Contribution ID: **1065** Type: **Oral**

Breeding of a drought-resistant rice variety as an application of mutagenesis induced by the neutron irradiation on the EG-5 installation in the FLNP, JINR

Monday 24 October 2022 14:15 (15 minutes)

Rice (Oryza sativa L.) is the main food crop for half of the world's population, which could increase by another 3 billion in the next 30 years [1]. Also, due to the relative simplicity of its genome [2], rice represents a key model for studying the genomics of agroecosystems. Thus, based on fundamental knowledge about the rice genome, it is possible to produce enough food in the future to satisfy the demands of the growing population of the planet.

It is important to consider the fact that just an increase in production is not enough, it is necessary to think about maintaining the current state of affairs in the growing influence of unfavorable conditions. Approximately 10 million hectares of agricultural land will be withdrawn from agricultural use each year due to salinization [3] associated with gradual sea level rise [4].

One strategy for the genetic improvement of rice is to use radiation-induced mutagenesis to find samples suitable for growing under unfavorable conditions such as drought and salinity [5].

At the same time, creating samples resistant to the abovementioned adverse factors leads to creation of gene combinations that increase the overall adaptability of the plant [6].

The mechanisms of neutron action on biological objects are poorly understood, but according to [2] they can be used to create new varieties, since in a number of studies the genes responsible for agronomically important traits have been changed.

The first stage of our study was to irradiate rice seeds of different varieties with neutrons with E=4.1 MeV to obtain a dose of 50 Gy. Irradiation was conducted at the electrostatic generator EG-5 in the FLNP, JINR. The place of research is the experimental site of LLP "Zhakhaev Kazakh Rice Research Institute" in the Republic of Kazakhstan located in Kyzylorda region. The climate of the Kyzylorda region is sharply continental, arid, with chloride-sulphate salinity [7]. Three rice varieties cultivated in this area (Syr-Syluy, Aikerim, Leader) were provided for irradiation. After irradiation, the seeds were germinated in a greenhouse, then planted in the fields, where they were subjected to additional treatment with salt and moisture-absorbing components.

It was found out that the reported dose of 50 Gy is sufficient to carry out mutagenesis in rice crops. The observed plants are weaker and dwarfish than the control plants. Also defects in the spike formation and the maturation of grain are observed. In the future, in this series of studies, it is additionally planned to implement the observation of the result of in vitro mutagenesis, which, according to study [8], reduces the number of chimeras and reduces the time for selecting the desired traits.

Acknowledgments. The study was performed in the scope of the Ministry of Agriculture of the Republic of Kazakhstan project number BR10765056 and within the framework of the JINR-Romania cooperation program in 2022 (topic 03-4-1128-2017/2022).

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Plants 11(3), 375.

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Session Classification: Applied Research

Track Classification: Applied Research