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Conditions and opportunities to realize the agricultural potential of the North *

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Abstract. The article shows the role of the agricultural sector of the North in providing the population with fresh food products, preserving the traditional way of life of the indigenous ethnic groups, sustainable development of the northern territories, and ensuring the country's food security. The organization of agriculture in the north and Arctic territories of Scandinavia, Canada and Alaska and the possibility of its use in the Russian North, considering its own rich historical experience, is discussed in the article. The generalization of agricultural practices in northern countries allows us to recommend the Scandinavian development of agriculture and, above all, the experience of Finland for the European North of Russia. Canadian model of agricultural development is of little use for the Russian North since it was designed for sparsely populated territories. The study revealed the possibilities and limitations of the development of agriculture in the North. The critical points for the socio-economic development in the agrarian sector are the availability of natural and labor resources, the possibility of organizing organic (ecological) production within the traditional industries, the industrial nature of the economy that directs significant financial resources for the industrial modernization and the integrated development of rural areas. The study also revealed the possibilities and limitations of the agricultural development of the North. The constraints of agricultural development and food self-sufficiency are explicit. They are related to extreme natural conditions, low availability of biological resources, the poor technical support of the agrarian sector, low-qualified employees and hard living conditions of peasants, unfavorable external environment, inefficient state support, unavailability of loans, and unsustainable sales of agricultural products. The changes in the agriculture of the northern territories after the All-Russian Agricultural Censuses 2006 and 2016 revealed. The results of the study serve the ground for substantiating conceptual approaches to the development of agricultural production and increasing the level of food self-sufficiency of the local population.
Keywords: *agriculture, foreign northern countries, opportunities and constraints on the agricultural development, All-Russian Agricultural Census, forms of economic management, resource potential, infrastructure, innovative technologies, the North.*

Introduction

The territories of the Far North and similar areas occupy almost 70% of the Russian Federation. It consists of 24 subjects: Republics of Karelia, Komi, Sakha (Yakutia) and Tyva; Kamchatsky Krai; Arkhangelsk, Magadan, Murmansk and Sakhalin Oblast; Nenets, Khanty-Mansiisky, Chukotka and the Yamal — Nenets Autonomous Okrug are in the North. The northern territories are of importance in the socio-economic development of the country. Significant reserves of oil, gas, coal, chromium, manganese, gold and diamonds, vermiculite, nickel, copper and other rare metals are concentrated here. The share of the northern areas in the catch of fish and seafood is more than 50%. In the northern territories, about 2/3 of the world number of domestic reindeers is concentrated.

Agriculture and fisheries of the North developed together with the territory. Its specialization

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is influenced by nature, location, historical and socio-economic factors in the production of low-transport and perishable products, as well as traditional industrial products.

At the beginning of the 20th century, the possibility of northern agriculture was proved by the founder of agricultural science in the European North of Russia A.V. Zhuravsky. In 1911, the order of the Department of Agriculture of Russia established the Pechora agricultural experimental station in Ust-Tsilma. Its founder and first director was A.V. Zhuravsky. He convincingly proved that "it was not the climate that kept Pechora's agricultural development, but conditions that had nothing to do with the climate. And not far, hopefully, is the time, when the circumpolar abundance of light will be used for the welfare of Russia..." [1, Zhuravsky A.V., p. 64]. The possibility of "northernering" agriculture was also considered by N.I. Vavilov, D.N. Pryanishnikov and others.

In 1950-1980s, biologists of the Komi branch of the Academy of Sciences of the USSR [2, Archheva I.B., Panyukov V.A., Andrianov V.A.; 3, Khantimer I.S.]. Agricultural producers of the polar Vorkuta got 2 thousand ha of crops of perennial herbs. Their green mass amounted to more than 100 tons per 1 ha [4, Kotelina N.S., Archheva I.B., Ivanov V.A.]. The method of "tinning" tundra was applied in Yakutia.

Agricultural products in the North (except for traditional industries) are more expensive, unable to compete with similar products imported from abroad and from southern Russia. At first glance, it is necessary to minimize agricultural production. However, it is illegal to approach the development of local agricultural products from the standpoint of: "Everything that makes a profit is good, but everything that does not make it should be disposed of." Assumptions of uncompetitive and limits of northern agriculture will result in enormous public expenditure on indigenous employment by non-agricultural activities. The elimination of the northern village is not only a painful and costly process, but it also weakens national security.

The aim of the article is to identify factors and conditions that contribute to the development of the northern agriculture of the Russian Federation.

To achieve this goal, the following research objectives are defined: to reveal the role of agriculture in providing the population with fresh food and fulfilling its social function: to summarize the experience of foreign northern countries and the possibility of its use in the North of Russia; to identify conditions and opportunities for the development of the agricultural sector; following the results All-Russian agricultural census 2006 and 2016, to consider changes in the agricultural sector.

Social and economic importance of agriculture

The share of the Northern population in the Russian Federation is 6.8%; the area of farmland — 2.5%, the number of cattle — 4.5%. In the northern and Arctic territories, there are 1906 thousand domestic deer.

The share in the total production of agricultural products the Far North of Russia and similar areas in 2016 was 3.4% for potatoes, 1.9% — vegetables, 2.3% — milk, 1.3% — meat. Due to

the reduction of production, the share of the North and the Arctic in the total production of agricultural products of the country decreases (Fig. 1).

Agriculture and fisheries in the North and the Arctic are related to the way of life of indigenous peoples. In the pre-reform period, almost 2/3 of small indigenous peoples were engaged in agriculture and industry [5, Seleznev A.I., p. 32]. Overall, in the Nenets Autonomous Okrug, more than 60% of indigenous peoples were employed in traditional industries, while in some rural municipalities of the Okrug, their share ranged from 79% to 92% [6, Severniy Ekonomicheskiy Raion..., p. 106].

