

SYSTEMS RESEARCH INSTITUTE,  
POLISH ACADEMY OF SCIENCES, SZCZECIN DEPARTMENT  
AGRICULTURAL UNIVERSITY OF SZCZECIN  
FACULTY OF ECONOMICS AND ORGANIZATION OF FOOD ECONOMY

# MODELLING OF ECONOMY IN SPECIALLY PROTECTED REGIONS

*Proceedings of the international conference  
held on 9-11 june 1994 in Drawno, Poland*

SZCZECIN 1994

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## SYSTEM FORMULATION OF THE ECOLOGICAL FOOD PRODUCTION

*Zygmunt Dowgiałło*

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The purpose of the paper is to present some selected problems regarding the production of ecological food. The study deals with some aspects of a system approach, concerning couplings and dependencies within the framework of a general ecological food production system and connections between this system and the environment.

The objective of the ecological food production is to protect both natural environment and consumers' health, as well as to ensure profitableness of ecological farms, supplying home and foreign markets with their products. The ecological production system includes such elements, as:

- a) farm production system,
- b) storage and processing,
- c) organizational elements and production conditions in a region,

- d) legal regulations (writs, prohibitions, rules),
- e) economical and financial aspects concerning environment protection costs, credit policy and charges for the usage of natural resources,
- f) institutional governing bodies, approving, supervising and controlling investments,
- g) training of specialists in the field of environment protection and education of the society,
- h) applied research and elaboration of technological standards,
- i) information system including: current monitoring of emergency states of environmental elements, a system of data bases on progress in the methods of prevention and repression, methods of prophylaxis, analysis and preservation.

As the ecological agriculture<sup>1</sup> we mean a farming system of balanced plant and animal production within a single farm, based on technologically non-processed means of production of biological and mineral origin. The system of ecological agriculture, despite low energy expenditures from beyond the farm, ensures permanent soil fertility and high biological quality of agricultural produce.

As the main distinguishing marks of the ecological production method *Urszula Soltysik*<sup>2</sup> mentions maintenance of a farm agrosystems efficiency, biological self-regulation through protection of agricultural production environment, assurance of obtaining agricultural produce of natural qualitative properties, that is the products which are grown in natural conditions with a limited interference of a man.

Legal standards of the European Community establish legal and organizational criteria referring to the production and

<sup>1</sup>Three notions are treated as synonyms: organic agriculture, biological agriculture, ecological agriculture.

<sup>2</sup>Urszula Soltysik: *Ecoagriculture - a chance on speciality*, Warsaw, 1993.

turnover of products manufacturing by the so-called ecological agriculture. EEC's Regulation no. 2092/91<sup>3</sup> determines the principles of both ecological agricultural production and trade designation of corresponding products and foodstuffs in conformity to the requirements of IFOAM (International Federation of Organic Agricultural Methods).

The choice of proper soil cultivation technology is motivated by effects concerning :

- a) quality of products,
- b) maintenance of productive values of soil of appropriate humus content and microorganisms activity.

Balanced proportions of the used mineral components, with avoidance of unreasonable specialization, are supposed to ensure the production of healthy food. The principles of biological agriculture in Japan postulate the creation of a relatively closed system of materials and energy within a single farm, which is also connected with religious farmers' beliefs.

Some American ecological farmers permit a possibility of the usage of pesticides on a limited scale. But the other reject the use of the latter and allow only the application of small doses of mineral fertilizers. The opinions on the usage of organic fertilizers are also divided. Some so-called ecological farmers think that it is permissible not only to use some organic wastes purchased beyond the farm, but also to apply, produced for commercial purposes, organic manures and composts stimulated by means of microorganisms.

A trend of bio-dynamic agriculture, popularized by *Rudolf Steiner* from Vienna, emphasized a great importance of the use

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<sup>3</sup>EEC Regulation No. 2092/91 (Regulation on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs).

of various ferments and vaccines, stimulating the activity of microbes, or the use of earthworms, influencing a creation of small composts.

*Joseph Cocannouer* from the USA has stated that one of the main farmer's tasks is to direct the circulation of matter in such a way that trophic elements of plants are reproduced. He has also claimed that large doses of artificial fertilizers can be safely used in the case of soils of high humus content.

Recommendations of the so-called *Report and Recommendations* on ecological agriculture, worked out in the USA, indicated that, within the production system, papilionaceous plants account for a significant part (up to 40 per cent of the cultivated area) of the whole crop rotation applied in the ecological farms. This type of agriculture is also characterized by high culture of meadows and pastures maintenance.

In ecological farms in the USA usually only shallow, not deep, ploughing is performed. Plant preparation to growing, seeding, planting and ways of crops harvesting do not differ considerably from those applied by conventional farmers. The manures used, crop residues, ways of stimulation of biological fixation of nitrogen with various organic materials are complemented by little amounts of mineral fertilizers.

