

# Prospects of Organic Market Development in the Republic of Sakha (Yakutia)

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**Abstract.** This article discusses the prospects of organic market development in the Republic of Sakha (Yakutia). The key factors justifying the feasible nature of developing such a market in Yakutia are provided. Three perspectives for development of organic agriculture are considered. The main distinguishing feature of these development perspectives is uniqueness of the grown products, resulting from special natural conditions of the republic. The traditional agricultural sectors of Yakutia are represented by Yakutian cattle and Yakutian horse. Wild plant harvesting is another promising area of development.

## 1. Introduction

The Republic of Sakha (Yakutia) is known throughout the world as one of the coldest inhabited places on earth, also famous for its diamonds and fossil reserves. Despite the cold climate and industrial resource production, Yakutia is also, in fact, an agricultural region of Russia. Agriculture is one of the major contributors to the economy of the republic, given that a third of the population lives in rural areas, where agriculture is the primary source of income. Agriculture is also fundamental for supporting food security.

In Yakutia, natural and climatic conditions are one of the main reasons behind the repression of economic development. Cold and permafrost slow down commercial development to a great extent, raising the costs, wherefore there is virtually no industrial processing of raw materials in the republic. However, there is also a positive side of these specific conditions. Extreme climate had contributed to the development of unique flora and fauna. A low rate of commercial development and a lack of industrial processing of raw materials are the reasons why Yakutia remains one of the most unpolluted and ecologically safe places on the planet.

Today, some disadvantages can be turned into a competitive advantage. Organic agriculture is developing very rapidly around the world, which is why the organic market is currently the fastest growing food market globally. However, this market is less developed in Russia; the law governing the industry will take effect in 2020.

## 2. Discussion

The Republic of Sakha (Yakutia) has all the necessary preconditions for development of such a market and its further growth. First, it is worthwhile noting the vast territory of the republic (3.08 million km<sup>2</sup>), which is sparsely developed and least affected by pollution. It is common knowledge that, unlike traditional (intensive) agriculture, the organic production requires relatively large areas of land due to its specific nature. In general, the environmental situation remains stable, which is

confirmed by the annual reports of the Ministry of the Environment, Natural Resource and Forest Management of the Republic of Sakha (Yakutia). Over the past 5 years, there have been no cases of extremely high (exceeding the short-term exposure limit by 50 times) and high air pollution (above 10 TLV).

One of the key determinants is the agriculture of Yakutia itself. The traditional way of farming still prevails in the republic: no external auxiliary agents (synthetic fertilizers, pesticides, etc.) are used, which makes the farming conditions the most similar to organic farming. The level of synthetic fertilizer application is one of the lowest in Russia (RS(Y) – 29.4%; RF – 53%), while the level of organic fertilizer application is higher than the national average (RS(Y) – 15.9%; RF – 9.3%). Smallholder farming is typical for the republic and, as evidenced by global best practices, this type of farm management is more characteristic of organic production. In general, it should be noted that the role of agriculture was predefined historically and is directly related to the traditions of the population. Despite the unfavorable conditions for agricultural development, it was always high priority and remains that way.

Of particular note is the region’s unique biodiversity. In Yakutia, there are unique (local) breeds of farm animals, as well as different kinds and species of both agricultural and wild plants. First, we should mention the Yakutian cattle.

*2.1. Yakutian cattle*

Yakutian cattle (*Bos Taurus Turano-Mongolicus*) is the result of local breeding and extreme conditions of the North. At the beginning of the 20th century, in 1916, the stock of Yakutian cattle was 375 thousand beasts, or allegedly almost 500 thousand beasts. Aboriginal cattle were purebred in Yakutia until 1929. It was then when an extensive crossbreeding with the more productive Simmental cattle and Kholmogory cattle began. Since that time, livestock started to reduce drastically, which almost led to extinction of the species. In the 1990s, the entire livestock population was less than 1000 beasts.