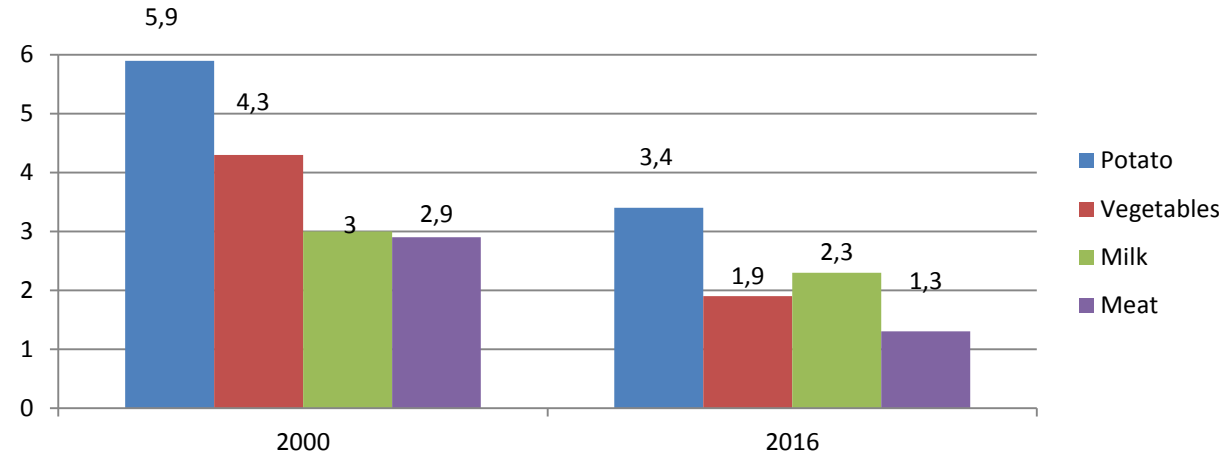

Figure 1. Share of production of basic agricultural products of the North in total production products of Russia, %.[1]

The special importance of agriculture is since this sector and forestry is the basis of rural development. It is the sustainable development of agriculture and fisheries as a socio-ecological-economic system that is appropriate to consider in relation to the interests of indigenous peoples.

Agriculture in the North not only provides the population with fresh biological and nutritious food but also stimulates the development of the food industry, stabilizes employment, prevents the monopolization of local food markets by individual suppliers, restrains the prices of food imported from outside the region, serves as a traditional way of life of the rural population, contributes to the preservation of spirituality, culture, traditions, morals, improvement of the demographic situation, the system of resettlement of people, preservation of the environment and natural landscape. Agriculture is both a branch of irreplaceable material goods and a sphere of human life. The elimination of agricultural production means a change of residence or even a way of life.

Agriculture, due to its specificity and features of market relations, is moving towards the social sphere and can be developed only with state support. The social role of entrepreneurship focused on counteracting social insecurity in areas with adverse conditions is discussed by A.N. Pilyasov and N.Yu. Zamyatin [7].

Especially important for the development of northern agriculture is the budget. Without

[1] Reference: 1. Ekonomicheskie i social'nye pokazateli rajonov Krajnego Severa i priravnennyh k nim mestnostej v 2000-2016 gg. [Economic and social indicators of districts of the Far North and equated areas in 2000-2016]. Rosstat. Moscow, 2017 URL: http:/www.gks.ru/bgdyreg/bl6_22/vain.htm. [In Russian] 2. Regiony Rossii. Social'no-ekonomicheskie pokazateli [Regions of Russia. Socio-economic indicators]. 2001, 2017: /Rosstat. [In Russian]

state support, agricultural enterprises and farms will be forced to reduce the production of environmentally friendly and perishable products. The state would then need disproportionately higher costs for the employment of indigenous ethnic groups than maintaining the agricultural sector of the North.

The need to develop agricultural production in the North is also due to the solution of the food sovereignty issue of the country. Until recently, the degree of medical nutrition standards at the expense of own production revealed that Russia belonged to countries not able to provide own food security. In 2016, due to its own production, the real consumption of potatoes (126%), poultry (101), pork (127) and eggs (102%) exceeded the rational consumption standards. The figure for beef is only 55%, milk — 58%, vegetables and melons — 75%.[2]

The agricultural experience of Nordic countries

Let us turn to the experience of agriculture in the northern and Arctic territories of Scandinavia, Canada, and Alaska, which can be useful for the Arctic zone of the Russian Federation. For our country it is necessary, first, to consider the agricultural models of Northern Europe [8, Lotte Hedeager, Kristian Kristiansen, Erland Porsmose; 10, Jonas Smitt; 11, Kauppala P.; 12, Soumen maatalouden historia]. A distinctive feature of agriculture in northern European countries is the diversification of agricultural production, based on a combination of crop and animal husbandry, which ensured the sustainability of agriculture. There, agrifood systems formed the principle of parity importance of agricultural production and rural society. According to it, any agricultural production can be considered effective only if it has a positive impact on the development of rural areas [13, Polbitin S.N., p. 132]. It is the principle of a combination of agricultural production, the northern rural way, and the development of rural areas can be the basis of methods and forms of agriculture in the Russian North.

According to Pekka Kauppal, in the European North and the Komi Republic the most acceptable way of development of agriculture is Finland's one. Unlike Canada, where agricultural production never functioned in the zone of coniferous forests, Finland's agriculture is in this zone, and in the tundra regions [14, Kauppala P.].

Finland is the northernmost of all Scandinavia countries, in terms of population distribution on the territory it is like the Russian North, closer to our country, has more than a century of experience stay in the Russian Empire (1809–1917). In Finland, agriculture and forestry are connected, farmers are legally provided with the use of forests, from the sale of wood they receive considerable income, which is used for modernization of agriculture. Integration of agriculture and forestry is especially relevant for the northern taiga of Russia due to additional income and increase of

[2] Source: 1. Rossijskij statisticheskij ezhegodnik. [Russian Statistical Yearbook]. 2017. Rostat. M., 2017. [In Russian] 2. Rekomendacii po racional'nym normam potrebleniya pishchevyh produktov, otvechayushchih sovremennym trebovaniyam zdorovogo pitaniya [Recommendations on rational norms of food consumption that meet modern requirements of healthy eating]: approved by the order of the Ministry of Health of the Russian Federation, August 19, 2016, No. 614. [In Russian]

employment of peasants.

Finnish farmers are successfully using the advantages of the northern economy to produce ecological food. Finland declared agriculture an ecological industry producing only environmental products according to European Union (EU) standards. Its production made the Central Fund of the EU allocate increased subsidies [15, Poskus B.I., p. 198].

