

Agroecology as a strategic direction in the system of rational land use

Irina V. Kovaleva^{1*}, *Margarita G. Kudinova*¹, *Natalia A. Shevchuk*¹, and *Tatyana G. Elistratova*²

¹Altai State Agricultural University, 98, Krasnoarmeisky avenue, Barnaul, 656049, Russia

²Altai Department of Russian Academy Government Service and National Brunch, 145, Partizanskaya avenue, Barnaul, 656049, Russia

Abstract. Today there is growing demand for organic products principals to the growth in the production of ecological products and biologization of land. Traditional organic farming is a complex of elements of a reproductive nature with industry specifics and a set of elements. Agroecology does not involve the practice of biochemical vegetable defense product. The transition to organic farming requires agricultural producers to fulfill several conditions, which is an element that slows down the pace of development of both land biologization and the attractiveness of the organic products segment for producers. The Russian market is characterized by high average annual growth rates of organic lands; increasing the share of land for the production of organic agricultural products; unstable number of producers; stabilization of the volume of the internal market for organic products at the level of 120 million euro; stabilization of the export volume of organic products at the level of 4 million euro. Production of organic products is advisable in local product markets, since the production of organic products is a product with high added value, increased requirements for certification of organic products and a narrow segment of consumers.

1 Introduction

The dynamic progress of biological agrobusiness and the making of biological foodstuffs is of cumulative planned position equally for the atmosphere and for refining the superiority of lifetime of the people. At the similar period, minor forms of organization have possible for the manufacture of carbon-based crops. Considering organic agriculture as a production system of agroecology, it is assumed that it contributes to the improvement of bionetworks and syndicates old-style rural methods, pioneering knowledges and contemporary technical and technical growths that have a helpful result on the setting and, providing a near association among all systems of lifetime, included in this organization, provision their favorable development. Altai region, as a region with agrarian specialization, has significant land capitals for the growth of organic farming, since the main territory is occupied by agricultural land with sufficient resource potential for the transition to organically oriented agriculture.

* Corresponding author: irakovaleva20051@rambler.ru

The cross-border position of the district is careful as one of the optimistic aspects together in footings of the growth of possible global marketplaces for carbon-based foodstuffs and in footings of logistics substructure. This, in turn, will deliver supplementary trades in farming, upsurge the equal of economical result and the equal of maintainable growth of country zones. The active development of agricultural production - organic farming, is of increasing strategic importance both for the environment. At the same time, small forms of management have potential for the production of organic products.

2 Problem statement

The carbon-based marketplace in Russia is not emerging as intensively as the international one. On the one pointer, this can be clarified by a little actual request. Agroecology does not involve the practice of biochemical vegetable defense product. On the other hand, there is inadequate source owing to the inadequacy of the governing basis, the absence of actions to provision manufacturers of agrarian crops.

3 Research questions

In this training, the authors research the growth tendencies of the national marketplace for agroecology in the regional system land use.

4 Purpose of the study

In assembly with comparatively high development of Agroecology and of carbon-based farming, the determination of this training is to learn the growth tendencies of nutrition marketplace.

5 Materials and methods

The academic and working foundation of this learning stood the works of national and far-off economic expert devoted to the development of industry-specific product. The data base of the learning was complete up of numerical information from the Federal State Statistics Service, the Combined Interdepartmental Data Orientation Structure, the Regional Form of the Federal Government Information Service for the Altai Area, the Siberian Customs Administration, materials of scientific and practical conferences on the problem under consideration, periodicals and special publications .The study used the following methods: abstract logical, economic and statistical, monographic, as well as methods of structure study, financial assessment, professional valuations, monetary and exact model.

6 Findings

Biological land-living organization syndicates old-style rural systems, groundbreaking knowledges and contemporary methodical and technical progresses that take a valuable result on the environment and, by providing a near connection among all lifetime procedures comprised in this structure, support their promising progress. When leading carbon-based farming, the use of agrochemicals, pesticides, antibiotics, growth stimulants is excluded. Organic agriculture is present in the economy of about 180 countries and includes more than 2.2 million producers. At the same time, according to experts, the growth rate fluctuates at the level of 14%. [1].

