

Use of Neutrons for Plants Breeding

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For the last ten years interest to the neutron irradiation in plant science has been increasing. According to the IAEA and the Food and Agriculture Organization of the United Nations (FAO) fast neutrons are more suitable in case of producing higher damage in genetic material of plants [1]. Neutrons show good perspective not only in mutagenesis but also in improving agronomic traits and yield parameters of the plants. In comparison with other physical mutagens neutrons show better relation between LET and RBE [2]. Despite the fact that the relative genetic efficiency of fast neutrons (FN) is 10 times higher than gamma radiation, the share of studies on gamma-induced mutagenesis is about 85% of all studies of physical mutagens, while neutron mutagenesis is only 10–11% [3, 4].

Research over the last ten years has shown the effectiveness of using FN for plants such as rice, wheat, cotton, soybeans, peas, peanuts, tomatoes. Irradiation with fast neutrons affects the structure of DNA, damaging nitrogenous bases, promoting standard breaks; in addition, the repair of DNA damage is greatly slowed down compared to gamma or X-rays. Also, compared to gamma rays, fast neutrons have a higher frequency of double strand breaking. Other studies have shown signs of changes in grain quality. Using the example of rice (*Oryza sativa*), a change in amylose content was found in some mutant lines. Irradiation with fast neutrons caused changes in the *FRO1* gene, which is responsible for increased tolerance and higher accumulation of iron in grains. Also, there are studies showing positive effect of the neutron irradiation on the germination energy and germination of wheat and cotton seeds.

For plant irradiation fast neutrons are mostly used with wide range of energy (1–15 MeV). Installation EG-5 is suitable for conducting such types of research.

References

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