

The Role of Breeding in the Creation and Conservation of Agrobiodiversity with Climate Change in Tajikistan

Kurbonali Partoev^{1*}, Safarmadi Mirzoali² and Sattorov Bakhtovar Norasovich³

¹Head of the Laboratory of Genetics and Breeding at the Institute of Botany, Plant Physiology and Genetics of the National Academy of Sciences of Tajikistan, Doctor of Agricultural Sciences, Professor, Phone: 918649505.

²Head of the Department of Genetics and Biotechnology Tajik State Pedagogical University named after S.Aini, Candidate of Biological Sciences, Phone: 935571771.

³Senior Researcher at the Laboratory of Genetics and Breeding of the Institute of Botany, Plant Physiology and Genetics of the National Academy of Sciences of Tajikistan, Tel: 101266363.

*Corresponding author

Kurbonali Partoev, Head of the Laboratory of Genetics and Breeding at the Institute of Botany, Plant Physiology and Genetics of the National Academy of Sciences of Tajikistan, Doctor of Agricultural Sciences, Professor, Phone: 918649505.

Received: July 30, 2026; Accepted: August 07, 2026; Published: August 13, 2026

ABSTRACT

The article provides information on the role of breeding in the creation and conservation of agro biodiversity under climate change in Tajikistan. The Institute of Botany, Plant Physiology and Genetics of the National Academy of Sciences of Tajikistan (IBFGR NAST) has combined classical breeding methods and modern biotechnology to produce new promising varieties of important field crops such as wheat (*Triticum aestivum* L), potato (*Solanum tuberosum* L), Jerusalem artichoke (*Helianthus tuberosus* L), corn (*Moise* L), sunflower (*Helianthus annus* L), cotton (*Gossypium hirsutum* L), oats (*Avena sativa* L), sorghum (*Sorghum* L), Chicory (*Checorium* L), legumes (*Legumes* L), vegetables (*Vegetable*) and other crops, which are more adapted to climate change when they are cultivated in various agro ecological conditions of Tajikistan. These crops play an important role in ensuring food security in the republic and enriching their gene pool and preserving them for future generations is one of the main goals and objectives of scientists in Tajikistan. In this regard, scientists at the IBFGR NAST Laboratory of Genetics and Breeding widely use breeding methods such as genetic screening and the introduction of new useful genotypes, hybridization of valuable source forms, and natural and artificial mutagenesis. In particular, when using the selective breeding method - targeted selection back in 2010 among the plant population of the local wheat variety "Zafar", valuable modified plants were identified, which differed significantly in leaf color, height of the main stem, precocity and yield. Further study of these altered genotypes for more than 12 years has shown that the isolated wheat samples differ significantly from the maternal "Zafar" variety in a number of genetic features. We have established that these altered traits are of a genetic nature, based on the natural process of mutagenesis in the conditions of the experimental site of the IBFGR NAST. The new modified forms of the plant were studied and propagated during 2011-2021 in various breeding nurseries. Thus, in 2022, based on the decision of the IBFGR NAST Scientific Council, the new wheat line was named the "Bakhti Istiklol" ("Happiness of Independence") variety and transferred to the State Commission for Variety Research and Protection of New Varieties of Agricultural Plants under the Ministry of Agriculture of the Republic of Tajikistan. Thus, it was found that the new wheat variety "Bakhti Istiklol" significantly exceeds the maternal wheat variety "Zafar" in such genetic characteristics as the length of the ear, the weight of the aboveground part of the plant, the weight of the ear, the number of grains in the ear, the weight of the grains of one ear, the weight of 1000 grains and other morphological characteristics.

Keywords: Breeding, Variety, Field Crops, Wheat, Oats, Potatoes, Jerusalem Artichoke

Introduction

Based on the use of the hybridization method, selection of valuable clones, reproduction of test tube plants and micro-tubers in a light room in the autumn-winter-spring period, IBFGR NAST scientists managed to halve the time required to obtain

and accumulate sufficient breeding material for new healthy potato clones. Based on this method, a new potato variety has been created – "Tajikistan", which is tall, with a stem length of 100-120 cm and has many leaves. The new potato variety has few flowers and berries formed compared to other potato varieties. The tubers of the new potato variety are round-oval in shape, have a red color and good taste qualities. The color of the flesh is yellow, with a purple tinge, and the tubers contain

Citation: Kurbonali Partoev, Safarmadi Mirzoali, Sattorov Bakhtovar Norasovich. The Role of Breeding in the Creation and Conservation of Agrobiodiversity with Climate Change in Tajikistan. J Biomed Sci Biotech Res. 2026. 4(3): 1-4. DOI: doi.org/10.61440/JBSBR.2026.v4.44

more iron (Fe) ions, which are very useful for the prevention of anemia in humans. In the new potato variety, the depth of the eyes is shallow, it is medium-late with a growing season of 110 - 115 days. It is resistant to high temperature and lack of moisture in the soil. Currently, the new potato variety "Tajikistan" is cultivated on an area of more than 8 thousand hectares and exceeds the yield of other potato varieties by 20-30%.

