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NUCLEAR TECHNIQUES IN FOOD AND AGRICULTURE

1. The combination of nuclear and conventional technologies offered by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (AGE) provides unique technical solutions for specific agricultural problems to the benefit of FAO member countries. These benefits include improved crop varieties, environment friendly control of insect pests, improvements in soil quality and the efficient use of fertilizer inputs, water resource management for crop and livestock production systems, animal disease diagnosis and traceability of pollutants in food, land and water through the provision of research, training and technical inputs in the area of food and agriculture.

2. Nuclear and related technologies can contribute to the productivity, stability, and resilience of food production systems. For example, nuclear applications through radiation induced mutations bring about favorable changes in the genetic make-up and increase the biodiversity of crop plants. They are unique in their sensitivity and specificity as markers to measure basic processes to diagnose and control plant and animal pests and diseases and to determine environmental constraints at the water, soil, plant and animal interfaces. They can be effectively applied for sanitary and phytosanitary purposes in support of food safety and the facilitation of international trade, and for specialized applications such as the Sterile Insect Technique (SIT). These techniques are especially efficient in optimizing holistic "farm to fork" food control systems through the increased production of better crops and safer foods with fewer inputs and less environmental impact.

3. The utility of nuclear applications in food and agriculture are substantial, with significant impacts in developing countries and emerging economies through additional income from better crop varieties, savings in agricultural inputs and increased access to export markets for agricultural produce. Worldwide, more than 100 countries are working with the Joint FAO/IAEA Division to increase their harvests, combat animal and plant diseases and pests, and protect the lands, water resources and environments on which food and agricultural production depends.

4. Specific examples of the impact of nuclear applications[1] include:

- Economic benefits from optimized fertilizer applications totalling at least USD 6 billion per year through the use of radioisotopes to more effectively determine fertilizer placement and timing of use. The adoption of fertigation, the dual application of water and fertilizer to crops, has boosted potato production in Turkey by significantly reducing water usage and is now practiced in more than 30 countries.
- More than 3 000 crop varieties of some 170 different plant species have been released in more than 100 countries through use of mutation breeding to improve food and industrial crops, including barley that grows at 5 000 meters and rice that thrives in saline soil.
- Insect pests threatening high-value fruit and vegetable production are now being more widely controlled by the environment-friendly Sterile Insect Technique, which has resulted in the eradication of fruit flies or the designation of areas with low pest prevalence in Mexico, several countries of Central America, Peru, Chile, Argentina, Brazil, Israel, Jordan, South Africa and Thailand. This has brought benefits of hundreds of millions of US dollars per year in increased fruit production, reduced production losses and insecticide use, increased exports and jobs.
- The eradication of Screwworm fly from Libya using SIT has brought estimated benefits of USD 280 million annually. The removal of the tsetse fly in Zanzibar also increased the contribution of livestock up to 34 percent for the agricultural economy.
- The use of nuclear and nuclear related diagnostic and surveillance technologies in the collective fight to successfully eradicate cattle plagues from the world resulted in substantial economic benefits.
- More than 50 countries have approved the use of irradiation to treat foodstuffs for food safety and quarantine purposes, which provides an alternative to the use of chemicals in fumigation and other processes. Collectively, there are 192 such food irradiation facilities worldwide (up from 32 in 2000). The increased application of food irradiation has stimulated interest in the development of international standards to ensure its safety.
- China, Chile, Morocco, Romania, Vietnam and 40 other countries are using nuclear tracer techniques and Joint FAO/IAEA Division guidelines to assess the extent of land degradation and soil erosion in successful measures aimed at soil conservation.

5. The FAO/IAEA Agriculture & Biotechnology Laboratory also plays a major role in the implementation of the work of the Joint Division and assists member countries in the development and adaptation of new and improved agricultural technologies involving radioisotopes and other nuclear applications. It provides a wide range of technical and analytical services pertaining to the efficient use of these technologies and carries out strategic and applied research and development activities. It offers capacity building by training scientists and technicians from member countries through individual fellowships, group training and regional and inter-regional training courses; guidance on the introduction of analytical quality control and assurance into counterpart laboratories; and training in the maintenance of laboratory equipment and instruments as part of technology transfer in support of AGE technical backstopping through the IAEA Technical Cooperation (TC) Programme.

6. With support of both FAO and the IAEA, the Joint FAO/IAEA Division carries out its work through coordinated research projects (CRP) to address specific practical problems in priority areas and technical cooperation projects (TCP) to provide technology transfer and capacity building (expert advice, training, and equipment) to member countries. Each year over 500 agricultural institutions are involved in CRP networks and close to 250 TCPs receive technical support and policy advice through the provision of USD 16.5 million IAEA-TC funding. As part of the Division's work, 29 training courses with 614 participants from developing countries and 17 symposia and workshops were organized in 2009. Also, 28 technical documents,

[1] More information, specific details and numerous other examples of country impacts may be found at http://www-naweb.iaea.org/nafa/index.html and in "Atoms for Food – a global partnership" at http://www-naweb.iaea.org/nafa/fao1008.pdf.

newsletters, guidelines and books were published while 89 articles were published in scientific journals.

7. Due to the foresight and longstanding investment of FAO and IAEA member countries in this area, the future application of nuclear techniques in food and agriculture will continue contributing to global food security in order to meet the demands of member countries in the field of food and agriculture. The Joint Division will focus on three major directions, namely global food security, better understanding of climate change and its impact on agriculture, and international trade in food and agriculture.

8. Future activities include reducing the risk of animal diseases (with AGA), the use of irradiation to treat foods intended for specific target groups (with AGN), the increased use of mutation induction for crop improvement (with AGP), the enhanced use of water management techniques (with NRL) and the use of isotopes to study insect biology, behaviour, biochemistry, ecology and physiology (with AGP).