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FOOD SECURITY THROUGH SUSTAINABLE AGRICULTURE

ABSTRACT

Food security is based in sustainable agricultural production, and the rational use of resources has a key role in ensuring a quality production. One of the most important challenges in ensuring food security consists in increasing food production under the background of soil degradation. Starting from this interdependence, the paper attempts to provide a theoretical-methodological framework referring to the clarification of the food security and sustainable agriculture concepts. For this purpose, relevant indicators have been identified: food and nutrition security indicators, indicators that can evaluate the multi-dimensional aspects of food security and agroenvironmental indicators that can describe the present situation and trends of agriculture environmental performance.

Key words: food security, natural resources, sustainable agriculture, Romania.

JEL Classification: Q01, Q10, Q18.

1. INTRODUCTION

Sustainable development in agriculture includes certain criteria for ecosystem, soil, air and water protection and biological diversity conservation. The economy of natural resource exploitation aims at maintaining the food security together with avoiding the exhaustion of the existing natural resource base, of soil resources in the first place. An important factor in ensuring food security consists of the study of anthropic influence upon land areas and soil resources.

2. GENERAL BACKGROUND

Food security is based on sustainable agricultural production, and **the rational utilization of resources** plays an essential role in this process. In this context, the most important challenges in reaching food security are the following: production growth under the background of soil degradation and limited fresh water resources; sustainable production methods for the protection of resources; the losses along the food chain; the sale of food production coming from the family farms; infrastructure and urbanization and the use of farm production for bioenergy purposes.

The main objectives of sustainable agriculture consists in agricultural production growth while tasking into consideration the conservation and protection of renewable resources; meeting the people's basic needs, health and environment

protection; maintaining the possible risks under control; development and implementation of certain integrated plans and programs, of good agricultural practices and last but not least of evaluation and monitoring methods.

3. METHODOLOGY AND DATA SOURCES

In order to define and delimit the subject, we conducted a bibliographic research study, several data sources being consulted, i.e. reference books and specialty scientific papers. The research was materialized in approaching the issues in their evolution, worldwide and at European level, within FAO, EUROSTAT, OECD etc. The relevant indicators for the approached domains were identified: the food and nutrition security indicators and the environmental indicators.

4. RESULTS

4.1. Food security. Concept and monitoring indicators

The concepts that presently lie at the basis of “food security” and “nutrition security” were established in the early 1940s, during the second world war, under the background of the severe hunger that affected numerous European populations. In the period May – June 1943, the United Nations Conference for Food and Agriculture took place; on this occasion, the participating governments committed themselves to establish a permanent organization of the United Nations for Food and Agriculture. Thus, the Food and Agriculture Organization (FAO) was established as specialized agency under the United Nations Organization in the year 1945, at the first session of the FAO Conference in the town Quebec in Canada.

With the emergence of the world oil crisis and of the food crisis in the period 1972-1974, the public interest in global and domestic food security grew very fast.

The first world Food Conference was held in Rome in November 1974, and on this occasion a declaration was adopted that recognized the inalienable right of each citizen, man, woman or child, of not suffering from hunger and malnutrition, in order to fully develop and maintain their physical and mental faculties. The Conference report specifies that the nowadays society already has sufficient resources and the necessary organizational and technological capacity, and thus the competence to reach this objective. The eradication of hunger is consequently a common objective of all countries from the international community.

The food security concept evolved in the last thirty years, with the development of the official public way of thinking (Clay, 2002; Heidhues et al, 2004)¹. Amartya Sen (1981) enlarged the food security concept, focusing on the rights of the natural persons and households. The author’s studies led to the recognition of the fact that a sufficient food supply does not permit *per se* the ensurance of food

¹ Bingxin Yu; Lingzhi You A typology of food security in developing countries, *Follow China Agricultural Economic Review*, Volume 5 (1): 36 Emerald Publishing – Jan 25, 2013.

security at individual and household level, as it is also necessary that the poor and vulnerable people have physical and economic access to food. In that period, the FAO studies focused on the access to food, which led to a definition of food security based on the equilibrium between supply and demand; yet, after a series of low cereal harvests in the early 1980s, the food security concept was revised and enlarged by FAO, in order to incorporate food security at both individual and household level, besides the regional and national aggregated levels.

