

ABSTRACT

of the dissertation work of Maxotova Aliya Maxotovna on the topic "Effect of mineral fertilizers on the productivity and quality of tomato foreign varieties in the conditions of the south-east Kazakhstan", submitted for the degree of Doctor of Philosophy (PhD) in the specialty 6D080800 - "Soil Science and agrochemistry"

Relevance of the research topic.

Tomato is one of the main types of vegetables, the prevalence and popularity are determined by the high taste qualities of the fruits, as well as their suitability for various types of processing. Every seventh ton of all vegetables harvested in the world are tomatoes, and their share in the total volume of processing of fruit and vegetable raw materials reaches up to 60-70%.

The Kazakhstan market is currently saturated with a large number of tomato varieties and hybrids of various companies of foreign countries.

The "State Register of Breeding Achievements Recommended for Use in the Republic of Kazakhstan" includes 56 varieties and hybrids of tomato, incl. 12 - Kazakh selection. Many unregistered tomato varieties and hybrids have been offered by foreign companies. Many of them are poorly studied and not adapted to the conditions of Kazakhstan. In this regard, there is a need to conduct domestic breeding work to create tomato varieties of various ripeness and purpose, characterized by high yields and better quality indicators, resistance to diseases, suitable for cultivation in specific ecological zones of the republic. Along with this, it is necessary to study and identify the best breeding achievements of other countries so that farmers could grow both Kazakh and foreign varieties and hybrids of tomato. There is a need for research on their adaptation to soil and climatic conditions of the regions of the country, including the south-east of Kazakhstan.

The relevance of research lies in the complex evaluation of tomato varieties and hybrids of foreign selection on the main economic-valuable features, for fresh consumption and processing, with high taste and technological qualities of fruits, relatively resistant to a complex of diseases, with good shelf life and transportability.

To fully realize the full genetic potential of new tomato varieties and hybrids, a varietal agro-technology should be developed. The most effective factor here is the mineral nutrition of plants. The conditions of tomato mineral nutrition influence not only the productivity of plants, they also determine the quality of fruits, enhance the adaptive properties of plants, increase their resistance to stressful environmental factors and harmful diseases. Therefore, along with the research and isolation of tomato varieties (hybrids) with economically valuable traits, the development of a fertilization system for isolated tomato samples is also important.

The purpose of the dissertation research is to evaluate and identify the most productive varieties and hybrids of tomato of foreign breeding with a complex of economically valuable characteristics, to study the influence of types and norms of mineral and bioorganic fertilizers on the yield of isolated tomato samples.

Research objectives:

- to evaluate tomato varieties and hybrids of foreign breeding for adaptability, productivity, resistance to environmental stress factors and diseases;
- to identify the most high-yielding varieties and hybrids of tomato with a complex of economically valuable characteristics;
- to offer tomato varieties and hybrids distinguished by a complex of economically valuable characteristics for use in production;
- to study the effect of different norms of mineral fertilizers on soil fertility;
- to establish the effect of different norms of mineral fertilizers and new types of organic fertilizers on the productivity of distinguished tomato foreign varieties and hybrids;
- determine the size of consumption and removal of mineral nutrition elements depending on the varietal characteristics of tomatoes and fertilizer standards;
- to evaluate the economic efficiency of using fertilizers on crops of tomato foreign varieties (hybrids).

Research methods

Field and laboratory researches on the topic of the dissertation were carried out according to the methods adopted in vegetable growing, agrochemistry and soil science:

- Agrochemical methods of soil research (M., 1975);
- Yudin F.A. Methods of agrochemical research (M., 1980);
- Dospikhov B.I. Methods of field experience (M., 1985);
- Methods of experimental business in vegetable growing and melon growing (Edited by V.F.Belik; M., 1992);
- Methods of state variety testing of agricultural crops (potatoes, vegetables and melons). - Issue 4. - M., 1975. - 183 p.;
- Litvinov S.S. Methods of field experience in vegetable growing. - M., 2011. - 648 p.

Main provisions to be defended

The following main provisions are put forward for defense:

- 1) The best foreign varieties and hybrids of tomato, selected on the complex of economically valuable features and adaptability to the conditions of southeast Kazakhstan are Shuruk (Netherlands), Falcon (Turkey) and Barin (Russia);
- 2) Scientifically based highly effective norms of full mineral fertilizers ($N_{180}P_{150}K_{120}$ and $N_{210}P_{180}K_{150}$) for tomato, contributing to the improvement of soil agrochemical parameters and increasing the productivity of the crop;
- 3) Biologized tomato fertilization systems using new types of bioorganic fertilizers (Biohumus, Baraebong Organic Fertilizer, BiooZZ, WORMic, ZhGU, etc.), providing reproduction of soil fertility, increasing yields and obtaining environmentally friendly products.

Description of the main results of the research.

According to the results of a three-year (2018-2020) evaluation in the adaptation nursery of 14 foreign tomato samples on the complex of valuable traits, Shuruk (Netherlands), Falcon (Turkey) and Barin (Russia) are recommended to production.

