CONTRIBUTING TO FOOD SECURITY IN THE CONTEXT OF CLIMATE CHANGE

Since the laboratories of the IAEA Department of Nuclear Sciences and Applications were established in Seibersdorf in 1962, the world's population has grown from 3.14 billion to 7.15 billion, which, combined with continuously increasing industrialization and economic development, has led to greater global food demand. This has placed substantial stress on natural resources as well as the agricultural production chain. The challenges to food safety and security have also been amplified by the impacts of climate change, which have global ramifications, as noted in the March 2014 report of the UN Intergovernmental Panel on Climate Change.

Climate change impacts include higher temperatures, drought, more frequent extreme weather events and increased soil salinity which can have severe effects on agricultural production. Helping Member States adapt to and mitigate these impacts is a main focus of the five laboratories of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture in Seibersdorf. These laboratories are dedicated to increasing food security and safety using nuclear science and technology.

Agriculture accounts for roughly 70% of global water consumption. As climate change can result in drought or variations in water quality due to extreme weather events, it is critical to use this resource efficiently. The Soil and Water Management and Crop Nutrition Laboratory (SWMCNL) assists Member States in using nuclear techniques to optimize on-farm water conservation and to improve irrigation methods to produce more crops and increase water use efficiency. In addition, the SWMCNL builds Member States' capacities to monitor and assess the repercussions of climate change and variations on soil erosion, land degradation, salinization and nutrient depletion. This includes developing climate-smart practices that enhance soil resilience against climate impacts, while also increasing soil productivity, promoting soil carbon storage and reducing greenhouse gas (GHG) emissions from farmlands.

This work is complemented by the activities of the Plant Breeding and Genetics Laboratory (PBGL), which uses nuclear technologies to induce and detect useful mutations in crop plants. These mutations can be developed into new plant varieties that are able to grow under harsher conditions such as drought, higher temperatures and high soil salinity. Such adverse conditions are increasingly prevalent as a result of climate change. In a number of Member States, new plant varieties are helping farmers to increase crop production. This, in turn, contributes to higher income and greater food security in spite of the growing difficulties presented by climate change.

Approximately 22% of all GHG emissions are the result of agricultural production, and nearly 80% of these emissions are caused by animal production. With the constant rise in demand for animal products, livestock can serve as instruments for poverty alleviation and food security as they provide a livelihood for around a billion people. Without mitigating steps, however, increased animal production will lead to increased GHG emissions. The Animal Production and Health Laboratory (APHL) conducts research and development involving nuclear and nuclear-related techniques to improve the genetic potential of local breeds in order to maximize animal productivity and health. These techniques can also be implemented to breed livestock that produce fewer GHGs and are more tolerant to the higher temperatures and drought conditions that may result from climate change.

Higher temperatures also increase the occurrence and geographical distribution of transboundary animal diseases that can affect livestock and humans. Through its work in developing rapid-response diagnostic tools and animal vaccines to combat disease outbreaks, the APHL is increasing Member States' capacities to respond to new disease threats that may emerge as a result of climate change. Just as higher temperatures increase the geographical distribution of animal diseases, they are also increasing the survival of many insect pests in previously inhospitable climates. These pests can destroy crops and carry illnesses that endanger livestock and people.

To help control these insects, the Insect Pest Control Laboratory (IPCL) assists Member States in developing and transferring the sterile insect technique (SIT). This technique involves mass-rearing and sterilizing male insects that

Training Member State Scientists in the Food and Environmental Protection laboratory on the use of radiotracer techniques to manage the risks associated with residues of pesticides in foods.
(Photo: Dean Calma, IAEA)

IAEA Fellows receive field training given by IAEA Soil Scientist at Seibersdorf Soil and Water Management and Crop Nutrition (SWMCN) Laboratory.
(Photo: Dean Calma, IAEA)

are then released in large numbers into wild populations to mate with wild females without producing offspring. This results in a reduction in the overall population of the targeted insect pest. The SIT can be highly effective when combined with other pest control measures, such as biological control, insecticide spraying and other suppression methods. The SIT is becoming increasingly important for the control of mosquito populations. Many mosquito-disease affected zones are in populated urban areas and mosquitoes are reaching and surviving in new areas. Responding to this particular challenge with the SIT is one of the IPCL's current priorities.

Climate change and variability also affect how food security, as well as food safety and quality, are managed. With the expanding geographical distribution of insect pests and animal diseases, more pesticides are used to control insect populations, and livestock are being kept healthy through antimicrobials and related pharmacological substances. Shifts in temperature and humidity also result in the more widespread growth of toxin-producing fungi, which can lead to a greater presence of toxins in food. Without appropriate monitoring and measuring techniques, residues of all of these potentially harmful substances can enter the food chain and endanger human health. The Food and Environmental Protection Laboratory (FEPL) assists Member States in using nuclear and isotopic techniques to monitor and measure the presence of any potential contaminants, and to trace their origins. This protects consumers and also helps producers increase their exports by ensuring compliance with the food safety regulations of importing countries.

Each of the laboratories is successfully responding to Member State needs for increased food security and safety by formulating effective responses to the wide-scale impacts and challenges of climate change. In doing so, the laboratories are continually demonstrating the potential and capacity that nuclear science and technology offer for enhancing the socio-economic development of Member States.

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