Our country in the zone of the North has much more opportunities to increase the production of environmentally friendly products and to work out technologies of organic farming than the Scandinavian countries. Production of environmentally friendly products in the vast northern territories is becoming the main competitive advantage. Here one can expect to receive additional income from the sale of environmental products. In the future, as the domestic market is full of domestic food, Russia and its vast northern territories may well become a major exporter of ecological food.

The use of the Scandinavian way of development for Russia can serve a good example also because in Scandinavia has a small concentration of property and income in the same hands. Too much income concentration among a small part of the population is a constraint on the development of the domestic market being a result of the low purchasing power of the population.

In the northern regions of Canada, which remain sparsely populated, a point of view on the commercial unsuitability of agriculture has a long tradition. Simplification and acceleration of logistics links, the cost of food production in the southern regions and transportation to consumers in the northern territories is cheaper than production [13, Polbitin S.N., p. 135]. In Canada, agricultural farms are not created under unfavorable conditions. Profit from production in the southern regions (with delivery) is higher than food production in the northern territories. The Canadian model of agricultural development is hardly applicable to the Russian North, as it is designed for sparsely populated areas, and these regions are inhabited much more densely. If one takes this model as a basis, it could possibly lead to a huge reduction in the population of these territories in Russia [14, Kauppala P., p. 250].

Currently, 10 million people live in the North of Russia (in 2000, the population was 11.1 million). The population of the Arctic is more than 2.5 million people, which exceeds half of the total population of the Arctic [16, Sinitsa A.L.]. In the regions of the Far North and related areas, the share of urban population is 79%, in the Arctic — 88%. Towns in the Arctic and northern territories of Russia are: Murmansk, Arkhangelsk, Vorkuta, Norilsk, Yakutsk, Magadan, etc.

At the same time, the Canadian experience of managing sustainable development of the northern territories is very valuable for the North of Russia. Canada is implementing a set of measures for sustainable economic development, environmental protection and welfare of the population, as it is in the federal sustainable development strategy (FSDS) 2016–2019[3]. The strate-

[3] Planning for a sustainable future. Federal sustainable development strategy for Canada 2016-2019. Consultation draft. URL: http://www.fsdssfdd.cf/downloads/3130%20%%20Federal%20SUSTAINABLE%20Development%20Stategy%202016-2019.pdf (Accessed: 21 June 2019).

gy focuses on innovation in agriculture, fisheries, aquaculture, and indigenous peoples.

In our opinion, an interesting model for the North is the Arctic microeconomics developed for the villages of Alaska by American scientists, based on a clear delineation of three sectors — traditional, state, market, awareness of their specificity and close connection with each other [17, Pilyasov A.N., p. 126].

Summarizing, we should note that due to the peculiarities of domestic northern agriculture, underdevelopment of transport infrastructure, multi-structure of the agrarian economy, historically developed peasant mentality expressed in collective labor, it is impossible to fully replicate the agricultural development models of the Nordic countries. In the development of agricultural production and food supply of the population of northern, subarctic and Arctic territories of Russia should rely on rich historical experience. Nordic experience is of interest when it is related to the case of Scandinavian countries and, above all, Finland. The model of the food supply of the population of sparsely populated northern territories of Canada, based on the full supply of food from the southern regions, is not suitable for the North and the Arctic zone of Russia.

Opportunities and constraints of agricultural development

The location and the length of the territory of the Russian North in latitudinal direction determine, on the one hand, considerable severity, and on the other, significant differences in the bioclimatic and economic conditions for agricultural production. A large part of the territory is located beyond the Arctic Circle, within the permafrost, captures tundra and forest-tundra, while the central and southern parts are in the northern and middle taiga zone. Natural conditions and, above all, climate, soil quality, vegetation period constrain the effective development of agricultural production. Particularly unfavorable are conditions for agriculture in the far North, where tundra soils are dominated and thermal resources are extremely limited.

Among favorable conditions and competitive opportunities for agriculture of the North, we should note the following. The composition of farmland is dominated by natural hayfields and pastures. To improve the food supply of the population, there are significant fish resources and the potential for increasing the collection and processing of wild crops.

Nearly 24 hours of natural light in the sub-Arctic and enough moisture during the vegetation period ensure rapid growth and the ability of plants to accumulate a large stock of organic substances in a short time. A long daylight day helps herbs grow here with increased intensity. It takes 70—80 growing days to accumulate such amount of green mass, which is formed in within 180 days in the southern regions. Average daily growth of herbs in early spring in favorable days is from 3 to 9 cm [18, Gagiev G.I., p. 24].

Regions of the North have good opportunities to produce feed yeast, mineral and vitamin feeding for livestock and poultry. Extremely favorable conditions are created for the vegetable growing of protected soil on an industrial basis using the thermal waste of gas compressor stations. The heat of such stations can also be used for artificial drying and briquetting of herbs.

The North has promising opportunities to produce organic (ecological) products. In addition to organic agricultural products, in extensive ecological areas, it is possible to collect mushrooms, berries, birch juice, wild honey, and medicinal herbs. Production of environmental products is a strategic goal of agricultural development.

Products of traditional industries (reindeer husbandry, fishing, hunting, wild mushroom and berry picking) are competitive not only in the region but also in the national and international markets. In addition to reindeer meat and products of its processing, pantas, endocrine-enzyme materials, and deer blood are in great demand abroad, especially in Asian countries.

A precondition for technical, technological and socio-economic development of the agrarian sphere is the industrial nature of the economy, allowing to direct significant financial resources for modernization of the industry and integrated development of rural areas.

Favorable factors and conditions of the development of the agrarian sphere are presented in Fig. 2.