Occupying about »...0.2% of the global marketplace for biological products, but has countless probable to expand their manufacture. According to the Russian Ministry of Agriculture, there are currently more than 10 million hectares in the country that container be place into flow. Maximum of them are parklands suitable for organic farming, in which mineral fertilizers have not been applied for a long time” [2].

From a scientific point of view, agroecology is, according to a number of economists, “... a set of agroeconomic approaches aimed at creating sustainable agricultural systems that optimize and stabilize crops. In the agro-ecological social movement, the emphasis is on the development of the multifunctionality of agriculture, the achievement of social justice, the development of identity and culture, and the enhancement of the economic viability of rural areas” [3]. Seeing this argument of opinion, it must be renowned that the procedures of minor commercial can be considered the most possible in the application of agroecological principles. For example, the FAO reverie for maintainable nutrition and farming, agroecology is one of the chief pillars of the global response to the current turbulence. It represents a unique approach to meeting the challenge of meeting our future food needs.” [4].

Given that this area of organic farming is aimed at the reproduction process of agricultural producers and end consumers, it is advisable to use and implement logistic models of supply chain management. According to a number of authors, "... communal and official novelties production a important character in moving the agro-ecological mode of manufacture and ingesting." At the similar period, it should be renowned that this course includes government rule in the method of various measures of state support. An analysis of world experience shows that countries solve this differently, but in general there are two main areas: direct and indirect support. As a rule, indirect measures involve compensatory measures in terms of costs “... for certification of organic production, assistance in intellectual and information support of organic market operators and promotion of the development of this area through various sources” [3].

“... In the US, the amount of such support is generally lower than in the European Union, and the difference in the structure is that most of the costs are for indirect support. Among the corresponding total mandatory budgetary expenditures, expenditures on scientific research predominate. They are followed by spending under the National Certification CostShare Program, with the remainder of the budget appropriation going to public awareness of the organic market. "[3] “... The maximum amount of financial assistance per year was set at \$20,000, and for a six-year period - \$80,000. These payments were calculated mainly for the transitional period for carrying out environmental activities, as well as meeting the requirements of the Organic Standards United States (NOP)" [3, 6].

The functional feature of supporting producers of the organic products marketplace in the EU states involves three areas (Figure 1).

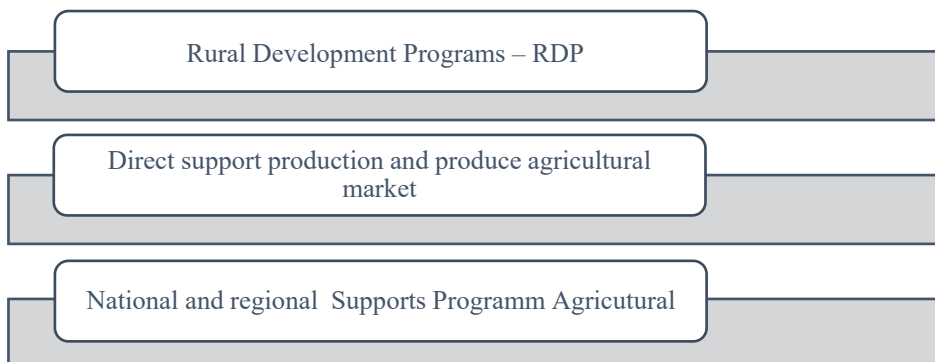


Fig. 1. Elements of support for organic producers.

The main requirements for production units in organic agriculture are non-GMO; clear separation between organic and traditional lands; a holistic view of the system of organic agriculture; soil fertility management; product marking; biodiversity, etc.

“...Traditional industrial agricultural systems deliver big capacities of world manufacture, but principal to degradation of land, aquatic capitals and ecologies, greenhouse air releases, and decrease biodiversity. At the similar period, the excellence worsens and the nutritious cost of the products decreases“ [3]. Specialists estimation the Russian marketplace of carbon-based foodstuffs at the level of 160 million dollars. As said by experts, the volume of the biological marketplace may comprise about 2,000 agrarian manufacturers. As said by the Union of Organic Farming, in Russia as of January 1, 2021, there are about 130 certified companies, of which 60 organizations have Russian certificates (Figure 2).

