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Production of Organic Products in Russia at the Modern Stage and on a Short-Term Horizon

(In the Context of Voronezh Oblast)

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***Abstract* — The possibility of producing organic products in the regions of Russia is determined, on the one hand, by the demand created by domestic and foreign consumers, and on the other hand, by the availability of land suitable for the production of these products, compensation payments allotted in the specific regulatory documents of the Departments of Agricultural Policy of regional administrations, and product prices. However, the production of organic products at its initial stage requires solving many problems associated with both production and sales, e.g. changing the technology of cultivation of various agricultural crops, industrial production of acceptable protection products, certification of not only finished products, but also organic fertilizers, protective agents, land, etc. The authors present the analysis of the basic physical and value indicators for conventional crop production, as well as economic forecast of their possible changes in the conditions of organic production. This publication also demonstrates the contribution of organic agriculture to the Sustainable Development Goals highlighting that the potential of organic farming contributes to a sustainable future.**

Keywords — organic farming; global statistics; organic food market; certified organic; main trends in the development; regulatory documents; changes in the technology; production efficiency.

I. INTRODUCTION

Agriculture is one of the most basic activities of all mankind because people all over the world need to nourish themselves every day. History, culture and community values stem from agriculture. The principles applied to agriculture in the broadest sense concern the ways people tend soils, water sources, plants, animals in order to produce food and other goods. The Principles of Organic Agriculture serve to inspire the organic movement in its full diversity.

Principle of Health: organic agriculture should sustain and enhance the health of soil, plant, animal, human beings and the planet as one and indivisible.

Principle of Ecology: organic agriculture should be based on living ecological systems and cycles, work with them and help sustain them.

Principle of Fairness: organic agriculture should be built on relationships that ensure fairness with regard to the common environment and life opportunities.

Principle of Care: organic agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

The role of organic agriculture, whether in farming, processing, distribution, or consumption, is to sustain and enhance the health of ecosystems (soil, plants, animals, human beings). In particular, organic agriculture is intended to produce high quality, nutritious food that contributes to preventive health care and well-being. In view of this it should avoid the use of artificial fertilizers, pesticides, food additives that may adverse health effects. Organic agriculture should attain ecological balance through the design of farming systems, protect and benefit the common environment including landscapes, climate, habitats, biodiversity, air and water.

In recent years the international market for organic products has been growing steadily with an excess of demand over supply. The demand to supply ratio for organic products varies from country to country. For instance, in Germany demand significantly exceeds supply, while New Zealand

traditionally exports different organic products in large volumes, having established a reputation as a good producer of such products.

In 2017, the global market for organic food reached 97 billion US dollars (approximately 90 billion euros). The United States of America is the leading market with 40 billion euros, followed by Germany (10 billion euros), France (7.9 billion euros), and China (7.6 billion euros). In 2017, many major markets continued to show double-digit growth rates, and the French organic market grew by 18 percent. The Middle Eastern countries are characterized by a small but growing market with an increase from $18 billion to $82 billion over the past 15 years.

In 2017, 2.9 million organic producers were reported, which is 5 percent more than in 2016. India continues to be the country with the highest number of producers (more than 830.000), followed by Uganda (210.352), and Mexico (210.000). More than 84. of the producers are in Asia, Africa, and Latin America.

At the end of 2017, a total of 69.8 million hectares were organically managed representing a growth of 20 percent or 11.7 million hectares over 2016, the largest growth ever recorded. Australia has the largest organic agricultural area (35.6 million hectares), followed by Argentina (3.4 million hectares), and China (3 million hectares). Due to the large area increase in Australia, half of the global organic agricultural land is now in Oceania (35.9 million hectares). Europe has the second largest area (21 percent; 14.6 million hectares), followed by Latin America (11.5 percent; 8 million hectares). The organic area can be defined as ever-increasing across continents [1]. Globally, 1.4 percent of the farmland is organic. However, many countries have far higher shares. The countries with the largest organic share of their total farmland are Liechtenstein (37.9 percent), Samoa (37.6 percent), and Austria (24 percent). In fourteen countries, 10 percent or more of all agricultural land is organic.

The highest consumption of organic products per capita was recorded in European countries: in 2017 Switzerland had the highest per capita consumption worldwide (288 euros per capita), the Danish spent a little less than the Swiss (280 euros per capita), and the Swedes spent a little less than the Danish (220 euros per capita) [1].

According to recent investigations conducted by the group of experts of Markets and Markets™ (Markets Research Reports), the main trends in the development of the global market for organic products include a steady increase in production and consumption figures, as well as global trade volume.

In some countries the market for organic products is stably formed, understandable and developing gradually. The same cannot be said about Russia, where this market is just beginning to take shape.

