

Agriculture's Sustainable Development in Bulgaria

**Senior Research Fellow
Violina Hadjieva, Ph.D.**

Summary: The objective of this article is to offer a system of indicators for the study of sustainable agriculture development in the period 1997 – 2005 after the adoption of the currency board, based on the concept of sustainability and the understanding that sustainable agriculture is economically efficient, socially acceptable and environment friendly.

Analysis showed a low-profile development of agriculture after 1997 – up to only about 1/2 of its potential. The demographic characteristics of rural population are deteriorating. New ecological issues emerge and the existing ones persist. The answer to the question whether Bulgarian agriculture is sustainable or not, is ambiguous: farming experienced some economic stabilization during the past nine years, on the one hand, but with low productivity, high capital inputs and extensive form of production that made it inefficient and highly dependent on weather and climate; from a social point of view, it is not among socially attractive activities not only due to its permanent specificity but also because of the slow crisis overcoming; its ecological characteristics do not comply with the regulations for preservation of environment, therefore, agriculture does not comply with the criteria of sustainability.

Keywords: agriculture, sustainable development, economic, social and environmental aspects.

JEL: 01, 013.

Appearance and essence of sustainable development

Sustainable development has been widely discussed in the recent years. Yet, this issue dates back in time. The concept of sustainable development of economy and population was first presented in economic literature by James Stuart Mill (1857). According to him, a static status is characteristic of a static population, operating with static capital¹.

Daly, H.² contributed further to the understanding of sustainable development by relating it to a steady reserve of population and resources, at that, technical progress and population are presented as an integral part of environment. H. Daly recommended that population is stabilized by means of birth control (2 offspring per family) as well as resource control within reasonable limits by means allocation policy. This is the solution he offered to excessive consumption of resources, claiming that in this case environmental activities did not have to be controlled.

The Roman Club (1968) presented its solution to the issue of limiting the intensive use of natural resources in the report "Limits to Growth",

¹ Mill J. S. Principles of Political Economy, Paret, L., 1857.

² Daly, H., Steady State Economics, Freeman, San Francisco, 1977.

which predicted extinction of humanity unless it ceased its development and changed its attitude to natural resources.

Other reports with more moderate and optimistic forecasts followed. Gradually, the theory of sustainability expanded beyond the limits of environmental economy. It acquired an interdisciplinary character by connecting multiple economic and non-economic sciences and posed the issue of resource allocation between generations that would make economic development a result of interaction of different forms of capital – natural, material and social.

Natural capital (C_n) encompasses natural resources such as land, water and air, the subject of analysis in the theory of sustainable development being this combination of the separate elements of the capital that would allow the preservation of ecosystems so that the living environment and welfare of future generations do not deteriorate compared to current status.

Material capital (C_m) is the material and technical foundation of economy. It comprises the machines, equipment, buildings, producing animals and perennial plants.

Social capital (C_s) is the form of capital that includes society with its institutional organization and social values.

The functional relationship between the different forms of capital are complex, they depend on many factors as well as the achieved level of social development and can be expressed in an unlimited number of variants and characteristics. This complexity is enhanced by the fact that economics treats the utilization of different forms of capital as alternates. In other words, the acquisition of one kind of welfare deprives

us of another one. For instance, the building of a pig farm takes away farming land, pollutes the air with ammonia and may cause environmental pollution with wastes. Some factors do not have an alternative, because nothing can compensate for their loss. Functioning of capital is accompanied by two types of changes:

- quantitative, expressed in economics by its depreciation (D) and
- qualitative, that may be positive when improving quality, marked with (Y) and negative or degrading (D), when quality is deteriorating.

Every capital may increase – this is progressive development (G) and, vice versa, decrease or regress. Development is assumed to be sustainable when quality improves and progressive development prevails over the quantitative changes related to capital decrease and quality deterioration. Conditionally, sustainable development can be expressed for all forms of capital as follows:

$$G + Y > A + D.$$

Sustainable development is a function of the capital as well:

$$Y_s = f (K_{np}, K_m, K_c).$$

The most recent concept of sustainable development in the XX century was adopted at the UN Conference on Environment and Development in Rio de Janeiro in 1992. It is based on a concept dating back to 1987 and states that sustainable development is “a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development; and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations”³. In Agenda 21 of Rio

³ Our Common Future. World Commission of Environment and Development, New York, 1987, p.46

de Janeiro, sustainable development is defined as “one that will accommodate the basic needs of its present inhabitants while preserving the resources that will enable future generations to flourish”. The agenda has formulated 27 principles of sustainable development that synthesize the global problems of mankind and have to be solved on world, national and local levels. Agenda 21 is not legally obligating as international treaties but is important for government policies concerning environment and development.

