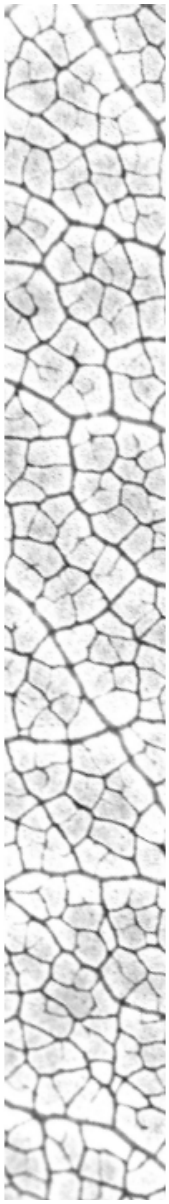

EurAsian Journal of BioSciences
Eurasia J Biosci 13, 587-594 (2019)

Analysis of territories - sources of food raw materials for the implementation of cross-cutting technologies for the production of functional foods in Russia

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Abstract
The article represents the analysis of territories as means of raw materials sources for the implementation of cross-cutting technologies for the production of functional food products. The article is based on the analysis and synthesis of works written by famous Russian scientists who examined the soil characteristics of the territories of the Federal Districts of the Russian Federation, taking into account their large territories, where biogeochemical provinces differ greatly in soil conditions. Particular attention is paid to arable land. The characteristic of the territories - sources of raw materials in the context of the Federal Districts of Russia in terms of their potential for the production of food raw materials for cross-cutting technologies for the production of functional foods is given.

Keywords: soil analysis, biochemical zoning, land resources, arable land, food agricultural raw materials, functional food products

Ivanovna GO, Romanovich SI, Olegovich SP, Sergeevich VA (2019) Analysis of territories - sources of food raw materials for the implementation of cross-cutting technologies for the production of functional foods in Russia. Eurasia J Biosci 13: 587-594.

INTRODUCTION

Theoretical and practical aspects of the problems of efficient use of agricultural land in the world, Russia, its regions and specific enterprises are discussed in the well-known works by V. B. Azarova, L.N. Alexandrova, A.I. Altukhova, N.B. Bakirova, S.A. Bartaleva and E.A. Lupyana, E.A. Bessonova, V.G. Bryzhko, I.N. Buzdalova, A.A. Varlamova, S.N. Volkova, A.P. Vorontsova and N.Z. Kharitonova, L.M. Derzhavina and D.S. Bulgakov, V.V. Dokuchaeva, N.Ya. Kovalenko, V.V. Kovalsky, Z.A. Mashinina, T.I. Nasedkina, A.I. Perelman and N.S. Kasimova, G.A. Ponomareva and V.V., Plotnikova, L.I. Prasolov, A.A. Rode, B.G. Rozanov, V.N. Savich, N.V. Parakhina and V.G. Sychev, V.A. Tyapkina, V.Ya. Uzuna and many other scientists.

The analysis of the well-known works has shown that at present time, special attention should be paid to the development of research in the field of analysis of territories - sources of raw materials for the implementation of end-to-end technologies for the production of functional foods.

It should be noted that it is through agrocenosis that a person receives agricultural products, which he uses as food and the basis for the food industry. The advantage of artificial communities is their controllability and unlimited ability to increase yields. But human activity leads to negative consequences. Plowing land, deforestation and other manifestations of inefficient nature management lead to imbalance. Therefore, when creating agrocenosis, it is necessary to take into account the links between wild and cultivated species (Belitsina et al. 1988). The main characteristics of agrocenosis include:

- poorly branched trophic chains;
- the absence of the cycle of substances and energy;
- insignificant species diversity;
- and constant monitoring by the person.

Received: October 2018
Accepted: March 2019
Printed: May 2019

Natural factors of soil formation associated with climate, the rocks underlying the soil and the time of their formation are of great importance. In addition, an important role are the so-called nodules, or wedging out of groundwater, which form an excess or deficiency of macro- or microelements in the structure of mineral nutrition.