Also, during 2005-2015, as a result of using the selection method among the Jerusalem artichoke variety "Interest" (Russian breeding), we identified a new Jerusalem artichoke variety "Sarvat" ("Wealth"), which differs from the original variety "Interest", with more even and smooth tubers, which is convenient for canning its tubers. This variety was zoned in the republic in 2017. In production conditions, it exceeds other varieties by 25-30% in yield, its yield is 45-50 t/ha, and the total biological mass is 60-70 t/ha, and its tubers are a good nutritious product for reducing blood sugar in humans.

Also, based on the use of the classical breeding method – hybridization and targeted selection, we have obtained a new intensive variety of oats "Nazar", which differs significantly from the original and other varieties of oats in a number of morphological features. Its distinctive properties are expressed in changes in grain color, stem height, precocity, leaf size, the number of grains in the spikelets (2-3 pieces in each spikelet), resistance to rust and high yield. In addition, the new oat variety differs from the mother variety in terms of bush habit, leaf color, and plant height. The new variety has heavier weight and more than 1000 grains than other varieties of oats.

In August 2022, the new breeding line at the Scientific Council of the IBFGR NAST was named "Nazar" and transferred to the State Commission for Variety Research and Protection of Varieties under the Ministry of Agriculture of the Republic of Tajikistan.

Based on the use of the mutagenesis method (by irradiating soaked wheat and barley seeds with Cesium-137 radiation), we have obtained new valuable forms that differ in a number of genetic features from the original forms of wheat and barley.

Thus, IBFGR NAST scientists, based on a combination of classical breeding methods (introduction, genetic screening and mutagenesis) and modern biotechnology, on the one hand, synthesize new valuable genotypes to enrich agro biodiversity, and on the other hand, these new valuable genotypes of crops are preserved for use in breeding and genetic programs that are characterized by higher yields, sustainable to adverse environmental factors and climate change in the future. Currently, the total area under these new varieties of these crops in the republic is more than 10 thousand hectares.

Many scientists report that the collection and preservation of various forms and genotypes of crops play an important role in the breeding process to create new varieties adapted to climate change in the future [1-3]. In this regard, scientists at the Institute of Botany, Plant Physiology and Genetics of the National Academy of Sciences of Tajikistan (IBFGR NAST) pay special attention to the collection, conservation and involvement of various genotypes of crops and their use in the breeding process [4,5].

Scientists at the Laboratory of Genetics and Breeding currently maintain more than: 100 valuable genotypes of wheat, 10 genotypes of oats, 50 genotypes of potatoes, 25 genotypes of Jerusalem artichoke, 15 genotypes of corn, 10 genotypes of sunflower, 15 genotypes of sorghum, 4 genotypes of chicory and other crops. In previous years, seeds of these genotypes were collected as a result of an expedition in remote villages of the republic itself, from mountainous areas (at an altitude of 1800-3000 m above sea level), and also obtained from the genetic centers of various research institutes of the Russian Federation, Belarus, Uzbekistan, Kazakhstan, China, Afghanistan and other countries.

Usually, we will obtain collectible samples of agricultural crops on the basis of scientific cooperation agreements with breeders from different countries [5-7].

The scientific cooperation of IBFGR NAST scientists has been particularly effective with scientists from the International Potato Growing Center in Peru (Lima) on the study of various potato genotypes in the conditions of the valley and mountainous zone of Tajikistan. Such a useful collaboration between our scientists and scientists from Peru on potato breeding and genetics was carried out during 2005-2015. Breeding achievements achieved by IBFGR NAST scientists in collaboration with scientists from the Tajik Academy of Agricultural Sciences and the Tajik Agrarian University named after Shirinsho Shotemur are valuable materials for Tajik scientists and plant breeders for the sustainable conservation of agro biodiversity in agriculture, the creation of a valuable gene pool of crops, increasing their yields and ensuring food security against the background of climate change in the future.