Sustainable Development of Agriculture

Agriculture fits most adequately into the sustainability concept for two reasons – on the one hand, it secures population nutrition and on the other, it is closest to the utilization and condition of natural resources. Therefore, the aspects of sustainability of farming are subject to lively discussions and comments.

The concept of sustainability of agriculture spread very fast and developed in different aspects such as biological, economic and social. The most popular concept of sustainability is related to ecology and says that a farming system can not be defined as sustainable if it harms the environment.

According to other points of view, sustainability is the capacity for sufficient and non-decreasing with time production of food products per capita. The focus here is social and concentrates on the utilization of technical progress and market mechanisms.

There is another understanding that relates sustainability mainly to the better revenue

distribution. In the USA, this understanding is based on farming tradition. It is supported by smaller family farms. In Europe, there are quite a few supporters of the thesis that agriculture, structured on the basis of smaller family-type units, is preferable from a social point of view.

There are different definitions of sustainable agriculture but they usually do not fully reflect its essence and only characterize one or more of its aspects: either the resource, e.g. soil, or the institution, e.g. semi-meat production farms that are supported, the means of production and technologies, etc.

According to Cordon (1988), sustainability “is the ability to maintain the productivity of a system, e.g. field, farm or a whole sector, as pertaining to environmental conditions”⁴. Brklacich et al (1991) and Hansen (1996) defined sustainable development as the “potential for maintaining the functions of agrarian systems in time”⁵. In the US legislation of 1990, sustainable agriculture is defined as a complete system of management in the field of plant and animal production, with specific characteristics that will satisfy human demands of food and plant fiber long-term, improve environment and natural resources that are the basis of agrarian economy; are resource-conserving and harmonized with the natural biological cycles and methods of control; support the economic viability of farm entities and increase the quality of life of farmers and society as a whole. This concept reflects the objectives of sustainable agriculture in the most comprehensive way.

A Bulgarian team of authors, Velchev, Valev and Borisov gave the following definition of sustainable agriculture (1997): “A modern environmentally consistent sustainable agriculture

⁴ Cordon C. and Edward B., After the Green Revolution: Sustainable and Equitable Agricultural Development, *Futurex*, N 6, 1988

⁵ Brklacich, M., C. Bryant and B. Smith: Review and appraisal of concept of sustainable food production systems, *Environmental Management*, 15 (1), 1991; Hansen J.: Is Agricultural sustainability a Useful Concept. – *Agricultural Systems* 50, 1996; Bashev, C., Evaluation of Bulgarian Farms Sustainability. *Agricultural Economics and Management*, 3, 2006.

practically means a strive to achieve the potential of high biological value yields in a certain agrarian ecological area by means of adequate farming practices that would guarantee the best economic results in a market economy and at the same time preserve and increase soil fertility and preserve the environment"⁶. In other words, the authors have placed agrarian ecology as the basis of sustainability. This is not accidental, because production results, environmental soundness and labor character depend on those practices.

Generally, sustainable agriculture can be regarded as production that secures stable supply of population with food products, preserving the economic stability of farmers' income. The term sustainable agriculture often implies sustainable production from agrotechnical, environmental and macroeconomical points of view.

We would rather combine the different emphases of sustainable agriculture into a more broad definition: sustainable agriculture is economically efficient, environmentally friendly and socially reliable. This means that from an economic point of view, sustainable agriculture is competitive, i.e. yields high quality products that satisfy consumers' demand and their marketing secures stable income to farmers. Environmental compatibility means that sustainable agriculture uses such methods of production that preserve or improve environment and secure resource-conserving and environmentally friendly utilization of nature. A socially reliable agriculture is one that ensures the improvement of welfare of farmers and consumers of farm products.

The multi-functionality of sustainable agriculture shows that it needs an integrated approach and the development of a common national strategy that would be economically acceptable to the society as a whole. Sustainable development

is a task of the whole nation and not only of separate activities and sectors. Then and then only it will come true.