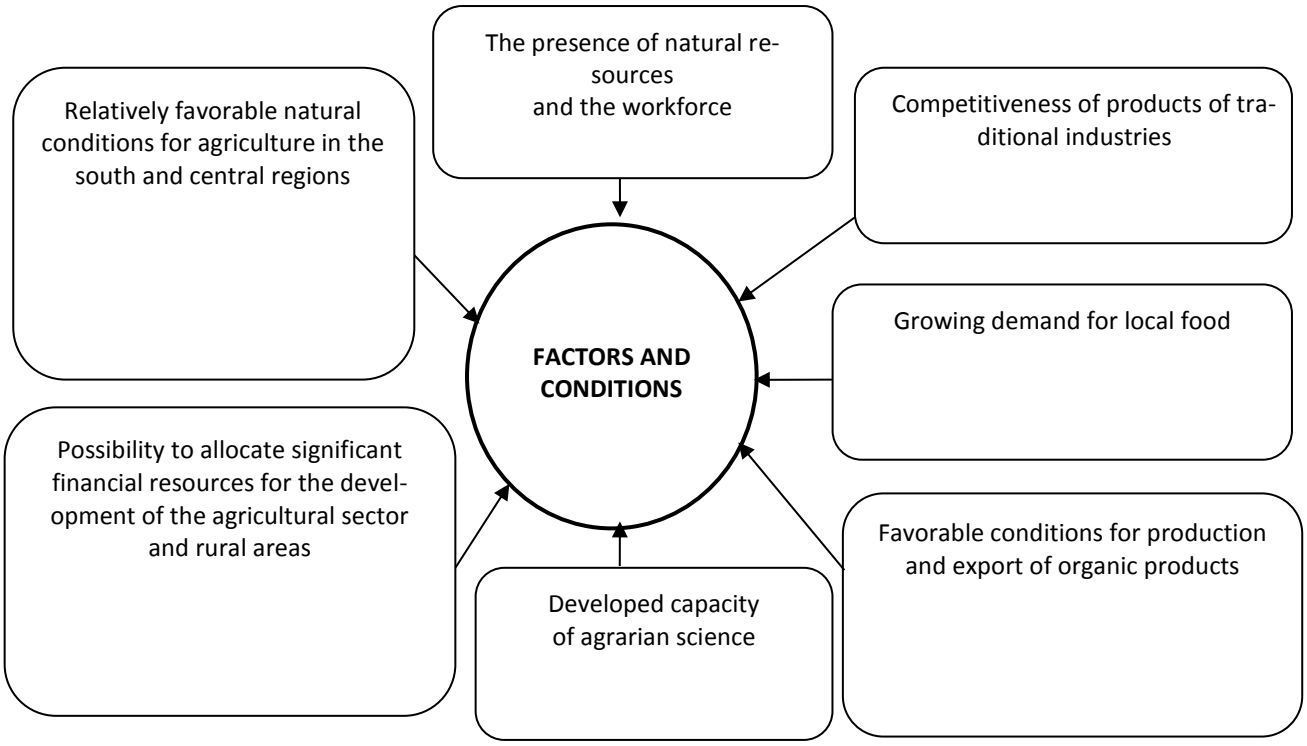

Figure 2. Factors and conditions contributing to the development of agriculture in the North[4].

The main barriers to the technical, technological and socio-economic development of agriculture in the northern and Arctic areas are related to the low availability of biological resources, the poor material and technical base of the agrarian sector, the shortage and low professional level and quality of life of peasants, the unfavorable environment, inefficient mechanisms of state support, inaccessibility of preferential credit, unsustainable sale of agricultural products (Fig. 3).

[4] Developed by the author.

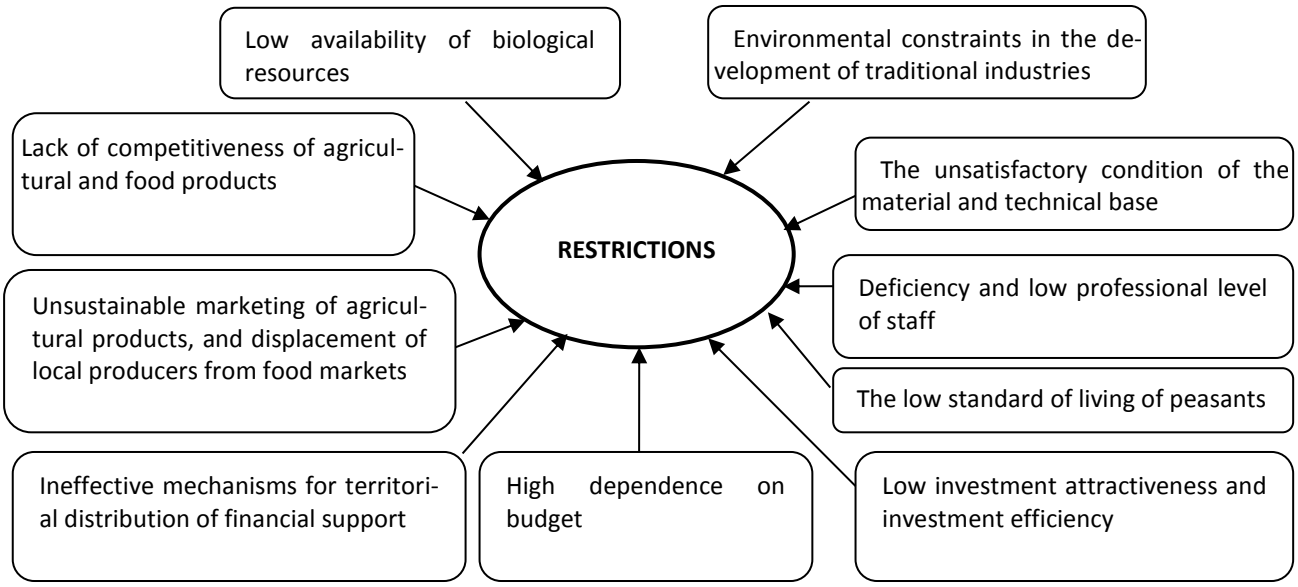

Figure 3. Limitations of the development of agriculture in the North[5].

Due to the peculiarities of agriculture in the North and the Arctic, the theory of liberalism is futile. Also, it is impossible to use the forms of agriculture typical to the southern regions of our country. An example of ignoring farming in extreme natural conditions — maize crops in the early 1960s. In 1962, in the state farms of the Komi Republic, this heat-loving crops occupied 2.9 thousand ha of arable land, i.e., 31% of the total area of silage crops and 14% of all crops of forage crops. The yield of green corn was only 44 kg/ha, and the cost of 1c — 3.70 rub.; these indicators for perennial herbs — 71 kg/ha and 1.11 rub. respectively. The development of agriculture in the northern and Arctic territories should be based on centuries-old agricultural traditions, considering extreme natural conditions and agrarian features.

Changes in the agrarian sphere according to the results of agricultural censuses 2006 and 2016

The history of agricultural censuses in Russia began in the early 20th century. The first census was carried out during the World War I (1916), the second — in 1920.[6]

[5] Developed by the author.

