

From lab to field: Indonesian scientists develop new crops for farmers by using nuclear science



BATAN researchers celebrate the success of rice varieties developed using irradiation

(Photo: National Nuclear Energy Agency (BATAN))

Over the last few years, farmers in Indonesia have grown enough rice for more than 20 million people using plants developed through the country's plant mutation breeding programme. The programme first took root through collaboration with the IAEA and the Food and Agriculture Organization of the United Nations (FAO) in 1997 and has since grown into a comprehensive partnership network that brings the results of scientific research using nuclear techniques to farmers' fields.

"Nuclear technology in Indonesia has been used in various areas of life, including agriculture," said Suryantoro, the Deputy Chairman of Indonesia's National Nuclear Energy Agency (BATAN). "Through radiation mutation engineering research, BATAN has improved the quality of local crop varieties so that the new and improved seeds can be widely used by the community."

When the first plant breeding cooperation project with the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture began in 1997, scientists at BATAN's research institutes received state-of-the-art equipment, extensive training in nuclear technologies and support from experts through IAEA coordinated research projects and technical cooperation projects. This laid the foundation for Indonesia's plant mutation breeding programme.

More than 35 new varieties of crops, including soybeans and rice, have since been developed through the programme. The new varieties are bred using irradiation and selected based on their improved characteristics compared to other local varieties, such as higher yields, shorter cultivation time, and resistance to climate change stressors and diseases (see Plant mutation breeding). Once ready, seeds for these new crops are then multiplied and made available to farmers.

"It's important that more seeds are produced to increase the area under cultivation," said A. Sidik Tanoyo, an official from the Ministry of Agriculture in East Java. "This will contribute to increased productivity and farmers' incomes."

To help ensure widespread use of these new crop varieties, the programme has grown into a comprehensive partnership network that is clearing the way for large-scale cultivation. The model is built on collaboration between research institutes, ministries, governmental agencies, seed breeding companies, farmers' cooperatives, market stakeholders and export groups. These partnerships span the whole supply chain, from seed development and multiplication to distribution and cultivation in fields.

"The programme, involving many national ministries and institutions

and three international organizations, is designed to run from upstream to downstream," said Totti Tjiptosumirat, Head of BATAN's Center for the Application of Isotope and Radiation Technology. "In the upstream position, BATAN develops superior seeds; the Ministry of Agriculture then distributes seeds to seed producers, and the Ministry of Industry transfers the innovation downstream to small and medium-sized enterprises or start-up companies."

Growing more rice around the country

Three of BATAN's 23 new rice varieties are now being widely cultivated in different regions around the country. Known as Bestari, Inpari Sidenuk, and Mustaban, these rice plants were selected because they can produce, on average, more than 150% more rice in a shorter time than other local varieties. They are also more resistant to changes in the climate, as well as to diseases and insects.

"In my area, the planthopper insect is everywhere, and when I saw these good Mustaban plants, I thanked God that the planthopper does not affect it," said Hamid, a seed breeder in Serang, Banten province. Nearby, in Kaseman village, another seed grower, Tatang, added: "We did not have to use insecticides. Once the flowers from our Mustaban plants came out, there were no rice stink bugs to be found."

Experts at BATAN plan to continue research and development to expand the number of new plant varieties and to incorporate farmers' feedback to further refine and improve how the plants perform. The research will also be geared towards optimizing how plants grow using local agricultural practices, such as fertilizer systems, and under different environmental conditions, such as local soils, strong winds and heavy rains.

—By Driss Haboudane