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Contemporary Direction of Eggplant Selection for the South of Russia

Elena Gabibova and Nadezda Geraskina

Federal State Budgetary Educational Institution of Higher Education "Don State Agrarian University", Persianovski, Russian Federation

ORCID:
Elena Gabibova: http://orcid.org/0000-0002-8174-7039

Abstract

Eggplant selection is crucial for the south of Russia due to the concentration of production and processing capacities in this region. When selecting eggplants, regional characteristics, in particular specific stressors, should be taken into account. The main stressors are low temperatures in the initial period of plant growth and development, sharp changes in soil and air temperature and humidity during the growing season, high temperatures during crop formation, and harmful fungal and mycoplasma diseases. It is possible to reduce the dependence on imports by developing production in spring greenhouses, which will extend the consumption period by 3-4 months. This requires varieties and hybrids with specific properties: high productivity, high adaptability, compact habit of plants, lack of thorns, low pubescence, etc. F_1 hybrids combining high productivity with adaptability and product quality can grow in greenhouses. When collecting linear materials for creating hybrids, it is advisable to use hard provocative backgrounds with a subsequent assessment of the combinational ability. This research aimed to develop new varieties and hybrids of eggplant for the south of Russia. The study was conducted in the Rostov Selection and Seed Center in 2010-2019 on fields and in spring greenhouses. Materials from different regions of the world were collected. Varieties and hybrids were evaluated by their valuable traits and properties. Linear materials were created for sources and donors of characters that are in demand. The collection of the best varieties was involved in selection programs for creating an assortment for the south of Russia. More than 10 eggplant varieties and hybrids with high productivity and adaptive qualities were obtained.

Keywords: eggplant, source material, variety, hybrid, selection, signs, applications, stability, heterosis.

Corresponding Author:
Elena Gabibova
elena.gabibova@mail.ru

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1. Introduction

Among the large group of vegetables, eggplant ranks third by areas and gross yields and second to tomato and chilli. According to FAO, the sown area occupied by the eggplant exceeds 1.867 million hectares, and the production volume is 49.5 million tons with an average yield of 26.5 t/ha. The largest producers of eggplant are China, India,

Iran, Egypt and Turkey, which together account for more than 90% of world production. Other countries have small areas and gross yield. Taking into account the population of these countries and their climatic conditions, the level of production is high. The leaders are Italy, Spain and Greece; in the CIS, the leaders are Russia, Azerbaijan, Ukraine and Kazakhstan. However, calculation of the cultivated area shows that in recent years more than 14 thousand hectares have been allocated for crops in all categories of farms, which is about 2 times more than in Ukraine and Azerbaijan and 4 times more than in Kazakhstan. The main regions involved in eggplant cultivation are the Republics of the North Caucasus, Astrakhan, Volgograd, Rostov Regions and Krasnodar Krai. Eggplant is grown for local consumption and industrial processing. It is exported to the industrial centers. In winter greenhouses, eggplant occupies extremely insignificant areas that have no effect on the balance of supply and demand in the off-season market. Relatively low yields do not contribute to the popularity of the crop in greenhouses. Most off-season products are imported from the Middle East and Western Europe. Eggplant production is gradually increasing in spring greenhouses, where the highest yields are obtained even earlier than on fields. The demand for eggplant is constantly growing. From 1998 to 2013, the volume of world production grew by 59% due to an increase in sown area by 0.627 million hectares and an increase in the yield by 38%. An increase in productivity is observed in China and Western Europe. In China, crop yields increased almost twofold. In Western Europe, the cultivation of hybrids in winter greenhouses increased the yield to the record level. In 2013, in the Netherlands eggplant yield amounted to 270.83 t/ha, in Great Britain - 255, 43 t/ha, in Belgium - 227.0 t/ha, and in Finland and Germany – more than 100 t/ha. An example of these countries shows the importance of eggplant growing in greenhouses [3].