[6] Selskohozyajstvennye perepisi v Rossii/Rosstat. M.: IIN «Statistika Rossii» [IIN "Statistics of Russia"], 2007. 304 p. [In Russian]; Itogi Vserossijskoj sel'skohozyajstvennoj perepisi 2006 goda [Results of the All-Russian agricultural census 2006]: In 9 vol. — Vol. 1: Osnovnye itogi Vserossijskoj sel'skohozyajstvennoj perepisi 2006 goda [The main results of the All-Russian agricultural census of 2006]: Book 1: Osnovnye itogi Vserossijskoj sel'skohozyajstvennoj perepisi po Rossijskoj Federacii [Main results of the All-Russian agricultural census of the Russian Federation]. Federal service of state statistics. M.: IIC «Statistika Rossii» [IIN "Statistics of Russia"], 2008. 430 p. [In Russian]; Itogi Vserossijskoj sel'skohozyajstvennoj perepisi 2006 goda [Results of the All-Russian agricultural census 2006]: In 9 Vol. VOL. 1. Osnovnye itogi Vserossijskoj sel'skohozyajstvennoj perepisi 2006 goda [The main results of the All-Russian agricultural census of 2006]: Book 2.: Osnovnye itogi Vserossijskoj sel'skohozyajstvennoj perepisi po Rossijskoj Federacii [Main results of the All-Russian agricultural census of the Russian Federation]. Federal service of state statistics. M.: IIN «Statistika Rossii» [IIN "Statistics of Russia"], 2008. 687p. [In Russian]; Itogi Vserossijskoj sel'skohozyajstvennoj perepisi 2006 goda [Results of the All-Russian agricultural census 2006]: In 9 vol. — Vol. 7.: Sel'skoe hozyajstvo rajonov Krajnego Severa

In accordance with the legislation of the Russian Federation [7]and the Program of the World Agricultural Census of FAO, from July 1 to August 15, 2016, was held all-Russian agricultural Census; in remote and hard-to-reach areas — from September 15 to November 15, 2016. The census showed what labor and land resources were available in the industry, how they were used, and it also provided data on livestock, equipment, production infrastructure and innovative technologies used by agricultural producers[8].

Agricultural forms of management. According to the census 2016, in the North, there were 1,757 agricultural organizations, 6,192 peasant farms, 1,419 individual entrepreneurs, 782,4 thousand personal subsidiary and other individual households. In a 10-year perspective, we observe a reduction of agricultural organizations by 36%, farms- by 24%. The most significantly decreased numbers are for large and medium-sized organizations in the North-West and Siberian Federal Districts (3 times), peasant farms in the North-West (2.1 times) and Far Eastern (1.5 times) districts. An increase in the number of individual entrepreneurs by 18%, private subsidiary and other individual farms by 0.5% was also observed.

The analysis of organizations showed that the share of large and medium-sized agricultural enterprises decreased from 36% in 2006 to 22% in 2016. The share of small enterprises increased from 38 to 48%, subsidiary agricultural enterprises of non-agricultural organizations — from 26% to 29%.

In 2016 agricultural activity was carried out by 79% of organizations, 72% of peasant farms and 70% of personal subsidiary and other individual farms of citizens. In comparison with 2006, the share of agricultural organizations and farms engaged in agricultural production increased. The share of households decreased from 88% in 2006 to 70% in 2016 (Figure 4).

Human resources. According to the census, on July 1, 2016, in the total number of employed in agricultural production of the North, the share of workers of agricultural organizations was 64%, incl. large and medium-sized enterprises — 44%, peasant farms and individual entrepreneurs — 36%. Large and medium-sized agricultural organizations in the Chukotsky AO employ 100% of the workforce, in the Murmansk Oblast and the Yamal-Nenets AO — 71%, in the Kamchatsky Krai — 70%. In the Khanty-Mansiysk Autonomous Okrug — Yugra, the share of peasant farms and individual entrepreneurs is 73% of all the employees, in the Republic of Tyva — 65%, in the Republic of Sakha (Yakutia) — 54%.

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i priravnennyh k nim mestnostej [Agriculture of the Far North and related areas]. Federal Service of State Statistics. M.: IIC «Statistika Rossii» [IIN “Statistics of Russia”], 2008. 392 p. [In Russian]

[7] Postanovlenie Pravitel'stva Rossijskoj Federacii «Ob organizacii Vserossijskoj sel'skohozyajstvennoj perepisi 2016 goda» [Resolution of the Government of the Russian Federation “On organization of the All-Russian agricultural census of 2016”] April 10, 2013 No 316. [In Russian]; Federal'nyj zakon «O Vserossijskoj sel'skohozyajstvennoj perepisi» [Federal Law “On the All-Russian Agricultural Census”] July 21, 2005, No 108. M., 2005. [In Russian]

[8] Itogi Vserossijskoj sel'skohozyajstvennoj perepisi 2016 goda [Results of the All-Russian agricultural census 2016]: In 8 vol. — Vol. 1.: Osnovnye itogi Vserossijskoj sel'skohozyajstvennoj perepisi 2016 goda po sub"ektam Rossijskoj Federacii [The main results of the All-Russian agricultural census of 2016 on subjects of the Russian Federation].Federal service of state statistics. M.: IIC «Statistika Rossii» [IIC “Statistics of Russia”], 2018. 711 p. [In Russian]

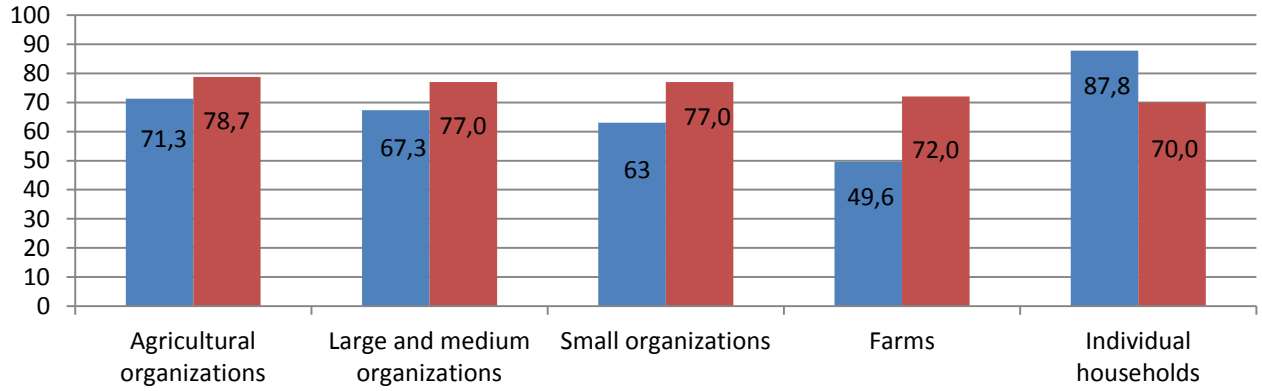

Figure 4. The share of agricultural organizations of the North that carried out activities in 2006 and 2016, in % of the total number of the corresponding category.