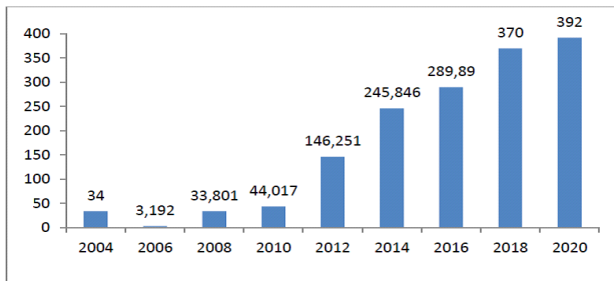


Fig. 2. The amount of land certified in the Russian Federation for organic matter, thousand hectares [2,5].

At the same time, more than 117 organizations produce food products, raw materials and feed; 9 organizations produce biological products and fertilizers.

In the structure of certified producers of organic products, Altai region occupies an average regional position, which is primarily due to certain difficulties in certification of organic products.

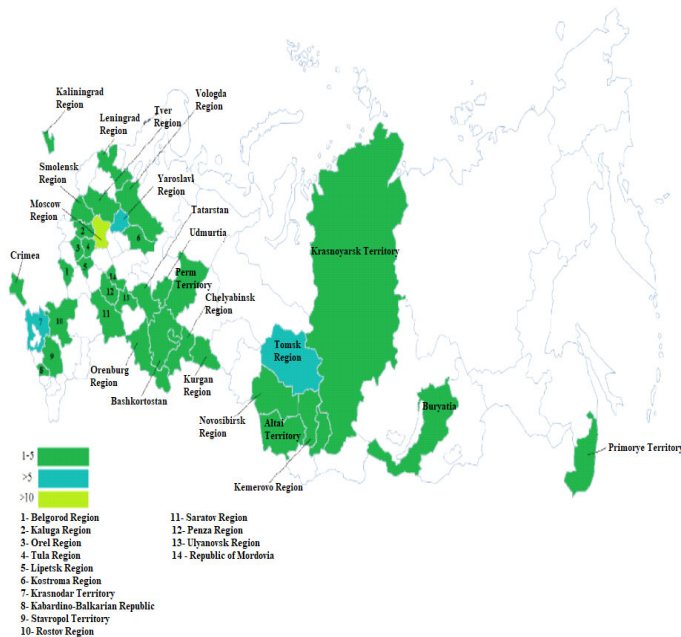


Fig. 3. Geographic segmentation of certified organic agricultural producers [3,7].

Unity of the planned guidelines for the progress of carbon-based farming is the increasing assistance of the state in creating conditions for small forms of farming in the production and sale of organic products. Thus, more than 87 thousand unimportant and average-sized productions are recorded in the county, which is about 23% of the full amount of persons working in the area's budget. Supplementary than 13% are employed in agriculture.

Altai region is in the TOP-10 in terms of arable land and production of spring wheat, buckwheat and oats, flour production (first place in Russia); 2nd place in the production of cereals, etc. (Table 1).

Table 1. The place of the Altai Territory in the all-Russian production of the main types of agricultural crops [5].

| Years | Major cultivated crops | | | | | | | |
|-------|------------------------|------|-----------|-----------|-------|-------------|------------|--------|
| | spring wheat | oats | buckwheat | sunflower | colza | linen curly | sugar beet | potato |
| 2018 | 1 | 1 | 1 | 9 | 1 | 1 | 12 | 13 |
| 2019 | 1 | 1 | 1 | 9 | 2 | 2 | 12 | 13 |
| 2020 | 2 | 1 | 1 | 10 | 2 | 2 | 11 | 11 |

According to the level of land chemicalization, Altai Krai (11.6 kg/ha) is considered as one of the potential regions with organic production. The dynamics of the composition of the sown areas of the region allows the development of organic farming and ensuring the agroecology of the reproduction process in the crop industries (Figure 4).