Application of increasing rates of mineral fertilizers to the soil has a positive effect on the humus state of the soil. Application of nitrogen-phosphorus-potassium fertilizers for tomato improves the parameters of soil fertility, increasing the content of nutrients in the soil.

In the version without fertilizers, the content of easily hydrolyzable nitrogen was 28.0 mg/kg, in the fertilized versions of the experiment - 30.8-38.0 mg/kg. At the control, the content of P₂O₅ in the soil under the tomato was 80 mg/kg, at the variants of the experiment with the introduction of phosphorus fertilizers - 86-104 mg/kg. High phosphorus content in the soil was noted at application of P150-180. Potassium content was 230-250 mg/kg. For a short period of application (one year in each field by crop rotation in the crop rotation) potassium fertilizers did not have a significant effect in terms of increasing the potassium content in the soil. At the same time, the application of potassium fertilizers to the soil under tomato contributed to the improvement of potassium nutrition of plants, which is expressed in the increase of tomato productivity. Obviously, it is necessary to apply systematically large rates of potassium fertilizers into the soil. Tomato yield has a close relationship with nutrition conditions.

In the experiment with the variety Ogonyok-777 (standard) on the control obtained a lower yield of tomato fruits - 27.1 t/ha. When moderate fertilizer rate (N₁₂₀P₉₀K₆₀) was applied, tomato yield increased to 30.1 t/ha, additional 3.0 t/ha (11.07%) of fruit yield was obtained. Application of average fertilizer rate (N₁₅₀P₁₂₀K₉₀) provided 32.2 t/ha of yield, increment to control - 5.1 t/ha (18,82%). Application of higher fertilizer rate (N₁₈₀P₁₅₀K₁₂₀) increased fruit yield up to 36.4 t/ha, the increase was 9.3 t/ha (34,32%). The highest tomato yield was obtained at high fertilizer rate (N₂₁₀P₁₈₀K₁₅₀) - 40.0 t/ha, additional yield of 12.9 t/ha was obtained, which is higher than the control by 47.60%. Productivity of fruit yield on fertilized variants - 94.7-98.1%, on control - 85.4%.

On the variety Barin (Russia) on the control yield of fruits - 26.7 t/ha, on the variant with a moderate rate (N₁₂₀P₉₀K₆₀) - 29.4 t/ha, with an average rate - 34.2 t / ha, with increased rate (N₁₈₀P₁₅₀K₁₂₀) - 37.3 t/ha of fruits, with a high rate (N₂₁₀P₁₈₀K₁₅₀) - 40.5 t/ha. Additional yield from fertilizers was - 2,7-13,8 t/ha (10.11-51.69%). Tomato yield marketability reached 97.4%, control - 86.2%.

According to the Shuruk hybrid (the Netherlands), the tomato yield at the control was 28.5 t/ha, in the variant with a moderate fertilizer rate (N₁₂₀P₉₀K₆₀) - 32.6 t/ha, with an average rate - 37.7 t/ha, with an increased rate (N₁₈₀P₁₅₀K₁₂₀) - 41.2 t/ha of fruits, with a high rate (N₂₁₀P₁₈₀K₁₅₀) - 45,5 т/га. The additional yield from fertilizers is 14.39-59.65%. Marketability of the crop - 96.5-99.2%, control - 94.3%.

According to the Falcon F1 hybrid (Turkey), the total fruit yield under control was 27.0 t/ha with a marketability of 94.6%. In the variant with N₁₂₀P₉₀K₆₀ получено 30.3 t/ha was obtained (an increase of 12.22%), with N₁₅₀P₁₂₀K₉₀ - 32.5 t/ha (20,37%), with N₁₈₀P₁₅₀K₁₂₀ - 38,0 t/ha (40.74%), with N₂₁₀P₁₈₀K₁₅₀ - 42.7 t/h (58,15%). Fertilizers improved the marketability of Falcon hybrid yield - 95.1-97.2%.

Among tomato samples the most responsive to the application of mineral fertilizers were hybrids Shuruk (Netherlands) and Falcon (Turkey).

Along with mineral fertilizers, the effect of different types of bioorganic fertilizers on the yield of tomato samples was studied.

Yield of tomato variety Barin (Russia) under the influence of bioorganic fertilizers increased by 35.43-61.40% compared to the control. The highest yields were obtained when plants were fertilized with manure (46.0 t/ha) and Biohumus (44.1 t/ha). Biofertilizers when combined with mineral fertilizers increased tomato yield by 46.32-49.82%. For hybrid Shuruk (Netherlands), mineral fertilizers ($N_{150}P_{120}K_{90}$) increased tomato yield by 40.38%, and their combination with biofertilizers (Black Jack, ZhGU) - by 53.21-55.45%. Bioorganic fertilizers contributed to obtaining 31.09-62.18% of additional production. The highest tomato yield was obtained in the variant with 40 t/ha of manure (50.4 t/ha). Bioorganic fertilizers showed high efficiency in the experiment with tomato hybrid Falcon (Turkey). The fruit yield increased by 39.54-67.65% compared to the control (30.6 t/ha). The most effective was the application of biohumus at a rate of 10 t/ha - 51.3 t/ha. Foreign varieties and hybrids showed high responsiveness to the application of bioorganic fertilizers.

