Nuclear application
in food and agriculture

Global food security

Global food security benefits directly from the wider adoption of sustainable food production practices. It is also helped by improved food safety and by increased international trade in food, as well as by greater local self-sufficiency.

Nuclear techniques can improve food safety by addressing the problem of harmful residues and contaminants in food products. Traceability systems can be strengthened by using stable isotope analysis.

Greater food safety also facilitates growth in food trade and combating food fraud. Countries as far afield as Pakistan, Mozambique and Angola already benefit from the use of these techniques. Nuclear derived technologies have also been successful in developing cross breeding programmes which can lead to more productive and climate-resistant animals.

They have also been used to help farmers in Kenya develop small scale irrigation projects. Seasonal famines can be alleviated by new mutant crop varieties which can shorten the growing process and enable farmers to plant additional crops during the growing season as has been successfully done in Bangladesh.

In all these ways developments in nuclear energy deliver benefits beyond their main purpose of providing very low carbon electricity. Cooperation between the nuclear and agricultural industries is leading to healthier and better nourished people in many parts of the world.

Applications in food and agriculture

The phenomenal opportunities that nuclear energy provides to communities are numerous, and technology advancements play a vital role in ensuring that the overall health and wellbeing of communities are met. Nuclear technologies commonly known as "N-tech" are supported by the IAEA and FAO. They not only contribute to improving energy and power production, fuel cycle and radioactive waste management, but also play a vital role in boosting human and environmental wellness. Some of the techniques used are:

- Sterilization Insect Technique (SIT): This is used to eradicate invasive pests that have a higher chance of survival due to climate change caused by anthropogenic greenhouse gas emissions. This ultimately aims at reducing reproduction of toxic insects for the greater good of the human and natural environment.

- Stable Isotope Technique used for soil and water management: Scientists can monitor soil quality and detect poor health by introducing nuclear isotopes, which help to determine when a boost in fertilizer is needed. Fertilizer, however, contaminates water which is harmful to human and marine life as it encourages algae growth which reduces oxygen levels in water. Scientists also use isotopes to monitor pollution levels in water.

Sustained food supply and resource-efficient agriculture would be jeopardised without such use of nuclear techniques. Continued use of such nuclear techniques may well become critical in light of new environmental challenges, e.g., climate change and diminishing biodiversity, to functionally sustain a robust food network that serves the global population.

YES TO NUCLEAR PERSPECTIVES I INDUSTRY PERSPECTIVE

Climate change adaptation

As the global population continues to grow and climate change increases the risk of drought and other extreme weather patterns, agricultural methods can adapt to sustainably increase resource-use efficiency and productivity with the application of nuclear technologies.

Nuclear technology is often discussed in the context of electricity production; however, certain conventional and advanced nuclear reactors can also produce radioactive isotopes that have agricultural applications. For example, radioisotopes have been used to produce high-yielding crop seeds and for determining the efficacy of fertilizers on different plants. These and other specialized techniques allow scientists to determine the exact nutrient and water demands of crops, making it possible to develop sustainable practices for different regions and prevent the overuse of vulnerable, resource-scarce environments.

Advanced nuclear reactors supplying electricity also benefit the agricultural sector. Many advanced reactor designs consume less water in operation than conventional reactors, leaving more of the resource available for agricultural use. Moreover, certain advanced reactors will be able to power water desalination, helping to create more fresh water for irrigation. Additionally, because nuclear fuel is so energy dense, nuclear power plants require far less land area to operate than other energy sources. This means that less rural or undeveloped land must be diverted away from agricultural use to meet electricity demand.

Some advanced nuclear microreactors are designed to be portable and can flexibly provide power to assist with disaster response to extreme, climate-related weather disruptions that could impact national or regional food systems. More generally, nuclear energy contributes greater resilience to electric grids, enabling the safe and efficient cultivation, harvest, distribution, and preparation of food globally.

Viewpoint
by Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture

The application of nuclear technology has a proven record in increasing agricultural production, protecting crops and animals, and improving food safety. Higher and more reliable yields not only improve farmers' livelihoods, they also mean better quality and safer food for consumers.

Nuclear science and application are dedicated to transformational and incremental innovation across five areas of food and agriculture, mainly in the areas of animal production and health; plant breeding and genetics; insect pest control; soil and water management and crop nutrition; and food safety and environmental protection. Through its focus on nuclear applications in food and agriculture, the Joint FAO/IAEA Centre provides dedicated solutions that contribute towards national, regional and global attainment of the Sustainable Development Goals.

Comparative advantages attributable to nuclear techniques include the following, with Member States receiving the full benefits of these techniques. With nuclear and isotopic tracers used as markers for research, traceability becomes a huge advantage. With radioactivity, advantages come by way of induced genetic variation, sterility and sterilization. Radio and stable isotope techniques also present a comparative advantage on measurability as well as nuclear techniques having more accuracy relative to conventional analytical methods. Finally, unique sensitivity and specificity contribute to nuclear techniques' mix of comparative advantages.

In future, the Joint FAO/IAEA Centre will continue its further contributions in applying innovative technologies to sustain the intensification of agricultural production and improvement of global food security. It will support techniques to strengthen resilience of livelihoods to threats and crises in agriculture and promote efficient agricultural and food systems for sustainable management and conservation of natural resources. Nuclear's role in agriculture has been significant in contributing to the Joint Centre's milestones and will mark next stages in meeting global challenges worldwide.

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