Among the factors, which significantly affect the quality of agricultural products one should name<sup>4</sup>: location of the cultivated land in relation to sources of pollutants emission, distance from storage yards with solid wastes, neighbourhood of roads of great traffic intensity, degree of dust and gas contamination. It is recommended not to grow edible plants within protection zones of industrial establishments, at distances less than 500 metres from dust storage yards or ponds containing pollutants and wa-

<sup>4</sup>Stefan Kozłowski: Economy and natural environment, PWN, 1991, p. 84.



stes, and at distances exceeding 50 metres from roads of high traffic intensity. Hazards for edible plants may also come from old dumping grounds of municipal or industrial, even recultivated, wastes and they can also arise because of cultivation of post-industrial land. It is estimated that in Poland 11.75 per cent of the total land area can be regarded as contaminated regions.

In the ecologically imperilled regions and with additional concentration of industry along communication lines the most endangered are plant growing and milk production. In cereals the pollutants cumulate in their ears and corn milling usually does not remove them.

The high degree of water pollution also causes a lot of negative phenomena and accounts for the lack of improvement in the food processing industry. Unfortunately, scientific investigations of rivers, streams and lakes, carried out every several years, do not indicate any satisfactory progress in this field.

Popularization of ecological food is accompanied by the research on manufacturing of more valuable, for our health, food. This research concerns:

- a) creation of new animal breeds, giving less fatty meat and of desired composition of fatty acids,
- b) creation of new specimens of plants. for instance rape, by carrying out proper breeding work,
- c) manufacture of products which satisfy the principles of dietetic nutrition and prevent tumour and allergic diseases.

The aim of the research carried out at present is to make products of higher content of cellulose. The research has proved that about 40 various plants reveal features preventing or stunting tumour processes. The biological investigations are expected

to enable the production of so-called medical food<sup>5</sup> for nutrition needs of sick people.

The problem of research on food quality and establishment of standards of "safe" pollution and admissible "contamination" is still of great importance. Food produced should maintain or recover consumers' health. In this respect as alarming must be considered the forecasts, which predict that in the year 2000 only about 10 per cent of all farms in the EC countries will deliver healthy, that means tested, satisfying all established standards, food.

On the basis of results of the research carried out in the USA by *Berardi* we quote the following table. In the table the efficiencies of both conventional and so-called biological economy types are compared.

The data presented show that the energy consumption is much higher in the conventional type of economy and, after all the costs have been calculated in megacalories, we can see that the total energy expenditure per 1 hectare is 33 per cent higher in the conventional economy, compared to the biological one. It is also seen that biological farmers produce at about 130 per cent higher own labour costs, which is due to partial use of horses, instead of tractors, in the ecological farms.

Table 1 also indicates that, with omitting living labour costs, the production cost per 100 kg of wheat is even slightly lower in the biological farms. On the other hand, inclusion of the former costs into the total costs increases the total production costs in ecological farms to the level of 40 per cent higher than in the conventional ones. The above-discussed results cannot be, however, generalized on the whole economy, because the comparison

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<sup>5</sup>Antoni Rutkowski: Medical and dietetic food, *Food Industry* (monthly), no. 4, 1993.

concerns only a small number of farms and the price relations characteristic for the United States' agriculture.

Table1

Comparison of wheat growing efficiency in conventional and ecological farms.

	Specification	Unit of measure	Type of farming	
			conventional	ecological
1	average land area	ha	13	7
2.	nitrogen fertilization	kg/ha	40.4	124.7
3.	yield	kg/ha	129.6	123.0
4.	total energy expenditure	Mcal/ha	2855	1934
5.	total production	Mcal/ha	9782	7608
6.	ratio between production an energy expenditure	%	343	394
7.	production cost of 100 kg of wheat (excluding labour cost)	US\$	5.20	15.06
8.	production cost per 1 ha (including farmer's labour cost)	US\$	256.7	360.9

It follows from the research carried out in the USA that the prices of fruit and vegetables produced in non-conventional conditions are about twice as much as those obtained in conventional conditions. The latter is explained by the fact that ecological foodstuffs are produced in the farms of smaller land area, with greater costs of handiwork, with smaller yield and greater losses, and with greater expenditures on transport, processing and sale.

Higher unit costs are due to lower yields obtained from 1 hectare of land and due to additional living work expenditures on composting, weeding and organization<sup>6</sup>.

<sup>6</sup>The World Wild Found in Geneva postulates a need of inclusion of natural environment

An ecological farmer invests in quality, not in quantity. That is why he has to get higher prices for the products which he delivers onto the market, in order to cover his higher production costs and to give him just wages for his work. In the Western countries we can now observe that the increase in prices of the production means surpasses the increase in sale prices on agricultural products. Because of that the transition of farms applying highly intensive technologies towards ecological production may be economically profitable. As an example may serve the German agriculture, where the level of production means prices has already been very high, and despite this still continues to grow. Therefore, as the economists maintain, the financial situation of ecological farms in this country is advantageous, since the production costs per unit of yield are about 25 per cent smaller in comparison with conventional farms.