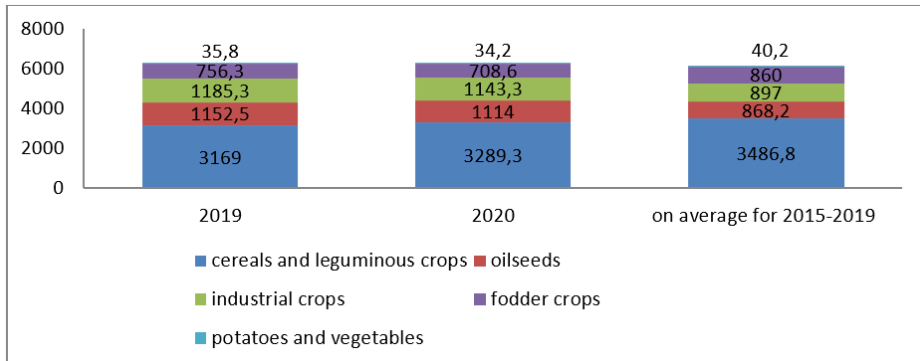


Fig. 4. Dynamics of the composition of sown areas in the Altai Territory, thousand tons [5,6].

The traditional predominance of spring and winter wheat grain harvests (more than 61%) in the structure of sown areas allows commodity producers to actively develop the flour-grinding and feed-processing industries. In the production of oilseeds, the cultivation of sunflower seeds for oil prevails (more than 62%), rapeseed and soybean crops occupy a total of about 24% (Figure 5).

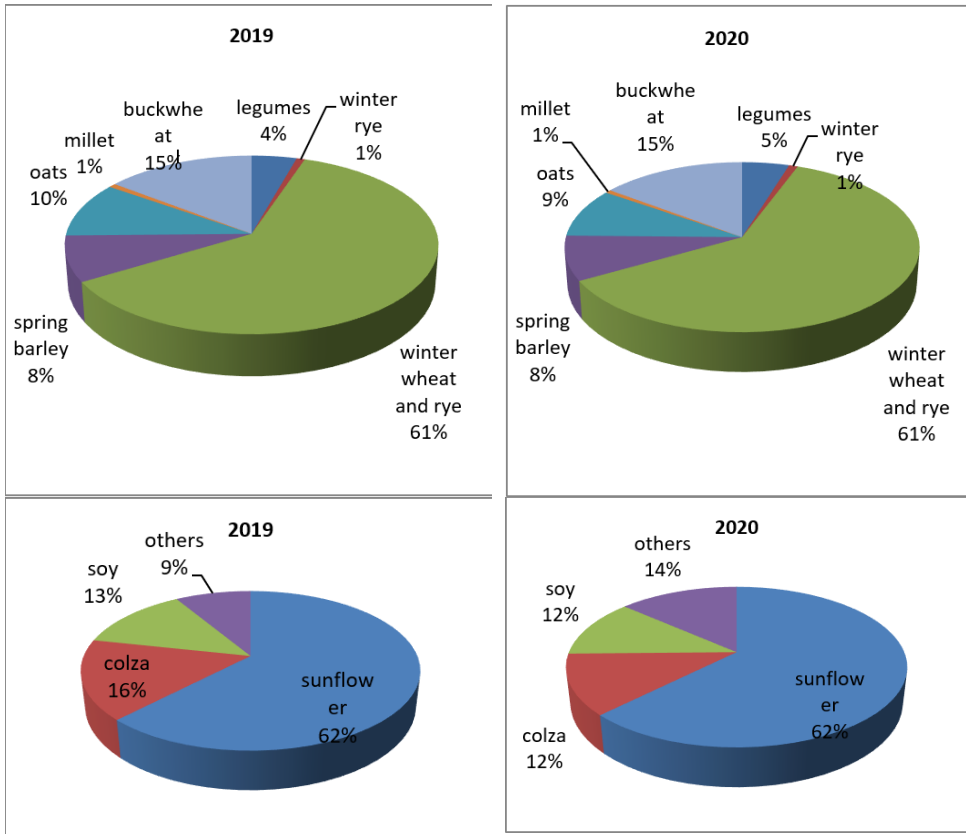


Fig. 5. The structure of sown areas of grain crops and oilseeds in the Altai Territory [5,6].