Food security of Russia largely depends on the efficiency of the use of territories - sources of raw materials for food production. In addition, the formation of logistics chains for the end-to-end processes of production and procurement of food-grade agricultural raw materials, their transportation, and the production of functional food products that are competitive in the domestic and foreign markets largely depends on this. There is no doubt the relevance of assessing the characteristics of territories - sources of raw materials in the context of federal districts of Russia for research and development conducted by Petrozavodsk State University for the formation of optimal end-to-end technologies for the production of functional foods that increase the food safety of the northern territories of Russia (Shegelman et al. 2018a, 2018b).

All this determines the need to assess the characteristics of the territories - sources of raw materials in the context of the federal districts of Russia in terms of their potential for the production of food raw materials on them for the formation of end-to-end technologies for the harvesting of food agricultural raw materials and the production of highly efficient functional foods from it.

MATERIALS AND METHODS

The task of developing agriculture on the basis of a well-organized system of managing the agro-industrial complex (AIC) using reliable data in Russia is crucial for the country's economy (Nasedkina 2011).Considering the above, organization of system monitoring and informational and analytical support for the processes taking place, and in particular, monitoring the status of agricultural areas, soil structure and quality, as well as yield, as the most important factors in the production of food raw materials, is required. The governing bodies of regional AIC need reliable monitoring, collection and analysis of a wide range of information. Such monitoring in the AIC should allow, on the one hand, to quickly obtain reliable analytical information necessary for making operational tactical decisions, and on the other, to provide a constantly formed and adjustable knowledge base for predictive management and planning of AIC development in the regions of the country and its enterprises.

Specialists of the AIC, government bodies and the media emphasize that if the results of the assessment of the volume, structure, fertility - the main indicator of the quality of agricultural land are biased, then the agricultural land will be partially or fully controlled, the agricultural land will appear the threat of the emergence and development on the lands of the agricultural regions of the country of uncontrolled soil degradation processes, reducing crop yields.

Thus, it can be stated that the effective use of agricultural territories in the context of priority agricultural crops in the regions of Russia can be implemented only on the basis of scientifically based system monitoring of the state of these agricultural territories. In the works of Bakirov (2009) and Bessenova (2011) rightly noted that the most important element of monitoring agricultural areas is land assessment work carried out by a multifaceted approach to land assessment:

- it is a means of labor;
- it is a subject of labor;
- it is a means of production.

At the same time, the authors of these works rightly emphasize that the existing system for assessing agricultural land is based on a rather extensive system and a developed (as will be shown below, requiring improvement) system for collecting, processing and analyzing the information collected and submitted on the state of agricultural lands, their advantages and disadvantages in fertility and yield. This monitoring system is based on the collection and analysis of data on objective signs and characteristics that have a decisive influence on the value of the productive capacity and yield of agricultural territories.

A significant proportion of the country's AIC areas falls on regions with developed industry and agricultural land. Naturally, man-made discharges and emissions (industrial, agricultural) adversely affect the quality of the environment and specifically these areas. In this regard, the task of the need to develop and implement a monitoring system for these territories, including a monitoring system, assessing the status and forecasting transformations of arable agricultural areas as a result of climatic and production factors, is rightly posed. Researches are devoted to this problem are Zakharov (2017), Baikin et al. (1997), Yakutin and Anopchenko (2007), Sychev and Kuznetsov (2005) Lebedeva (2012) and others.

According to the data of Russian scientists, the areas of agricultural land of a specific purpose during the period of substantial post-perestroika transformation of the Russian economy were significantly reduced. Specialists emphasize the growth of agricultural areas in Russia, which are either not used or not used effectively. Negative trends in the field of agriculture, mentioned and expressed in various regions of Russia, are noted throughout the country. At the same time, problems of shortage of agricultural land in the land balance are exacerbated by inefficient control over their market turnover, there is a release of productive agricultural

land for the development of settlements, the construction of various industrial, transport and energy facilities. This situation and the current state of the AIC make it necessary to dictate attention to the assessment and use of agricultural land, forecasting the development of the AIC of Russia for the medium and long term (Bryzhko 2005).