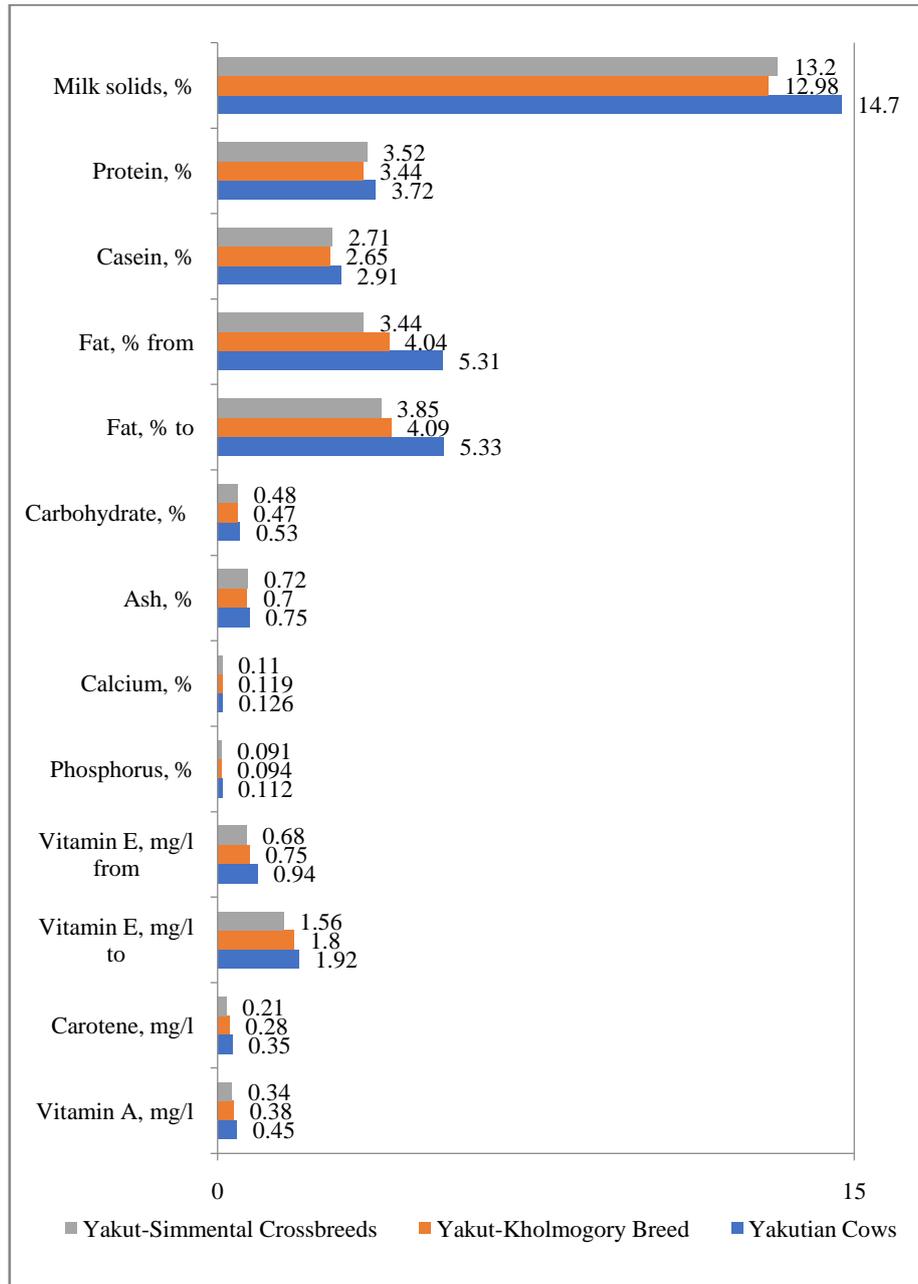
As of the beginning of 2018, the cattle number is 1681 heads, including 666 cows, which is why the Yakutian cattle is considered an endangered breed according to the international classification, which defines that a breed with a breeding population of less than 1000 heads has an endangered conservation status, since it is too undersized to compensate for genetic losses.

The Yakutian cattle breed has a great potential, given the following quality indicators of meat and milk (Table 1 and Figure 2). Scientists conducted a series of comparative studies on the quality indicators of meat and milk of Yakutian cattle and other stud breeds of cattle, which showed the following.

**Table 1.** Comparative Table of Meat Quality Indicators of Stud Breeds and Yakutian Cattle.

Elements	Stud breed meat	Yakutian cattle meat	Stud breed meat / Yakutian cattle meat
Protein, %	18.6	37.5	2.02
Fat, %	16.0	23.5	1.47
Energy value of meat, kcal/100 g	2180	2825	1.29

As Table 1 shows, the protein content of the Yakutian cattle meat is 2 times higher, fat content is 1.5 times higher and the overall energy value is greater by almost a third. The meat is called “marbled” and has outstanding palatability traits.



