Rapeseed production as a promising direction for the agricultural complex development of the Krasnoyarsk Region

A V Rozhkova
Krasnoyarsk State Agrarian University, Krasnoyarsk, Russia

E-mail: alena-mf@mail.ru

Abstract. The article considers rapeseed production as a promising direction for the agricultural complex development of the Krasnoyarsk Region. The relevance of this topic is primarily related to the relevance of the production sector itself. The variety of cultivation methods, sowing, processing technology, as well as selection used in the study of rapeseed, requires a specific description and definition of each of them. In addition, the relevance is also determined by the demand for this topic, which has now spread around the world. The basis of the activity in this area is, among other things, the variety of options for using rapeseed in the household and in agricultural enterprises. The purpose of this article is to point out the sagging parts of oilseeds development, including rapeseed and its seeds and also to show solutions to these problems. In this paper, various sources of information on the value, cultivation and development of rapeseed in Russia and abroad will be considered. Also, the origin of rapeseed and its value at the moment will be considered.

1. Introduction
Rapeseed is a very important oilseed crop worldwide. Rapeseed is a valuable oilseed and forage crop. In terms of food and feed advantages, it is significantly superior to many agricultural crops. Its fats and proteins are important for food and feed. Rapeseed oil containing unsaturated acids (oleic, linolenic, linoleic) is high in calories and tastes like olive oil. The high demand for rapeseed oil seeds is due to the versatility of their use. The oil can be used in the food, pharmaceutical and cosmetic industries, as well as in the chemical and metallurgical industries, textiles, leather, soap and paint industries. The continued high demand and unsecured demand from manufacturing companies have had a positive impact on prices, which is an important incentive for farmers to expand rapeseed production. The possibility of rapeseed oil as an environmentally renewable fuel also helps to meet the growing demand for rapeseed oil [1-4].

2. Rapeseed development in Russia
The development of rapeseed began from time immemorial – in the culture it became known for four millennia before our era. Some researchers consider Europe to be the birthplace of rapeseed, others the Mediterranean. In the second half of the XIX century, the rapeseed culture, which turned out to be one of the most useful oilseeds in European climatic conditions, was greatly developed not only in Asia, but also in Europe.

Also, in connection with the development of rapeseed crops (including rapeseed oil), it is possible to explain the general industrial rise, this is explained by the peculiarities of the composition (the presence
of a large amount of erucic acid) rapeseed oil at that time was primarily in demand as a technical one. But, with the appearance of a large number of cheap refined products on international markets at the beginning of the XX century, the interest in rapeseed in Europe has significantly decreased. The methods improvement of vegetable oils purification gave an impetus to the intensive use of rapeseed oil for food purposes, significantly expanding the global geography of rapeseed cultivation.

Who is the leader in sown area in the world? According to the consulting company “Kleffmann Group”, the total area sown with rapeseed in the world in 2019 was 35 million hectares.

The five leaders in terms of sown area sow 29.8 million hectares, which is 85% of all crops in the world:
- Canada - 8.4 million hectares;
- India - 7.3 million hectares;
- China - 6.6 million hectares;
- EU - 5.6 million hectares;
- Australia - 1.9 million hectares.

And the main regions of the world for rapeseed production can be called: Asia - it occupies 46.8% of world production, Europe — 30.3% and North America - 19.2%.

In Russia, rapeseed began to be cultivated at the beginning of the XIX century, mainly in the Penza and Nizhny Novgorod provinces.

In the late 40s-50s of the XX century, rapeseed production in Russia was almost completely curtailed. The main reason was the intensive development of sunflower production, with which rapeseed could not compete economically. The same role was played by such reasons as: the lack of productive varieties and effective means of protecting the plant from pests. Rapeseed reproduction in our country was resumed only in 1980, and by 1990 its area was 258 thousand hectares.

Since the 1990s, development in Russia has been rapidly growing upwards. However, the sown area of rapeseed in the Russian Federation for 10 years (1991-2000) amounted to approximately 179 thousand hectares and decreased by 1.5 times compared to the level of 1986-1990. In 2000, the harvesting area was 183.8 thousand hectares, in 1999 - 102.4 thousand hectares. The largest areas of sowing were concentrated in the Volga, Central, North Caucasus, West Siberian and East Siberian regions [5,6].

At the time from 2008 to 2018, the sown area in the Russian Federation more than doubled – from 680 thousand hectares to 1576.5 thousand hectares. The average gross harvest for ten years was 1.1 million tons, with an average yield of 11.7 c/ha.

In 2018 – 2019, the area of rapeseed cultivation in the Russian Federation was at historically high levels and amounted to 1576 thousand hectares and 1547 thousand hectares.

