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THE BIOLOGICAL PRODUCTION OF GRAIN CROPS – A PERSPECTIVE FORM OF SUSTAINABLE AGRICULTURE IN BULGARIA

Introduction

Over the last years the popularization of biological agriculture has continued to increase. The country in general has exceptional soil and climate characteristics which can facilitate the production biological products and more than 80% of the cultivated land is suitable for the development of biological agriculture. The country has set the ambitious goal to develop biological agriculture and realize its potential by planning to increase the percentage of biological products on its domestic market and stimulate their consumption so that by 2013 3% of all sold food products will have to be biologically produced¹. Another important objective is to have 8% of the total area of used land biologically cultivated by the same time. The fulfillment of these goals has been integrated in the National Plan for Development of Biological Agriculture for the period 2007 — 2013.

Discussion

Currently there are 432 controlled businesses which deal with the production, processing and selling of biological products in the country and the total area of certified land for the production of biological products amounts to 166 741 hectares. Of these the area used for biological plant breeding (in a period of conversion or having passed the period of conversion) amounts to **9370.88 ha**, while the permanent meadows and pastures (in a period of conversion or having passed the period of conversion) occupy 155 792.55 ha and the free areas of the fallow areas occupy (in a period of conversion or having passed the period of conversion) occupy 1577 ha. To the certified 166 741 hectares we should add 242 677.31 ha of land that is approved by the controlling organs as suitable for harvesting wild plants. In this way, the total amount of the controlled area managed under the requirements of biological production is **409 418.31 hectares**. The highest rate of certified areas is observed in the Northern Central

Table 1
Condition of biological agriculture in Bulgaria as of 31st
December 2007

<i>A. Biological production of plants</i>	
Crop Types	Total area (hectares)
Grain crops	1 362,91
Fodder crops	914,30
Pharmaceutical and aromatic crops	1 428,10
Fiber crops	1 285,00
Tubers: potatoes, sugar cane and fodder cane	56,73
Vegetables	393,93
Greenhouse production	58,90
Fruit crops	3 565,48
Vineyards	298,53
Total amount of cultivated areas	9 370,88
Permanent meadows and pastures	155 792,55
Wild plants harvesting	242 677,31
Free/ fallow land	1 577,57
TOTAL AMOUNT OF AREA	409 418,31

Region and in the South Central Region of the country. (see table 1)².

The latest data about the condition of the biological agriculture in Bulgaria shows that the total area of the certified land, i.e. 166 741 ha is 3.12% of the land used for agricultural purposes, i.e. 5 330 000 ha. According to this indicator Bulgaria occupies one of the top places in the European Union together with countries like France, Great Britain, Spain, and Germany. Compared to the results from the previous report from 31.12.2006, the highest increase is observed in the land for permanent meadows and pastures — 5400%; next come the bee hives with an increase of 5040%, followed by the cultivated land with an increase of 300% and the areas for harvesting wild herbs, fruits and mushrooms with 220%. These incredible figures are partly due to the fact in 2007 the Ministry of Agriculture and Food gave control and certification licenses to 4 new organizations

¹ National plan for the development of biological production in Bulgaria for the period 2007-2013

² The data is based on the annual reports of the six controlling organs approved by the Minister of the Agriculture and Food for 2007 ("Balkan Bioset OOD", „QC&I International services" AD, „Seres" OOD; „Lakon" OOD; „BCS Oeco-Garanti" OOD, and „Control Union Certifications" AD)

which have not submitted official reports to the Ministry until then.

The biological agriculture is a specific method of plant breeding which maintains the ecological balance. Its products are also obtained by maximum preservation of the soil-plant-animal system and the natural growth cycles³. In addition, it is of great importance for the sustainable development of the rural regions and the preservation of the natural environment.

According to the definition of FAO (the Food and Agriculture Organization of the UN), the biological agriculture is an “overall system for management of production which stimulates and enhances the sustainability of agricultural systems, including biodiversity, biological cycles, and biological activity of the soil”. The bio-agriculture focuses on the adaptation of this system through practices for its realization that are region specific by the use of agronomical, biological, and mechanical methods for protection from weeds, pests and diseases. These methods aim at improvement of soil fertility, maximum utilization of natural self-reproducible resources, and introduction of agricultural practices which are in balance with nature, decrease of energy consumption and safety foods. The alternative, nature-friendly methods for plant protection not only create biodiversity but also restore and maintain it in farms.

The main objective of the *biological production* is, if possible, to preserve and expand the natural relations in the system which involves plants, soil, and animals so that farmers can avoid the use of the fertilizers and the means for plant protection which damage the natural environment.