The aim of the study was to analyze the assessment of the characteristics of territories - sources of raw materials in the context of the federal districts of Russia in terms of their potential for the production of food raw materials for them for end-to-end technologies for the production of functional foods. To achieve this goal, a detailed information search was performed for references and regulatory documents in the considered area.

RESULTS AND DISCUSSION

According to the administrative and economic division of the country, federal districts have been allocated for different geographical zones of the Russian Federation, whose territories are characterized by different environmental conditions and different production and agricultural potential, and, accordingly, different soil conditions that affect the formation and use of arable land and the development of agriculture. Consider the specificity of the territories of these districts as sources of raw materials in terms of their potential for the production of food raw materials for end-to-end technologies for the production of functional foods.

The territory of the North-Western Federal District (NWFD), where two republics are located, seven regions and one national district make up 9.8% of the entire territory of Russia, and the share of the population is 9.9% of the population of Russia. Most of the district are located in the European North. A significant part of the Murmansk region and the Nenets Autonomous Okrug are located beyond the Arctic Circle. The NWFD has almost half of the water resources of the European part of the country (Kovalsky 1968). Due to unfavorable natural-production conditions, agriculture is poorly developed in most parts of the North-West Federal District (4.7% of the production of agricultural products in Russia). On the territory of the North-Western Federal District, the southern part of the Arkhangelsk region, the Vologda, Leningrad, Pskov, Novgorod and Kaliningrad regions are most suitable for the development of agriculture. In 2015, the sown areas in the North-West Federal District accounted for 1.8% of all the sown areas in Russia. In the North-West Federal District, in 2015, 10.5% of the total volume of rapeseed grown in the country, 6.1% of potatoes, and 5.2% of vegetables were produced. The share of the North-West Federal District in grain production in 2015 is only 0.9% of the wheat share produced in the Russian Federation, rye accounts for 0.6%, and barley accounts for 1.8%. From grain crops, rye and oats are cultivated, in small quantities in the Pskov region - spring wheat (Pskov region) (Ponomareva and Plotnikova 1980). Throughout the territory of the NWFD, the provinces are poor in cobalt, copper, iodine, calcium and phosphorus, copper and cobalt, and there is a low content of mobile forms of nitrogen. An excess of fluorine is characteristic of the soils of the northern part of the North-West Federal District (Murmansk region). The entire north-taiga nonchernozem zone (up to 55^0 nl.) Is poor in cobalt, copper, iodine, calcium and phosphorus. In the region of the Murmansk region there is also a biogeochemical province (BGCP) with an excess of fluorine.

The Central Federal District (CFD) is represented by 18 constituent entities of the Russian Federation - the regions: Moscow, Ivanovo, Lipetsk, Orel, Tula, Belgorod, Vladimir, Kaluga, Kursk, Tambov, Bryansk, Yaroslavl, Ryazan, Smolensk, Voronezh, Kostroma and Tver. The territory of the Central Federal District's sown areas in 2015 amounted to 15357 thousand hectares (19.4% of all the sown areas of Russia). Natural areas are quite diverse: mixed forest, deciduous forest, forest-steppe, steppe. From the historical, economic and climatic points of view, the territory of the Central Federal District is divided into the Non-Black Earth and Black Soil Areas. Thanks to the natural and industrial conditions in the Central Federal District, high-intensity agriculture is developed, producing in Russia (2015) 33% of the potato harvest, 47.7% of the sugar beet, 17.2% of the grain, 15.2% of the seed sunflower, 23.3% from vegetables, 15.2 from sunflower seeds, 27.3 from peas, 24.7 from buckwheat, 33.1 from rape, 19.3 from wheat, 17.2 - from oats.

For the CFD, soil heterogeneity is characteristic, allowing them to be assigned to different zones and determines the features in relation to the initial fertility. The balance of humus in different areas of the district, both positive and negative, before leaching 0.5 hectares from 1 hectare or more. In general, there is a sufficient amount of strontium and calcium deficiency (Lobkov et al. 2014), there are areas with excess iodine. In the Nonchernozem zone there are both soil areas containing a sufficient number of chemical elements, and extremely poor ones.