At the moment, the production of rapeseed is constantly increasing. Rapeseed occupies 1.9% of the total area sown in Russia in 2020. According to Rosstat, the sown area of winter and spring rapeseed in our country in 2020 was at the level of 1 500 thousand hectares. In 2020, the Central Federal District surpassed Siberia in gross revenue. For the first time in a long time, the leader among the regions in rapeseed cultivation may change: for two years (2018-2019), Siberia remained the main producer in the country.

Forecasts for the development of rapeseed in 2021 from the message from the Ministry of Economy are as follows: agricultural enterprises sowed 862.6 thousand hectares of rapeseed for the harvest in 2021.

The Krasnoyarsk region is one of the leading regions that are engaged in the production of oilseeds. Directly, the cultivation of various crops, especially rapeseed, on the territory of the Krasnoyarsk region is a promising direction.

The main production of this crop in the territory of the region is deployed on the territory of the Sharypovo, Uzhur, Nazarovo and Uyar districts, where 42% of rapeseed is grown.

In 2019, the Krasnoyarsk farmers grew 183 thousand tons of rapeseed oil seed, which allowed them to become the leader in rapeseed production in the country. The crop yield itself was 14.6 quintals per ha - this is the best indicator in the Siberian Federal District.
The Minister of Agriculture and Trade of the Krasnoyarsk region noted that the achievement of such significant results was made possible thanks to the agrotechnics of growing oilseeds in the region, the effective and safe use of fertilizers and plant protection products [7-9].

A key feature of rapeseed is its high export potential. Its demand is growing both in the Russian and foreign markets [10-13]. Last season, 91.3 thousand tons of oilseeds were sent outside the region. This year, it is planned to export 140 thousand tons of oilseeds. To date, about 84 thousand tons of rapeseed seeds have been shipped, including 54 thousand tons to such countries as Belarus, China, Kazakhstan, Mongolia, Latvia, Kyrgyzstan and Azerbaijan. At the same time, it is planned that by 2024, the products export of the agro-industrial complex in the Krasnoyarsk region will grow 2.5 times and amount to 47.9 million dollars.

Table 1. Rating of the Russian Federation subjects on the gross harvest of rapeseed in 2018 and 2019, thousand tons.

| Region                  | Gross yield |
|-------------------------|-------------|
|                          | 2018 year   |
| the Altai region        | 184.4       |
| the Omsk region         | 171.4       |
| the Krasnoyarsk region  | 148.4       |
| the Novosibirsk region  | 123.2       |
| the Republic of Tatarstan| 118.2      |
| the Tula region         | 114.4       |
| the Kursk region        | 99.7        |
| the Kemerovo region     | 95.3        |
| the Stavropol region    | 83.6        |
| the Kaliningrad region  | 74.8        |
|                          | 2019 year   |
| the Krasnoyarsk region  | 182.7       |
| the Altai region        | 170.0       |
| the Tula region         | 150.4       |
| the Republic of Tatarstan| 123.2      |
| the Kaliningrad region  | 118.7       |
| the Omsk region         | 101.1       |
| the Lipetsk region      | 99.0        |
| the Novosibirsk region  | 92.0        |
| the Kemerovo region     | 85.0        |
| the Kursk region        | 83.5        |

According to the data for 2019-2020 the Krasnoyarsk region occupies a leading position in Russia. Krasnoyarsk ranked third in Russia, rising to the first place helped by a stable increase in sown area over the past five years (4.9 times - from 29.2 thousand hectares in 2014 to 144 thousand hectares in 2019), and an increase in yield.

The increase in sown area can be justified by various reasons. To begin with, this is the country's current pricing policy for agricultural products. This, in turn, generates a reaction from local farmers. According to Rosstat, over the past three years, the average price for rapeseed seeds is 21.1 thousand rubles/ton, which is 3 thousand rubles/ton more than sunflower seeds. Also, the reasons can be attributed to the fact that the development of animal husbandry in the region has generated a demand for oilseeds. Due to the climatic conditions of the region, it is almost impossible to grow soybeans and sunflowers for the production of oil, but the crops are used in the production of mixed feed, silage and green mass [14-17].

About two hundred producers, most of which are large enterprises, are engaged in the cultivation of oilseeds in the region.
Among oilseeds, rapeseed occupies a leading position in terms of profitability. Since its oil is not traditional, the demand for it is not particularly high, but it can be exported very profitably, which is also attractive for the development of the region.