Indicators of Sustainable Agriculture

The evaluation of sustainable development of agriculture needs a system of indicators that would characterize is as a whole and in detail at the same time. To achieve this, the indicators should fulfill the following requirements:

- to reflect the development of the agricultural sector and its contribution to a never-ending change for a better world;
- to serve as a means of information for the identification of the used characteristics of sustainable development of the sector;
- to outline the contribution of agriculture in the strive for perfection of real life by adequate quantitative and non-quantitative factor transformations;
- to reflect the principle " think global – act local" by characterizing the domestic sector and regional management levels in agriculture;
- to serve as a menu for every researcher to use the indicators he needs;
- to be intelligible – simple, clear and non-ambiguous;
- to be realistic – from the point of view of access to information, time and other limitations;
- to be based on valid concepts;
- to be adapted to future development;
- to be based on available data or such that can be derived with reasonable expenses for adequate filing, good quality and regular updates;
- to reflect the principles of Agenda 21 and expand over all aspects of sustainable development.

⁶ Velchev, V., Valev, V, Borisov, G. Problems of sustainable agriculture and production of organic cereals, *Agricultural Science*, 4 - 6, 1997

Other requirements can be added to those mentioned above – of methodical, operational, information and organization nature, e.g. methodological and information compatibility as well as transitivity between aggregated and constituting indicators.

In its five-year 1996 – 2000 program, the United Nations Commission on Sustainable Development (UNCSD) offered a system of indicators of sustainability⁷. They are 132 and are divided into four categories: social – 39; economic – 23; environmental – 55 and institutional – 15. The proposed 132 indicators for the analysis of sustainability are not obligatory. The European Commission on Statistics has adopted 47 of them for the European Union for the reason that there is no reliable information for the rest of them. Complying with the requirements of Agenda 21 and the capacity of the national statistics and agro statistics, we propose a complex of indicators to characterize sustainability of agriculture. They are classified in 4 groups: efficiency, resource utilization, financing of sustainable development and adoption of technologies and innovations.

I. Economic Indicators of Sustainable Development

1. Efficiency indicators
 - 1.1. Gross domestic product (GDP) contributed by agriculture
 - 1.2. Value of export of agricultural products
 - 1.3. Efficiency – GDP per capita employed in the agricultural sector
2. Resource utilization
 - 2.1. GDP per unit of area
 - 2.2. Capital-output ratio – long term assets (LTA) per unit GDP produced by agriculture
 - 2.3. Labor consumption – salary per unit of GDP produced by agriculture

- 2.4. Energy consumption in kWh per unit of GDP produced by agriculture
- 2.5. Average yields of farm crops
- 2.6. Average performance of farm animals
3. Financing of sustainable development
 - 3.1. Investments per unit of utilized farm land
 - 3.2. Investments per capita employed in agriculture
 - 3.3. Expenses for environmental protection
4. Utilization of investments and innovations
 - 4.1. LTA acquired in agriculture
 - 4.2. Utilized foreign investments in agriculture
 - 4.3. Utilized financing for innovation in agriculture
 - 4.4. Utilized investments for environmental purposes
 - 4.5. Number of scientists in agriculture

The economic indicators for the analysis of sustainable development of agriculture were studied in dynamics for at least five years, they were compared to similar indicators for other sectors, evaluated vs. potential that can be achieved and compared to the achievements of other countries.

II. Social Indicators of Sustainable Development

Income and employment

- 1.1. Employees in agriculture
- 1.2. Average annual salary of employees in agriculture
- 1.3. Average pension of employees in agriculture
- 1.4. Unemployment in the villages
2. Settlement of population
 - 2.1. Population of the villages
 - 2.2. Population density
 - 2.3. Migration coefficient

⁷ Sustainability Indicators. Report of the Project on Indicators of Sustainable Development, SCOPE 58, Edited by B. Moldan and S. Billharz, 1997, Willay and Sons, Great Britain, 1977.

