rice cultivation". The traditional way of cultivating rice was like agriculture in the aquarium. Most of the production was recycled into suitable fertilizers. Nutritious organic and mineral substances have been used in accordance with the irrigation system. The yields, although slowly, grew during the period.

The third example is the system of integrated farming and livestock, characteristic of the late Middle Ages in Western Europe. First of all, the system emphasized the possibility of using various plant and animal fertilizers for the purpose of increasing soil fertility.

3. Interaction between agriculture and environment

Agriculture should provide adequate agricultural products at affordable prices in response to the existing demand for food and bio-energy in line with the ever-growing global population. At the same time, increased production costs, limited natural resources and climate change should be taken into consideration. Increasing awareness of the (unintentional) impact of agricultural production leads to great social expectations regarding the improved environment, as well as the welfare of the community, workers and the animals in agriculture (OECD_b, 1999).

Agriculture affects the environment in a variety of different ways, influencing water, land, but also the use of fertilizers and phytosanitary measures (Sustainable Development Solutions Network, 2013). From the aspect of its relation to the environment, certain specific characteristics of agriculture make it different in comparison to other sectors in the economy. First of all, the relationship between agricultural activities and the environment is complex and non-linear. They are determined by different agro-ecological systems and physical characteristics of the land, prevailing conditions and production technology, as well as the practice of managing agricultural farms from the aspect of natural conditions (Ashraf, Öztürk, 2012, p. 25).

The following table provides basic agricultural activities and their interaction with environmental problems.

Table 1. The environmental issues caused by the impact of agriculture

Agricultural activities	Environmental issues caused by agricultural activities
Use of pesticides, artificial fertilizers, etc.	Impact on human health through residues in food, soil and water
Throwing fertilizers and animal waste into underground and aboveground waters	Water pollution
Converting harmful gases in steam due to excessive use of fertilizers, straw firing and similar	Air pollution
Inadequate land and waste management	Filling, erosion and soil contamination
Destroying natural habitats as a result of the abandonment of traditional agricultural production; replacing old local varieties with new ones	Loss of biodiversity and genetic erosion
Increasingly large holdings within the farm that impose the use of intensive machinery with monocultures	Landscape change
Excessive irrigation with low efficiency	Groundwater exhaustion
Livestock on farms and waste that it produces	Unpleasant smells

Source: Lasa, B., Aparicio-Tejo, P.M.; Lamsfus, C., Irigoien, I. (2010): *Interaction between agriculture and the environment*. Agricultural Sciences: Topics in Modern Agriculture, Texas, USA: Global Media

Although there are few agricultural methods that can be considered as purely sustainable, there are still some of the other methods that contribute to the achievement of this goal (Horrigan, Lawrence, Walker, 2002, p. 452). Those methods are the following:

- *Crop rotation*. Farmers interrupt the reproductive pest flow and reduce the need for their control by rotating two or more crops in the fields; rotation sometimes reduces the need for fertilizer use since one type of crop produces nutrients for the next crop.
- *Covered crops*. They contribute to the maintenance of soil quality, prevention of erosion and minimization of weedy appearance.
- *Agriculture with or without minimal land cultivation*. This system is based on the fact that minimizing soil treatment increases the retention of water, nutrients and maintenance of the surface layer of the soil.
- *Land management*. A good farmer should adequately manage everything in his possession, in particular physical, biological and chemical means. In this way, the products obtained by cultivating the soil become safe for human health.
- *Variety*. The cultivation of different types of crops appears as a solution to both economic and environmental problems. Monocultures are not suitable either for pests or they are more sensitive to market price fluctuations.
- *Integrated pest management*. This system uses biological methods against pests; the use of pesticides is practiced only as the ultimate solution if the previous ones did not end up with adequate results.

Agricultural activities have a wide range of positive and negative impacts on the quality of the environment. They can lead to disturbing the quality of soil, water and air, but also to endangering natural habitats and biodiversity. However, agricultural activities can be useful in reducing the greenhouse effect, preserving and improving biodiversity, but also in the prevention of floods and landslides. Therefore, in most countries, the

agricultural sector is under strong state intervention and policies to control the impact on the environment. This has a significant impact on agricultural production, its location, agricultural practice, but also the used management system (OECD_b, 1999).

Conclusion

At the global level, economic progress has brought numerous, both positive and negative changes. They have been reflected in almost all economic sectors, emphasizing the need to take into account their long-term sustainability in addition to short-term economic goals.

The future agricultural development will focus on the ecological aspect which will bring out new strategies and policies paying more attention to the environmental protection. Permanent reforms of agricultural policy should keep pace with the requirements for environmental protection. Proposing further directions of development also implies taking into account possible implications for the environment. It is obvious that market liberalization and subsidy reduction contribute to achieving this goal by reducing incentives for intensive production (Nielsen, Pedersen, Christen, 2009, p. 383).

Agricultural production modifies the natural environment much more than other human activities. It represent at the same time an opportunity and threat for the preservation of biodiversity.

The aim of sustainable agriculture is to have benefits throughout the society, not only in food production, but also in maintaining ecosystems in terms of water, forest and soil quality. Thus, farmers should be rewarded not only for food production, but also for the provision of various ecological services. By rewarding sustainable production, the productivity would increase and its profitability would be encouraged in the short, medium and, first of all, the long-term (Clay, 2003, pp. 2-3).

The future farms will be significantly different from the present ones. They will employ managers who are creative and innovative, and who will base their business on economic, ecological and social sustainability, thereby contributing more to the welfare of the community. However, the transition to a "sustainable world" will primarily depend on the ability to integrate technological, economic, environmental and social principles into the service of a healthy environment and economic development.

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