Name of the project: AP22785049 "Plant breeding process improvement based on chemical mutagenesis for obtaining early-ripening mutant forms of proso millet (*Panicum miliaceum* L.)".

Problem statement: The idea of the project is aimed at creating early-ripening mutant forms of proso millet using highly effective chemical mutagens and molecular genetic methods for their use in targeted plant breeding with unique traits and properties of genetic variability. At the current stage of crop breeding history the use of experimental mutagenesis methods, cytological and biochemical approaches along with new achievements of molecular biology will significantly expand the study of the sensitivity mechanisms to the effects of mutagenic factors and the identification of positive traits, which in turn will help to increase the efficiency of the plant breeding process for precocity.

Project Objective: Creation of early-ripening forms of proso millet using induced mutagenesis and molecular analysis to expand genetic diversity and effective use in plant breeding programs.

Project objectives:

- model experiments on the selection of effective doses and exposure periods to various chemical mutagens at the stage of seed germination;
- cytological analysis of proso millet genotypes to identify the degree of mutability at the cellular level;
- assessment and selection of mutant forms for precocity in the conditions of Northern Kazakhstan;
- molecular genetic analysis of the original varieties and resulting mutant forms of proso millet to study genetic variability;
- creation of valuable early ripening mutant forms for their future use in the breeding process.

During the implementation of the project the following results will be obtained:

- an effective laboratory protocol for proso millet seeds treatment with chemical mutagens will be developed;
- the impact of mutagens at the cellular level of proso millet genotypes will be determined;
- valuable early ripening mutant forms for the conditions of Northern Kazakhstan will be selected;
- the variability of M1-M3 mutant generations of proso millet at the gene level will be revealed using the method of molecular genetic analysis;
- promising early-maturing mutant forms based on induced mutagenesis will be obtained, they will subsequently be involved in the selection process.

Level of technological readiness of developments at the stage of application and completion of the project. For this project, there is a basic level of technology readiness for applied research in the field of selective mutagenesis of millet, such as improving methods and methods for using various types of effective mutagenic factors in millet breeding. Based on the results of the project, a modified protocol for the use of chemical mutagens in millet breeding will be developed. The results

of applied research are planned to be published in peer-reviewed scientific journals indexed by international scientific citation systems.

Members of the research group:

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Planned publications and patents within the framework of this project:

According to the research results of 2024-2026, there will be:

- Based on the research results, 2 (two) articles and (or) reviews will be published in peer-reviewed scientific journals with accordance to the scientific area of the project, indexed in the Science Citation Index Expanded of the Web of Science database and (or) having a CiteScore percentile in the Scopus database of at least 50 (fifty); or 1 (one) article or review in a peer-reviewed scientific publication, indexed in the Science Citation Index Expanded and included in the 1st (first) quartile of the impact factor in the Web of Science database and 1 (one) patent for invention;
- 1 (one) monograph will be published in the local press;
- 1 (one) article will be published in Materials of The international conference;

Information for potential users: applicability and (or) possibility of commercialization of the obtained scientific results: the scientific results obtained as a result of the project will be used in scientific organizations, such as breeding institutions and leading higher educational institutions. The impact of the expected results on the development of the main scientific direction and related areas of science and technology: the results obtained as a result of the project will contribute to the development of science and technology, in particular in the field of application

of innovative technologies in the intensification of the breeding process of millet and in developments to expand and study the biodiversity of species in in general

Additional information: The results of studies on expanding genetic diversity by mutagenesis with the aim of creating forms with a complex of economically valuable traits indicate the great promise of this direction.

Along with the theoretical significance, the planned research is also of great practical importance, since with the creation of high-yielding, plastic forms of millet with complex resistance to stress factors, the problem of obtaining varieties with high technological qualities of the grain of this crop is successfully solved. In the implementation of this project, mutation selection methods and molecular genetic analyzes will be used.

The implementation of the project will contribute to import substitution and increase the provision of the population and enterprises with millet material with economically valuable characteristics in the republic in the future.