**Figure 1.** Milk Quality (Chemical Composition) by Cows Bred in the Republic of Sakha (Yakutia).

The quality of milk by Yakutian breeds was studied in the 1970s, 1990s and recently in 2012. Figure 1, produced using the study data, shows that the milk of Yakutian cows has overall more useful substances and vitamins compared to the milk of crossbred cows; the fat content is especially high: it was established as a fact that the fat content of milk sometimes reaches 11%.

Another feature of the Yakutian cattle is that they are easy to keep and temperature tolerant (towards freezing temperatures); there is a record of a unique case when several individuals survived in the taiga in winter at a temperature of  $-40^{\circ}\text{C}$ . The Yakutian breed can survive poor feed conditions, and also has a lower feed consumption.

**Table 2.** Milk Producing Ability and Food Requirements of Cows by Breed Depending on the Duration of Their Use.

Item	Unit	Yakut-Simmental crossbreeds	Yakut-Kholmogory crossbreeds	Yakutian cows
Milk producing ability of cows during the period of use				
Duration of use	a year	8	7	10
Annual yield of milk, 3.4% fat		2970	3963	2508
Total milk yield		23760	27741	25080
Compared to Yakutian cows	(* / -)* kg	-1320	+2661	-
Food requirements of cows over the period of use				
Feed consumption	in oat feed units	26992	27741	14350
Compared to Yakutian cows	(+ / -) oat feed units	+12642	+13391	-
Food requirements in-kind:				
Hay	dt	213.3	197.6	189.0
Silage	dt	196.9	269.3	-
Pasture forage	dt	375.3	362.0	314.0
Concentrated feed	dt	70.2	74.6	-

As Table 2 shows, the annual milk yield is low. This shortcoming is compensated for by the qualitative characteristics of milk and a longer duration of use of Yakutian cows, which exceeds that of the other breeds by 2-3 years. If compared by the food requirements, the Yakutian cows give more milk. They do not have a dietary need for silage and concentrated feed, generally requiring less hay and feed.

In the future, providing the conservation and breeding of the Yakutian cattle livestock, this breed has a great potential for the organic market, given the unique properties of the products (meat and milk).

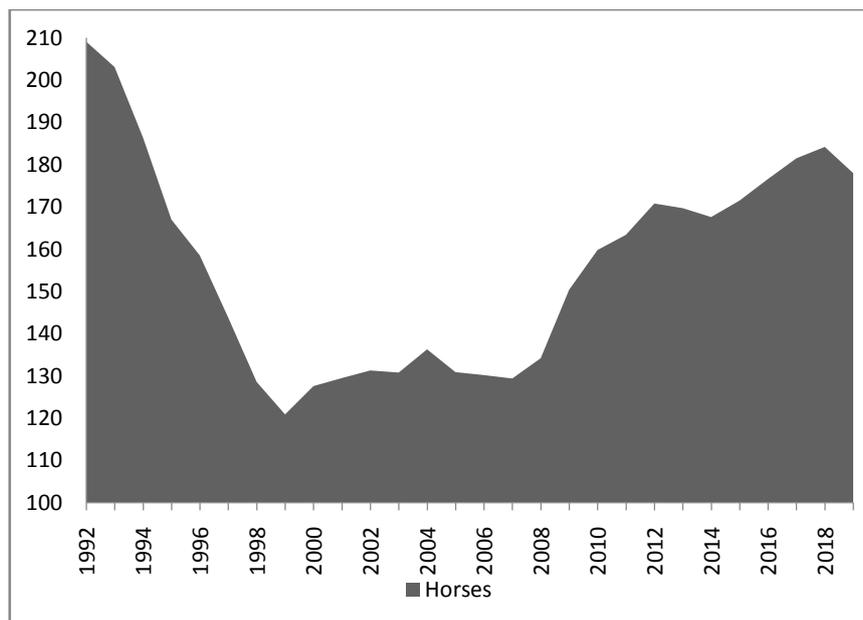
## 2.2. Yakutian horse

Another unique type of a farm animal is the Yakutian horse, which has been treasured since ancient times. “We take a special pride in herd horse breeding, it is our national treasure, the original and traditional industry of the Republic of Sakha (Yakutia). The material and intellectual culture of the people is fully committed to the culture of horse breeding,” the Ministry of Agriculture and Food Policy pointed out on the official information portal of the republic, in the light of the Head of the Republic signing a Decree No. 1373 dated August 22, 2016 “On Measures to Promote Herd Horse Breeding in the Republic of Sakha (Yakutia)”, generally noting that: “The Decree to promote herd horse breeding in the republic will jump-start the industry development” [1].