In the central non-chernozem zone, in almost 80% of the soil samples studied, the amount of iodine is 5-50 times less than the chernozem soil (in Yaroslavl, Ivanovo, and adjacent areas only 6-10% of the samples are enriched with iodine and contain about 5-10-4 -7.5-10-4%). Low iodine content in soils occurs throughout the non-black earth zone, for example, in the Yaroslavl region (Gromov and Solov'ev 2012). The black earth zone of the Central Federal District is represented by podzolized chernozem on south of the region, these soils are characterized by an optimal content of calcium and cobalt, copper, manganese (Alexandrova 2008), and iodine, zinc and molybdenum are balanced with

other elements of mineral nutrition. Voronezh black soils contain an average of about 1 × 10–3% cobalt, i.e., 2-3 times more than the central nonchernozem soil zones (Alexandrova 1980). In the Yaroslavl region of the Central Federal District there is a BGCP poor in iodine and cobalt. The soils of the forest-steppe zone of the Central Federal District are partly poor in iodine.

The area of the Southern Federal District (SFD) is 591.3 thousand km2 (3.5% of the territory of Russia), the population is 22.8 million people (15.8% of the population). The share of the urban population is only 57.5%. Agricultural lands employ nearly three-quarters of the SFD lands.

One of the leading regions of Russia in the development of the AIC is rightfully considered to be the Krasnodar Territory (Bezuglova 2001). According to the total index of land in the region occupy 7546.6 thousand hectares. Two thirds are occupied by plains. The most fertile black soil in our country covers the largest Azov-Kuban plain. They differ from similar soils of other regions and regions of Russia. Their humus layer has a greater capacity exceeding 120 cm. Irrigated lands, which occupy 453.4 thousand hectares, deserve special attention. They are rice paddies and large sprinkler systems.

Thus, the Southern Federal District as a whole is characterized by high soil fertility, the presence of leached chernozems and eroded lands in varying degrees, with sufficient amounts of calcium, cobalt, copper, manganese, iodine, zinc and molybdenum are balanced with other elements. In the dry-steppe and semi-desert zone, living organisms are affected by elevated levels of sulfates, boron (88%), zinc (76%), often strontium (47%), molybdenum (40%), low copper (40%), and sometimes cobalt (52%), a lot of sulfur and molybdenum (Kovalsky and Yarovaya 1966).

The soils of the North Caucasus Federal District are characterized by a high content of molybdenum, cobalt, lead, boron and a low content of zinc, manganese, copper, molybdenum and cobalt. The territory of the North Caucasus Federal District has provinces (BGCP) with an excess of fluorine, a high content in the mountain soils of molybdenum and selenium (Gireyev 1968, Zimovets 1991).

The Volga Federal District, occupying only 6.1% of the territory of Russia, includes 14 constituent entities of the Russian Federation, including the six republics of the Volga region and the Ural region, producing a fourth of the total agricultural output of Russia. That is, the productivity of its agricultural areas is almost as good as that of the SFD.

The territory of the Ural Federal District makes up more than 10% of the territory of Russia. In the Ural Federal District in general, it should be noted that there are large amounts of copper, silicon, zinc and lead in copper in the Yamalo-Nenetsky District in the middle and southern Urals. The southern Urals of the Ural Federal District has territories with copper-rich soils and areas with a lack of copper, but with an excess of molybdenum and sulfates, as well as areas with an excess of nickel, magnesium and strontium, but with a low content of cobalt and manganese. Virtually the entire territory of the Sverdlovsk, Chelyabinsk, Kurgan regions includes territories with an excess of a number of trace elements and a deficiency of others (Alexeeva-Popova and Drozdova 1970).

