Economic efficiency of growing domestic hybrids of sweet peppers in the steppe zone conditions

M I Mamedov¹, S F Gavrish² and O N Pyshnaya³

¹ Federal Scientific Center for Vegetable Growing, 14 Selektionnaya str., VNIISSOK Village 143080 Russia
² Research Institute of Vegetable Crop Selection, 11/1 2ya Khutorskaya str., Moscow 127287 Russia

Email: mubaris-mamedov@yandex.ru

Abstract. One of the main factors for increasing the efficiency of production of sweet peppers is the introduction of new high-yielding varieties and hybrids adapted to the growing conditions in order to fully realize their potential productivity. Every year, the leading breeding institutions of the country and foreign companies supply a large number of new hybrids to the market for subsequent introduction into production of the most productive ones. The main criterion for evaluating the effectiveness of varieties and hybrids is the annual economic effect of their introduction into production. The purpose of our research was to test domestic heterotic pepper hybrids suitable for production in industrial volumes, clarify the varietal cultivation technology for the steppe zone, and establish the economic efficiency of their cultivation. The work shows the economic efficiency of growing domestic hybrids of sweet pepper \( F_{1} \) Victor, \( F_{1} \) Medok, \( F_{1} \) Lekar, \( F_{1} \) Aleksiy, \( F_{1} \) Erivan using advanced cultivation technology. The article shows that domestic hybrids with a planting period of March 15-20 and plant density of 72 thousand / ha provided a yield of 73-78 t / ha, which was 12-20% higher than the \( F_{1} \) Vedran standard. The calculations showed that the profitability of production is determined by the productivity of a particular hybrid. Among the studied samples, the most profitable (more than 30%) are \( F_{1} \) Lekar, \( F_{1} \) Aleksiy, which had a yield of 77-78 t / ha. High profitability was observed in \( F_{1} \) Victor (28.9%) and \( F_{1} \) Erivan (27.2%) hybrids, profitability is slightly lower in \( F_{1} \) Medok (23.8%). In general, domestic hybrids have a 2.3-3.1 times higher profitability compared to the standard, which indicates the high efficiency of their cultivation in industrial production.

1. Introduction

Pepper is one of the most valuable vegetable crops, having a universal use in the food, pharmaceutical, perfumery and cosmetic industry, traditional medicine due to the rich biochemical composition of fruits [1]. In the face of increasing environmental stress, increasing the resistance of the human body to stress becomes one of the main problems of science [2]. One of the main ways to solve this problem is to provide the population with vegetable products, where the main role belongs to pepper as a multivitamin product. Continuous demand and growth in pepper consumption requires an increase in varietal diversity and yield growth. A variety characterized by high productivity potential combined with resistance to biotic and abiotic stressors with improved biochemical composition, high technological qualities of the products obtained is the key to providing the industry with this valuable product. At the same time, it is
important for specific hybrids to have a variety cultivation technology, in which the cultivation of pepper will be less expensive and more profitable.

There are 786 varieties and hybrids of sweet peppers in the State Register of Breeding Achievements Approved for Use in 2019, 646 of them are domestic breeding achievements and 140 are foreign products. Every year, the leading breeding institutions of the country and foreign companies supply a large number of new hybrids to the market for subsequent introduction into production of the most productive ones.

The purpose of our research is to test domestic heterotic pepper hybrids suitable for production in industrial volumes, to clarify the varietal cultivation technology, and to establish the economic efficiency of their cultivation.

2. Materials and Method

In 2016-2017, on the basis of the “Agrosvit” Research and Production Association (Kherson region), a comparative variety testing of the following sweet pepper hybrids was conducted: F1 Victor, F1 Medok, F1 Lekar, F1 Aleksiy, F1 Erivan [3], [4]. A hybrid of sweet pepper F1 Vedran (Enza Zaden) was used as a standard. It is grown in industrial vegetable production in the south of the country. The introduction of new varieties and the technology of their cultivation primarily based on the calculation of economic efficiency. For the economic evaluation of domestic varieties and their agrotechnological passport, we used the following system of indicators: (1) the yield of products from 1 ha in physical and monetary terms, (2) the cost of 1 ton of products, (3) the conditional net income and profitability of production [5], [6].