The harvest of agrarian harvests in the Altai Territory for the study period shows a negative downward trend (Figure 6).

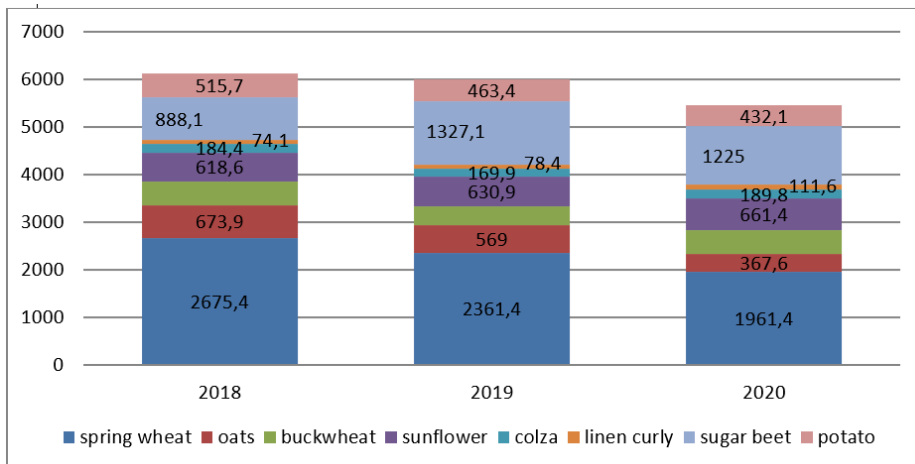


Fig. 6. Dynamics of gross harvest of the main agricultural crops in the Altai Territory, thousand tons [5,6].

The yield of grain crops is subject to volatility (Figure 7), which is explained by natural and climatic conditions - the region belongs to the zone of risky farming.

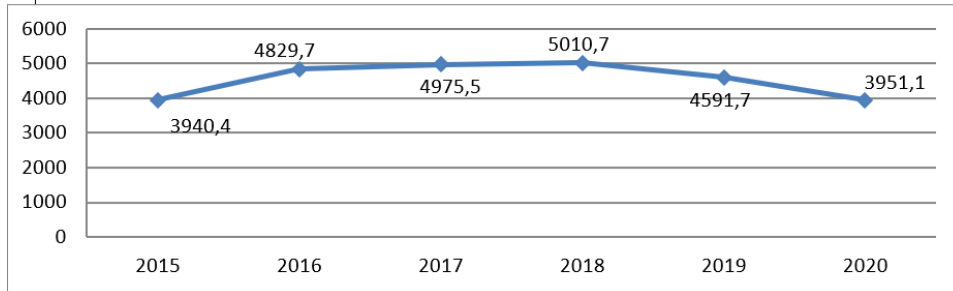


Fig. 7. Dynamics of gross grain harvest in the Altai Territory, thousand tons [4, 6].

In the Altai Territory, various modern systems for the cultivation of crops are widely rummage-sale, which brand it conceivable to get high yields. Thus, in 2020, resource-saving technologies were introduced in seven natural and economic zones of the region, agricultural machinery was updated and modernized, and high-yielding varieties and hybrids of agricultural crops were used when planting. To obtain good yields in the region, the system of plant protection against harmful insects, as well as mineral and organic fertilizers, is widely used. The use of highly efficient technologies in the region makes it possible to process more than 4 million hectares of area, including 400 thousand hectares - due to no-till technology and 18 thousand hectares - strip-till technology.

In today's realities, the region is implementing a project for the digitalization of the agro-industrial complex, which involves about 3 thousand farms, in which elements of point farming have been introduced using a complex of space navigation and field monitoring in more than 100 farms, including 15 agricultural organizations, on an arable land of 661 thousand hectares, as well as unmanned aerial vehicles are used in the fields of more than 10 farms and remotely controlled tractors and combines. The structure of commodity producers is dominated by agricultural organizations (52%); households - about 30%, Farmers - about 18%.