In Russia, the average per capita consumption of eggplant is not inferior to the global average, but less than in the developed countries. Eggplant is in demand in the south of Russia and industrial centers. In recent years, the needs of the population have been satisfied completely, but there is a shortage of raw materials for the canning industry. The main period of open ground production does not exceed 3 months - from July to September. In the off-season period, there is a deficit compensated by imports and local production in spring greenhouses. High prices for imported products and poor development of eggplant production in greenhouses are constraining factors for further growth in consumption. An important limiting factor is low productivity of and adaptability to regional stressors. Given its high nutritional advantages, dietary and medicinal qualities, there is an urgent need to develop eggplant selection in southern Russia.

2. Methods

Therefore, the research aim is to develop new varieties and hybrids of eggplant for the south of Russia.

The studies were conducted in Rostov Selection and Seed Center of the Agroholding in 2010-2019. The soil was chernozem. Weather conditions were typical of the climatic zone of southern Russia. Summer was hot and dry, with long periods of drought at temperatures above 30 °C. The sum of active temperatures exceeded 3500 °C, and the amount of precipitation was 280 mm.

The research material was modern commercial varieties and hybrids of eggplant of various ecological and geographical origin.

The study of the source material was carried out according to the standard methods [2] on fields and in spring greenhouses. A number of techniques have been improved [1]. The source material was evaluated on special provocative backgrounds. The most stable genotypes were included in hybridization, and linear material was created on their basis. Varietal and heterotic selection was carried out. For the purposeful assessment and selection of selection materials, models of varieties and hybrids were developed, and the resulting material was grown in various soil and climatic conditions [4].

3. Results and Discussion

Over 12 years, more than 100 varieties and hybrids of the world's leading eggplant selection companies were studied. More than 300 samples of own selection were studied as well.

When studying the source material, high-productivity genealogies were identified. The most productive varieties are Diamond F_1, Valentina F_1, Bagira F_1, Galich, Donskoy 14, Almaz. It was found that for the conditions of greenhouses, varietal samples with a long fruiting period are required, and for open ground, samples with an early crop production period are required (Table 1).

In spring greenhouses, plant productivity was higher than on fields due to the formation of more branches and flowers. In spring greenhouses, shedding of flowers and ovaries decreased by 20-30% compared with open ground. The average mass of eggplant grown in greenhouses was 10-12% higher. This led to the fact that during the growing season one and the same variety sample in the spring greenhouse formed a crop 2 - 2.5 times higher than in open ground. The average productivity of eggplant in spring greenhouses and open ground varied from 0.5 kg/plant to 2.5 kg/plant, which

Table 1: The average yield of new eggplant varieties for 2014-2018.

Name of the sample	Yield, kg/m^2				Average mass, g
	Open ground	% of the standard	Protected ground	% of the standard	
Almaz standard	3,1	-	11,1	-	180
Khalif	3,9	126	12,0	108	200
Samurai sword	4,4	142	13,5	122	220
Goliath Dessert	4,0	129	13,8	124	230
Galich	3,3	106	12,5	112	240
Donskoy-14	3,2	103	12,0	108	280
Bagira F_1	4,5	145	13,4	120	210
Diamant F_1	4,6	148	13,9	125	230
Valentina F_1	3,8	122	14,2	128	180
HCP_{05}	*0,87-0,92*	-	*1,83-2,02*	-	*43,09-51,71*

amounted to 23.8 to 119 t/ha per hectare. F_1 had higher productivity than free-pollinating varieties by 10 - 25%.

An analysis of crop formation by various eggplant genotypes showed that productivity depended on the degree of adaptability of the sample. The factors limiting the crop were temperature in the initial period of plant growth, sharp changes in temperature and humidity of soil and air during the fruiting period, low relative humidity and abnormally high temperatures during flowering. Diseases were a result of stressors. The most adaptive varieties are Donskoy 14, Universal 6, Batayskiy and Almaz, which were better than foreign variety F_1. The most cold-resistant varieties were Almaz and Donskoy 14. In more comfortable conditions of spring greenhouses, the hybrids produced higher yields. When creating universal varieties and hybrids, it is necessary to use old varieties of local selection which are rsistant to regional stressors.