One of the basic principles of biological production, and this method of agriculture in general, is to cultivate crops under conditions which as close as possible to their requirements of these crops to the environmental factors. The provision of the necessary conditions makes the crops more adaptive to the climate factors and the attacks from various diseases, weeds and pests. The knowledge about the specific requirements of these crops allows farmers to apply properly the cultivation technologies and solve problems related to fertilizing and presence of pests, pathogens, and weeds.

The biological agriculture, which has a positive influence on the future potential of the agricultural production, is based on both traditional and modern technologies. These technologies have proved their

efficiency throughout the years and encompass the following activities:

- Development of balanced crop rotation and natural stimulation of plants;
- Soil tillage;
- Usage of fertilizers that do not harm the environment;
- Stimulation of the useful insect and animal populations and plant protection with natural plant extracts and means;
- Weed, disease, and pest protection of plants;

The main grain crops in Bulgaria are wheat, rye, triticale, barley, oats, maize, sorghum, rice, and millet which are cultivated for food supplies, fodders and other technical reasons. When these crops are biologically cultivated, it is important to meet some important requirements referring to the particular agro-technical activities, namely place/sequence in the crop rotation, tillage, sowing, fertilizing, plant protection.

Crop rotation. The appropriate rotation of the grain crops is the main source farmers have for utilization of the economic and ecological recourses of the particular agro-ecological regions and the realization of the genetic potential of the cultivated plant types. The crop rotation which is based on scientific principles is an efficient method for the regulation of the biological factors of soil fertility. In addition, its phyto-sanitary role is of key importance for the cultivation of the crops.

When crops are rotated, the chemical composition of the plants is very important. According to this, they are divided into two groups:

I group — *grain crops*, whose residues contain less hydrogen, their biomass decomposes less slowly, their nutrients are released slowly. As a result, the semi decayed plant residues allow the appearance of fungi which release toxic substances;

II group — *leguminous plants, beet, vegetables, etc.* — their residues decompose quickly, release nutrients quickly and clear the soil from toxic substances.

In field crop rotation the grain crops should not exceed 60% of all plants, the sugar beet and potatoes respectively 20% and 30-40%. When 25-40 % of grass (cereals, legumes, and mixtures) are included in the rotation of crops the soil loss caused by erosion decreases from 3 to 8 times⁴. Except for the necessary inclusion of grasses and legumes in the crop rotation, the sustainable agriculture is based on the efficient soil tillage and application of organic fertilizers. Some of the grain crops can be grown in succession in the same place — wheat,

³ Yancheva, H., I. Manolov, Basics of organic agriculture, ET “Vasil Petrov”, Plovdiv, p 480

⁴ Peneva, S. Manager of the biological farm affiliated to the Agro-ecological Centre at the University of Agriculture, “Practical guidelines for conversion to biological agriculture”, 2008, Plovdiv

barley for up to 2 years, maize for up to 4-5 years but when there is shift to alternative agriculture this should be an exception.

Under the conditions of biological agriculture it is important to use efficiently the cultivated areas by the use of catch crops. This is done to allow the longer use of these areas with vegetating plants and for the longer periods for production of biomass. The efficient crop rotation in the country is done in several ways: the plating of second crops; planting of winter and spring crops, the simultaneous planting of two and more crops (maize and beans, maize, sunflower, pumpkins, etc.), trap cropping (the main crop is surrounded by clover and on the second year the trap crop is replaced by maize). The catch crops play an important role in the protection of soil from erosion and pollution with chemical substances.

For example, after harvesting the wheat and the necessary treatment of the soil it is possible to plant crops such as lacy phacelia, legumes, mustard, etc. which are not winter resistant. Until winter comes they produce big vegetation mass which dies when it becomes cold and covers the soil surface like mulch. Since the covered soil is heated more slowly, strips of land are left during the sowing of the catch crop. These strips are planted with the next earthed-up crop next spring. This technology allows farmers to avoid the use of herbicides not only for the removal of the catch crop but also during the vegetation of the main crop because the mulch can also protect the plants.

Place in the crop rotation — very good crops that can be planted before the main crops are the one-year grain legumes — peas, vetch, chick peas, lentils, beans, fodder legumes, early potatoes, and melon field crops. Other types of crops that can be planted before the main crop are the earthed-up crops such as maize, sunflower, tobacco, late potatoes, and cotton.

Soil tillage. Soil tillage depends on the crop which is planted before the main crop, the soil humidity, and the amount of weeds in the soil and with reference to these aspects biological agriculture does not differ from conventional one. The appropriate system for soil tillage is very important when all types of crops are planted, including field crops. All activities should help the reduction of soil depletion and the increase of soil fertility.

In a period of conversion when there is a shift from conventional to biological production it is necessary to spend enough time and make efforts to restore soil structure. With reference to this the following important measures should be applied:

- Careful tillage;
- various schemes for crop rotation;

- regular use of organic fertilizers.