Wheat (*Triticum Aestivum* L). Based on the use of the classical breeding method of selection in 2010, among the plant population of the local wheat variety "Zafar", one source plant was identified, which differed sharply in leaf color and plant height. Further study of this plant in subsequent years of research showed that the isolated wheat sample differed from the mother variety "Zafar" in a number of genetic features. In our opinion, this modified plant arose on the basis of natural mutagenesis in the field conditions of the experimental site of the Institute of Botany, Plant Physiology and Genetics of the National Academy of Sciences of Tajikistan. The newly isolated wheat sample was studied and propagated during 2011-2021 in various breeding nurseries, and in 2022, based on a decision of the Academic Council of the Institute of Botany, Physiology and Plant Genetics of the National Academy of Sciences of Tajikistan, it was named the "Bakhti Istiklol" "variety ("Happiness of Independence") and transferred to the State Commission for Variety Research and Protection of New Varieties of Agricultural Plants of the Ministry of Agriculture of the Republic of Tajikistan. The new wheat variety "Bakhti Istiklol" significantly exceeds the maternal wheat variety "Zafar" in a number of genetic characteristics, such as the length of the ear (by 20.76%), the weight of straw with leaves (by 13.69%), the weight of the ear (by 80.75%), the number of grains in the ear (by 65.26%), the weight of the grains of one ear (by 23.53%) and a mass of 1,000 grains (by 28.05%). The new "Bakhti Istiklol" variety matures 15 days earlier than the original one and exceeds the "Zafar" variety in yield by 23.53%.

However, the new wheat sample, “Bakhti Istiklol”, is inferior to the “Zafar” variety in such features as the length of the ear from the tip (by 16.78%) and the weight of the chaff (by 29.03%). Also, the new variety is a precocious variety, the length of the stems reaches 55-60 cm, multi-leaved, broad-leaved, strongly green leaf (The authors of the variety are Partoev K, Sattorov BN).

Potato (*Solanum Tuberosum* L). Based on the hybridization of two new potato lines: 387521.3 x Aphrodite, a new potato hybrid was obtained at the International Potato Growing Center (SIP, Peru). The seeds of this hybrid (F1) were obtained by us in 2005. As a result of breeding operations in the mountainous zone of Tajikistan (at an altitude of 2,700 m above sea level) during 2006-2015. A new promising potato clone was selected, which was later named the “Tajikistan” variety and transferred for testing to the State Commission for the Study and Protection of New Crop Varieties under the Ministry of Agriculture of the Republic of Tajikistan in 2012. By the decision of this commission, the new potato variety “Tajikistan” was zoned in 2015 across the republic. (The authors of the variety are breeders: Partoev K, Aliev K, Karimov B, Melikov K, Sulangov M, Nazarova N). Acceleration of the breeding process was carried out at the Laboratory of Molecular Biology and Biotechnology of IBFGR NAST micro-spinning of test tube plants in in-vitro conditions, planting of test tube plants and micro-tubers in a light room, greenhouse and in an open field. By propagating test tube plants and micro-tubers in a light room in the autumn-winter-spring period, we managed to halve the time required to study and accumulate sufficient breeding material for this clone. The variety is tall, the stem length reaches 80-100 cm, multi-leaved, the leaves are dark green. It forms few flowers, the color of the flowers is purple, the duration of flowering is short. The variety has a small berry formation and small size. Tubers have a rounded-oval shape, red color and good taste qualities. The color of the flesh is yellow, with a purple tinge. The depth of the eyes is shallow. The color of the eyes and sprouts is purple. The variety is medium-late with a growing season of 110-115 days and is resistant to high temperatures and lack of moisture in the soil. Currently, the new potato variety “Tajikistan” is cultivated on an area of more than 8 thousand hectares and exceeds the yield of other potato varieties by 20-30%.

Currently, based on the use of traditional breeding and biotechnology methods, such promising new potato varieties as “Faizi Istiklol” and “Mastchok” have been obtained, which are currently being tested by the State Commission for Testing and Protection of New of Crops under the Ministry of Agriculture of the Republic of Tajikistan.

Jerusalem artichoke (*Helianthus tuberosus* L). During 2005-2015, as a result of using the selection method among the Jerusalem artichoke variety “Interest”, a new Jerusalem artichoke variety “Sarvat” (“Wealth”) was isolated. The new Jerusalem artichoke variety, unlike the mother variety “Interest”, has more even and smooth tubers, which are convenient for canning tubers. This variety was zoned in the republic in 2017. It exceeds other varieties by 25-30% in terms of yield in production conditions. The yield of tubers of the “Sarvat” variety is 45-50 t/ha, and the total biological mass is 60-70 t/ha. Jerusalem artichoke tubers are a good way to reduce the sugar content in human blood

(The authors of the variety are Partoev K., Akhmedov Kh.M., Mirzoev N.R., Saidaliev N.H. and Yasinov Sh.M.). The variety is grown on stony and infertile soils. It should be noted here that, based on our research, it has been established that dried Jerusalem artichoke tubers have an extremely important valuable property that has not lost its nutritional properties for more than 10 years as a food product in the future. As you know, many food products such as dried apricots, mulberries, nuts, grains of cereals and legumes lose their nutritional properties or are spoiled by pests within 2-3 years.