3. Results and Discussion

For the study of domestic varieties, the technology of cultivation of pepper using fertigation was used, it is used in the economy with specifying the time of sowing and plant density. As a result of studying various dates for sowing seeds, the period from March 15 to 20 is recommended for growing seedlings (cassette technology) for the steppe zone. With earlier plantings, the plants outgrow and age in advance, which leads to the loss of the first ovaries and a decrease in yield. Study of various planting patterns, such as 90 + 50 x 20 cm (72 thousand plants / ha) and 90 + 50 x 25-30 cm (55 thousand plants / ha), made it possible to establish that the best yield results were obtained when growing peppers with a planting density of 72 thousand plants per 1 hectare. With such planting density, an average yield was more than 70 t / ha, which was 50% higher compared to another study.

Analysis of the cultivation data of domestic pepper hybrids showed that the profitability of production is directly dependent on crop yields. The final useful effect from the use of means of production and living labor, the return on total investment shows the economic efficiency of their production. It is known that the level of costs and their combination, expressed in the cost of production, are the most informative components of the criterion of economic efficiency of agricultural enterprises, along with profit and profitability [7]. The results of our research show that the following indicators account for the largest share in the cost of growing peppers: items for labor costs – 33.80%, applying mineral fertilizers and means of protection – 14.19%, and also costs for seeds and planting material – 29.58% (Fig. 1).

As a result of various testing techniques, it was noted that the domestic hybrids of sweet pepper have a sufficiently high genetic potential of productivity and adaptive properties for their effective cultivation. Features of growth and development of the studied pepper hybrids directly affected their productivity. According to the results of the analysis, domestic hybrids formed a sufficiently high yield (73-78 t / ha) and exceeded in productivity the standard F1 Vedran hybrid by 12-20%. The calculations showed that pepper as a whole is a profitable crop, the profitability of its production is determined by the productivity of a particular hybrid (Fig. 2). F1 Lekar and F1 Aleksiy hybrids are the most profitable (more than 30%) among the studied hybrids. They had a yield of 77-78 t / ha. A high profitability was observed in the F1 Victor (28.9%) and F1 Erivan (27.2%) hybrids, the F1 Medok hybrid has a slightly lower profitability (23.8%).

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Fig. 1. The cost structure for the production of sweet pepper.

| Costs, RUB per 1 ha |
|--------------------|
| Salary             |
| Means of protection, fertilizers |
| Irrigation (fertigation) |
| Laying the drip system |
| Seeds and planting material |
| Combustible / lubricants |
| Fixed agricultural tax |
| Other expenses     |

Fig. 2. Dependence of the profitability of production from the yield of hybrids.

In general, the domestic hybrids have a higher profitability (in 2.3-3.1 times) if compared to the standard. This indicates a high efficiency of growing domestic sweet pepper hybrids in industrial production.

4. Conclusion
Based on studies of the economic efficiency of growing sweet pepper hybrids, it was revealed that all tested hybrids ($F_1$ Victor, $F_1$ Medok, $F_1$ Lekar, $F_1$ Aleksiy, $F_1$ Erivan) are promising for industrial production in open ground conditions, because they provide high yields and profitability of production.

References
[1] Gish R A 2017 Pepper culture (Krasnodar, Russia: KubSAU)
[2] Borisov V A, Litvinov S S, and Romanova A V 2003 The quality and keeping quality of vegetables (Moscow, Russia: Mytishchinskaya interdistrict printing house)
[3] Litvinov S S 2011 Methods of field experience in vegetable growing (Moscow, Russia: Rosselkhozakademiya)
[4] Ministry of Agriculture of the Russian Federation 2015 Methods of state variety testing of agricultural crops, fourth release (potatoes, vegetables and melons) (Moscow, Russia: Kolos)
[5] Polunin G A et al 2007 Guidelines for determining the overall economic effect of the use of the results of research and development in the agro-industrial complex (Moscow, Russia: RAAS)
[6] Razin A F, Bukharov A F, Ivanova M I, Bukharova A R, and Razin O A 2017 The basic principles for calculating the economic efficiency of new varieties of vegetable crops In Current and New Trends in Plant Breeding and Seed Production of Crops (pp 167-169) (Moscowm Russia)
[7] Soldatenko A V, Pivovarov V F, Razin A F, Shatilov M V, Razin O A, Rossinskaya O V, ... Bashkirov O
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