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METHODICAL APPROACHES TO THE BREEDING PROCESS IN VEGETABLE GROWING

The article highlights methodological approaches to the development of new varieties and hybrids of tomato for different uses. Having used the developed techniques we obtained a number of varieties and hybrids, widespread in production, such as Iskorka, Lahidnyi, Flora, Iryshka, Sviatoslav F_1, KDS-5 F_1, Bohun F_1.
Keywords: *breeding process; tomato; varieties and hybrids*

Introduction. Modern vegetable growing requires F1 hybrids as main crops [1]. It is known that heterosis in hybrids can be achieved for performance and early ripening; also hybrids can combine quality, resistance to stress and diseases [2, 3]. The breeding process is based on the requirements of vegetable production using, that is search for and evaluation of signs required to meet specific needs [4]. For example, tomato F1 hybrids for mechanical harvesting should possess a set of specific characteristics: good and even ripening, certain physical and mechanical properties of the fruit, their high quality and marketability. For industrial processing, it is required a slightly different set of features; so is for long-term storage. Requirements for creating F1 hybrids resistant to stress and disease vary from these and breeding process is carried out by other approaches [5]. Each breeder chooses its own approach to breeding techniques and success comes to those who correctly identified them and applied.

Based on the above, the goal of our research was to monitor vegetable breeding techniques and make recommendations for their successful implementation.

Materials and methods. The author of the article has been going in for breeding of various vegetable crops over 45 years, possesses around one hundred of patents, among them many patents for creating original material, varieties and hybrids. In his breeding work, he has exploited a number of existing techniques [5] and approaches, such as mutagenesis, polyploidy, intraspecific and interspecific hybridization, different types of crosses and ways to create a genetic diversity of hybrid populations.

When breeding for immunity, applied were specific methods [6, 7]. The author found his own approaches in breeding for different economically valuable features [8, 9]. In different years, in our breeding works of different directions we used different well-known statistical methods. Since 1971, the long-term breeding was work carried out in different climate zones of Kyiv, Kharkiv and Kherson regions.

Results and discussion. Long-term breeding research on vegetable crops showed that success in breeding begins with a creating starting material. It is necessary to create starting material keeping in mind the model of future variety and hybrid, i.e. to saturate breeding line with the most valuable attributes desirable in

future varieties or hybrids F_1. The basis for the creation of special populations can be mutated forms, polyploids, varieties, hybrids, half-wild and wild forms. By crossing them with cultivars and lines, we create the necessary background for selection of initial genotypes. The more genetically diverse hybrid population we create, the better will be the background for the selection of valuable signs.

The features to be inherent in future varieties and hybrid are the basis of selection. Creation of early-ripening genotypes requires direct selection for signs of early ripening, and the creation of stable genotypes requires selection of plants with resistance genes. And so on in other areas of use, such as for mechanical harvesting, canning processing, use fresh, pickles, storage. Each of these areas requires a specific set of sighs. Signs must be found and unite in one genotype.

Through selection and assessment of progeny, we get a complex of inherited traits. The necessary starting material then undergoes crossing for assessments of recombination ability of testers. Selections must be directed to the creation of varieties, and lines with high combination ability - to creation of hybrids F_1.

The most distant genetic diversity of tomato hybrid populations was received by us when distant crossings. The most selected genotypes feature early ripening, fruit quality parameters, resistance to diseases. Using the genetic diversity of created varieties we obtained varieties Iryshka and Myt feature field resistance to late blight.

Having interbred starting forms feature recessive mutant genes we obtained heterosis hybrids of tomato, combining stem bush of determinant growth and genes of early ripening, plum-like fruit without spot near the fruit stalk, stalk without node, simple inflorescence with one, two, or three fruits. Using mutant genes led to obtaining new varieties, such as Zolotyi Potik, Oberih, Dama, Khudozhnyk, Konservnyi Kyivskyi, Amiko and others.

Involvement of parthenocarpic original forms into crossing led to the creation of a new early-ripening cold-resistant tomato variety Eol promising for growing in greenhouses.

Having used tetraploids in crossing, we received considerable genetic diversity of diploids, triploids, tetraploids characterised with complex of economically-valuable features. Having used such a diversity, early ripening tomato varieties were created, such as Temp 35, Svitanok, Iskorka.

Complex crossing also contributed to the expansion of the genetic diversity within the starting populations. The optimal number of components in the crossings is six. For complex crossings, selection according to recessive signs can be already started in the first hybrid generation. The use of complex crosses promoted obtaining early-ripening, cold-resistant original forms feature recessive traits, thus we created varieties Zoren, Flora, Boian.

Hybridization among the best hybrids of Ukrainian and foreign origin led to the creation of well-known varieties like Lahidnyi, Lenhoranzh, F_1 hybrids Kozachok and Sviatoslav.

In the selection process, we have developed a number of methodological approaches to assess genotype phenotype: through individual assessment of each phenotype, integrating in one genotype the number of desirable traits, checking their inheritance in progeny. In the process of selection, we determined the average

characteristics in a population, the average signs within individual selections; also, we evaluated the degree of difference between carried signs in individual selection according to the system + 2-3G. These methods created target source material for the successful breeding process according to the purpose of fruits and precise model of the future hybrid.

In the selection process, we carried out estimation against provocative backgrounds: cold-resistance, shadow-resistance, resistance to cracking, late blight and Tobacco mosaic virus. Using laboratory devices of Research Institute for Vegetable and Melons growing, we determined physical and mechanical properties of fruits individually in the field as well as biochemical indices of fruit in the laboratory. Harvesting fruits was performed manually, by shaking and detailed analysis of each fruit, and with harvester KTM-2 on small plots.