The 1986 World Bank Report on poverty introduced the difference between the chronic food insecurity, associated to permanent poverty problems or to structural problems and low incomes and the food insecurity mainly linked to critical transitory periods caused by natural disasters, economic conflicts, etc.

The specialty literature on food security considerably developed, numerous definitions being proposed. Maxwell and Frankenberger (1992) identified 194 different studies on the concept and definition of food security and 172 studies on the specific indicators. John Hoddinott² (1999) considers that the assessment of food security is necessary from the very beginning for any development project, in order to identify the unreliable food products, in order to evaluate the food deficit severity level and to characterize the type of food insecurity (seasonal versus chronic). Furthermore, this provides the basis for monitoring the progress made and assessing the impact of projects on the food security of the targeted groups. Concerning the potential food security indicators of households, Hoddinott identified about 450 indicators in the specialty literature.

The World Food Summit of 1996 and the Declaration of Rome on the world food security together with the Plan of Action lay the basis of a common objective – food security at individual, household, national, regional and global levels. In these documents it was agreed that “Food security exists when all people, at any moment, have physical and economic access to sufficient, safe and nourishing foodstuffs, that meet the food requirements of the human body, so as to lead a healthy and active life”.

The definition given on this occasion became one of the most frequently used in the specialized literature, this covering the **multidimensional aspects of food security** that can be taken into consideration, both in quantitative and qualitative terms, according to **four characteristics**:

1. **food availability** – availability of foodstuffs in sufficient amount and adequate quality, supplied from the domestic production or from import (food aid included).

2. **access to food** – everybody has access (rights) to adequate resources to get adequate and nourishing food; from economic perspective, accessibility means the possibility of individuals and households to procure food either from their own production or by buying it, without sacrificing other basic needs; physical accessibility means access to food for all persons, for physically vulnerable persons included, such as children, sick people, disabled people or elderly people.

² Hoddinott, John. *Choosing outcome indicators of household food security*. Washington, DC: International Food Policy Research Institute, 1999.

3. **availability and access stability** – the access to food should not be endangered by the emergence of sudden shocks (for instance an economic crisis or adverse weather conditions) or cyclical events (e.g. seasonal food insecurity).

4. **health** – the foodstuffs should meet the nutritional requirements, taking into consideration the age, living conditions, health, work, gender, etc.; at the same time, food must be produced under safety conditions for people and free from noxious substances such as pollutants from industrial and agricultural processes, including residues of pesticides, hormones and veterinary drugs.