Deep ploughing has a negative effect on those pests that spend their whole life or part of it in the soil. Soil tillage stops the natural life cycles of development of these pests. It also destroys the self-planted plants and prevents the appearance and development of powdery mildews and rusts which attack grain crops and thus also stop the appearance of many pests which feed on these weeds.

The simultaneous planting of several crops is an important prerequisite for successful plant protection and can allow farmers gradually minimize its use. It gives good results if beet and sunflower are planted simultaneously because the two crops develop well together and mutually protect themselves from diseases and pests.

To include legumes in the crop rotation is of key importance for the improvement of soil fertility and also stimulates green manuring. The successive planting of deep-root and shallow-root plants facilitates the better assimilation of nutrients and improves the soil structure.

It is advisable to plant *strips with flowering plants along the field crops* such as lacy phacelia, mustard, rapeseed, sunflower.

Use of fertilizers. In order to secure the necessary nutrients needed for good yields, it is necessary to enrich the soil with phosphorus and potassium. The whole range of *phosphorus and potassium based fertilizers* is applied with the main tillage after the harvesting of the crops which are planted before of the main crops or when these preceding crops are planted to enrich the soil for their proper development.

To use *manure* with grain crops is not appropriate because it is mineralized rather late when the intensive absorption of nutrients by the grain crops is already done. For these reasons manure should be used for the preceding crop.

To enrich the soil with nitrogen farmers should use biological fertilizers two times — from 1/3 to 1/2 of the norm when the soil is treated before sowing and the rest 1/2 to 2/3 of the norm in early spring in the form of feeding up in February and March. When done in this period the feeding is most effective because then there is enough humidity in the soil. In addition, it secures enough nitrogen needed for the beginning of the ear development processes when the ear length and the productivity of the crop are determined.

Sowing terms and sowing norms — are not different from those referring to conventional production.

Cares during the vegetative period — generally they take the form of protection from weeds through the appropriate sequencing of crops; appropriate soil treatment; usage of clean sowing material; securing the

appropriate thickness of crops; performing of all activities by respecting optimal terms and deadlines.

Watering. To receive stable yields from the grain crops it is necessary to water them especially when they are cultivated biologically⁵. Watering is done before sowing and during the vegetative period. The former type is done in years with heavy autumn drought while the latter sustain the optimal soil humidity according to the type of the soil and vegetative period.

Harvesting. *One phase harvesting* — when the grain is fully ripe and its humidity is 13-18%. *Two — phase harvesting (separate harvesting)* — in the transitional period from wax ripeness to the beginning of the full ripeness. It is done when there are many weeds and danger of heavy rains and hailstorms. The threshed grain is transported to special places where it is left to dry naturally to reach a humidity of 13-14% and is the stored in silos or storehouses.

Plant protection

Weeds — when farmers have to protect the crops from perennial weeds they use the *methods of drying and exhaustion*. When earthed-up plants are grown the activities related to plant protection involve their rotation with winter grain crops. In modern agriculture it is also efficient to use specially treated organic waste (compost) which enriches the soil and can act as a good herbicide.

Diseases and pests — protection from diseases and pests is done by applying agro-technological and biological measures:

- inclusion of grain crops in crop rotation after peas, beans, sunflower, beet and other earthed-up plants;
- choosing varieties of plants that are resistant and not so susceptible to climate influences and planning for various crops;
- moderate and balanced application of organic fertilizers against all types of pests, dust-brand and powdery mildew;
- sowing of high quality seeds with high absolute weight, germination, and germinating energy;
- analysis of used seed material against various types of smut, fusaria against smut, root decay, various bacteria and fusaria caused diseases;
- complying with the optimal sowing terms for the respective crops, trying to avoid early and late sowing;
- complying with the optimal sowing norms and depths;
- timely harvesting by avoiding crumbling and over-drying of the grain to prevent from various fusaria, *Aelia accuminata* L and storehouse pests;

- surface treatment of stubbles against self-planted species and to prevent the appearance of diseases such as rusts and powdery mildew; and insects such as the tiger beetle, the cereal leaf beetle, the Hessian fly, sunn pests, plant lice, and various rodents;

- covering of the plant residues;
- keeping the cultivated areas clean of wheat weeds against rusts, powdery mildew, smuts, fusaria caused diseases, tiger beetles, Hessian flies, and stink bugs which can damage the crops;

- elimination of the weed hosts such as bindweed, corn thistle, amaranth, orach, etc.;

- use of «AgroBioStim» biological products such as organic fertilizers, micro-fertilizers, ecological fertilizers, and natural stimulant.