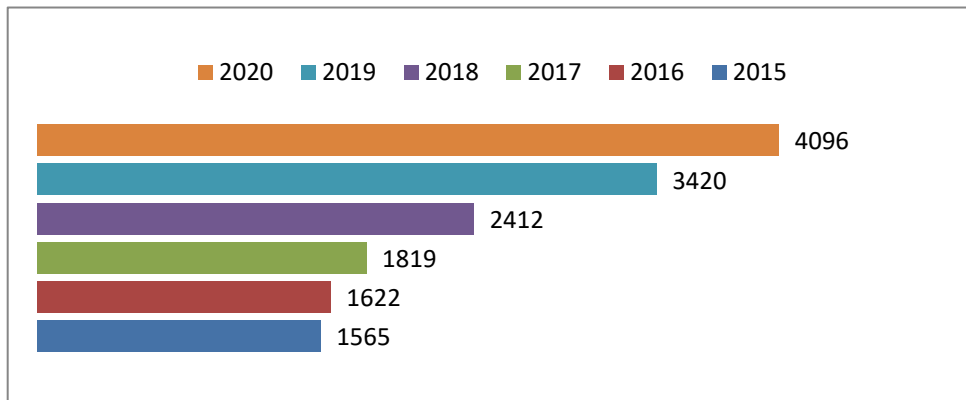


Fig. 8. Dynamics of the number of autotractor equipment with GLONASS navigation used by agricultural producers in the Altai Territory, units [4].

It would be renowned that appreciations to these knowledges, farming administrations in the region achieved to become a high harvest of grain and leguminous yields in 2020. Thus,

Agrofirma Niva of the Zonal Area established 64.1 c/ha of grain and leguminous harvests, with winter wheat - 51.3 c/ha and spring wheat - 50.1 c/ha; and in company of Virt, 55.5 c/ha, including winter wheat - 57.9 c/ha, barley - 61.4 c/ha; in Agrofirma Goodwill LLC of the Soviet District 38.7 centners per hectare, including 44.5 centners per hectare for peas; 13.7 centners/ha of grain were harvested in KH Partner LLC, Mikhailovsky District (despite the drought), including 22.7 centners/ha of corn grain.

In 2020, a space navigation system was introduced in the farming organizations of the region, which makes it conceivable to satisfy the necessary conditions for the introduction of modern knowledges for the manufacture of agrarian crops and their transport. So, in the region during this period, 4096 units of automotive and tractor equipment with GLONASS navigation were involved (in 2019 - 3420 units or 676 units less than in 2020). All this contributes to the application of agroecology techniques in crop production (Figure 9). The increase in costs for the cultivation of grain, leguminous and oilseeds in the region ran to an upsurge in their cost by 26.8%, including for wheat - by 25.9%, rye - by 35.8%, buckwheat - by 30.0%, oats - 38.1%, barley - 18.9%. There was also an increase in the cost of oilseeds, among which sunflower showed a significant increase - 22.1%.