The territory of the Siberian Federal District occupies more than 30% of the area of Russia. In the Siberian Federal District, there are different types of soil: from tundra to black soil, with the presence of mountain. In the taiga-forest nonchernozem zone there are soils rich in lead, with an excess of fluorine and a violation of the ratio of copper, molybdenum and lead; there are provinces poor in iodine. The Republic of Tuva has a high content of selenium, nickel, lead, molybdenum and chromium in the soil. In the Khanty-Mansi National District of the Siberian Federal District in the middle reaches of the river. Ob there are BGCP, soils of which have an excess of fluorine and uranium. The Irkutsk Region is a soil with iodine deficiency and an excess of uranium (Leontiev 1956). On the vast territory of the region for agricultural production the most favorable zones are southern taiga, hemiboreal forest, island forest steppes and steppes. For agriculture in the southern taiga zone, the most interesting are the sod-gley soils of the terraces of the Yenisei and its major tributaries. To use them, a number of measures are required to improve hydrothermal conditions, enhance microbiological processes, and introduce organic and mineral fertilizers.

The territory of the Far Eastern Federal District (FEFD) accounts for about 36% of the territory of Russia, with 48% of its soil cover being mountainous. In general, in the Far Eastern Federal District, with the exception of the extreme northern territories with permafrost, it should be noted the presence of iodine-enriched soils; poor in cobalt, copper, but with an excess of soil fluoride; soils with a neutral environment and with sufficient calcium content. There are lead outs in mountainous areas. In some districts of the Amur region, the soil is poor in calcium compared to the neighboring healthy areas by 2 times, and in comparison with black soil - by 21 times, it is noted (Kovalsky 1958, Samarina I960) the excess of strontium in soils by 30% (i.e. 7 times) than in the sod-podzolic soils of the central non-chernozem zone and 3–4 times more than in the upper horizons of chernozem soils; barium - 2.8 times more than in the neighboring and 4.6 times more than in black soil. The ratio of strontium and barium to calcium in the soils of the province is higher than in others, especially compared to black soil (the ratio of Sr/Ca is 36 times higher; Ba/Ca is almost 100 times higher). In the region of Central Yakutia of the Far Eastern Federal District between the Aldan and Lena rivers at the junction on

permafrost soils there is a province (BGCP) with an excess of fluorine and with a normal content of copper and cobalt, enriched with boron and strontium. In the same district in the Chita region there is a BGCP, the soils of which are enriched with strontium, but poor in calcium.

On the basis of the analysis of the soils of the considered federal districts, their large territories should be noted, in which there are very different biogeochemical provinces in terms of soil conditions. However, in general, it should be noted that above 600 northern latitudes, there are practically no soil conditions that are distinguished by favorable conditions for plant growth.

Thus, the formation of podzols and podzolic soils leads to their significant acidification and accumulation of aluminum and iron ions harmful to plants. Peaty soils contain a sufficient amount of organic matter, but due to climatic conditions and anaerobic soil conditions, its decomposition is slow.

In general, only the soils of the Southern, Central and Volga Federal Districts are generally favorable for growing soil in large volumes of crops. Under the conditions of the Ural and North Caucasus regions, outgrowths of rocks unfavorable for plant growth were noted with the formation here of zones of an excessive amount of a number of mineral nutrition elements. The same picture is taking shape in Yakutia, the Far Eastern Federal District and the Tuva Republic of the Siberian Federal District. Thus, areas of access to the surface of some rocks do not allow here to recommend large-scale cultivation of crop products. Only after a detailed acquaintance with the biogeochemical conditions of the formation of provinces it is possible to draw conclusions in mountain conditions about its suitability for growing raw materials of the food industry for use in end-to-end technologies for the production of functional products.

Considering arable land in the context of their distribution by federal districts, it should be noted that the arable land area of the North-Western District is less than 1%, the Far Eastern Region - 2%, Uralsky - 8%. The share of the Siberian Federal District in the area of arable land in Russia is 28%, the Southern is 17%, Privolzhsky is 31% and the Central is 14% (Electronic version of the National Atlas of Soils of the Russian Federation).