Over the decade, the number of workers in large and medium-sized organizations decreased by 2.7 times, farms and individual entrepreneurs — by 1.5 times, and in small enterprises increased by 17%.

According to the census, in 10 years, on average, the number of employees decreased by 9% per one large and medium organization, and by 19% per one farm and individual economy. The average of small enterprises increased by 57%.

In 2016, the share of households with 1 person engaged in agricultural work was 28.9%, with 2 people — 50%, with 3-4 people — 24.1%, over 4 people — 3%. Thus, single-person and two-person households predominate in the number of employed persons (79%).

The results of the census showed that in agricultural organizations the share of male leaders is 75%, female — 25%. Men under 29 years — 2.5%, 29 — 49 years — 48.2%, 50 years and over — 49.3%, female leader leaders — 3.4%, 32.2% and 64.4%, respectively. The total number of managers, nearly 2/3 are women of retirement age.

The census showed that the share of managers with higher education in large and medium-sized agricultural enterprises is 62.7% (in Russia — 87%), with professional education — 24.8%, in small enterprises — 65.4% and 22.2% respectively. Especially low level of higher professional education is among leaders of farms and individual entrepreneurs (24.9%). 34.6% of them do not have higher or secondary education (Table 1).

Table 1

Level of education of farm managers of the North, July 1, 2016, % of the total number of managers

Education	Large and medium-sized organizations	Small business	Farmers and individual entrepreneurs
Higher	62.7	65.4	24.9
Including agricultural	33.1	36.6	9.3
Secondary professional	24.8	22.2	40.5
Including agricultural	10.6	13.0	11.4
Do not have higher or secondary professional education	12.6	12.4	34.6

Land resources. The total land area of the region is 182.6 million ha, the share of reindeer pastures accounts for more than half (57%). Almost 2/3 of reindeer pastures are in Yamal-Nenets

AO, Chukotsky AO and the Republic of Sakha (Yakutia). Only a small part of the land is used for agricultural purposes — 1.2% and the share of arable land is only 0.2%. Low development of the North is due to unfavorable natural conditions for agriculture, huge forest, and small population.

In the farmland area, natural hayfields and pastures are dominating. Thus, 5.3 ha of meadows were accounted for per ha of arable land in the North. The areas and structure of the land fund are in Table 2.

The results of the census showed that agricultural organizations did not use 11% of farmland, incl. large and medium-sized organizations — 6%, peasant farms — 10%, personal subsidiary, and other individual households — 5%.

Table 2

The land area by categories of farms of the North, July 1, 2016, thsd ha

Land resources	Farms of all categories	Including			
		Agricultural organizations	large and medium	Farmers	Households
Total land area	182,593.5	143,651.0	142,394.4	2 235,8	720.1
Agricultural land	2 170,1	1 181,8	739.7	330.9	636.2
Including Arable land	322.6	224.4	113.0	60.7	33.8
Hayfields	601.6	222.8	100.7	115.1	252.4
Pastures	1 110,5	689.5	509.6	146.5	3.0
Of the total area of agricultural land is actually used	1 934,6	1 053,6	692.3	299.1	605.6
Dried land	45.2	53.3	37.4	2.3	-
With the actual drainage system	37.8	37.2	27.0	0.6	-

Compared to the previous census (2006), in all categories of farms, there was a decrease in the total land area by 18%, incl. agricultural land by 27%, a reduction in the area of agricultural land occurred at the expense of agrarian enterprises. The growth of farmland in peasant farms amounted to 51%.

Analysis of the distribution of the area of farmland among agricultural forms of management showed that in 2016 the share of agricultural organizations was 54%, peasant farms and individual entrepreneurs — 17%, households — 29%. In 2006, these figures were 67%; 9%; 24% respectively. According to the census, July 1, 2016, in Russia, the share of agricultural organizations in the farmland area was 63%, farms and individual entrepreneurs — 28%, households — 9%.

For 10 years, crops in farms of all categories decreased by 19%, incl. agricultural enterprises — 27%. In 2016, the main part of the acreage was in agricultural enterprises — 67%, incl. 53% in large and medium-sized organizations; the share of peasant farms accounted for 19%, individual farms of the population — 12%.

The totals sown area in farms of all categories were dominated by forage crops (75.9%), the share of grain and leguminous crops accounted for 8.5%, potatoes — 13.0%, vegetables — 2.6%.

The census data provided information on protected soil areas. In 2016, the share of agricultural organizations accounted for 44.2%, peasant farms and individual entrepreneurs — 55.8% of

the total area of greenhouses and greenhouses. In agricultural enterprises, the totals of protected soil were dominated by winter greenhouses (54%), on farms and in individual entrepreneurs — spring greenhouses (76%).

The main areas of protected soil in agricultural enterprises were concentrated in the Sakhalin region (36%), Komi (18), the Republic of Sakha (13) and the Arkhangelsk Oblast (9%). 91% of greenhouses were in the far Eastern Federal district.

In comparison with the previous census (2006), the area of greenhouses in agricultural enterprises decreased by 2.1 times; in peasant farms and individual entrepreneurs increased by 3.6 times.

Livestock population. The change in the livestock population for 2006-2016 in various agricultural forms of management showed that there was a decrease in the number of cattle and pigs in agricultural enterprises and individual farms. Significantly decreased is the number of poultries in agricultural enterprises (1.5 times). The growth of the livestock was observed on farms.