Let us analyze what has changed since Yakutia was given its today’s name using the data of the regional office of the Federal State Statistics Service for the Republic of Sakha (Yakutia) [] based upon the number of horses in all farms and households as the main indicator.

**Table 3.** Number of Horses in All Farms and Households in the Republic of Sakha (Yakutia), 1992-2019, as at the Start of the Year.

Stock				Stock			
Year	Thousand heads	Against prev. year, %	Dynamics, %	Year	Thousand heads	Against prev. year, %	Dynamics, %
1992	209.1	-	100.0%	2006	130.2	99.5%	62.3%
1993	203.1	97.1%	97.1%	2007	129.4	99.4%	61.9%
1994	186.4	91.8%	89.1%	2008	134.2	103.7%	64.2%
1995	167	89.6%	79.9%	2009	150.4	112.1%	71.9%
1996	158.5	94.9%	75.8%	2010	159.8	106.3%	76.4%
1997	143.8	90.7%	68.8%	2011	163.4	102.3%	78.1%
1998	128.6	89.4%	61.5%	2012	170.8	104.5%	81.7%
1999	120.9	94.0%	57.8%	2013	169.7	99.4%	81.2%
2000	127.6	105.5%	61.0%	2014	167.6	98.8%	80.2%
2001	129.5	101.5%	61.9%	2015	171.5	102.3%	82.0%
2002	131.3	101.4%	62.8%	2016	176.6	103.0%	84.5%
2003	130.8	99.6%	62.6%	2017	181.5	102.8%	86.8%
2004	136.3	104.2%	65.2%	2018	184.2	101.49%	88.09%
2005	130.9	96.0%	62.6%	2019	178.0	96.63%	85.13%



**Figure 2.** Dynamics of the Number of Horses in the Republic of Sakha (Yakutia), 1992-2019, as at the Start of the Year, thousand heads.

As Table 3 and Figure 2 show, the number of the Yakutian horses was rapidly reducing from 1992 until 1999, afterwards the situation slowly stabilized, however, after some steady growth over the recent years (2014-2018) there has been a dramatic reduction in over 6 thousand heads.

In Russia, herd horse breeding was developed and became common in several regions following no particular pattern. A distinctive feature of herd horse breeding in Yakutia is that there are three local subtypes bred from the native Yakutian horse, the former having unique biological attributes (endurance, adaptability, etc.). Furthermore, breeders use an “in liberty/on pasture” method of breeding. A key aspect of local breeding is a year-round pasture and winter-grazing of horses, which is impressive

for a domesticated farm animal, taking into account the climate of Yakutia (in winter, the temperature drops to  $-50^{\circ}\text{C}$  or lower, depending on the area).

From the earliest times, the Yakutian horse was used not only as a means of transport to cross the vast expanses of Yakutia and impenetrable taiga, but also as a source of meat and milk. Both cases of use retain their relevance, even after several hundred years have passed. Naturally, horses are now less often used as a means of transport; however, they are still used in agriculture and hunting, as well as in particularly remote and inaccessible areas. With regard to the above features and due to a high biological value of horsemeat and mare's milk, as well as low labor and material costs per unit produced, breeding horses for meat and milk is currently the most practical direction of agriculture under the conditions of Yakutia. Besides, the young of the Yakutian breeds mature very fast in the first 6-8 months of life.

In Yakutia, horsemeat and foal meat are traditionally in great demand with the population. Meat and by-products of Yakutian horses are highly nutritious and have good dietary properties. There are many meat dishes in Yakut national cuisine, including frozen raw foal meat known as "foal stroganina", and mare's milk is used to make kumis.

The experts note that the fat of horses of the Yakutian breed contributes a lot to the diet, being a source of polyunsaturated fatty acids (PUFAs), which help to repair liver damage, reduce tendency of thrombosis and improve immunity. This is why foal meat is recommended as a dietary product for protection against atherosclerosis and prevention (or reduction) of PUFA deficiency in patients with cardiovascular diseases and alimentary obesity. While there are certain similarities between foal fat and milk fat, the former can be regarded as a raw material, which has a potential to be used for manufacturing of children's dietary and therapeutic food products [2].