Eggplant growing had a number of negative consequences, in particular, strong overgrowth of plants, a large number of shoots, a significant increase in the total height of plants and the volume of vegetative mass. An increase in the vegetative mass occurred due to the self-thickening of plants and inhibition of photosynthesis. In the conditions of spring greenhouses, there is a need plant formation. Among the studied source material, a small group of variety samples satisfying these requirements was identified (Table 2).

The varieties Galich, Almaz, Khalif, Samurai Sword and hybrids Valentina F_1, Maksik F_1 were of the greatest interest for selection due to a low degree of pubescence. It is possible to use slightly pubescent forms in which leaves are used for food, but it

Table 2: Morphological features of the vegetative organs of eggplants in spring greenhouses, 2014-2018.

Name of the sample	Number of side shoots, pcs.	Height of the first branch, cm	Number of leaves	Fuzziness of a leaf, point	Degree of prickling, point
Almaz standard	7	21	110	3	1
Galich	6	24	120	3	0
Maksik F_1	6	26	137	5	1
Valentina F_1	7	21	126	3	0
Bataskiy	7	20	181	5	2
Donskoy-14	7	30	243	7	3
Khalif	7	33	162	3	0
Samurai sword	8	29	157	3	0
HCP_{05}	0,45	3,76	25,61	-	-

is necessary to use either interspecific hybrids, or to obtain such forms as a result of mutagenesis, since the existing assortment has a strong and medium pubescence.

In the south of Russia, in spring greenhouses, even completely non-bearing forms with sharp changes in temperature are able to form spikes on the leaves and calyx of the fruit. With the normalization of the microclimate, the spike disappears. To create thornless forms, both parents must be thornless, due to the complex nature of inheritance of this trait. Donors of the thornless trait are samples from Western Europe: Valentina F_1, Annette F_1, Tirreniya F_1, Epik F_1, Classic F_1. The shortest varieties were Maksik F_1, Almaz.

Of particular danger to the cultivated eggplant Solanum melongena L. are diseases and pests. In open ground, plants are subject to more severe diseases. In spring greenhouses, the harmfulness of such dangerous eggplant diseases as columnar and fungal wilting is significantly reduced, but the likelihood of damage to plants by spider mites and aphids increases. No sources of resistance to the column were found among the samples.

Testing the resistance of various varieties and hybrids of eggplant against the rigid infectious background showed that even relatively stable genotypes are affected when plants are weakened under the influence of adverse environmental factors. Parallel selection for resistance to biotic and abiotic stressors gives more significant results. An important role is played by artificial hard provocative backgrounds. The use of seedling estimates does not allow us to achieve the desired result, which is associated with the genetic control of the response to stressors in young plants and plants during the fruiting

period, as well as the complexity of the effects of many field factors. First-generation hybrids stand out against stiff provocative backgrounds.

Selection of eggplant for heterosis is of particular importance. Many heterotic hybrids are characterized by a combination of high productivity and resistance to stressors. Creation of such hybrids requires linear materials with high stress resistance and combining ability.

To produce linear materials, genealogies of valuable traits and selections were used. When achieving a sufficiently high uniformity of the material, the combining ability of the varieties was determined.

Along with high productivity and stability, it is important to obtain varieties and hybrids with high quality of products. When evaluating the source material for commercial varieties and hybrids, an important indicator is high marketability of products, i.e. a combination of fruit uniformity in size, shape and color. Under the influence of adverse factors, the eggplant has small fruits of an ugly shape; flowers and ovaries may crumble, the color changes. The products are extremely uneven. Part of the samples exhibit parthenocarpy, which eliminates these disadvantages. A partial parthenocarpy is characteristic of Khaliph and Samurai Sword.