- 2.4. Natural population growth in the villages
3. Education, personnel qualification and information of the population
 - 3.1. Number of agricultural high-school graduates per 1000 inhabitants
 - 3.2. Number of agricultural university graduates per 1000 inhabitants
 - 3.3. Scientific workers in the field of agriculture
4. Settled towns and villages
 - 4.1. Birth rate in the villages
 - 4.2. Mortality in the villages
 - 4.3. Marriage rate in the villages
 - 4.4. Average life expectancy
 - 4.5. Average age of rural population
 - 4.6. Living area per capita of rural population

III. Environmental indicators

1. Rational utilization of natural resources
 - 1.1. Arable / non-arable land ratio
 - 1.2. Utilization of farm land – crop structure
 - 1.3. Recultivated land
 - 1.4. Water consumption for agricultural purposes
 - 1.5. Preservation of biodiversity
2. Ecological condition of natural resources
 - 2.1. Eroded farm land
 - 2.2. Salinized farm land
 - 2.3. Acidified farm land
 - 2.4. Deteriorated farm land
 - 2.5. Water quality
 - 2.6. Purified animal waste water
3. Sustainable development of agriculture and rural areas
 - 3.1. Use of chemical fertilizers
 - 3.2. Use of pesticides
 - 3.3. Irrigated land
 - 3.4. Agricultural wastes

IV. Institutional Indicators of Sustainable Agriculture

1. Management of environmental impact evaluation

2. National (sector) councils of sustainable agriculture
3. Ratified international agreements of environmental protection
4. Programs for sustainable development of agriculture
5. Access to the information on sustainable development

Our opinion is that the proposed system of indicators is a good foundation for the analysis of sustainable development of agriculture. It won't be a problem if any of the indicators can not be used due to lack of information. It is more important how they are going to be analyzed, because there are different correlations between them – some of them concern efficiency, others are diverse and even contradictory. For example, fertilization is a positive factor for intensification of production from the economical point of view but the excessive use of mineral fertilizers is harmful from the standpoint of environmental protection.

Is the Development of Bulgarian Agriculture Sustainable?

Bulgarian agriculture is undergoing a reform. It is a well known fact that the collapse of planned economy and the accompanying crisis had an extremely strong effect on agriculture. For this reason, we are not going to evaluate the sector's sustainability only in the context of its intensive development before the crisis but will research into its development within the last 9 years after the Currency Board in order to find out whether it is environmentally friendly and socially supportive and to what extent, i.e. to compare and accommodate the different aspects of our understanding of sustainable agriculture. For this purpose, we shall use the proposed economic, social, environmental and institutional indicators.

The main general indicator of our statistics for each economic sector is the gross domestic product (GDP). Its value for agriculture in the period of study was highest in 1997 – BGN 4,008.00 million and lowest in 2000 – BGN 3,301.00 million (Table 1), marking a decrease of 18 %. If we take the average annual GDP for the period of nine years studied, i.e. BGN 3,574.00 million as an indicator of sustainability of the agricultural sector, we will find out that in 1997, 1998 and 2004, GDP was 8 % higher and in the remaining years – 4 % lower, i.e. its fluctuation was within the limits of 12 %. The fluctuation of GDP of agriculture around its average value shows that the development of the sector has been stabilized around this average value. However, average yields and animal performance were low – about $\frac{1}{2}$ of their biological potential and the favorable soil and climate conditions, in which they developed. Hence, the conclusion that production of the sector was stabilized but at a very low level, compared to its capacity. This condition of agriculture was due to many factors: non-compliance with the agrotechnical and technological requirements, many small plots of land, prevailing number of small farms and low quality.

The export of agricultural products was much lower than at the end of last century. Regardless of its 7x increase after 1997 and the positive balance of farm produce trade, it doesn't mean yet that the market capacities of the sector are being fully utilized.

The unsatisfactory condition of agriculture was clearly reflected in labor efficiency and farm land productivity. Labor efficiency was the highest in 1997 – BGN 5,214.00 per capita employed in agriculture, subsequently going down. It was 3-4 times lower than that of developed countries, hence the conclusion that Bulgarian agriculture should be modernized and re-structured. Otherwise, it will continue to simply mark the time.