Table 1
Food and nutrition security indicators

Indicator	Indicator description
Food energy consumption	This indicator estimates the average individual energy consumption from food. It is expressed in kilocalories per capita per day (kcal / capita / day)
Total food consumption in monetary terms	This indicator estimates the money spent on food per capita per day. This includes only the food consumption expenditures. It is expressed in monetary terms, per capita per day (MU / capita / day).
Total consumption in monetary terms	This indicator estimates the money spent on consumption per capita per day. This includes both food and non-food expenditures (for example goods and services). It is expressed in monetary units per capita per day (MU / capita / day).
Average carbohydrate consumption	The indicator estimates the average amount of carbohydrates consumed by individuals. It is expressed by grams per capita per day (g / capita / day).
Average fat consumption	The indicator estimates the average fat value consumed by individuals. It is expressed in grams per capita per day (g / capita / day)
The average protein consumption	The indicator estimates the average amount of proteins consumed by individuals. It is expressed in grams per capita per day (g / capita / day)
Energy consumption from food in monetary value (MU/1000 kcal)	This indicator estimates the average monetary value spent for the procurement of 1,000 de kilocalories. This is expressed in currency per 1000 kilocalories (MU / 1000 kcal).
Share of energy consumption from glucides and alcohol (%)	This indicator estimates the share of food energy consumption from glucides and alcohol in total dietary energy consumption. It is expressed in percentage (%).
Share of energy consumption from fats (%)	This indicator estimates the share of food energy consumption from fats in total dietary energy consumption. It is expressed in percentage (%).
Share of energy consumption from proteins (%)	This indicator estimates the share of food energy consumption from proteins in total dietary energy consumption. It is expressed in percentage (%).
Share of food consumption (%) in total income	This indicator estimates the percentage of total income devoted to food (Engel correlation) that tends to be higher on the poor households, as these give priority to purchasing goods for primary needs and limit their expenditures on other items; it tends to be lower on rich households, as these increase their expenditures for non-food and luxury goods. The indicator is expressed in percentage (%).
Share of food products <i>produced on the household</i> in total food consumption (%) (in the food energy consumption)	The households can procure their food in different ways. The food sources are classified into four main categories: bought, from their own production, from other sources (including gifts/aids, payment-in-kind, etc.), and outside the house. The share of food energy from own production is an estimation of the food energy consumption from own production in total food energy consumption. This is expressed in percentage (%).
Share of <i>bought</i> food in total food consumption (%) (in food energy consumption)	The households can procure their food in different ways. The food sources are classified into four main categories: bought, from their own production, from other sources (including gifts/aids, payment-in-kind, etc.), and outside the house. The share of food energy from bought foodstuffs is an estimation of the energy percentage from these foodstuffs in total food energy. This is expressed in percentage (%).
Share of food <i>consumed outside the household</i> in total food consumption (%) (in food energy consumption)	The households can procure their food in different ways. The food sources are classified into four main categories: bought, from their own production, from other sources (including gifts/aids, payment-in-kind, etc.), and outside the house. The share of food energy outside the household is an estimation of the energy percentage from these foodstuffs in total food energy. This is expressed in percentage (%).
Share of food <i>from other sources</i> in total food consumption (%) (in food energy consumption)	The households can procure their food in different ways. The food sources are classified into four main categories: bought, from their own production, from other sources (including gifts/aids, payment-in-kind, etc.), and outside the house. The share of food energy <i>from other sources</i> is an estimation of the energy percentage from these foodstuffs in total food energy. This is expressed in percentage (%).

4.2. Role of agriculture in ensuring food security. Agroenvironmental indicators

Food security is most often associated with food self-sufficiency and with the need to produce more food. For the low income economies, in which a high population percentage lives in the rural area and their incomes depend on agriculture, food production growth could be an important element in food security increase, from the perspective of increased incomes for the small farmers. However, food security has much closer links with poverty problems, labour employment and income generation. In the developed countries, the focus lies on food quality and safety and on the social protection of different categories of persons.

The more recent approaches provide a special importance to “food autonomy” as factor of food security stability, which reduces the vulnerability related to the domestic and world agricultural market fluctuations³.

The food security for the population is based on sustainable food production, and the **rational use of resources** has an essential role in obtaining the necessary food production. Sustainable agriculture has as main objectives the optimization of soil productivity and at the same time the conservation of basic natural resources. This means that in the agricultural production systems an equilibrium will be maintained between inputs and outputs, between investments and benefits, in the conditions of ensuring an adequate environment quality and promoting an overall sustainable economy.

The agroenvironmental indicators developed by OECD and EUROSTAT in the last 20 years can describe and evaluate the situation and tendencies in the environmental performance of agriculture so as to provide useful indications to scientists and political decision-makers on the environment situation, on the effects of different policies as well as on the efficiency of financial resources allocated to environment protection. The monitoring indicators target the domains on which agriculture may have a major impact, namely air and climate changes, energy, fertilizer consumption, land, animal herds, pesticide use, soil and water.

As the **rational use of natural resources** plays an essential role in agricultural production, one of the most important **challenges** in reaching food security consists of the increase of food production under the background of soil degradation.

There is an increasing demand of soil data, as the crucial role of these data in food security matters is widely recognized at present.

At global level, man-induced soil degradation is monitored by the study *Global Assessment of Human-induced Soil Degradation* (GLASOD). This study was a joint work by ISRIC – World Soil Information and the United Nations Environment Program (UNEP) in the 1980s. The GLASOD database is the only set

³ Dinu Gavrilăscu (coordonator), Cecilia Alexandri, Interdependențe între dezvoltarea durabilă a agriculturii și a spațiului rural românesc cu țările membre ale UE, Editura Expert, București, 2007.

of data available on soil degradation problems. GLASOD has identified five soil degradation degrees: non-degraded (0), slight degradation (1), moderate degradation (2), strong degradation (3), extreme degradation (4). The definitions of degradation degrees are given according to the following: agricultural adequacy, extent to which the biotic functions have been or not affected, possibility of productivity restoration.