However, there is an aspect that hinders the development of the industry - the lack of processing enterprises. According to the “Center of Agroanalytics”, there is only one company for the production of rapeseed oil - LLC “Host” in the Achinsk district, where 9 thousand tons are produced per year. The company plans to increase its production capacity to 45 thousand tons per year. In this regard, most of the rapeseed crop is sold both in other regions and abroad [18-20].

3. Problems in the development of oilseeds

Rapeseed production is one of the most promising industries at the moment, but there are also a number of problems that complicate the development process.

Among the problems of the rapeseed production development is the low level of farms provision with seed material of domestic selection. The rather high dependence of Russian farmers on foreign suppliers of rapeseed seeds is a risk not only in the sustainable production of rapeseed, but also partly in food security [21-23].

When growing rapeseed, it is necessary to observe all technological operations, perform everything strictly in accordance with the recommendations, since any violation threatens to reduce the yield. The preparation of the soil should be perfect, with a good structure, since the seeds are small. As soon as cotyledons appear on the surface, insects such as cruciferous fleas, cabbage moths, and rapeseed flower eaters begin to harm the plant. Despite the fact that the seeds and fields are processed, all pests can still spoil the plants. This can lead to a reduction in the area of sowing.

For each type of insect there are different ways of fighting. For cruciferous fleas there is a treatment of the field with chemical agents. For cabbage moths, these are pheromone traps that fix the first gathering of butterflies and then you can start processing, so as not to lose part of the crop. With rapeseed flower-eater, it is worth fighting before budding. At the moment, the situation is not easy, many pests adapt to insecticides, which is why it is difficult to fight them, so not all enterprises agree to experiments with rapeseed [24-27].

Also, when seedlings appear, constant monitoring for the presence of pests is necessary. That is, on rapeseed, you cannot just treat the field from pests and then do not appear for a long time. You need constant monitoring. It all comes down to building a competent defense system. At the same time, it is not necessary to use only chemicals, because the problem can be prevented, rather than then cope with the consequences.

4. Development prospects or solutions

Russia can rightfully be considered the only country in the world whose agro-climatic conditions can be considered optimal for the production of oilseed rapeseed raw materials. Thanks to them, you can deploy large-scale production. But, unfortunately, in Russia this has been ignored until recently.

Taking into account the fact that it is problematic to meet the needs of the Russian Federation in vegetable oil, we can safely say that a significant part of the oil and feed protein can be met by rapeseed. Since its high yield and gross yield will increase significantly, if the following conditions are met:

1. Implementation of state incentive measures, as well as the formation of measures aimed at creating a sustainable market for rapeseed seeds and products of its processing. This provides for:

   • Allocation of subsidies from the budget of the Russian Federation.
   • Change in the rate of export customs duty on seeds.

2. Implementation of research works, measures for the implementation of developments that provide for the implementation of the following activities:

   • Creation of modern adaptive, technological varieties of rapeseed.
• Development and implementation of special tools for the cultivation of rapeseed, which in turn will help to increase the profitability of production.
• Popularization and introduction of more modern breeding achievements, exchange of scientific and technical information between cities and different states.
• Introduction of artificial intelligence in the agro-industrial complex, which will increase labor productivity and production efficiency. After all, it is able, first, to conduct the entire cycle of agricultural production and secondly, not to be interrupted at nightfall and not to depend on the human factor.

5. Conclusion
Rapeseed production is an important area for formation of the agro-industrial complex, as well as one of the most important areas.

According to market participants, interest in rapeseed and other oilseeds will increase, since the cultivation of this crop remains highly profitable. Reproduction is increasing rapidly, prices for it are increasing from year to year, and this can explain the huge export potential of this crop. But in addition, Russia opens up new prospects for import substitution of foreign soybean meal, rapeseed, which is the most important factor for domestic animal husbandry.