Farm land productivity, besides being unstable, was very low as well. On the average, it was EUR 334.00/ha, while in Greece it was EUR 2,930.00/ha, Romania – EUR 726.00/ha, The Czech Republic – EUR 800.00/ha, Hungary – EUR 952.00/ha, Slovakia – EUR 1,200.00/ha, Slovenia – EUR 1,859.00/ha, the 15 previous EU members – EUR 2,203.00/ha, The Netherlands – EUR 10,423.00/ha and Italy – EUR 2,902.00/ha, etc., which showed that the use of farm land was at the extensive level, close to its natural fertility and crop structure included mainly low-profit crops. Environmentalists do not relate intensive agriculture to sustainability. However, it would be wrong to identify this idea with going back to outdated farming practices or define conventional agriculture as sustainable, because of breach of technological requirements and primitive practices. Sustainable agriculture is less intensive but is based on the so called good farming practices, with emphasis on crop rotation, integrated plant protection and cultivations, etc., and the need for high qualification and rigid technological discipline.

The level of GDP from agriculture vs. investments for long term assets (LTA) was decreasing and reflected an extremely disturbing tendency. It was the highest at the beginning of the period – BGN 147.40 down to the minimum of BGN 10.40 in 2004. This is explained by the increase of assets and their value, on the one hand and the GDP keeping the same level, on the other, the result being increased capital-output ratio. Even if we do not ignore the growing span between LTA and farm produce prices, the inadequate utilization of assets is obvious. Capital-output ratio in the agrarian sector is also reflected by the indicator of investments per unit of used farm land, the latter having increased almost 10x in the period studied.

In conclusion, we have to say that from economical point of view the last nine years have lead to a low-productive system of

agriculture with high capital-output ratio that made it dependent on natural and climatic conditions, unstable and non-competitive.

In spite of the very unstable dynamics of economic indicators in the recent years, social indicators showed two tendencies: on the one hand, the income of employees in the agricultural sector was growing slowly and on the other, the demographic characteristics of rural population were deteriorating (Table 2). The average salary of agricultural employees increased twice in the last nine years. A positive phenomenon at first sight but unsatisfactory at that, especially if comparing to the income of agricultural employees in developed countries that was 10x higher.

The purchasing capacity of the population, expressed in major food products of Bulgarians, reflected the low living standard. It increased twice for bread and meat, milk – 30 %, fruits – 8 % and vegetables – 60 %, meaning that price increase of most of agricultural products was ahead of income increase. The low living standard also reflected on major food products consumption that did not reach the physiological rates in fruits – 76 %, fish and fish products – 62 %, milk – 60 %, eggs – 26 % and vegetables – 15 %. The domestic market of food products shrunk. The number of people that left the marketplace and satisfied their needs from their own production, grew. This became obvious from the number of agricultural employees, which was 24.5 % of total employees in the national economy.

The low living standard and unsatisfactory health care were the reason for the average life expectancy of rural population of 69.4 years in 1997 to go down to 67.9 in 2004. At the same time, the average age of rural population for this period increased from 43.5 to 45.2 years, which reflected population aging. Of all agricultural employees, 35 % were over 60 years old. This

is not surprising, having in mind the decrease of birth rate in the villages and the negative natural population growth. It was 13.9 people/1000 inhabitants in 1997 with a slight decrease in 2005 to 12.7 people/1000 inhabitants. The aforementioned developments did not leave us any optimism with regard to demographic issues in rural areas, which deteriorated further. Hence, the reasonable concern about the perspectives of agriculture and rural areas. How can we make it modern and competitive, shall we find the shortest way to sharp increase of productivity, innovation and entrepreneurship that are essential to success.

If we go back to the definition of sustainability of agriculture as economically efficient and socially acceptable, than it currently does not qualify as a socially attractive activity not only due to its long term specificity but also due to slow crisis overcoming.

Was it the step back from intensive production that caused the positive effect on environmental characteristics of agriculture? This is a frequently asked question with the expectation for a positive answer due to the fact that sustainable development in developed countries is related to the policy of chemical fertilizers and herbicides control and the transition to alternative farming systems. This concept was supported by GATT that eliminated the subsidies for nitrogen and phosphorus fertilizers and pesticides as well as the Directive of West European Countries for 50 % reduction of their application until the year 2000 at the expense of improved technologies, without affecting the quantity of agricultural production.

The sustainability of the sector, projected through environmental protection and rational utilization of natural resources, becomes yet more important not only because of increase of environmental problems but mainly due to the strive of people for a more reasonable life

style in compliance with nature for an ultimately better welfare.