However, legislative documents have been adopted at various levels to regulate this sphere of activities [2–4]. Accredited bodies for certification of products of this sphere are appearing in the Russian regions (one of the first was accredited in Voronezh Oblast), and conditions are being created to provide support to the participants of the market for organic products.

Organic products are defined as "... environmentally friendly agricultural products, raw materials and food, the production of which meets the requirements established by ... law" [2].

The cultivation technology involves the production of grain products, fruits and vegetables without applying pesticides, growth stimulants and mineral-based fertilizers. Organic production is understood as manufacturing of environmentally friendly products.

Production of organic products is enshrined in the regional program documents, the purpose of which is comprehensive and efficient development of the region that contributes to the improvement not only in economic, but also in social and environmental activities [5, 6].

Many scientists have previously spoken about the need for agricultural biologization [7–11], and regulatory documents were adopted [12], but the market required an increase in production indicators, which were difficult to achieve without mineral fertilizers and protective agents.

II. Results and Discussion

In Voronezh Oblast the implementation of organic farming began in 2018. Only five producers (organizations and individual entrepreneurs) were reported to manage organically the area of 3,740 hectares that year.

Producers entered a transition period, which includes inspection and assessment of organic production with visits to the applicant during the transition period in order to collect evidence of compliance or non-compliance with the established requirements (a buffer zone between conventional and organic fields to limit the ingress of pollutants, application of fertilizers and plant protection products, sampling of plants for GMOs and soil for pollutants, phytosanitary inspection, etc.).

The presence of an accredited products certification body in the region will allow financial support for enterprises. The Department of Agrarian Policy has developed measures to support organic farming starting from 2020. They are as follows:

- compensation of 100. of the costs of production certification;
- compensation of 50. of the cost of fertilizers, biological preparations, feed additives, etc., allowed in organic production;
- allotment of 10 thousand rubles per 1 ha during the transition period and 7 thousand rubles upon the receipt of certificate.

It is known that in the market economy environment a commodity producer always determines the efficiency of production of particular products (including organic) and above all, the economic efficiency [13].

During research the authors considered the specific figures of possible benefits and losses in the production of organic products by large agricultural commodity producers and peasant (farm) enterprises analyzing the actual and possible results for those types of products that will primarily be in demand as organic.

The physical and value indicators for the production of some types of products in the whole Voronezh Oblast in 2018 are presented in Table I.

TABLE I. THE MAIN INDICATORS OF PRODUCTION BY COMMODITY PRODUCERS OF VORONEZH OBLAST IN 2018

Types of products	**Costs, rubles per 1 ha**					**Yield, c/ha**	**Production cost, rubles**
	total	***including***					
		seeds	***fertilizers***		***protective agents***		
			total	***organic***			
Grain crops, average	28.155	3.119	3.017	352	2.503	36.3	676.58
of which buckwheat	12.338	1.739	609	86	570	12.3	1,000.50
Soybean	26.767	4.026	2.132	24	4.859	16.5	1,624.76
Field vegetables	319.031	36.332	19.983	45	26.458	440.8	723.57
Potato	188.188	52.400	23.023	672	30.665	246.0	764.94

[a.] Calculated by the authors on the basis of annual reports of agricultural organizations in Voronezh Oblast

As it shown in Table I, on average the share of costs of seeds, fertilizers and protective agents, respectively, is as follows:

- 11.1, 10.3 and 8.9 for grain crops;
- 14.1, 4.9 and 4.6 for buckwheat;
- 15.0, 8.0 and 18.2 for soybean;
- 11.4, 6.3 and 8.3 for vegetables;
- 27.8, 12.2 and 16.3 for potato.

In total, these costs ranged from 23–26 for buckwheat and vegetables to 41–56 for soybean and potato.

In the production of organic products, the costs associated with the purchase and application of seeds, fertilizers, and protective agents will inevitably change, since the use of other current assets and technologies is required. In this case one of them (the cost of seeds) will be increased by about 2 times due to the need to purchase certified seed material.

The cost of fertilizers and protective agents may decrease by 3–4 times due to the impossibility of applying mineral fertilizers and the lack of permissible organic fertilizers in required quantities.

Organic farming methods combine scientific knowledge of ecology and some modern technologies with traditional farming practices based on naturally occurring biological processes. Organic farming methods are studied in the field of agroecology.

Organic agriculture developed as a response to the chemicalization of agriculture. While conventional agriculture uses synthetic pesticides and water-soluble synthetically purified fertilizers, organic farmers are restricted by regulations to using natural pesticides and fertilizers (an example of a natural pesticide is pyrethrin, which is found naturally in the Chrysanthemum flower).