The nitrate content in tomato fruits of the Ogonek-777 variety was 35-107 mg/kg, Barin variety - 42-116 mg/kg, Shuruk hybrid - 56-134 mg/kg, Falcon hybrid - 37-128 mg/kg at MPC 150 mg/kg. Higher levels of nitrates were noted in the crop grown using $N_{150}P_{120}K_{90}$ separately and in combination with biofertilizers, however, they were significantly lower than the maximum permissible concentration, which makes it possible to consider the products environmentally safe.

Joint use of bioorganic and mineral fertilizers significantly increases the adaptability of foreign tomato varieties and hybrids to stress factors and diseases, which is expressed in increased productivity.

Under the influence of fertilizers, the quality indicators of tomatoes have improved.

In the fruits of the Barin tomato variety, the dry matter content at the control was 5.48%, total sugar 3.26%, vitamin C 19.65%. In the fertilized variants, the dry matter content was 5.59-5.77%, total sugar - 3.57-3.65%, vitamin C - 22.98-23.47 mg%. The acidity was in the range of 0.35-0.41%. The nitrate content was 78-126 mg/kg at a maximum concentration of 150 mg/kg.

The fruits of the Falcon hybrid grown without mineral fertilizers contained 5.56% solids, 2.95% total sugar, 20.24 mg% vitamin C, and on the fertilized variants - 5.61-5.72% solids, 3.27-3.41% total sugar, 21.93-22.50 mg% vitamin C. The acidity was 0.52-0.55% when 0.47% is under control. The nitrate content in the fruits was 112-151 mg/kg.

The fruits of hybrid Shuruk contained 5.71% of dry matter in the control and 5.78-6.03% in the fertilized variants. On the control tomato fruits contained 3.38% of total sugar, on fertilized variants - 3.69-3.76%. Vitamin C in the products on the control was 21.09 mg%, on the variants of the experiment with enhanced mineral nutrition - 21.34-24.05 mg%. Acidity of fruits amounted to 0.36-0.40%. According to the nitrate content (109-142 mg/kg), the grown products of this hybrid can be considered ecologically harmless.

Substantiation of the novelty and importance of the results obtained.

For the first time in the conditions of the south-east of Kazakhstan for the purpose of adaptation and evaluation of economically valuable traits for further recommendation of the best varieties (hybrids) to vegetable farms in the region, studied 14 tomato samples of foreign selection - Falkon, Burzhuy, Marglobe, SC-2121, Kyzeykoy, Pembekoy, Shuruk, Rio Grande, SV-5215TD, Barin, Babinicz, Super Red, Ryabchik, Marzano, in comparison with the variety-standard Ogonek 777 (Kazakhstan). The complex of economically valuable traits (yield, quality indicators, suitability for processing, resistance to stress factors and diseases) was identified 3 tomato samples, which are recommended for production - hybrids Shuruk (Netherlands), Falcon (Turkey) and variety Barin (Russia).

A fertilizer system for foreign tomato varieties and hybrids has been developed. Effective norms of mineral fertilizers ($N_{180}P_{150}K_{120}$, $N_{210}P_{180}K_{150}$), have been established to improve the agrochemical parameters of dark chestnut soil, increase tomato productivity and improve fruit quality. New types of bioorganic fertilizers were studied on foreign tomato varieties and hybrids. Biohumus, Baraebong Organic Fertilizer, WORMic, BiooZZ, MERS, ZhGU, BlackJack, Terra Sorb and others have been identified and proposed for production.

Relevance to science development directions or government programs.

The dissertation work was carried out within the framework of the Central Scientific and Technical Program of "Kazakh Research Institute of Fruit and Vegetable Growing" LLP on the theme "Recovery of potato planting material from virus infection on the basis of innovative methods and adapted to the introduction of more highly productive varieties (hybrids) of potato, vegetable and melon crops of foreign selection for soil and climatic conditions of the south-east of Kazakhstan" (state registration No. 0118RK01258).

Description of the PhD student's contribution to each publication.

A personal contribution is to conduct research on the development of a fertilizer application system (establishment of effective types and norms of organic and mineral fertilizers) on varieties and hybrids of tomato of foreign selection. Directly participated in field experiments to assess the economic-valuable traits of foreign varieties and hybrids of tomato. Doctoral student published 7 scientific articles, including 3 - in the publications of the Committee for Quality Assurance in the field of science and higher education of the Ministry of Science and Higher Education of the Republic of Kazakhstan, 1 article - in peer-reviewed publications, in 6 articles is the first author, and 1 article is written alone.

The scope and structure of the dissertation.

The dissertation work is presented on 120 pages, includes 28 tables and 11 figures. The dissertation consists of an introduction, 3 main chapters, 8 sections (subsections) based on the results of scientific research, conclusions, recommendations to production and applications. The list of references includes only 120 titles, including 20 in a foreign language.