The environmental condition of farm lands (Table 3) changed in various ways. The most common process of degradation, i.e. erosion, conquered 2327 ha more in 2005 vs. 1996 and became the most important environmental problem to overcome in the sector. The area of salinized and acidified soils decreased as a result of the reduced application of chemical fertilizers and irrigation. There is a reduction of the area of soils polluted with heavy metals. We have no new data on deteriorated soils and those for recultivation but according to unofficial records in this sphere no essential changes are expected. Obviously, the improved condition of land resources was not due to planned care but was more the result of objectively running processes in our country's economy.

Another indispensable resource for agriculture is water for irrigation and animal production. Until 1990, agriculture was the major consumer of water resources in the country with an estimated consumption of about 2 billion m³ for irrigation. In 2005, as much as 18 % of the total water consumption was utilized for irrigation. Limited irrigation after the beginning of the reform, mainly for financial reasons, reduced the use of water resources. Regardless of economic restructuring accompanied by downsizing of a number of polluting industries that caused self-purification of river waters, it was not complete because water pollution in the areas of large settlements was still well above admissible rates. Dam waters are good for irrigation and comply with the standard.

Annually, animal production produces about 8 million tons of manure. As little as 15-20 % are used for fertilization. Therefore, this valuable resource is turning from wealth to waste. Our survey in the districts of Sofia, the town of Chepelare and Banite village showed that only

1/3 of their animal farms had manure storage facilities and sewerage system for the liquid fraction, hence the conclusion that manure was not handled properly and were not only a potential but a real pollutant of environment. The issue of peaceful coexistence of small farms with recreational living areas is posing more and more problems as well as the hazard of surface and underground water pollution with nitrates and the bilateral relationship between crop and animal production is jeopardized.

The summarized environmental characteristics of agriculture shows that regardless of the fact that agriculture nowadays does not comply with the modern economy standards, neither does it comply with all the requirements for environmental protection.

Conclusion

We analyzed the status of Bulgarian agriculture in the period 1997–2005 based on the concept that sustainable agriculture is economically efficient, environmentally sound and socially reliable. The research showed that the sector is in stagnation and it does not comply with sustainability standards. Its economic development is unstable and does not even reach half of its potential. The demographic characteristics of rural population are deteriorating. Some environmental problems persist and new ones emerge. The question is whether agriculture advances to sustainable development or, on the contrary, retreats. The answer to this is not optimistic because there are a growing number of negative symptoms parallel to the positive:

- GDP of agriculture was stabilized at an average value rating well below its potential;
- the export of farm produce has increased about 7x compared to 1997, which showed that

the sector is getting adapted to the market economy but is still far from its potential;

- labor efficiency is low and maintains this level;
- farm land and LTA are not used to their full capacity, resulting in the increase of capital-output ratio of farm products;
- yields and productivity are low and unstable;
- the income of rural population is increasing but at a slow rate;
- the area of salinized, acidified and polluted soils is decreasing but erosion increases;
- manure is not properly utilized and therefore becomes an environmental pollutant.

Bulgaria is a member of the European Union and has adopted the Common Agricultural Policy. Shortly, farmers will receive direct payments per unit of area and are about to adopt European standards of quality, hygiene and humane treatment of animals as well as preservation of environment and, moreover, competing with other EU producers. Compliance with the requirements for sustainable agriculture is becoming a must and they have to be ready for this for the sake of prosperity.

References

1. Bashev, C., Evaluation of Bulgarian Farms Sustainability. *Agricultural Economics and Management*, 3, 2006.
2. Brklacich, M., C. Bryant and B. Smith, Review and appraisal of concept of sustainable food production systems, *Environmental Management*, 15 (1), 1991.
3. Cordon C. and Edward B., *After the Green Revolution: Sustainable and Equitable Agricultural Development*, Futorex, N6, 1988.
4. Daly, H., *Steady State Economics*, Freeman, San Francisco, 1977.
5. Hansen, J., Is Agricultural sustainability a Useful Concept. – *Agricultural Systems* 50, 1996.
6. Mill J. S., *Principles of Political Economy*, Paret, L., 1857.
7. *Our Common Future*. World Commission of Environment and Development, New York, 1987, p. 46.
8. *Sustainability Indicators. Report of the Project on Indicators of Sustainable Development, SCOPE 58*, Edited by B. Moldan and S. Billharz, 1997, Willay and Sons, Great Britain, 1977.
9. Velchev, V., V. Valev, G. Borisov, Problems of sustainable agriculture and production of organic cereals, *Agricultural Science*, 4-6, 1997. **VA**