Another important product of horse breeding is mare's milk used to make kumis, which has unique restorative and healing properties. It helps to improve human immunity, prevents and treats gastrointestinal and bone diseases, as well as tuberculosis [2]. At one time, kumis made from mare's milk was used in children's health camps for prevention of tuberculosis along with other preventive remedies.

Overall, today the state of herd horse breeding is considered stable. The produce of the Yakutian horse breeds has tremendous potential in the organic market, owing to the above features, which could be fulfilled in the nearest future, unlike the potential of the Yakutian cattle.

### 2.3. Wild harvest

Collection and processing of wild plants, fruits, berries and mushrooms is another high-potential sector of agriculture in Yakutia. Wild plant harvesting was mastered in Soviet times, when wild harvest reserves were studied and their environmental and resource assessment was made. After perestroika, this industry has almost ceased to exist, giving way to the selective collection of wild harvest by the population for their own needs; the existing procurement (handling) centers were closed one after another and the system stopped functioning.

There is a multitude of different wild plants growing in Yakutia. Harvesting of berries has a lot of potential for agriculture. The most common wild berries are lingonberry, blueberry, black and red currant, strawberry, cloudberry, honeysuckle and others. According to the SB RAS Institute of Biological Problems of the Permafrost Zone, today, the estimate total area of berry-bearing land in the North is about 308 million ha. Estimated berry reserves: lingonberry – 2.1 million tons on the area of 20 million ha; blueberries – 0.6 million tons on the area of 4.6 million ha.

There are 11 primary food processing facilities in the republic located in 8 districts (uluses). According to the Ministry of Agriculture and Food Policy of the Republic of Sakha (Yakutia), 129.6 tons of wild-growing raw materials were collected and about 288.2 tons of products were manufactured in 2017 [5]. Over the previous periods, due to the lack of working capital for procurement of the raw materials (wild berries), only 5 out of 11 facilities were in business in 2015, and 9 facilities in 2016.

Most of the harvesting of wild berries is done in the Central and Vilyuysk group of uluses. This is explained by the availability of sales markets (proximity of cities) and accessible transport infrastruc-

ture. The existing enterprises of the industry with a total capacity of 1.2 million reference cans per year are able to harvest and process the raw materials of wild berries in Yakutia. Despite the available capacities, the existing potential is not realized due to a lack of a balanced system for receiving raw materials.

The main problems of harvesting and processing wild plants in the Republic of Sakha (Yakutia), as well as in Russia in general, are a lack of working capital for the procurement of raw materials for the enterprises, besides, the process of harvesting and processing wild plants has a limited appeal to attract credit resources and other sources of long-term and short-term financing. Moreover, one of the main problems is a lack of a full environmental and resource assessment of wild plants reserves; the existing estimates are not completely realistic, since large-scale assessments have not been made since the past century.

Among the problems typical only for the republic are the following: a marked seasonality of wild plants harvesting due to natural and climatic conditions, a lack of industrial processing of wild harvest, and limited material and equipment for harvesting and processing of wild plants. It is worth noting individually the issues of spatial fragmentation, including remoteness from the centers of consumption and processing, and the inaccessibility of areas where wild plants are harvested.

As it was previously mentioned, on the one hand, cold and permafrost were the main factors of development repression, but on the other hand, they make the products unique. For example, there is a thin active layer of soil where the mineral substances turnover is minimal, but plentiful; there are no comparables to this soil anywhere in the world (according to V.G. Zolnikov). At the same time, individual natural and climatic characteristics of Yakutia contribute to powerful biochemical processes in the plant tissues, whereby the local plants are characterized by a more intensified accumulation of a number of valuable nutrients [3].

This is why both wild and agricultural plants have fine taste and nutritional qualities. The quoted estimated reserves are not completely realistic, as it was previously noted no comprehensive environmental and resource assessment of reserves was made.

### 3. Conclusion

All things considered, the discussed sectors have the highest potential for organic farming. The Republic of Sakha (Yakutia) has the capacity to manufacture organic products. Of particular note is reindeer breeding, which is most developed in the Arctic regions of the Republic of Sakha. This industry is classified as a traditional agricultural sector of Yakutia, which may become an important segment of the organic market.

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