Melon Growing Industry Analysis in Modern Economic Conditions

T G Koleboshina¹, E A Varivoda¹

¹Bykovsky melon selective experimental station - the branch of the Federal State Budgetary Institution "Federal Scientific Center for Vegetable Growing", Volgograd, Russia

E-mail: BBSOS34@yandex.ru

Abstract. The purpose of this study is to analyze the development of the melon cultivation industry in the world and in Russia in the context of globalization and economic integration. Systematic and comparative analyses of information and statistical data of the Russian Federation and the United Nations were used in the research. Despite the fact that Russia has significant soil and climatic resources for the production of melons and gourds, the crop productivity is almost three times lower than the world average. The main areas of commercial melon cultivation in Russia are highlighted. Data on the main indicators are given (crop productivity, land under cultivation and gross output) for the regions of the Russian Federation and the districts of the Volgograd region. The analysis findings are the identification of the main trends in the development of Russian melon cultivation industry. The main ways to increase the gross output of melons and gourds are outlined. An increase in crop productivity is one of the reserves for growth in the production of food melons and gourds. The determining factor for a high and stable productivity of melons and gourds is the creation and introduction of high-quality varieties and hybrids of intensive type crops into production, as well as the use of new agricultural techniques.

1. Introduction
Ensuring food independence of Russia in modern economic conditions is a fundamental factor in the development of the agricultural sector in the Russian Federation and, as reflected in the State Program for the Development of Agriculture, should be based on scientific and technological development and integration of the agricultural sector. In 2017, the indicators of food self-sufficiency in Russia were the following: for grain - 170, 8%, for vegetable oil - 153, 1%, for sugar - 105, 2%. For meat and meat products, milk and dairy products, potatoes, this indicator does not reach the level of 100% and is in the 82-93% range, as for vegetables, it is 85.9% [9]. Rational norms for the consumption of vegetable products, developed by the Ministry of Health of the Russian Federation, are 140 kg per year per person, consumption of melons should be 15 kg per year per person. According to the Federal State Statistics Service, in 2016 the consumption per person was 105 kg of vegetables, 14.8 kg of watermelon and melon, in 2017 these figures decreased to 102.3 kg of vegetables and 13.7 kg of watermelon and melon [10]. The global leaders in producing vegetables per capita are: China - 406 kg, the Netherlands and Greece - 302, Spain - 265, Kazakhstan - 252, Ukraine - 231, Italy - 218, Belarus - 208. To provide the Russian population with vegetables, it is necessary to increase the production of vegetables and food melons and gourds to 22.5 million tons, including field vegetables (up to 18.1
million tons), indoor plantings (up to 2.2 million tons), food melons and gourds (up to 2.2 million tons) [4].

One of the most important conditions for the independence, self-sufficiency and prosperity of a country is the health and increased longevity of the nation. Providing vegetables in the population nutritious diet is of great importance in addressing this issue. Low self-sufficiency in vegetables places on the first place an increase in the development rate of domestic breeding process in order to provide vegetable product producers with high-quality, highly productive varieties, the creation of which directly depends on the development of Russian crop breeding program, on support and investments in it [1].

Melons and gourds play an important role among vegetable crops, as the nutritional value is quite high and is of great importance in human life support. Therefore, an analysis on the current state of the melon cultivation industry is necessary to increase the production of melons and gourds in order to create conditions for the development of domestic breeding and methods for growing new domestic varieties.

2. Research methodology
Systemic and comparative analysis was used in the analysis on the development of domestic melon cultivation. The research is based on the collection and analysis of information and statistical data from RosGosstat (The Russian Federal State Statistics Service), FAO (the Food and Agriculture Organization of the UN) and statistical data on the districts and regions of the Russian Federation, which are the main areas of commercial melon cultivation. The indicators of gross output, land under cultivation and crop productivity of melons and gourds in the world, in Russia and in the administrative districts of the Volgograd region were used for the analysis.

3. Research results and discussion
The high nutritional and dietary value of watermelon is due to the presence of sugars (fructose, sucrose, least glucose), vitamins C, B 1, B2, B3, PP, fiber, hemicellulose, pectin substances, potassium, sodium, calcium, magnesium, iron, sulfur in its composition [3]. In addition to other beneficial nutritional properties, melons and gourds are more than 90% bio-related water, which makes it possible to use them as a source of water [2].