The principal methods of organic farming include crop rotation, green manures and composts, biological pest control, and mechanical cultivation. These measures use the natural environment to enhance agricultural productivity: legumes are planted to fix nitrogen into the soil, natural insect predators are encouraged, crops are rotated to confuse pests and renew soil, and natural materials such as potassium bicarbonate and mulches are used to control disease and weeds. Genetically modified seeds and animals are excluded.

Organic farming relies heavily on the natural breakdown of organic matter, using techniques like green manure and composting, to replace nutrients taken from the soil by previous crops. The main source of humus replenishment in the soil is the application of organic fertilizers (manure), the application rate for which is 6–8 t per hectare with the actual application of 2 t per hectare in Voronezh Oblast [14–16].

It is recommended to apply poultry manure, decomposed cattle and swine manure as organic fertilizers for winter cereals. For spring cereals, in addition to the above, it is possible to apply fresh cattle and swine manure. However, this should be manure from livestock fed with natural feeds.

Organic fertilizers (manure) currently produced in animal husbandry do not meet the imposed requirements due to intensive character of animal husbandry and can not be used in the production of organic products. Compost production has as yet been organized only in small volumes, its purchase is expensive, and there are no reasonable calculations on the efficiency of this type of fertilizer. Whereas for grain crops, soybean, and potato there are breeding developments on the resistance of cultivars to pests and diseases, for vegetable crops there are much fewer developments.

The impossibility to use herbicides will reduce the costs under the “Protective agents” item, but will require costs of manual labor to a certain extent, which will entail an increase in the wage fund with allocations to insurance funds. Most likely this will affect the production of vegetables and potatoes, which are still being produced in small volumes. The use of manual labor in the cultivation of other crops is problematic due to the lack of labor resources for these works (e.g. manual weeding) in rural areas.

Many biological preparations available on the market for pest and disease control have no noticeable effect compared to chemical products, which in our opinion will lead to a decrease in yield by about 2 times.

To a certain extent the appropriate use of crop rotations (as a way of controlling plant diseases and crop pests) as well as modern cultivation technologies can counteract the decrease in yields of agricultural crops. When choosing crop rotations, experts recommend using legumes, pulses and perennial legumes as preceding crops. It is also recommended to cultivate intermediate crops, exclude the alternation of cereals with cereals, and avoid a high proportion of cereals in crop rotation.

As a result of refusal to use quick-release nitrogen fertilizers the content of nitrogen, free amino acids and various sugars in plants decreases, which leads to a decrease in damage caused by grain aphids, powdery mildew and cereal rust.

Underwinter tillage should be thorough using a plow to destroy weeds, and presowing tillage should comply with all technological requirements for the time frame of works. In terms of suitability for organic farming there are varietal differences.

Therefore, it is recommended to choose cultivars that are more competitive with weeds, require less nitrogen (low-input cultivars), and are resistant to diseases. In organic farming it is allowed producing sowing and planting material only according to established rules, which include prohibited use of chemical treatment.

At the same time the role of diseases transmitted by seeds is increasing. For instance, this concerns common bunt of wheat (*Tilletia caries*), loose smut of barley and wheat (*Ustilago nuda*, *Ustilago tritici*), as well as some types of leaf spot disease. In order to combat them it is allowed using thermal disinfection with hot water, electromagnetic radiation, and a number of biological preparations.

Seed material for organic farming is usually subjected not only to mandatory testing, but also to additional analysis ("cold test"), which allows earlier identification of possible diseases and removal of the corresponding seed batches from breeding and cultivation.

A significant problem after plowing of perennial grasses may be the presence of wireworms (larvae of click beetles (*Elateridae* species), which pose a particularly serious threat in humus-rich soils.

Due to the large proportion of perennial grasses in crop rotation of organic production enterprises, there is a higher risk of vole (*Microtus arvalisis*) infestation. In order to reduce their population, it is advisable to mount special poles 2.0–2.5 m high at a distance of 200 m from roads, based on the viewing radius of most birds of prey (50 m in low grass stand, 1 bird per hectare). It is better to perform acceptance immediately after harvesting grain or forage perennial crops. Thus, organic farming enhances the role of birds of prey that hunt for harmful rodents.

In order to control rodents, pests and fungal diseases it is recommended to apply different types of stone flour (e.g. granite, basalt, dolomite, crude phosphate, etc.), although the efficiency of some types is questionable. Granite and basalt (basalt flour) are more effective against fungal diseases and lodging of grain crops.

A set of measures listed above helps to create more favorable conditions for protecting crops from outbreaks of pests and diseases. However, during periods of epiphytotics and mass reproduction of harmful organisms the production of organic products becomes more complicated, since direct chemical control measures are excluded. Therefore, the dependence of production on weather conditions and their impact on the phytosanitary condition is usually greater than with conventional farming, which will affect production efficiency. Thus, in the production of organic products the uncertainty in the final results increases.

