

Philippines: radiation-processed seaweed increases typhoon resistance of rice

By Laura Gil



The weather resistance of rice increases when treated with irradiated seaweed.

(Photo: IAEA)

“Carrageenan plant growth promoter is the answer to harvest shortage. This technology increases harvest yield and, with it, farmers’ livelihoods.”

— Lucille Abad, Chief, Atomic Research Division, Philippine Nuclear Research Institute

Researchers in the Philippines have found that an extract of seaweed, when processed with radiation, can make plants more resistant to typhoons and boost rice production by 20–30%. The extract, called carrageenan, comes from algae that is abundant in the sea. While carrageenan is already used widely as a gelling agent and thickener in the preparation of processed foods, this is the first time researchers — with the support of the IAEA — have applied it on a large scale as a plant growth promoter.

“It worked from the very first day I used it,” said Isagani Concepción, a supervising engineer and part-time farmer at San Manuel in the central province of Tarlac. Concepción’s four-hectare rice field was used for testing. After he applied the modified carrageenan, he noticed a 30% increase in production. “I used to get 291 cavans, now I get 378. Even spraying only a small dose is as effective as using organic fertilizer.” One cavan is a sack of approximately 50 kg.

Plants also started growing more extensive roots, sturdier stems and more tillers. This, Concepción said, has made them resilient to typhoons. In Bulacan, Typhoon Lando in 2015 devastated all the control plants, which were not given irradiated carrageenan. Those treated with the new growth promoter remained standing.

For farmers in East Asia, the irradiated product is pertinent at a time when — according to projections by the United Nations’ Intergovernmental Panel on Climate Change — rising temperatures will heat the oceans. The implication for farmers is that warming oceans can lead to more intense and frequent typhoons.

Agricultural researchers at the National Crop Protection Center of the University of the Philippines in Los Baños tested the benefits of carrageenan as a plant growth promoter on more than 5000 hectares. The IAEA provided the irradiators and the training of local experts on their use. In a study in Pulilan, a central province of Bulacan, researchers found that sprayed areas produced crops with yields 65% above that of the control group, while using only half of the recommended fertilizer dose.

“The first difference we noticed was that its fertilizing effect lasted a long time,” said Joselito Colduron, a farmer in Bulacan. “And that the grain-bearing tip part of the stem was full to the brim.”

Radiation replacing chemicals

The technology consists of subjecting the material to radiation to reduce the molecular weight of carrageenan and thereby increase

its effectiveness. Carrageenan is a mixture of natural polymers derived from weeds, with high molecular weight, explained Sunil Sabharwal, radiation processing specialist at the IAEA. Irradiation with gamma rays degrades the natural Carrageenan into smaller oligomers with comparatively low molecular weight, which are known to stimulate plant growth.

“We do with radiation what others do with chemicals, but the use of chemicals often produces residues that can be harmful to people and the environment,” said Lucille Abad, Chief of the Atomic Research Division at the Philippine Nuclear Research Institute (PNRI), part of the Department of Science and Technology.

Farmers realized that plants also grew resilient to insects and arthropods such as centipedes when treated with radiation-processed carrageenan. At the same time, the population of spiders, which kill virus-carrying green leafhopper, increased. “We didn’t need to use pesticides because we realized more friendly insects chased away the pests. These insects have helped to decrease the number of the pests, and we have stopped using insecticides,” said Colduron.

The technology also affects weight. Farmers recorded an increase of around 9% per sack. And the increase in grain weight affects the rice stalk and ear length, which have improved, according to observations made comparing carrageenan-fed plants with conventional farming.

“Carrageenan plant growth promoter is the answer to harvest shortage,” Abad said. “This

technology increases harvest yield and, with it, farmers’ livelihoods.”

Industrial applications of radiation technology

The initial research on modified irradiated carrageenan took place at PNRI. Two facilities — a semi-automated gamma irradiation facility and an electron beam facility established with IAEA assistance — are what researchers at the institute use to meet the needs of clients from industry, academia and research.

“We irradiate food to reduce the microbial load for food safety purposes,” said Luvimina Lanuza, Head of Irradiation Services at PNRI. “This includes spices, herbal products, dehydrated vegetables, cosmetic raw materials and accessories.”

Irradiation, Lanuza said, has many advantages over other, chemical-based methods. For example, irradiation is a cold process that enables modification of plastic materials without melting them. Gamma rays are highly penetrating, which means they can irradiate food products in their final packaged form. In 2017 alone, PNRI staff irradiated 1400 cubic metres of food and non-food products.

“We are expecting to increase this by next year,” Lanuza said. Through an IAEA technical cooperation project, they are upgrading the gamma irradiation facility from a semi-automated to a fully automated one. “We hope that with the upgraded facility we can increase our services and cater to the needs of the medical industry, too, to sterilize medical devices.”

(Infographic: R. Kenn/IAEA)

The effect of irradiated carrageenan