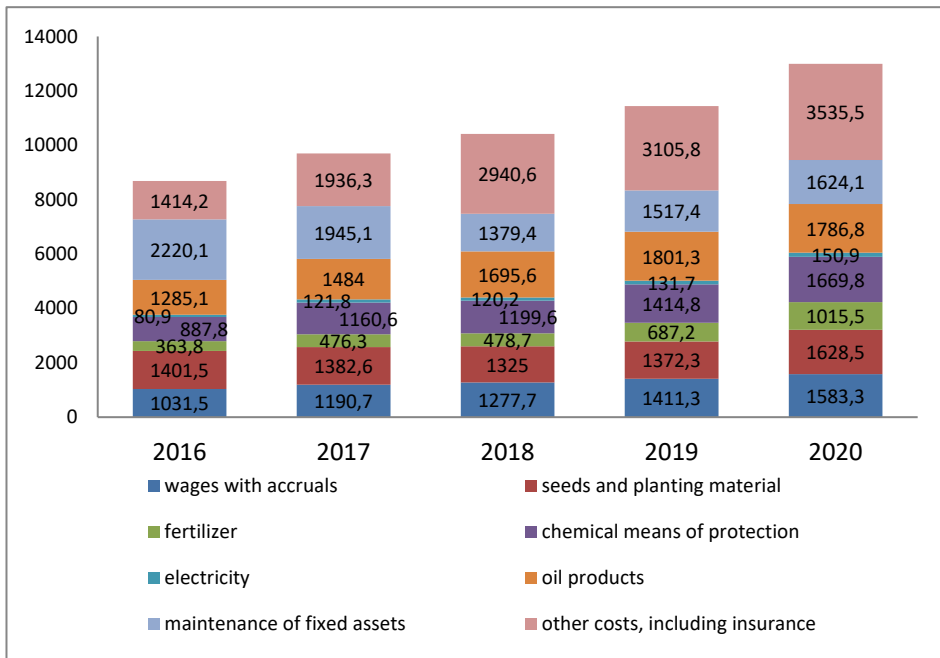


Fig. 9. Dynamics of the composition of costs for the cultivation of grain and leguminous crops in the Altai Territory per harvested area, rub/ha [4].

Stabilization of the value state in the harvest manufacture marketplace ran to an upsurge in the marketing value of grain associated to the previous time - the price of grain harvests increased by almost 1.5 times. A significant jump occurred for buckwheat, after falling prices in the previous two years, its growth was 1.9 times compared to 2019 [4,9]. The selling price of sunflower, soybeans and rapeseed also increased by 38.7%, 30.0% and 44.6%, respectively (Figure 9,10,11) [4,8].

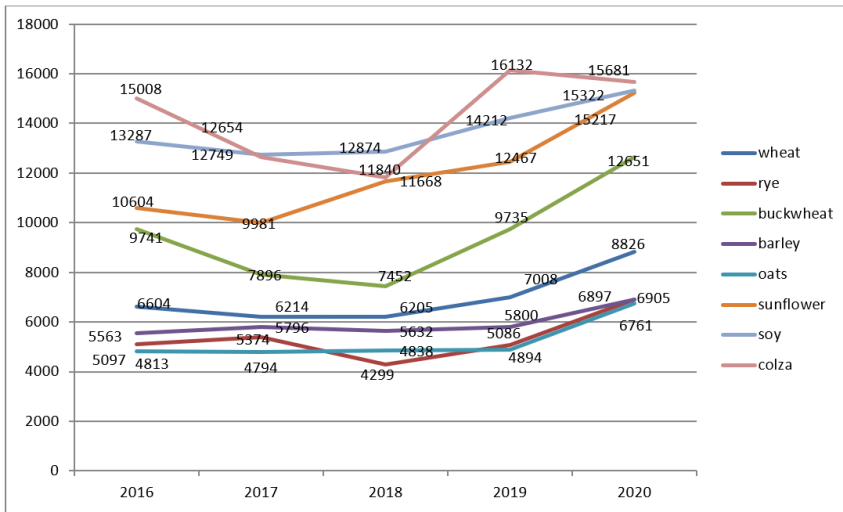


Fig. 10. Dynamics of the cost of sold crop products, rub/t.

The profitability of grain in 2020 reached 50.5% compared to 2019. The highest profitability was noted for buckwheat - 113.4%, the lowest - for barley - 29.3%. It must be renowned that in the setting of agricultural crops, especially cereals, production efficiency is unstable, which affects the competitiveness of crop sub-sectors and effects the development of the structure of sown areas in the region.

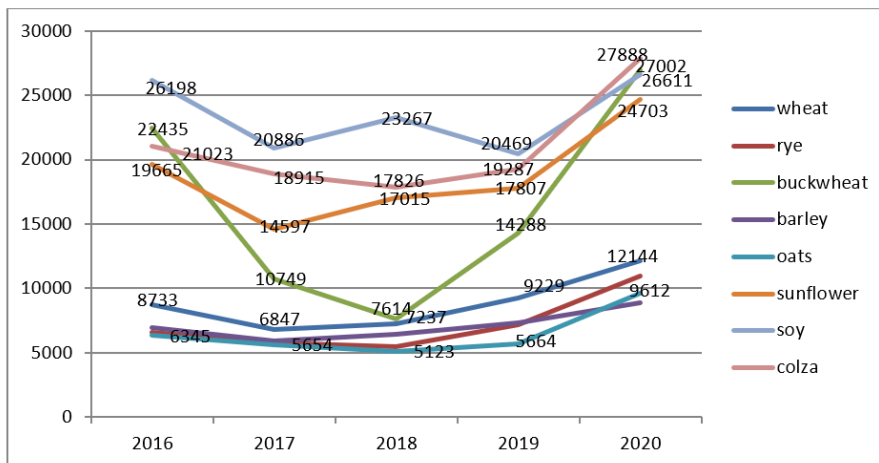


Fig. 11. Dynamics of sales prices of crop products, rub/t.