The developed approaches made it possible to create a full-value breeding material, high-quality varieties and hybrids. At that, important is the number of plants under study, the number of new hybrid combinations, and the number of selections taken from the same population. According to existing theories, availability of ten F_1 plants in a nursery is enough for starting selections. In F_2 nursery, the number of plants per each combination should be 300-500. The more selections are carried out against the background of one hybrid population, the greater the opportunity to find unique recombination or transgression.

It is desirable to have 50-100 plants per each selection in third generation of desirable plants per each selection, because splitting signs still going on. For these generations (F_2, F_3), selections are carried out by a number of signs, preferably marker and recessive signs. When carrying out selection for complex traits, it is possible to determine the directions for the future variety. For example, selection of short determinant samples will contribute to short-stem sign, early-ripening plants to early-ripening progeny. Selection for small, plum-like fruits will not lead to obtaining of large fruit etc.

During ontogeny, estimation should be performed several times, rejecting shrunken and ill plants with fruits that burst, soft to the touch, overripe, not tasty, without flavour. In the final evaluation of the phenotype, which is suitable to the planned model, it is necessary to evaluate the purity of plant vessels, rejecting brownish vessels, and in this way getting rid of internal infection. The final assessment can be performed on the size of the root system and using provocative backgrounds.

In F_3, F_4, we estimate performance and fruit quality characteristics. When assessing on the resistance, individual inoculation of each plant of hybrid populations F_2, F_3 should be carried out. For seeds, only plants that combine features of desirable economic resistance to pathogens selects must be selected. Of course, it is desirable to evaluate individually taste too, with the help of field refractometer and tasting.

Thus, we get high-quality source material as the basis for a new variety. In further steps it is necessary to carry out broad ecological and production test. Within the net of vegetable growing there are all possibilities to that purpose: research institutions are located in all the typical vegetable growing regions, such as Crimea, Kherson, Kharkiv, Dnipropetrovsk, Donetsk, Kyiv, Chernihiv region. Joint

participators are located in Cherkasy, Mykolayiv, Sumy, Lviv, Zakarpattia regions. According to a prominent theoretician of vegetable growing O. O. Zhuchenko [1], testing in many eco-niches gives more accurate assessment of the new variety, as compared to test within few years.

Conclusions. Thus, success in creating new varieties and F_1 hybrids of tomato can be ensured by purposeful selection of source material, creating hybrid populations for selection, selection of the best genotypes for the marker characteristics, environmental testing and estimation against provocative backgrounds.

References

1. Zhuchenko, A.A. (1973). *Genetika tomatov* [*Genetics of tomato*]. Kishinev: n.d. [in Russian].

2. Pivovarov, V.F. (1999). *Selektciia i semenevodstvo ovoshchnykh kultur* [*Breeding and seed production in vegetable growing*]. Moscow: n.d., (vols. 1-2, vol. 2) [in Russian].

3. Kravchenko, V.A., & Prylipko, O.V. (2007). *Pomidor: selektsiia, nasinnytstvo, tekhnolohii* [*Tomato: breeding, seed production, technologies*]. Kyiv: Ahrarna nauka [in Ukrainian].

4. Kravchenko, V.A., & Prylipko, O.V. (2001). *Metodyka i tekhnika selektsiinoi roboty z tomatom* [*Methods and techniques in tomato breeding*]. Kyiv: Ahrarna nauka [in Ukrainian].

5. Kravchenko, V.A., Sych, Z.D., Korniienko, S.I. et al. (2013). *Selektsiia ovochevykh roslyn: teoriia i praktyka* [*Vegetables breeding: theory and practice*]. V.A. Kravchenko, Z.D. Sych (Eds.). Vinnytsia: Nilan-LTD [in Ukrainian].

6. Udovenko, G.V. (Ed.). (1988). *Diagnostika ustoichivosti rastenii k stressovym vozdeistviiam* [*Diagnostics of plant resistance by stressors*]. Leningrad: VIR [in Russian].

7. Kravchenko, V.A. (1995). Henetyka zrushennia shchodo stiikosti do abiotychnykh faktoriv seredovyshcha u pomidora [Genetics of shift for resistance to abiotic environmental factors in the tomato]. *Tsytolohiia i henetyka* [*Cytology and Genetics*], *28*, *4*, 31-33 [in Ukrainian].

8. Kravchenko, V.A. (1987). Otbory po priznakam produktivnosti v rannikh gibridnykh pokolenii tomatov [Selection of early ripening tomato generations for their performance signs]. *Selektciia i semenovodstvo* [*Plant Breeding and Seed Production*], *47*, 34-37 [in Russian].

9. Horova, T.K., & Yakovenko, I.I. (Eds.). (2001). *Suchasni metody selektsii ovochevykh i bashtannykh kultur* [*Modern methods of breeding vegetables and melons*]. Kharkiv: n.d. [in Ukrainian].

Анотація

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Методичні підходи до селекційного процесу в овочівництві

Висвітлено методичні підходи до створення нових сортів і гібридів помідора різних напрямів використання плодів. Використовуючи розроблені

методики отримано ряд сортів і гібридів, широко розповсюджених у виробництві – Іскорка, Лагідний, Флора, Іришка, Святослав F_1, КДС-5 F_1, Богун F_1.

Ключові слова: *селекційний процес, помідор, сорти та гібриди.*

Анотация

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Методические подходы к селекционному процессу в овощеводстве

Освещены методические подходы к созданию новых сортов и гибридов томата различных направлений использования плодов. Используя разработанные методики, получено ряд сортов и гибридов, широко используемых в производстве – Искорка, Лагидный, Флора, Иришка, Святослав F_1, КДС-5 F_1, Богун F_1.

Ключевые слова: *селекционный процесс, помидор, сорта та гибриды.*