Table 2
Agroenvironmental indicators

Field	Sub-field	Indicator	
Air and climate changes	Ammonia emissions	Ammonia emissions (NH ₃) from agriculture in total ammonia emissions	
Energy	Energy consumption in agriculture and forestry	Energy consumption in agriculture and forestry as % of total energy consumption	
	Bioenergy production	Bioenergy production as % of total production of energy from renewable sources	
Fertilizer consumption	Nitrogen consumption	Utilization of nitrogen fertilizers on arable area and area under permanent crops (tons of N/1000 ha)	
	Phosphorus consumption	Utilization of phosphorus fertilizers on arable area and area under permanent crops (tons of P ₂ O ₅ /1000 ha)	
	Nitrogen and Phosphorus	Utilization of Nitrogen and Phosphorus fertilizers on arable area and area under permanent crops (tons of N+ P ₂ O ₅ /1000 ha)	
Land	Agricultural area	Agricultural area as % of land area	
	Change of agricultural land destination	Changes in agricultural land area (% per year)	
	Area equipped with irrigation facilities	Area equipped with irrigation facilities as % of agricultural area	
	Conservative agriculture	Area under conservative agriculture (>30% group coverage) as % of agricultural area	
	Type of crop		Area under permanent crops as % of agricultural area
			Area under meadows and pastures as % of agricultural area
	Area under organic farming	Area under organic farming as % of agricultural area	
Protected areas	Protected (terrestrial) areas as % of agricultural area		
Animal herds	Livestock density	Livestock density per agricultural hectare (Total number of animals/ha)	
	Cattle and buffaloes	Cattle and buffaloes as % of total animal herds	
	Pigs	Pigs in total animal herds	
	Sheep and goats	Sheep and goats as % of total animal herds	
Pesticides	Backyard poultry	Poultry in total animal herds	
	Pesticide use	Pesticides used on arable land and land under permanent crops (tons/1000 ha)	
Soil	Soil erosion – GLASOD	Average soil degradation expressed in GLASOD erosion degrees	
	Land degradation – GLASOD	Average land degradation expressed in GLASOD erosion degrees	
	Carbon in the upper soil layer	Average carbon content in the upper soil layer as weight percent	
Water	Water utilization in agriculture	Water used in agriculture as % of total utilized water	

At European level, the relation between agriculture and environment was taken into consideration when the integration of environmental concerns and environment protection measures into the Common Agricultural Policy (CAP) was envisaged. Under PAC, the focus is laid on the diminution of environment degradation risks and the improvement of agricultural ecosystem sustainability through:

- Cross-compliance criteria on the agricultural market measures – **as a condition to receive direct payments** (farmers have to comply with certain conditions, including certain environment requirements)
- The targeted agroenvironmental measures – **as part of the rural development programs** (the agroenvironmental payments are provided to farmers who commit themselves, for a minimum period of five years, to adopt agroenvironmental management systems).

At present, under the Common Agricultural Policy, the responsabilization of each farm is a must for the respect of a set of agrotechnical set of principles with beneficial impact upon soil, the main requirement of which is the incorporation of environmental factors in measuring the performance of agricultural holdings.

5. CONCLUSIONS

The specialty literature on food security has considerably developed, numerous evaluation indicators being proposed.

Food security assessment is necessary for any development project, in order to identify the unreliable food products and evaluate the severity of food deficit and to characterize the nature of food insecurity.

The base of food security is represented by a reliable and sustainable agricultural production, and the **rational use of resources** plays an essential role in obtaining this production.

The agroenvironmental indicators have the role to describe and evaluate the situation and trends in the environmental performance of agriculture in order to supply useful indications to scientists and political decision-makers.

6. ACKNOWLEDGEMENTS

“This work was financially supported through the project: *Routes of academic excellence in doctoral and post-doctoral research – READ*, co-financed through the European Social Fund, by the Sectoral Operational Program Human Resources Development 2007-2013, contract no. POSDRU/159/1.5/S/137926.”

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