Russia has significant soil and climate resources for the production of melons and gourds. Favorable climatic and economic conditions for melon cultivation are available in many regions of the country. The core production areas of melons and gourds in the Russian Federation are concentrated in the south-east of the country. The largest areas cultivating melons and gourds are in three Federal Districts: Southern (SFD) - 45.4%, Volga (VFD) - 41.8% and North Caucasian (NCFD) - 8.5%. In 2018, 95.7% of the lands under cultivation of the melon total production in the Russian Federation is concentrated in these districts. Volgograd region occupies a leading position in the Southern Federal District of the Russian Federation in melon production area, the land under cultivation is 4, 9-6, 8 times more than in Astrakhan, Rostov regions and Krasnodar Territory. Recently, there has been a rapid growth in the melon cultivation development in the Orenburg Region of the Volga Federal District of the Russian Federation; in 2018 the planting acreage exceeded the indicator of the Volgograd Region by 7.65 thousand ha. According to the Russian Federal State Statistics Service, the melon production area increased from 152.34 thousand ha in 2012 to 181.17 thousand ha in 2015. In 2018, there was a decrease in land under cultivation, therefore the area under melons and gourds amounted to 140, 31 thousand ha, which is 40, 68 thousand ha less compared to 2015. The noticeable advance of commercial melon production to the north is caused by "global warming." In connection with the change in climatic factors, the specialization of the melon cultivation in the Russian districts is also changing. Whereas in the southern regions early, middle and late varieties of melons and gourds are grown, in the northern regions the main areas are under varieties of melons and gourds of early and medium maturity, as in the northern regions late-maturing varieties of melons and gourds do not ripen. Despite the prevailing conditions, the leader in the cultivation of melons and gourds is the
Orenburg region. In 2018, its land under cultivation was 34.4% of the total melon production area in the Russian Federation and 82.1% in the Volga Federal District. The Volgograd region is in second place in the land under cultivation, having 28.9% of the Russian crop acreage.

In 2012 and 2015, the Volgograd region occupied a leading position in land under cultivation (55,19 thousand ha and 60,35 thousand ha, respectively) (Table 2). The downward crop acreage trend is observed not only in melons and gourds, but also in all vegetable crops [8].

Table 1. Gourds/Melon crop land under cultivation in the Russian Federation (according to the Federal State Statistics Service of the Russian Federation, 2019).

| Federal Districts of the Russian Federation | Land under cultivation, thousand ha |
|------------------------------------------|-----------------------------------|
| Russian Federation                       | 152.34                            |
| 2012                                     | 18117                             |
| 2015                                     | 140.31                            |
| Southern Federal District                | 88.53                             |
| 2012                                     | 88.57                             |
| 2015                                     | 63.74                             |
| Krasnodar Territory                      | 11.07                             |
| 2012                                     | 8.08                              |
| 2015                                     | 7.27                              |
| Astrakhan region                         | 9.46                              |
| 2012                                     | 7.18                              |
| 2015                                     | 8.19                              |
| Volgograd region                         | 55.19                             |
| 2012                                     | 60.35                             |
| 2015                                     | 40.55                             |
| Rostov region                            | 10.75                             |
| 2012                                     | 10.16                             |
| 2015                                     | 5.88                              |
| North Caucasus Federal District          | 14.31                             |
| 2012                                     | 15.55                             |
| 2015                                     | 11.92                             |
| Republic of Dagestan                     | 7.15                              |
| 2012                                     | 8.96                              |
| 2015                                     | 8.09                              |
| Stavropol Territory                      | 5.69                              |
| 2012                                     | 3.97                              |
| 2015                                     | 1.97                              |
| Volga Federal District                   | 43.28                             |
| 2012                                     | 70.89                             |
| 2015                                     | 58.71                             |
| Orenburg region                          | 30.4                              |
| 2012                                     | 54.77                             |
| 2015                                     | 48.2                              |
| Saratov region                           | 11.97                             |
| 2012                                     | 15.22                             |
| 2015                                     | 9.51                              |

Despite the decrease in lands under cultivation (Table 1), gross output in 2018 was 1.97 million tons, increased by 0.44 million tons in comparison with 2012. The increase was due to increased crop productivity [11].

Studies on the effectiveness of vegetable production, conducted at the Federal State Budget Scientific Institution "Federal Scientific Vegetable Center", showed a significant gap between Russia and the leading vegetable producing countries. Studies on the use effectiveness of agriculturally used areas showed that the plowing level in Russia was 68% with a generally recognized limit of 60%.

Therefore, the main increase in vegetable production must be obtained by increasing the productivity of vegetable crops [7].

World average crop productivity from 2015 to 2017 was 33.49 t / ha. The highest crop productivity in China was 41.95 t / ha, Turkey ranked second with 41.62 t / ha, the average crop productivity of watermelon in Russia was 11.91 t / ha, which is 3.5 times less than in China [6] (Figure 1).