Table 1. Economic Indicators

Nº	Indicator / Year	1997	1998	1999	2000	2001	2002	2003	2004	2005
1.	GDP of agriculture, million BGN	4,008.00	3,980.00	3,369.00	3,301.00	3,533.00	3,557.00	3,498.00	3,581.00	3,341.00
2.	Export of agricultural products, million BGN	233.80	429.70	510.90	1042.90	1113.60	1479.30	1343.50	1658.20	-
3.	Productivity, GDP per capita of employed, BGN	5,214.00	5,001.00	4,238.00	4,281.00	4,610.00	4,639.00	4,341.00	4,438.00	4,171.00
4.	GDP per unit of area, BGN/ha	646.00	642.00	543.00	591.00	643.00	668.00	657.00	672.00	635.00
5.	Acquired LTA in agriculture, million BGN	53.90	95.00	88.20	99.20	124.60	119.90	237.30	342.90	272.70
6.	GDP in agriculture per unit of LTA, BGN	147.40	65.70	38.20	33.30	28.40	29.70	14.70	10.40	12.30
7.	LTA per 1 ha of land, BGN	6.50	6.40	14.20	17.80	22.70	22.50	44.60	64.30	51.80
8.	Average wheat yields, kg/ha	2,950.00	2,805.00	2,735.00	2,835.00	3,010.00	3,012.00	2,380.00	3,810.00	3,157.00
9.	Average corn yields, kg/ha	3,576.00	2,731.00	2,810.00	1,751.00	2,470.00	4,236.00	2,800.00	5,540.00	5,308.00
10.	Average sunflower yields, kg/ha	967	972	1030	826	1040	1370	1196	1820	1472
11.	Dairy milk industry productivity, l/annually	3,102.00	3,148.00	3,144.00	3,198.00	2,252.00	2,843.00	3,359.00	3,440.00	3,477.00

Source: Statistical Book 1998 – 2006 and personal calculations

Table 2. Social Indicators

Nº	Indicator / Year	1997	1998	1999	2000	2001	2002	2003	2004	2005
1.	Average annual salary of agricultural employees, BGN	1,437.00	1,939.00	1,901.00	2,170.00	2,227.00	2,359.00	2,431.00	2,675.00	2,782.00
2.	Natural population growth per 1000 inhabitants in rural areas	-13.90	-13.60	-11.10	-11.50	-12.30	-12.60	-12.20	-11.10	-12.70
3.	Number of medical doctors per 1000 inhabitants in rural areas	3.50	3.50	3.50	3.60	-	-	-	-	-
4.	Average life expectancy, years	69.40	-	-	70.00	70.80	70.70	67.50	67.90	-
5.	Average age of rural population, years	43.50	43.80	44.00	44.10	44.60	44.70	44.90	45.00	45.20
6.	Purchasing capacity per capita									
	- bread, kg	1,652.00	2,491.00	2,682.00	2,422.00	2,877.00	2,870.00	2,957.00	2,769.00	3,057.00
	- meat, kg	169.00	251.00	335.00	303.00	245.00	329.00	393.00	382.00	335.00
	- fresh milk, kg	2,480.00	2,500.00	2,731.00	2,580.00	2,445.00	2,963.00	3,178.00	3,192.00	3,220.00
	- fruits – apples, kg	1,903.00	1,905.00	1,458.00	1,431.00	1,573.00	1,601.00	1,990.00	2,253.00	2,047.00
	- vegetables – tomatoes, kg	1,261.00	2,585.00	2,146.00	2,127.00	1,914.00	2,513.00	2,765.00	2,189.00	2,013.00

Source: Statistical Book 1998 – 2006.

Table 3. Environmental characteristics of farm land fund (thousand ha)

Year	Farm land	Eroded land	Salinized land	Acidified land	Heavy metals polluted land	For recultivation	Deteriorated land
1990	6845.80	1026.00	30.50	567.00	47.40	n.a.	762.30
1996	6003.00	1722.80	40.00	1523.90	47.40	30.00	n.a.
2005	5264.50	4050.00	35.50	1500.00	40.20	n.a.	n.a.

Source: National report on protection of environment, 2004. Soil degradation processes and possible measures for sustainable land management in Bulgaria, Project on Capacity for Sustainable Land Management in Bulgaria, S. 2006.