IAEA Nuclear Sciences and Applications

Securing A Better Future For All

Nuclear Techniques for Global Development and Environmental Protection

Food and Agriculture

Building Better Agriculture One Atom at a Time

Nuclear Technology: A Tool for Improving Agricultural Production

In a world facing the dilemmas posed by exponential population growth and changing climates, nuclear technology offers possible avenues to solve production problems, protect soil and water resources and conserve biodiversity, which, in turn, means increased hope for global food security. Application of nuclear technology has a proven record in increasing agricultural production. Higher and more reliable yields not only improve farmers' livelihoods, they mean better quality and safer food for consumers.

The methods used vary: isotope measurements identify and trace the efficiency of crop inputs such as water and fertilizer and of animal feeds; gamma rays sterillize male insects so that when they are returned to the wild they are unable to produce progeny; irradiation stops the growth of pests and expands the shelf life of grains, spices and processed foods; radiation induced mutation speeds up natural genetic changes in crops to support plant breeders; and genetic markers expedite the identification of animal diseases thereby allowing treatment to begin sooner. All of these methods, plus a host of others that come under the heading of nuclear technology, are invaluable tools for agriculture and food production.

For almost five decades, the IAEA, together with its partner the FAO, guided development of new nuclear based methodologies, requested by its Member States and facilitated their adaptation, adoption and application. A harbinger of the United Nation's Delivering as One, the Joint FAO/IAEA Division stands as the United Nations' system's only joint venture. It also operates its own agriculture and biotechnology laboratories in Seibersdorf where technical services, R&D and laboratory training activities are conducted in support of the development and transfer of new technologies and their adaptation to local needs and environments.

Success Stories from the Field

Bangladesh has used nuclear technologies to improve its water management practices and to identify saline tolerant crop varieties. This has enabled farmers to grow a second crop, for example wheat in addition to rice, on up to 2.6 million ha of fertile coastal lands that would otherwise lie fallow.

Nuclear technologies make powerful and critical contributions to improving agricultural production systems and food security. Using cutting edge, value adding nuclear applications provides modern and efficient avenues for addressing agricultural issues.

Developed through the use of nuclear techniques, Qatar is currently planning to use 60 million m^3 of treated sewage water to irrigate 83 300 ha of highly saline coastal and inland sabkha lands to produce livestock fodder, thereby increasing the country's total arable land from 8000 to 91 000 ha.

The IAEA, together with its partner the FAO, works on developing and applying nuclear technologies in five areas:

Soil and Water Management and Crop Nutrition: Isotopic and radiation methods measure and monitor nutrients and water in the soil-crop system as the basis for strategies to ensure best results through the judicious and efficient use of scarce resources.

Plant Breeding and Genetics: Radiation creates variability in desired traits of food and industrial crops and is used to speed breeding of varieties that have higher yields and improved resistance to disease and to environmental stresses such as drought and salinity.

Animal Production and Health: Isotopes are used to develop diets and feeding strategies that improve productivity and reproductive efficiency while immunoassay methods help diagnose diseases and monitor effectiveness of disease control and eradication programmes.

Insect Pest Control: Sterile insect techniques offer alternative means of suppressing and, in some cases, even eradicating insects, such as fruit flies, tsetse flies, moths and malaria carrying mosquitoes.

Food Safety and Control: Irradiation provides a safe and environmentally friendly way of controlling food-borne diseases and stored product insect pests; other nuclear technologies are used to trace and authenticate food products and to detect, monitor and track the fate of contaminants in foods and the environment.

Different scenes, different parts of the world, but they are connected through nuclear technology. In each case, cutting edge nuclear technologies have added value to traditional farming and food systems by making it possible to:

- Speed up the genetic development of robust new crop varieties
- Control pathogen growth in grains and processed food
- Trace a crop's uptake of water and sequestration of nitrogen
- Diagnose and treat animal diseases and maintain surveillance
- Control the presence of harmful pests in high cropping areas.

Global eradication of rinderpest will be officially declared in 2011: it was the most important livestock disease in Africa, costing the continent about US $5 billion per outbreak. The IAEA, the FAO, the OIE and the AU, have made a significant technical contribution over a period of almost 20 years, through the development, evaluation, validation and distribution of immunological and molecular nuclear and nuclear related technologies for the diagnosis and control of rinderpest.

California implements preventive releases of radiation sterilized medfly males to guard against the permanent establishment of this pest that could potentially cause economic losses of US $1.9 billion annually.

Mutation breeding has provided Vietnamese farmers from the Mekong delta and the highlands with higher yields and better market prices due to the high quality of mutant rice varieties. In highland areas, farmers are halting deforestation as they can now produce sufficient crops in lowland areas.

Analytical methods and protocols, developed under an IAEA coordinated research project and provided to Brazil, helped to address shortfalls in quality assurance and to ensure compliance with EU regulations on the safety of food commodities. This enabled Brazil to maintain trade in beef and poultry exports to the EU valued at € 1.5 billion annually.

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Nuclear Techniques in Food and Agriculture

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