References
[1] Stepanova E V and Rozhkova A V 2020 Resource Saving Technologies at Rapeseed Growth in the Region of the Russian Federation E3S Web of Conferences 161 01075
[2] Shalaeva D S, Kukartseva O I, Tynchenko V S, Kukartsev V V, Aponasenko S V and Stepanova E V 2020 Analysis of the development of global energy production and consumption by fuel type in various regions of the world IOP Conference Series: Materials Science and Engineering 952(1) 012025
[3] Rozhkova A and Stepanova E 2021 Improving the Competitiveness of Poultry Farms in the Krasnoyarsk Region of Russia E3S Web of Conferences 247 01026
[4] Stepanova E V, Dalisova N A, Karaseva M V 2021 Engineering centers for the innovative development of the regional agricultural enterprises IOP Conference Series: Earth and Environmental Science 677(2) 022085
[5] Belyakova G, Stepanova E and Zabuga E 2019 High knowledge level for an innovation cluster environment formation in the Russian Federation Proceedings of the European Conference on Knowledge Management ECKM 1 111–121
[6] Stepanova E V 2020 Strategic directions for the development of agricultural exports in the regions of the Russian Federation IOP Conference Series: Earth and Environmental Science 548(2) 022098
[7] Rozhkova A 2020 Bank’s personnel as a tool for improving its competitiveness ACM International Conference Proceeding Series 3444530
[8] Dalisova N A, Sharapatova A V and Karaseva M V 2020 Value and role of the strategic management in the development of agricultural enterprises IOP Conference Series: Earth and Environmental Science 548(2) 022102
[9] Stupin A O, Kukartsev V V, Tynchenko V S, Kukartsev V A, Cherepanov A I and Rozhkova A V 2020 Management modelling of the natural resources extraction station by agency modelling means Journal of Physics: Conference Series 1661(1) 012196
[10] Stepanova E V 2021 Strategic guidelines for the development of the agricultural cluster in the region IOP Conference Series: Earth and Environmental Science 677(2) 022084
[11] Fedorova N V, Dzhioeva N N, Kukartsev V V, Dalisova N A, Ogol A R and Tynchenko V S 2020 Methods of assessing the efficiency of the foundry industrial marketing IOP Conference Series: Materials Science and Engineering 734(1) 012083
[12] Zinina O V, Dalisova N A and Olentsova J A 2020 Dynamics and structure of manufacturing bread and bakery products in the Krasnoyarsk region *IOP Conference Series: Earth and Environmental Science* **548**(2) 022028

[13] Stepanova E 2020 Innovative development of the export oriented regional agro-industrial cluster *ACM International Conference Proceeding Series* 3444479

[14] Dalisova N A and Karaseva M V 2020 State support for export of agro-industrial complex products of the Krasnoyarsk region *IOP Conference Series: Earth and Environmental Science* **548**(2) 022093

[15] Rozhkova AV, Dalisova N A 2021 Risk management in the export activities of agricultural enterprises *IOP Conference Series: Earth and Environmental Science* **677**(2) 022048

[16] Zinina O, Dalisova N and Olentsova J 2020 The importance of strategic analysis for agricultural holdings in the innovative development of the agricultural sector *ACM International Conference Proceeding Series* 3444480

[17] Rozhkova A and Olentsova J 2020 Development of New Technological Solutions for the Dairy Industry *E3S Web of Conferences* **161** 01086

[18] Yanova M A, Oleynikova E N, Sharopotava A V and Olentsova J A 2019 Increasing economic efficiency of flour production from grain of the main cereal crops by extrusion method *IOP Conference Series: Earth and Environmental Science* **315**(2) 022024

[19] Rozhkova A 2021 Features and problems of lending to agricultural enterprises *IOP Conference Series: Earth and Environmental Science* **677**(2) 022045

[20] Matskevich I V, Nezvorov V N, Kolomeitsev A V and Kapsargina S A 2021 Resource-saving technology of two-stage pressing in the production of rapeseed oil *IOP Conference Series: Earth and Environmental Science* **640**(4) 042001

[21] Belousov A A, Belousova E N and Stepanova E V 2020 The influence of soil protection technologies on the content of organic substance in leached chernozem *IOP Conference Series: Earth and Environmental Science* **421**(3) 032001

[22] Dalisova N A, Rozhkova A V and Stepanova E V 2019 Russian export of products of maral breeding and velvet antler industry *IOP Conference Series: Earth and Environmental Science* **315**(2) 022078

[23] Mikhalev A S, Tynchenko V S, Korpacheva, L N, Kukartsev V A and Rozhkova A V 2020 Storage and analysis of natural resources information in various territories *Journal of Physics: Conference Series* **1661**(1) 012181

[24] Rozhkova A V and Olentsova J A 2020 Development of the dairy industry in the region *IOP Conf. Ser.: Earth Environ. Sci.* **421**(2) 022035

[25] Chebokchinova N M and Kapsargina S A 2021 The role of agriculture in the economy of modern Khakassia *IOP Conference Series: Earth and Environmental Science* **677**(2) 022046

[26] Eremeev D V, Boyko A A, Kukartsev A V, Rozhkova A V, Mylnikova E V and Korpacheva L N 2020 The use of mathematical calculations to determine the feasibility of borrowing in the planning period *Journal of Physics: Conference Series* **1582**(1) 012027

[27] Boyko A A, Kukartsev V V, Tynchenko V S, Korpacheva, L N, Dzhioeva N N, Rozhkova A V and Aponasenko S V 2020 Using linear regression with the least squares method to determine the parameters of the Solow model *Journal of Physics: Conference Series* **1582**(1) 012016