Consumers are ready to support more expensive, but safer for their health, products. In particular, in concerns developed countries, where the share of food expenditures in the total living costs does not usually exceed 20 per cent. It is confirmed by still growing demand for the so-called "green products", "ecological food" etc.

The system of ecological production comprises farms or groups of farms of a given region and forms a certain entirety, corresponding to assumed requirements. The methods of ecological economy are implemented under appropriate supervision. The period of transition to the type of ecological production takes usually two to three years. The products of such farms can be sold as ecologically guaranteed only after full implementation of the new production system has been completed. Thus, the

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protection costs into the final product prices. Disregard of this postulate by GATT leads to further increase of environment degradation. In: *Ecological Agriculture*, Warsaw, 1993, p. 88.

EC provides financial support for such farms during the entire period of transition to a new type of production.

Market designation of ecological products takes into account the consumers' interest. The farm is treated as a system constituting a certain economical entirety connected with the environment.

Transition to the ecological agriculture affects the farm as a whole, not only changes in chosen production profiles. During the transition period an appropriate recording of undertaken steps and production expenditures is carried out. The farms are supervised and controlled. Only on the basis of regular inspections of a farm, and after the assertion that the farm and its products satisfy established criteria, the farm is granted a certificate giving the right to designate its products with special trade marks. The certificate is valid for only one year, and its further prolongation is possible only after the next controlling procedure has been passed.

Legal regulations impose on the EC countries, as well as the countries trading with them, the duty to indicate institutions which are entitled to supervise ecological production systems and to carry out conformity certification. An adaptation to the standards of the Community has already been possible also in Poland, owing to the EKOLAND organization. This organization, now covering the whole country, has based its activities on international criteria recommended by IFOAM<sup>7</sup> i.e. the same regulations which were used during establishment of legal acts in the EC countries<sup>8</sup>.

The Association of Food Producers Applying Ecological Me-

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<sup>7</sup>IFOAM - International Organization of Organic Agricultural Methods.

<sup>8</sup>Council Regulations (EEC) No. 2092/91 of 24 June 1991 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs.

thods "EKOLAND" was registered by a court on 1st September 1989. This association is an all-Polish conformity certification organization, which means that it has the authority to grant certificates, acknowledged on international markets, to the farms which satisfy the criteria of ecological agriculture.

In the West European countries the awareness is now developing, that the more processed foodstuff (i.e. preserved, crumbled, refined, heated, conserved, granulated, coloured, enriched) the more it loses its original natural values.

Plastic packs are a source of serious danger for the environment. A consumer wishes to buy a natural, full value product, without any pollutants. Making a decision of buying the food produced in ecological farms, the consumer should be aware that this type of food has advantageous features, overpassing the values of conventional products. The former products have less nitrates, less pollutants, greater storage capacity, greater health values, greater dry matter content and better flavour values.

Before the strategic decisions in the field considered have been made some preparatory work must have been done, including:

- a) market analysis;
- b) elaboration of promotion programmes;
- c) proper forecast of credit policy;
- d) design of ecological regions, in accordance with assumed requirements;
- e) design of farms organization, orientated to production of ecological food;
- f) design of production systems of specific agricultural materials, in conformity with the EC standards,
- g) design of processing systems, providing products satisfying market needs for ecological food.

The present boom on the ecological foodstuffs must be met by us. In order to successfully implement programs of ecological production in the farms it is necessary to prepare competent specialists-advisers in this field. The process of making decisions by farmers wishing to pass on to ecological economy should be preceded by collection of relevant knowledge and specific information concerning:

1. Organization system and criteria of ecological production;
2. Sales opportunities as well as demands and needs of local, nation-wide and foreign markets;
3. Regulations and standards being currently in force.

The advisers ought to have complemented a proper specialistic training courses. In their work they should apply the results of research on organization and economics of farms, which have already implemented the ecological system of production. But in the first place the problem of profitableness of ecological farms should be taken into account.

### **Concluding remarks**

The production of healthy food requires appropriate legal regulations concerning the conditions which entitle to the use of of the terms: "ecologically healthy food" or "food produced in ecologically controlled conditions". The above-said is associated with the need of working out organization projects of agricultural farms orientated to healthy food production. These projects ought to be elaborated on the basis of economical criteria and indicate the unit production costs of ecologically clean commodities. The costs of undertaken pro-ecological activity should be

covered not only by a given unit, but also by means of bank credits.

The producer wishes to obtain such an income from his agricultural farm, which will allow to satisfy his family's needs, will give him insurance against the risk of working in agriculture and which will enable to reproduce means of production as well as fixed assets.

One should create such conditions for the farming system, so that the consistence of the above-mentioned consumers' objectives and general interest of the whole society as well as economical goals of the producer of ecological food, satisfying market demand, are all ensured.

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