Therefore, dried Jerusalem artichoke tubers can be used as a valuable strategic raw material in addressing food security in the face of climate change in the future.

Oats (*Avena Sativa* L). The new variety of oats “Nazar” (“Vzglyad”) was bred as a result of long-term breeding work by us using the classical family selection method among the variety sample population from the collection of the Institute of Botany, Physiology and Plant Genetics of the National Academy of Sciences of Tajikistan from sample No. 3. This type of oats during 2014-2021. it was studied and propagated in various breeding nurseries based on the use of methods of classical breeding, individual selection (Authors: Sattorov B.N., Kamolov N.K., Partoev K).

The variety has a number of distinguishing features from the original variety and other varieties of oats in terms of grain color, stem height, precocity, leaf size, the amount of grain in the ears (2-3 pieces in each ear) and high yield. Also, the new variety of oats “Nazar” differs from the original variety in the habitus of the bush, in the color of the leaves and in the height of the plants. The new variety has heavier seeds and a greater mass of 1000 grains than the original variety (by 15-20%). The height of the plants is 5-7 cm higher than the original oat sample. The yield of the variety on rain-fed lands reaches 2.0 t / ha, and on irrigated lands up to 3.3t/ha, which is 0.5-0.7t/ha more than the initial sample of oats No. 3.

The biological feature of this variety of oats is the white color of the grain, tallness, precocity, high yield, more wide leaves with a bright dark green color, which distinguishes it from the original variety of oats and other varieties of oats.

The variety is high-yielding and resistant to lodging and fungal diseases. In August 2022, a new sample was named “Nazar” at the Academic Council of the Institute of Botany, Plant Physiology and Genetics of the National Academy of Sciences of Tajikistan and submitted to the State Commission for Variety Research and Protection of Varieties of the Ministry of Agriculture of the Republic of Tajikistan.

Conclusion

Thus, scientists of the Institute of Botany, Plant Physiology and Genetics of the National Academy of Sciences of Tajikistan, based on the use of such classical breeding methods as genetic screening and introduction, hybridization of valuable parental forms, mutagenesis and their combination with modern biotechnology methods in collaboration with scientists from the Tajik Academy of Agricultural Sciences and the Tajik Agrarian University named after Shirinsho Shotemur has now obtained

new promising genotypes and varieties of wheat, potatoes, Jerusalem artichoke, oats and other crops that play an important role in replenishing and preserving agro biodiversity in the future in Tajikistan.

The newly obtained valuable varieties of agricultural crops are currently widely cultivated in the fields of farmers in the republic. The new crop genotypes obtained are more adaptive to climate change and have a greater economic effect when grown in various agro ecological conditions in the republic. In the future, in order to increase the adaptive potential of new crop varieties to climate change, to enrich and preserve rich agro biodiversity, it is necessary in breeding and genetic programs. use local vegetation genotypes and strengthen collaboration with scientists and plant breeders from other countries of the world.

References

1. Vavilov NI. Five Continents. The story of travels for useful plants in the main agricultural areas of the Earth / N.I. Vavilov/-M.: Mysl, 1987. -170 p.
2. Goncharov NP, Shumny VK. From the preservation of genetic collections to the creation of a national system for storing plant gene pools in permafrost. Inform. west. VOGiS. 2008. 12: 509-523.
3. Pasko NM. Selection and seed production of Jerusalem artichoke. Collection of scientific papers. 2003. 163-171.
4. Partoev K. Potato breeding and seed production in Tajikistan. Dushanbe, Donish. 2013. 190.
5. Partoev K, Kurbonov MK, Naimov A, Sadriddinov M, Aliev U. The variety is an important factor in the intensification of potato growing in Tajikistan. Collection of scientific articles of the International Scientific Conference on the topic: "The past, present state and prospects of development of vegetable growing, potato growing and viticulture in Tajikistan. 2024. 152-156.
6. Sattorov BN, Partoev K. The role of traditional breeding in the creation of new precocious forms of wheat. Collection of scientific articles of the scientific and practical conference on the topic: "Biotechnological breeding – its role in ensuring food security: problems and ways to solve them." 2023. 90-95.
7. Safarmadi M, Yasinov ShM, Partoev K. The prospects of using Jerusalem artichoke in Tajikistan. International Scientific journal "Science and Innovation". Special issue "Current issues of innovative development of the agro-industrial complex: problems and modern solutions in the future". 2024. 381-384.