In 2016, the share of agricultural organizations of the total number of the livestock accounted for: cattle — 27%, incl. 31% cows, pigs — 48%, poultry — 81%, deer — 58%, foxes and minks — 100%, blue foxes — 80%.

In households, the total number of animals was 51% of cattle, 47% of sheep and goats, 39% of horses, 40% of deer. Peasant farms concentrated 20% of the total number of cattle, pigs — 28%, sheep and goats — 23%, poultry — 5%, horses — 32%, deer — 1%.

Over the decade, the domestic deer increased in all categories of households: in agricultural enterprises — by 12%, in peasant farms — by 4 times, in households — by 5%. Reindeer breeding is the industry most suited to the nature of the North and the Arctic, the labor skills of the indigenous population and has high efficiency. Due to the lack of costs for forage and construction of premises, the production of venison is highly profitable: the cost of its quintner on farms is more than 2 times lower compared to the production of beef. In addition to strengthening the food security of the region's population, pante and enzymatic endocrine materials are in great demand in the domestic and international markets.

The territories, which are entirely part of the North, account for 91% of the total reindeer population of the Far North and its equivalent areas. Among northern and Arctic territories, the first place is taken by the Yamal-Nenets Autonomous Okrug (47% of the total number of reindeer in the country), the second — the Nenets Autonomous Okrug (11%), the third — the Chukotka Autonomous Okrug (10%), the fourth — the Republic of Sakha (Yakutia) (9%), the sixth place — the Komi Republic (6%) (Fig. 5). The share of the Ural Federal district accounted for 49% of the total deer in the country, the far Eastern district — 23%, the North-Western Federal district — 20%.

The rapid growth of the reindeer population in Yamal caused the degradation of the vegetation cover of the tundra. According to environmentalists, to bring it into line with the available norms of ecological load, on the peninsula, they will have to reduce the deer by three times[9].

[9] Tundra protiv kommercii [Tundra vs Commerce]. Ros. gazeta. Ekonomika URFO. No 7069 (201). 2016. 9 July.

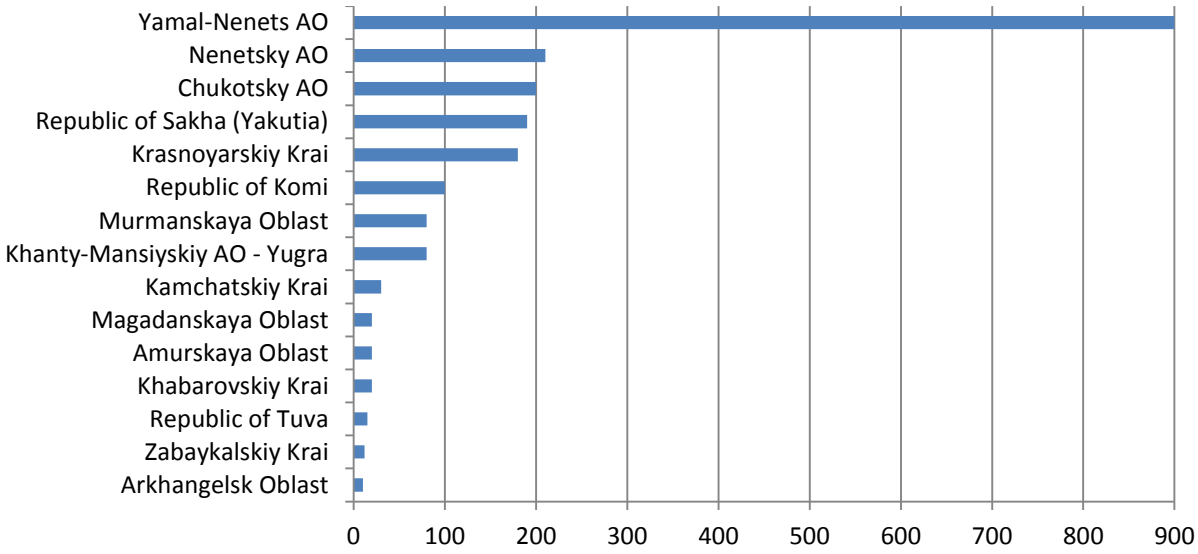

Figure 5. Deer in the North and the Arctic territories, all categories of farms, July 1, 2016, thsd.[10]

Technical facilities and infrastructure. The agricultural census allowed to obtain information on the availability of agricultural machinery, equipment, and infrastructure by categories of agricultural producers. For 10 years, on average, per agricultural organization, there was a reduction of tractors, cars, and some types of agricultural machinery. Increased availability of hay machines, equipment for feeding cattle, milking, cleaning, and cooling of milk. Farmers and individual entrepreneurs have improved the equipment of some types of machinery and equipment. In personal subsidiary and other farms, the availability of tractors, motor blocks — cultivators and cars increased.

Over the decade, agricultural producers have improved the structure of tractors. If in 2006, in agricultural enterprises, the share of tractors under 4 years was 5.6%, aged 4–8 years — 12.7%, aged 9 years and more — 81.7%, in 2016, it was 13.2%, 23.5%, and 63.3% respectively. The age structure of the tractors has also improved among farmers and individual entrepreneurs (Table 3).

Table 3

The age structure of tractors o agricultural organizations (farms) of the North July 1, 2006, and in 2016, %

Age of machinery	Agricultural organizations		Farms and individual entrepreneurs	
	2006	2016	2006	2016
Under 4 years	5.6	13.2	7.9	22.4
4-8 years	12.7	23.5	18.1	29.8
9 years and more	81.7	63.3	74.0	47.8

The results of the census showed that the lowest provision of infrastructure remains among peasant farms and individual entrepreneurs. Especially poor infrastructure is in the Siberian Federal District. Only 9.5% of agricultural enterprises have intra-farm roads with a hard surface, connection to heat supply networks — 1.1%, and water supply — 1.7%. No agricultural enterprise or private subsidiary is connected to gas supply networks (Table 4).

[10] Note: In the Irkutsk Oblast, the Sakhalin Oblast and the Republic of Buryatia, the livestock is less than 1 thsd goals.