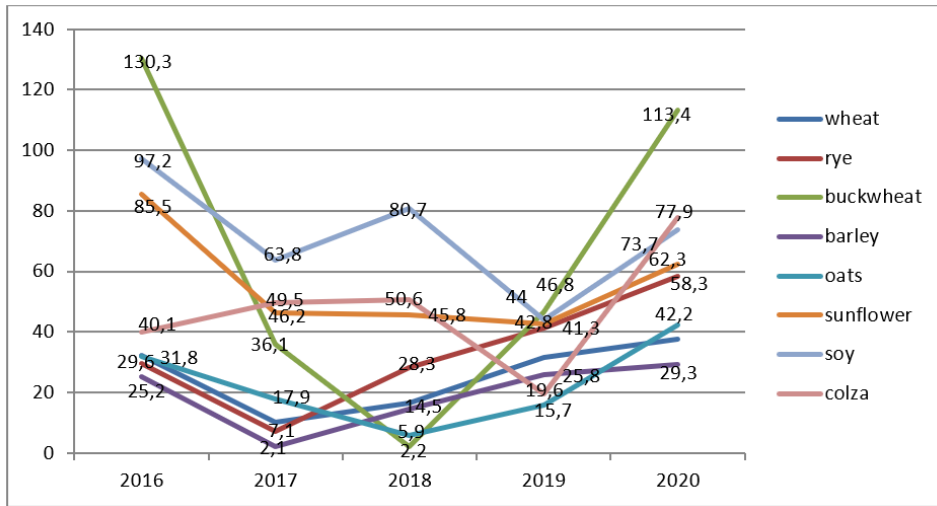


Fig. 12. Dynamics of the achieved level of profitability in the cultivation of crop products, %.

7 Conclusion

Altai Territory, using its potential, produces about 40% of agricultural products with improved environmental characteristics. However, the development of organic production is slow, only four organizations in the region received certificates for the production of such products - three of which produce grain and legumes [8]. The issues with low rates of modernization and technical re-equipment of the industry remain unresolved; lack of financial resources; low level of raw materials processing; underdevelopment of the logistics infrastructure; low rates of development of inter-farm and sectoral cooperation and integration, internal migration processes associated with the outflow of the rural population and the predominance of the population of retirement age. Thus, the development of agroecology - organic farming and organic products, is of increasing strategic importance both for the environment and for refining the excellence of lifetime of the people. At the same time, small forms of management have potential for the production of organic products.

References

1. The world of organic agriculture (2020). Available at: <https://www.ifoam.bio>
2. Research Institute of Organic Agriculture FiBL (2022). Available at: <https://statistics.fibl.org/>
3. O. V. Mironenko, Considers and bakery production **1(2)**, 52-57 (2018)
4. Territorial authority of the Federal State Statistics Service for the Altai Territory (2022). Available at: <http://akstat.gks.ru>
5. Regions of Russia. Socio-economic indicators (2018). Available at: http://www.gks.ru/free_doc/doc_2018/region/soc-pok.rar
6. Agricultural products in (2020). Available at: <http://rosstat.gov.ru/>
7. O. Voronkova, I. Kovaleva, IOP Conf. Series: Materials Science and Engineering **1079**, 072007 (2021). <https://doi.org/10.1088/1757-899X/1079/7/072007>

8. I. V. Kovaleva, IOP Conf. Ser.: Earth Environ. Sci. **548**, 022067 (2020)
9. O. Yu. Voronkova, I. V. Kovaleva, Quality Access to Success **20(172)**, 114-118 (2020)