The analysis showed that chernozem soil types are concentrated mainly in the Central and Southern Federal Districts. Forest-steppe and steppe zones. chestnut soils are also concentrated here. Only on an insignificant part of the Volga, Ural and Siberian districts, we observe the distribution of relatively rich typical and ordinary chernozem, in the northern regions, up to 60 °. sh., such soils are absent, and in the places of rock concentration processes of water and air erosion are observed. Thus, as the main arable land we can consider mainly the lands of the Southern and Central Federal Districts.

CONCLUSION

1. The complex state of agriculture in the AIC of Russia and its individual enterprises necessitates increased attention to its development in the country as a whole and, in particular, in its regions with developed agriculture. Thanks to agrocenosis, a person receives agricultural products, which he uses as food and the basis for the food industry. The advantage of artificial communities is their controllability and unlimited ability to increase yields. But human activity leads to negative consequences. Plowing land, deforestation and other manifestations of inefficient nature management lead to imbalance. Therefore, when creating agrocenosis, it is necessary to take into account the links between wild and cultivated species (Belitsina et al. 1988).The main characteristics of agrocenosis include: poorly branched trophic chains, the absence of the cycle of substances and energy, insignificant species diversity and constant monitoring by the person. Natural factors of soil formation associated with climate, the rocks underlying the soil and the time of their formation are of great importance. In addition, an important role are the so-called nodules, or wedging out of groundwater, which form an excess or deficiency of macro- or microelements of mineral nutrition.

2. Climatic conditions determine the basic pattern of soil geography - their latitudinal zoning. Together with the change of climatic regions, a change in soil types is observed.

3. Based on the soil characteristics and the content of the main elements of mineral nutrition, the type of soil is determined and a forecast is made on the prospects for growing agricultural plants. With a shortage or excess of the content of one of the elements, its increased content in food may be observed, which can lead to an imbalance in the human body.

4. Despite the large availability of land in the northern regions, the amount of arable land in these regions is small. The development of the northern territories for crop production in agriculture, with their limiting factor in the amount of heat, is very limited to a small range of crops capable of growing in these regions.

5. Considering the arable land in the context of their distribution by federal districts, it should be noted that the arable land area of the North-Western District is less than 1%, the Far Eastern Region - 2%, and the Urals - 8%. The share of the Siberian Federal District in the area of arable land in Russia is 28%, the Southern is 17%, Privolzhsky is 31% and the Central is 14% (Electronic version of the National Atlas of Soils of the Russian Federation). The analysis showed that chernozem soil types are concentrated mainly in the Central and Southern Federal Districts. Forest-steppe and steppe

zones. chestnut soils are also concentrated here. Only on an insignificant part of the Volga, Ural and Siberian districts, we observe the distribution of relatively rich typical and ordinary chernozem, in the northern regions, up to 60^0l., such soils are absent, and in the places of rock concentration processes of water and air erosion are observed. Thus, as the main arable land we can consider mainly the lands of the Southern and Central Federal Districts.

6. Chernozem soil types are concentrated mainly in the Central and Southern Federal Districts. Forest-steppe and steppe zones. chestnut soils are also concentrated here. Only on an insignificant part of the Volga, Ural and Siberian districts, we observe the distribution of relatively rich typical and ordinary chernozem, in the northern regions, up to 60°l., such soils are absent, and in the places of rock concentration processes of water and air erosion are observed. Thus, as the main arable land we can consider mainly the lands of the Southern and Central Federal Districts.

7. It is necessary to activate and increase the role of the formation and implementation of the state monitoring system for the state, the effectiveness of the functioning of agricultural areas. Obviously, this need requires prioritizing the state approach to quickly obtaining a complex of the required total amount of reliable information about the volumes and quality of the state of agricultural land, their fertility, potential yield, and evaluating the effectiveness of their use in the regions as a whole and in specific agricultural enterprises.

8. Specialists of the agro-industrial complex, government bodies and the media constantly focus on the fact that if the results of the assessment of the volume, structure, fertility - the main indicator of the quality of agricultural land are biased, you will lose some or all control over these indicators will be removed from circulation agricultural land, there will be a threat of the emergence and development on the lands of the agricultural regions of the country uncontrolled degradation processes soil, reducing the yield of specific crops. Effective use of agricultural territories in the regions of the country in the context of priority agricultural crops in the regions of Russia can be realized only on the basis of scientifically based system monitoring of the state of these agricultural territories.