Characteristic of rye — is that it can be included in the crop rotation after legumes, sunflower, beet and vegetables weeded with perennial root weeds or it can be a compact crop together with winter peas used for grazing and green manure against economically important diseases and pests such as the ergot, fusaria based diseases, various smuts, root and stem rot, powdery mildew and perennial weeds. Seeds clear from fungi should be used. This is achieved in the following ways — the seeds are dipped in a sodium chloride solution, then they are washed out and dried; or the seeds are cleaned through a process of semi-wet disinfection with copper sulphate against ergot or stem smut.

Characteristic of barley — is that when it is grown farmers should select varieties that are resistant and not so susceptible to climate influences. They should also plan for various crop structure by using different varieties such as Obzor, Krasi 2, Yubilei 100, Rusi, etc. Farmers should also use high quality seeds which have been tested for diseases such as loose smut, barley stripe, smuts and pests or treated thermally against diseases if there are not available healthy seeds.

Conclusion

The biological production of grain crops allows the harvesting of yields with high biological quality through minimum energy consumption and other costs. Under the conditions of contemporary environmentally-friendly and sustainable agriculture it is a good possibility for the development of mixed biological plant growing and animal breeding farms.

When there is sufficient knowledge of the environmental factor requirements of the particular crops it is entirely possible to deal efficiently with the basic difficulties related to the provision of appropriate nutrients

⁵ Yancheva, H., 2008. Handbook on biological agriculture, Plovdiv, p. 128

and protection from pathogens and pests necessary for the biological production of these crops. Nevertheless, despite these difficulties, the biological production of grain crops has good prospects in Bulgaria. What is more, the demand for healthy and safe food products constantly increases which leads to an increase in the production of biologically grown products.

Nikolova M. The biological production of grain crops — a perspective form of sustainable agriculture in Bulgaria

Agricultural ecology is a key element of the EU legislation and over the last years its importance for the common agricultural policy has increased. One of the biggest challenges for Bulgaria in the process of its economical restructuring is to secure a balance between the sufficient production of food supplies and the increase of employment on one hand and the preventive protection of the environment on the other hand.

The biological agriculture has been chosen as a pilot agricultural activity within the framework of the agricultural ecological measure in the country. Regardless of this fact, Bulgaria has been late compared to a number of European countries which have gained experience in the field of biological production. Nevertheless, despite the existing problems in the realization of the agro-ecological activities in animal breeding, the biological production is gaining momentum and is turning into a profitable strategy for each modern agricultural business.

Key words: biological agriculture, biological production of grain crops, specific characteristics in Bulgaria.

Николова М. Біологічне виробництво урожаїв зерна — перспективна форма підтримуваного сільськогосподарства в Болгарії

Сільськогосподарська екологія — ключовий елемент законодавства ЄС, і за минулі роки його значимість для загальної сільськогосподарської політики лише збільшилася. Один з головних викликів для Болгарії в процесі її економічної реструктуризації — забезпечити баланс між достатнім виробництвом продуктів харчування та збільшенням зайнятості з одного

боку і попереджувальним захистом навколишнього середовища — з іншого.

Біологічне сільське господарство було вибрано як експериментальна сільськогосподарська діяльність в рамках сільськогосподарського екологічного заходу в країні. Не зважаючи на цей факт, Болгарія була порівняна з низкою Європейських країн, які вже мають досвід у сфері біологічного виробництва. Проте, незважаючи на існуючі проблеми в реалізації агро-екологічних дій в тваринництві, біологічне виробництво набуває інерції і перетворюється на прибуткову стратегію для кожного сучасного сільськогосподарського бізнесу.

Ключові слова: біологічне сільське господарство, біологічне виробництво урожаїв зерна, специфічні характеристики в Болгарії.

Николова М. Биологическое производство урожаев зерна — перспективная форма поддерживаемого сельского хозяйства в Болгарии

Сельскохозяйственная экология — ключевой элемент законодательства ЕС и за прошедшие годы его важность для общей сельскохозяйственной политики только увеличилась. Один из главных вызовов для Болгарии в процессе её экономической реструктуризации — обеспечить баланс между достаточным производством продуктов питания и увеличением занятости с одной стороны и предупредительной защитой окружающей среды — с другой.

Биологическое сельское хозяйство было выбрано как экспериментальная сельскохозяйственная деятельность в рамках сельскохозяйственного экологического мероприятия в стране. Несмотря на этот факт, Болгария была поздно сравнена с рядом Европейских стран, которые имеют опыт в сфере биологического производства. Однако, несмотря на существующие проблемы в реализации агро-экологических действий в животноводстве, биологическое производство приобретает инерцию и превращается в прибыльную стратегию для каждого современного сельскохозяйственного бизнеса.

Ключевые слова: биологическое сельское хозяйство, биологическое производство урожаев зерна, специфические характеристики в Болгарии.

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