The profitability of organic agriculture can be attributed to a number of factors. First, organic farmers do not rely on synthetic fertilizer and pesticide inputs, which can be costly. In addition, organic foods currently enjoy a price premium over conventionally produced foods, meaning that organic farmers can often get more for their yield. The price premium for organic food is an important factor in the economic viability of organic farming.

The efficiency of production and sales of products with conventional methods of cultivation in 2018 is presented in Table II.

TABLE II. EFFICIENCY OF PRODUCTION AND SALES OF PRODUCTS WITH CONVENTIONAL METHODS OF CULTIVATION IN 2018 FOR THE WHOLE VORONEZH OBLAST

Types of products	**Production cost of 1 c, rubles**	**Total cost of 1 c, rubles**	**Selling price, rubles**	**Profit (loss) per 1 c, rubles**	**Cost-benefit ratio (cost recovery), .**
Grain crops, average	676.51	653.56	877.37	223.81	34.2
Buckwheat	1,000.50	1,117.99	944.60	(173.06)	(84.5)
Soybean	1,624.76	1,964.26	2,381.97	417.71	21.3
Field vegetables	723.57	813.42	767,67	(45.75)	(94.3)
Potato	764.94	751.90	805.66	53.76	7.1

[b.] Calculated by the authors on the basis of annual reports of agricultural organizations in Voronezh Oblast

The difference between production and total cost is, on the one hand, due to an increase in the total cost by selling costs (for buckwheat, soybean, and vegetables), and on the other hand, to the sale of previously (2017) produced products, the production cost of which is lower than the cost in the current year (for grain and potatoes). Of the products under consideration, buckwheat and field vegetables are unprofitable with the cost recovery of 84 to 94.

During research the authors predicted the costs, yield, production cost, and efficiency of sales taking into account the possible changes in these indicators in the conditions of organic production (see Table III).

TABLE III. FORECAST INDICATORS OF PRODUCTION IN ORGANIC FARMING

Types of products	Costs, rubles per 1 ha				Yield, c/ha	Production cost, rubles
	total	*including*				
		Seeds	*fertilizers*	*protective agents*		
Grain crops, average	28.000	5.500	700	2.000	20	1.400
of which buckwheat	13.300	3.400	200	400	10	1.330
Soybean	25.500	8.100	350	2.100	13	1.961
Field vegetables	265.000	50.000	1.200	15.500	300	883
Potato	180.000	70.000	5.000	25.500	130	1.385

[c.] Calculated by the authors

Forecast calculations show that a significant increase in production cost can occur for those types of products that currently have a high yield due to the use of mineral fertilizers and chemical plant protection products (e. g. for grain crops, potatoes, etc.).

The changes in the technology of crops cultivation and use of organic protective agents instead of chemical ones will prevent a significant increase in the cost of production of soybeans and vegetables with a slight decrease in yield and costs.

III. CONCLUSION

The weak point of organic agriculture due to which most of the farmers keep from switching to this method of production, is a significantly higher cost of production in comparison with industrial agriculture.

For most farmers, the ideological component alone is not enough to make them decide to become engaged in organic farming. Profit for them is still more important, and for this it is difficult to blame them, given that agriculture is already difficult to call a highly profitable business.

The losses of commodity producers caused by lower yields and higher cost of production can only be compensated by higher sales prices of organic products and free access to the global market, which requires the creation of an appropriate infrastructure.

At present the Association of Organic Market Participants is being created, which will include the following:

- Scientific and Research Innovative Company the Institute of Organic Agriculture (developing organic production technology, e.g. agricultural consulting, training, process automation, process quality control, etc.);
- Association The Chamber of Commerce and Industry of the Regions (federal and regional support, working with local business owners, international contacts and trade missions, etc.);
- Organicum Connect Company (contracts with agricultural producers for purchase and export of agricultural products);
- National Association of Genetic Safety (mandatory biological and genetic safety quality control, as well as nutritional value control of all products produced by self-regulatory organizations);
- Autonomous Non-Profit Organization of Continued Professional Education the Arsenal Institute of Advanced Training (online training in organic agriculture ensuring the wide availability of knowledge and increasing the number of well-trained specialists by regions);
- Bon Group LLC (organizing the process of certification of self-regulatory organizations), etc.

These numerous organizations will not solve all the problems associated with the difficulty of the initial period of production of organic products, which will undoubtedly affect the low profitability of these products.

In Russia, where the majority of the population buys food products focusing primarily on their cost rather than quality, the market niche for organic producers is extremely small. In fact, only Moscow, St. Petersburg, and some other major cities have a sufficient number of customers who are willing to pay more for healthier food.

Thus, we can safely say that without significant support from the state, the production of organic products in Russia in the coming years will develop at an extremely low rate. And given the recent economic difficulties, there will probably even be a pullback, since the already small market is shrinking.

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