9. According to the data of Russian scientists, the areas of agricultural territories of a specific purpose during the period of substantial post-perestroika transformation of the Russian economy have significantly decreased. Specialists emphasize the growth of agricultural areas in Russia, which are either not used or not used effectively.

10. For the NWFD as a whole, growing crops can be offered only on the territory of the southern part of the district for a number of soil-poor fertility crops that can grow in acidic and neutral soils. By analogy with Finland, potatoes, vegetables, grains and fodder crops are grown in the NWFD. Soils of the NWFD are characterized by a lack of calcium, phosphorus, cobalt (73% of all soils), copper (70%), boron (50%), iodine (80%), molybdenum (53%), boron (50%), zinc (49%), the optimum content of manganese (72%), relative excess of strontium (15%). Peat-bog soils although contain relatively much copper and iodine, but these elements are little absorbed by plants, as they are firmly associated with organic compounds of peat soils.

The following provinces are spread throughout the zone:

- poor in cobalt;
- poor in copper;
- poor in iodine;
- poor in calcium and phosphorus;
- poor in copper and cobalt (more often on peat soils);
- low content of mobile forms of nitrogen. The soil of the northern part of the region (Murmansk region) is characterized by an excess of fluoride.

Moscow province, with outputs of bauxite, diamonds, phosphorites). The entire north taiga nonchernozem zone (up to 55^0nl.) Is poor in cobalt, copper, iodine, calcium, and phosphorus. In the region of the Murmansk region of the Northwestern Federal District there is a biogeochemical province (BGCP) with an excess of fluorine.

11. Soils in the Nonchernozem loamy are sandy. South of the Oka are gray forest soils. There are many swamps here. In the Vladimir region dominated by loess loam, sometimes resembling a typical loess. In the Moscow region dark-colored soil. The decrease of nitrogen, phosphorus and potassium from 40 to 60 kg / ha per year. There are areas of soil with excess iodine. In the central non-chernozem zone, about 80% of all soil sample studies contain less than 1–10–4% iodine, of which 25% are less than 1–10–5% iodine, i.e., 5–50 times less than chernozem soils (In Yaroslavl, Only 6–10% of samples are enriched with iodine in the Ivanovo and adjacent areas and contain about 5–10–4–7.5–10–4%. Soils with a very low iodine content are characteristic of the entire nonchernozem zone. Example - Yaroslavl Region (Gromov & Soloviev, 2012). The Chernozem zone of the Central Federal District is represented by podzolized chernozem in the south of the region. These soils are characterized by an optimal content in the soil of calcium and cobalt (77% of the soil), copper (72-75% of the soil), manganese (71-75%) (Shcherbakov and Vasenev 1980). Iodine, zinc and molybdenum balanced with other elements of mineral nutrition. Voronezh black soil contains on average about 1 × 10–3% cobalt, i.e., 2–3 times more than the soils of the central nonchernozem zone (Aleksandrova 1980). In the Yaroslavl region The Central Federal District has BGCP, poor in iodine and cobalt. The soils of the forest-

steppe zone of the Central Federal District are partly poor in iodine.

12. In general, the Southern Federal District is characterized by high soil fertility, the presence of leached chernozems and eroded lands to varying degrees. In general, here agricultural land makes up 78.4% of the total area.

13. For the North Caucasus Federal District, black soil soils of foothills with a high content of mineral nutrients and mountain soils with low fertility are characteristic. The weighted average content of humus in soils is 4.6%, the content of mobile phosphorus on arable land is currently 23.8 mg/kg of soil, and exchangeable potassium is 229 mg/kg of soil. Weighted acidity - pH 7-8. The soils of the NCFD have a high content of molybdenum, cobalt, lead, boron. Low content is noted for zinc, manganese, copper, molybdenum and cobalt. The territory of the North Caucasus Federal District has provinces (BGCP) with an excess of fluorine, a high content in the mountain soils of molybdenum and selenium.