Since eggplant is used for processing, quality indicators are indicators of raw materials. The priorities include a high content of pigments, increased content of dry substances and sugars, snow-white and dense pulp, a small amount of seeds, and technical ripeness. A small presence of bitterness is a disadvantage. The excellent quality of raw materials is inherent in special varieties created for processing. The most interesting varieties are Universal 6, Batayskiy, Albatros, Nizhnevolzhsky and hybrids Valentina F_1, Epik F_1.

Along with the priority areas of selection (productivity, adaptability, quality, manufacturability), some new ones have appeared. There are varieties which differ in color, size and shape of the fruit. In amateur gardening, these varieties are very popular. They are used for producing grilled vegetables, where green and white-fruited fruits are more delicious. There is a demand for decorative eggplants with the most diverse shapes, sizes and colors used to decorate balconies and create decorative gardens. Over the research years, the authors obtained valuable materials with various shapes and colors: Eskimo F_1 hybrid and Umka and Albion varieties. The most promising sample of green color is Kit 53. Screening of the selection material made it possible to select samples for pot growing and decorative landscaping. The most promising samples for the decorative gardening are L 67, L 83; samples for balcony and pot growing are 85/17, 94/16, L 107.

4. Conclusion

Today, the main areas of selection are:

- selection for heterosis;

- selection for various applications, including in the canning industry, for cooking and decorative purposes;

- selection for resistance to biotic and abiotic environmental factors;

- selection for nutritious, valuable and taste qualities of products.

The authors have studied more than 300 varieties of eggplant grown on fields and in greenhouses. Among the studied eggplant varieties, valuable traits were distinguished for various directions of crop selection in the conditions of southern Russia.

References

[1] Mamedov, M. I. (2015). *Eggplant (Solanum spp.) Monograph*. Moscow: VNIISSOK.

[2] Altinok, H. (2005). First Report of Fusarium Wilt of Eggplant Caused by *Fusarium Oxysporum* f. sp. *melongenae* in Turkey. *Plant Pathology,* vol. 54, p. 577.

[3] Altinok, H. (2010). Characterization of *Fusarium Oxysporum* F. Sp. *Melongenae* Isolates from Eggplant in Turkey by Pathogenicity, VCG and RAPD analysis, *Phytoparasitica,* vol. 38, pp. 149-157.

[4] Drankhar, B. S. (1980). Heterosis in Relation to Yield Components and Shoot Fruit Lorer (*Leucinodes Orbonalis* G.N.) in Brinjal (*Solanum melongena* L), *Genetica Agraria*, vol. 34, issue 3-4, pp. 215-220.

[5] Geraskina, N. V. (2014). Improved Eggplant Prick Scale. *Potatoes and Vegetables*, vol. 4, pp. 30-32.

[6] Litvinov, S. S. (2011). *Methodology of Epy Field Experiment*. Moscow: VNIIO.

[7] Ognev, V. V. (2014). Eggplant: Cultivation Technology and Prospects for Selection. *Potatoes and Vegetables*, vol. 11, pp. 18-22.

[8] Geraskina, N. V. (2015). Heterosis Selection of Eggplant. *Potatoes and Vegetables*, vol. 12, p. 35.

[9] Geraskina, N. V. (2019). Prospective Selection of Eggplant for the South of Russia. *Potatoes and Vegetables*, vol. 6, pp. 35-37.

[10] Ludilov, V. A. (1981). *Tomatoes, Peppers, Eggplant. Recommendations*. Rostov: Kn.

[11] Kigashpaeva, O. P. (2016). New Varieties of Eggplant for Canning. *Potatoes and Vegetables*,vol. 7, pp. 33-34.

[12] Prasad, V., *et al*. (2013). Heterosis for Yield and other Yield Contributing Economic Traits in Eggplant (S. melongena). In *15 EUCARPIA meeting on Genetics and Breeding of Capsicum and Eggplant*. Torino: Institute of vegetables breeding. pp. 697-700.