Table 4

Infrastructure facilities of agricultural organizations and farms of the North, July 1, 2016, % of the total number of business entities

Federal District	Agricultural organizations.	Farmers and individual entrepreneurs	Personal subsidiary
Road communication with the district center or with a trunk network			
North-West	61.7	51.7	62.0
Ural	40.8	41.6	44.4
Siberian	84.4	68.3	85.5
Far Eastern	33.6	46.7	51.3
On-farm roads with hard surface			
North-West	31.8	-	-
Ural	35.3	-	-
Siberian	9.5	-	-
Far Eastern	14.9	-	-
Connecting to power supply networks			
North-West	72.3	53.2	66.9
Ural	63.9	46.8	91.7
Siberian	44.7	21.9	86.7
Far Eastern	48.6	46.3	72.4
Connecting to heat supply networks			
North-West	72.1	1.9	3.8
Ural	42.2	12.6	5.7
Siberian	1.1	0.3	2.7
Far Eastern	12.5	5.2	13.5
Connecting to water supply networks			
North-West	31.2	9.9	8.3
Ural	39.5	16.4	40.1
Siberian	1.7	0.4	4.9
Far Eastern	18.3	4.6	10.4
Connecting to gas supply networks			
North-West	4.6	1.2	2.2
Ural	10.1	6.5	16.4
Siberian	-	0.1	-
Far Eastern	5.6	5.2	14.3
Internet access			
North-West	56.1	16.3	15.1
Ural	36.3	26.2	37.8
Siberian	34.1	10.9	20.1
Far Eastern	27.8	11.5	16.7

The use of innovative technologies in agriculture. The results of the 2016 census allowed to get information on the application of innovative technologies in agricultural organizations, farms and individual entrepreneurs (Table 5).

The data shows an extremely small share of agricultural producers who applied innovations. Drip irrigation system was used in only 0.4% of agricultural organizations and 1.3% of farms and individual entrepreneurs; biological methods of plant protection against pests and diseases — 1.8 and 1.2% respectively; the system of individual feeding for the livestock — 3.6% and 4.2%: the method of cellular content of poultry — 0.5% and 1.9%; treatment plants on farms were available in 2.2% of agricultural enterprises and 1.4% peasant farms and individual entrepreneurs; the system of water disposal and treatment of industrial effluents — 4.2% and 3.2%. In the Republic of

Buryatia, the share of agricultural organizations using solar panels was 27%, farms and individual entrepreneurs — 63%.

Table 5

The share of agricultural organizations and farms of the North that applied innovative technologies July 1, 2016, % of the total number of business entities.

Types of innovations	Agricultural organizations.	Farmers and individual entrepreneurs
Drip Irrigation System	0.4	1.3
Biological methods of plant protection against pests and diseases	1.8	1.2
Individual Livestock Feeding System	3.6	4.2
The method of non-cellular poultry content	0.5	1.9
Treatment facilities on livestock farms	2.2	1.4
Wastewater disposal and treatment system	4.2	3.4
Renewable sources of energy supply:	6.7	9.0
bioenergy plants	-	0.0
wind power plants	0.1	0.1
solar panels	6.6	8.8

The main factors constraining the use of innovative technologies are insufficient level and mechanisms of financial support for agricultural producers, inaccessibility of preferential credit resources. In 2015, less than half (46%) of farms received budget support. Only 12% of agricultural enterprises and 8% of farms had access to loans.

Acceleration of modernization on an innovative basis in the North relates to the strengthening of the role of the state. It is proposed to increase subsidies not only from the region but also from the federal budget for the speedy transfer of the agricultural economy to a new technical and technological basis. For the federal budget it is advisable to provide more support to increase the number of cattle and deer, the volume of production of beef, venison and milk; to compensate part of the cost purchased modern machinery and high-performance equipment, mineral fertilizers, fuel, spare parts, mixed fodder, as well as tariffs in the amount of 50% for transportation by rail and water transport of material and technical resources; subsidize interest rates on loans; provide subsidies for rural poverty eradication and reimbursement of district rates; and Northern increments to a salary.

Conclusion

The study of agriculture, its experience in Scandinavian countries, Canada and Alaska, changes in the agricultural sphere of Northern Russia allows drawing the following conclusions and recommendations.

1. The objective preconditions for the development of agriculture and fisheries in the North revealed are conditioned by the provision of the population with fresh and full-fledged foodstuffs, and social function of the agrarian sphere. Due to extreme natural conditions and market relations in agriculture, the industry can develop only with state support. Without financial support, agricul-

tural enterprises and peasant farms will be forced to reduce the production of biologically complete products. The state will then need to disproportionately more expenditure to employ indigenous peoples than to support the agricultural sector.

2. On the basis of the study of the agricultural experience of Nordic countries, it is possible to conclude that the best way of development is the example of Scandinavia and, first of all, Finland, focused on the combination of crop and animal husbandry and the positive impact of agricultural production on rural society. Due to the significant population density, undeveloped transport in the Russian North, it is impossible to use the Canadian model based on the delivery of food from the southern territories to the sparsely populated northern areas of the country.

3. The author reveals the conditions and possibilities of development of agriculture in extreme conditions. Natural conditions, especially in the Arctic, constrain the development of agricultural production. Favorable conditions and competitive opportunities for agriculture are: long daylight during the growing season, the proper water supply of plants; large amounts of fodder land, incl. floodplain meadows, and labor resources: good opportunities for organic production in ecologically clean areas; industrial nature of the economy, allowing to allocate significant financial resources for modernization and integrated rural development; the existence of a significant potential of agrarian science. Products of traditional industries are competitive not only at regional but also national and international food markets.

4. Data of census held 2006 and 2016 revealed structural changes in agriculture, trends in the development of the industry, the role of each category of agricultural producers in the food resource formation. Extensive information will give an opportunity to agro-economic science to develop reasonable proposals for improving the state agrarian policy and contribute to dynamic development of rural areas. The results of the census are of great importance for the development of the State program for the development of the agro-food sector in the medium term. The information presented will also be used for educational purpose.

5. The results of the census showed that over a decade the number of agricultural organizations and farms decreased as well as the number of employed in agricultural production. In farms of all categories, there was a decrease in the total land area and farmland, the number of cattle, pigs, poultry and fur-bearing animals. In agricultural organizations, there was a reduction in the equipment of tractors, cars and agricultural machines. The census showed a very significant proportion of organizations and farms that did not produce agricultural products. The received information testifies to the insufficient level of innovation activity of agricultural producers with significant scientific potential in the North and the Arctic.

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