14. In general, in the Ural Federal District, it should be noted that in the middle and southern Urals there were exits in the sub provisions of iron, chromium, in the Yamalo-Nenetsky district there are large reserves of copper, silicon, zinc and lead, copper. The southern Urals of the Ural Federal District has provinces whose soils are enriched with copper, there are provinces with a copper deficiency but an excess of molybdenum and sulfates; provinces with an excess of nickel, magnesium, strontium, but a low content of cobalt and manganese. Virtually the entire territory of the Sverdlovsk, Chelyabinsk and Kurgan regions includes territories with an excess of a number of trace elements and a shortage of others.

15. In the Siberian Federal District there are different types of soil: from tundra to black soil, with the presence of mountain. In the taiga-forest nonchernozem zone there are soils rich in lead, with an excess of fluorine and a violation of the ratio of copper, molybdenum and lead; there are provinces poor in iodine. The Republic of Tuva has a high content of selenium, nickel, lead, molybdenum and chromium in the soil. In the Khanty-Mansi National District of the Siberian Federal District in the middle reaches of the Ob River there are soils with an excess of fluorine and uranium, in the Irkutsk region - with a lack of iodine and an excess of uranium. With the exception of the extreme northern territories with permafrost, it should be noted that the soils here are more enriched with iodine, there are provinces poor in cobalt, copper, with an excess of fluorine. There are lead outs in mountainous areas. In a number of regions of the Amur region and the region, poverty is observed in calcium compared to neighboring healthy areas by 2 times, and in comparison, with black soil - by 21 times. Especially interesting differences are found in the content of strontium and barium in them (Kovalsky 1968, Samarina 1960): strontium is 30% more in the soils (i.e., 7 times) more than in the sod-podzolic soils of the central nonchernozem zone and 3 - 4 times more than in the upper horizons of chernozem soils; barium - 2.8 times more than in the neighboring and 4.6 times more than in black soil. The ratio of strontium and barium to calcium in the soils of the province is higher than in others, especially compared to black soil (the ratio of Sr/Ca is 36 times higher; Ba/Ca is almost 100 times higher). In the region of Central Yakutia of the Far Eastern Federal District between the Aldan and Lena rivers at the junction on permafrost soils there is a province (BGCP) with an excess of fluorine and with a normal content of copper and cobalt, enriched with boron and strontium. In the same district in the Chita region there is a BGCP, the soils of which are enriched with strontium, but poor in calcium.

16. On the basis of the analysis of the soils of the considered federal districts, their large territories should be noted, in which there are very different biogeochemical provinces in terms of soil conditions. However, in general, it should be noted that above 60° north latitude there are practically no soil conditions that are distinguished by favorable conditions for plant growth. Thus, the formation of podzols and podzolic soils leads to their significant acidification and accumulation of aluminum and iron ions harmful to plants. Peaty soils contain a sufficient amount of organic matter, but due to climatic conditions and anaerobic soil conditions, its decomposition is slow. In general, only the soils of the Southern, Central and Volga Federal Districts are generally favorable for growing soil in large volumes of crops. Under the conditions of the Ural and North Caucasus regions, outgrowths of rocks unfavorable for plant growth were noted with the formation here of zones of an excessive amount of a number of mineral nutrition elements. The same picture is taking shape in Yakutia, the Far Eastern Federal District and the Tuva Republic of the Siberian Federal District. Thus, areas of access to the surface of some rocks do not allow here to recommend large-scale cultivation of crop products. Only after a detailed acquaintance with the biogeochemical conditions of the formation of provinces it is possible to draw conclusions in mountain conditions about its suitability for growing raw materials in the food industry.

ACKNOWLEDGEMENT

The project “Research and development of end-to-end technology of functional food manufacture for achieving food supply security for north territories of the Russia” is carried out with granting by Russian Federation represented by Ministry of Education and Science of the Russian Federation (project identifier – RFMEFI57717X0264, agreement No 14.577.21.0264, 26.09.2017).

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