Figure 1. Dynamics of watermelon crop productivity in the main producing countries, t / ha (according to the FAOSTAT, 2018)
The average crop productivity in the Federal Districts of the Russian Federation over the research years ranged from 5.8 t / ha to 14.8 t / ha. In the Southern Federal District, the crop productivity of melons and gourds in 2018 increased by 61.5% compared to 2012 (Table 2). In the Volga Federal District, maximum growth was observed in 2016, and the North Caucasus Federal District showed a decrease in crop productivity by 6.4 t / ha compared to 2012. The highest crop productivity over the research years is preserved in the Astrakhan region, this is due to the fact that the majority of melons and gourds grown under plastic cover. In the Republic of Dagestan, melons and gourds are also grown under the plastic cover using irrigation. In other regions, the main lands under cultivation of melons and gourds are under boharic conditions, therefore, the crop productivity depends on weather conditions and remains at a fairly low level (Table 2).

**Table 2.** The average Gourds/melon crop productivity by the main melon districts of the Russian Federation (according to the Federal State Statistics Service of the Russian Federation, 2019).

| Federal Districts                        | Crop productivity, t / ha | 2012 | 2015 | 2018 |
|------------------------------------------|----------------------------|------|------|------|
| Southern Federal District                |                            | 9.1  | 9.2  | 14.8 |
| Krasnodar Territory                      |                            | 9.3  | 8.6  | 10.9 |
| Astrakhan region                         |                            | 29.8 | 33.3 | 39.6 |
| Volgograd region                         |                            | 4.8  | 4.6  | 7.1  |
| Rostov region                            |                            | 2.6  | 3.1  | 5.5  |
| North Caucasus Federal District          |                            | 16.5 | 11.4 | 10.1 |
| Republic of Dagestan                     |                            | 14.8 | 9.4  | 9.2  |
| Stavropol Territory                      |                            | 28.7 | 14.7 | 17.2 |
| Volga Federal District                   |                            | 5.8  | 5.4  | 6.5  |
| Orenburg region                          |                            | 6.1  | 5.0  | 7.0  |
| Saratov region                           |                            | 5.6  | 5.9  | 6.1  |

Volgograd region, although inferior in the development of melon cultivation in the Orenburg region, however, its importance remains very high in the economic indicators of agricultural production. The main lands under cultivation of melons and gourds are located in six of the 33 municipal districts and in 2018 comprise 88.6% of all melon crop acreage in the Volgograd region. The main commercial production of melons and gourds is concentrated in the Volgograd region, in the Serafimovichsky and Bykovsky municipal districts. Moreover, if in 2012 the largest crop acreage were in Bykovsky district (10.89 thousand hectares), then in 2018 the Serafimovichsky district took the leading position with 13.6 thousand hectares.

**Table 3.** Land under cultivation and crop productivity of the Gourds/melon crops by municipal regions of the Volgograd region (according to the Federal State Statistics Service of the Russian Federation, 2019).

| Municipal districts of the Volgograd region | Gourds/Melon land under cultivation, thousand hectares | Gourds/Melon productivity, tons per hectare |
|--------------------------------------------|-----------------------------------------------------|--------------------------------------------|
| Volgograd region                           | 55.5                                                | 6.4                                        |
| Serafimovichsky district                   | 8.15                                                | 5.2                                        |
| Bykovsky district                           | 10.89                                               | 10.5                                       |
| Nikolayevsky district                       | 3.96                                                | 7.4                                        |
| Kamyshinsky district                        | 4.32                                                | 3.9                                        |
| Ilovinsky district                          | 5.75                                                | 3.3                                        |
| Dubovskiy district                          | 1.34                                                | 7.7                                        |
The highest crop productivity over research years was observed in Bykovsky district and exceeded the average productivity in the region by 4.1 t / ha in 2012 and by 6 t / ha in 2018. In 2018, productivity indicators in the Kamyshinsky, Ilovlinsky, Dubovsky and Serafimovichsky districts significantly increased compared to 2012, changes ranged from 2.2 to 5.9 t / ha (table 3).

The increase in the crop productivity of melons and gourds is due to the development and implementation of new highly effective growing technologies, the use of innovative varieties and hybrids of melons and gourds, adapted to the conditions of the growing area. The increase in crop productivity and in the volume of melons and gourds produced in the Russian agrifood industry, in particular, in the Volgograd region, is equally associated with the development success of breeding and agricultural cultivation technologies. Breeding in the melon cultivation industry is aimed at creating new varieties of melons and gourds with high crop yield (productivity), integrated resistance to the most dangerous pests, diseases and abiotic stressors along with the high quality [5].

4. Conclusion
The analysis conducted on the development of melon cultivation industry in the Russian Federation and the comparative analysis of global melon production values are the basis for formulating measures for development of the melon cultivation industry, aimed at increasing the economic significance of this industry in the Russian agrifood industry and, in particular, in the Volgograd region of the Southern Federal District of the Russian Federation.

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